ILLINOIS STATE WATER SURVEY

No. 40

STATE OF ILLINOIS
DEPARTMENT OF REGISTRATION AND EDUCATION

DIVISION OF THE
STATE WATER SURVEY
A.M. BUSWELL, Chief

BULLETIN No. 40

PUBLIC GROUND-WATER SUPPLIES IN ILLINOIS

Compiled
by
ROSS HANSON
Associate Engineer

(Printed by authority of the State of Illinois)

URBANA, ILLINOIS
1950

ORGANIZATION

STATE OF ILLINOIS

Hon. ADLAI E. STEVENSON, Governor

DEPARTMENT OF REGISTRATION AND EDUCATION

NOBLE J. PUFFER, Director

BOARD OF

NATURAL RESOURCES AND CONSERVATION

NOBLE J. PUFFER, M.A., LL.D.
Chairman

ROGER ADAMS, Ph.D., Chemistry

LOUIS R. HOWSON, C.E., Engineering

WALTER H. NEWHOUSE, Ph.D., Geology

LEWIS HANFORD TIFFANY, Ph.D., Forestry

ALFRED E. EMERSON, Ph.D., Biology

GEORGE D. STODDARD, Ph.D., Litt.D., LL.D., L.H.D.,
President of the
University of Illinois.

STATE WATER SURVEY DIVISION

A.M. BUSWELL, Ph.D., Chief

SCIENTIFIC AND TECHNICAL STAFF
of the
STATE WATER SURVEY DIVISION

Water Resources Building,
Box 232, Urbana

A. M. BUSWELL, Ph.D., Chief

ENGINEERING

Herbert E. Hudson, Jr., B.S., Engineer and Head

Ground Water Hydrology

Harman F. Smith, B.S., Engineer
Francis X. Bushman, B.S., Assistant Engineer
George E. Neher, B.S., Engineering Assistant
Ven T. Chow, Ph.D., Engineering Assistant

Hydraulic Laboratory

Robert E. Roberts, M.S., Assistant Engineer

Meteorology

Glenn E. Stout, B.S., Supervisory and Assistant Scientist
Floyd A. Huff, B.S., Assistant Professional Scientist
Douglas M. A. Jones, M.S., Assistant Professional Scientist
Gerald W. Farnsworth, B.S., Engineering Assistant
Homer W. Hiser, A.B., Assistant
George F. Beatty, B.S., Assistant
Kenneth A. Faulk, Radar Operator
James A. West, Radar Operator

Municipal Ground Water Survey

Ross Hanson, B.S., Associate Engineer
J. L. Geils, B.S., Associate Engineer

Reservoir Sedimentation

John B. Stall, B.S., Assistant Engineer

Surface Water Hydrology

Wyndham J. Roberts, M.S., Associate Engineer
Jack Bruin, B.S., Engineering Assistant

ENGINEERING RESEARCH

Max Suter, Ph.D., Engineer and Head
Carl C. Chamberlain, Assistant Engineer

Peoria Region and Laboratory

Adolph R. Knodel, B.S., Field Engineer
Orville W. Vogel, B.S., Assistant Chemist
Howard L. Wakeland, B.S., Engineering Assistant
Virginia Wisegarver, B.S., Engineering Assistant

Chicago-Joliet Region

John B. Millis, Field Engineer
Jacob S. Randall, B.S., Field Engineer
Harold E. Bement, Engineering Assistant

East St. Louis Region

Eugene G. Jones, B.S., Field Engineer

CHEMISTRY

T. E. Larson, Ph.D., Chemist and Head

Boiler Water Control

Russell W. Lane, M.S., Chemist

Research

Robert M. King, B.S., Assistant Chemist

Analytical

Wilma L. Printy, B.S., Assistant Chemist
Arthur H. Bodenschatz, B.S., Assistant Chemist
Phyllis N. Cady, B.S., Assistant Chemist
Laurel M. Henley, A.B., Assistant Chemist

CHEMICAL RESEARCH

Chemistry

Henry F. Mueller, B.S., Special Research Assistant
Arthur T. Yahiro, B.S., Special Research Assistant

Supersonics (In Cooperation with Food Technology Department, University of Illinois).

Lillian Russell, M.S., Special Research Assistant

Organic Contaminant Detection in Water (In Cooperation with U. S. Public Health Service).

Walter F. Claussen, Ph.D., Research Assistant Professor
Dayle Clark, Special Research Assistant
Ruth Evans, M.S., Special Research Assistant
Dean D. Fortney, B.S., Special Research Assistant
Mary A. Scheri, M.S., Special Research Assistant

Nitrification Studies (In Cooperation with U. S. Public Health Service).

M. Irene Van Meter, M.S., Research Instructor
John Gerke, M.S., Special Research Assistant
Tetsuo Shiota, M.S., Special Research Assistant

Fundamental Properties of Water Substances (U. S. Navy ONR Contract)

W. L. Masterton, M.S., Special Research Assistant

CONSULTANTS

Radar

William G. Albright, M.S., University of Illinois

Meteorology

Horace R. Byers, Ph.D., University of Chicago

CONTENTS

ILLUSTRATION

PUBLIC GROUND-WATER SUPPLIES IN ILLINOIS

Introduction and Plan of Presentation

Bulletin No. 40 is published to fill the need for revising and supplementing the contents of Bulletin No. 21 and Supplements I and II, published in 1925, 1938 and 1940 respectively. It is intended not only to include in this Bulletin all of the basic data which were written into Bulletin No. 21 and Supplements I and II but to make Bulletin No. 40 more complete. This is possible because prior to the time of publication of the original Bulletin No. 21 the public-was not aware of the need for accurate records of their water resources. In many cases, no records were kept of water levels and other important well data. At that time a public well could be constructed without notice to the State Department of Public Health. Notice was later made compulsory by law. Possibly ten or fifteen public well supplies were not included in Bulletin No. 21 because their existence was not known to the Water Survey staff.

Many well logs were not available in 1925. With the publication of Bulletin No. 40, there is included a log for more than 90 per cent of the ground-water supplies.

No analyses of treated waters were included in Bulletin No. 21. These are included in this Bulletin where samples could be collected.

The list of surface-water supplies in Bulletin No. 21 has been amended and, in Bulletin No. 40, is included all those ground-water supplies in Bulletin No. 21 which have since changed over to surface-water supply. This Bulletin includes a digest of all of the previously published material on public ground-water supplies plus all of the data which have been collected since the last publication.

Since its inception in 1895 the State Water Survey has collected r?? tailed information on groundwater and other water resources of Illinois. During World W?? the years since, the number of requests made to the Water Survey for information on the?? ce and availability of ground-water supplies has increased to about 400 annually. To fac?? wering these requests it is desirable for the Survey to publish all the factual physical, cher?? hydrological data which have been collected since the last publication.

Available data on Illinois water resources may be obta?? riting to the Survey. Specific location and information desired should be furnished.

Format

The format of Bulletin No. 40 differs from Bulletin No. 21 and Supplements I and II, in that it is loose-leaf with the heading for each water-supply system placed at the top of a right-hand page. All pages are punched for use in a standard 8 1/2 x 11-inch three-ring binder, which should make for more convenience to the reader who may be concerned at the moment with only one or, even a few, water-supply systems.

Lost or mutilated sheets may be replaced without issuing the entire bulletin. In future years, descriptions of newly-installed water systems may be published and inserted, in alphabetical order, in the binder. When sufficient additional information, on any pne or more of the sections now included in the binder, has accumulated in the Water Survey files to justify publication, supplements will be issued on such sections without reprinting the present contents of the bulletin.

Acknowledgements

Mr. J. L. Geils, Associate Engineer, initiated the field work in April, 1946, and completed several counties in the northern part of the state, where public ground-water supplies are numerous. In October, 1946, Mr. E. G. Jones, Field Engineer, commenced field work. The remaining counties of the state were divided between these two engineers and their field work was completed in 1949. Acknowledgement is given to Mr. Geils and Mr. Jones for their painstaking collection of physical data in the field, making it possible to portray, herein, a fairly accurate historical and factual summary of each public ground-water supply.

Acknowledgement is given to all other staff members of the Illinois State Water Survey: to Mr. W. D. Gerber, Engineer Emeritus, for his careful building-up of the file records since the publication of Bulletin No. 21; to Commander C. O. Reinhardt, Engineer, for preliminary planning of this bulletin before his return to U. S. Naval Service; to Mr. H. E. Hudson, Jr., Engineer, for his assistance in management of the preparation of the bulletin and review of the work; to Dr. T. E.Larson, Chemist, for his laboratory analyses, chemical discussions, and comments which he contributed. Every engineer and chemist on the staff of the Water Survey, since it was organized, has had a part in the collection of the data which appear in this bulletin.

Acknowledgement is given to the Illinois State Geological Survey for the furnishing of well logs.

We are particularly indebted to water-works officials, well-drillers, pump manufacturers and agents, and all who so willingly gave of their time and effort in assisting our engineers in the collection of data for the bulletin.

General

Field work, in which a visit was made to every-known public ground-water supply within the State of Illinois, was started in April, 1946. A preliminary draft on each public well-supply was prepared from the office files and transmitted to the field engineers who checked the earlier information with local water-works authorities, well-drillers, equipment manufacturers, and others, after which the field engineers proceeded to collect all available physical data on each source of public water supply in order to bring the records up to date.

The information sought by the engineers included abandoned sources and their replacements; a complete physical description of each present source of public supply covering location, depth, hole and casing size, pumping equipment, water levels, quantity of water pumped, and water treatment facilities. Where the information on public supply sources was insufficient and there was available information on representative industrial wells, this was recorded and, while not published herein, is available from the Water Survey files. Water samples were collected at each source of supply.

In some cases the engineers were unable to collect complete information, either because it was not being kept by the local authority or because records had been lost or destroyed. In some wells the air lines have not been maintained in good condition. In other wells no air lines were installed, inexpensive as they are when compared to the total cost of the wells. The air line leads to the heart of the well.

Without periodic readings of the water levels, the warning signs of a failing water supply are not observed in time. The cost of maintaining a water-level record is small but the economic loss to a community for lack of such a record can be very large.

In some municipalities, chlorination equipment is available but was not in use at the time of inspection. Some municipalities own water treatment plants but the plant was not in service at the time of inspection. Treated water samples could not be obtained in such cases.

After completion of the field work the field report and office draft, including the chemical discussion, were edited. Abbreviations and Symbols have been freely used, and a table of them is

shown following this chapter.

The date in the upper right hand corner under the name of the municipality is the date of the last visit of any member of the staff to that particular location. Present and past tenses are as of that date for each article. Many of the reports have been dated in 1948 and 1949 because of a visit by a staff engineer subsequent to Mr. Geils or Mr. Jones report in 1946 or 1947. The Bulletin, therefore contains all the data available to the Survey up to January 1, 1950.

The population, 1940 census, is shown in parentheses immediately following the first mention of the name of the municipality.

All elevations are in feet above mean sea level datum.

Pumpage figures, where metered, are so stated. Otherwise pumpage is estimated and allowances made for water-use in sewage systems.

The historical data on water sources and wells are included where the supply continues to be, even partly, from ground water. On a following page are listed public surface-water supplies among which are those which originally used ground water but later abandoned the wells. For most, if not all, of such abandoned wells, reports can be made available from the Water Survey files.

Other information which is not published in this bulletin but may be available in the Water Survey files, includes municipalities which have no public water supplies but do have:

1. Numerous individual wells, or
2. Fire prevention systems, or
3. Industries with well-supplies

A copy of the third draft of the manuscript was sent to a water-works official of each municipality to be reviewed before going to press. A large number of replies were received.

Summary

The descriptive articles in this Bulletin include incorporated municipalities, some unincorporated subdivisions, State Institutions having a population of 100 or more, State Parks which have housing accommodations for twenty or more persons. There are 535 articles on ground-water supplies, consisting of:

501 Incorporated Municipalities
18 Unincorporated Communities
10 State Institutions
6 State Parks

There are 16 counties in which ground water is not used for public supplies, surface water

being the sole source.

The map on the following page shows the distribution of the sources of public and semi-public ground-water supplies over the State, which are described herein. As of January 1, 1949, there were 1213 wells in service for the 535 supplies, producing an estimated average of 141.7 mgd. Table 1 shows the sources of ground-water, the number of wells in service and the average daily pumpage from each source.

TABLE 1

Source	No. of Wells	Pumpage mgd.
Unconsolidated	683	63.74
Limestone	186	24.78
Sandstone	344	53.18
Total	1213	141.70

An analysis of the data collected for this publication is being made for a separate publication.

Abbreviations and Symbols

Ave.	Avenue (s)
ci.	cast iron
cu. yd.	cubic yard (s)
^{o}C	degree Centigrade
^{o}F	degree Fahrenheit
E.	east
epm.	equivalents per million
ft.	foot (feet)
gal.	gallon (s)
gi.	galvanized iron
gpd.	gallons per day
gpm.	gallons per minute
gps.	gallons per second
gr. per gal.	grains per gallon
gwi.	galvanized wrought iron
HC.	high capacity
hp.	horsepower
hr.	hour (s)
id.	inside diameter
in.	inch (es)
Lab.	laboratory
lb.	pound (s)
LC.	low capacity
MC.	medium capacity
mg.	million gallons
mgd.	million gallons per day
min.	minute (s)
MSL.	mean sea level
N.	north
No.	number
od.	outside diameter
ppm.	parts per million
psi.	pounds per square inch
R.	range
rpm.	revolutions per minute
S.	south
spm.	strokes per minute
St.	street (s)
T.	township
W.	west
wi.	wrought iron
%	per cent
$\pm$	plus or minus

MUNICIPALITIES HAVING SURFACE-WATER SUPPLIES

Municipalities which use surface waters for public supply are listed below. The asterisk (*) before a name indicates that municipality originally obtained its water supply from wells.

Municipality	Source of Supply	Municipality	Source of Supply
Albion	Bon Pas Creek	Chester	Mississippi River
Alcoa	From East St. Louis	*Chicago	Lake Michigan
*Altamont	Second Creek	Christopher	Brandy Creek
Alton	Mississippi River	Cicero	From Chicago
Ashley	Tributary - Muddy River	Clay City	Little Wabash River
*Astoria	Otter Creek	Clayton	Walnut Creek
Auburn	From Springfield	Colp	From Herrin
Augusta	Crooked Creek	*Columbia	From East St. Louis
*Bannockburn	From Deerfield	Coulterville	Tributary - Mud Creek
Beckemeyer	From Carlyle	Dallas City	Mississippi River
*Belleville	From East St. Louis	Danville	North Fork-Vermilion River
Benld	From Gillespie	Decatur	Sangamon River
Benton	Branch - Big Muddy River	Deerfield	From Highland Park
*Berwyn	From Chicago	Divernon	From Springfield
Blandinsville	Little Creek	Dixmoor	From Chicago
*Bloomington	Money Creek	Dolton	From Chicago
*Blue Island	From Chicago	Dupo	From East St. Louis
Breese	Shoal Creek	DuQuoin	Reese Creek
*Broadview	From Chicago	East St. Louis	Mississippi River
*Brookfield	From Chicago	Effingham	Little Wabash River
Brooklyn	From East St. Louis	Eldorado	Wolf Creek
Bulpitt	From Kincaid	Elizabethtown	From Rosiclaire
Bunker Hill	Wood River	Elkville	Hollidayboro Lake
Burnham	From Chicago	Elmwood Park	From Chicago
Bush	From Royalton	Energy	From Herrin
Cahokia	From East St. Louis	*Eureka	Tributary-Walnut Creek
Cairo	Ohio River	Evanston	Lake Michigan
Calumet City	From Chicago	Evansville	Kaskaskia River
Calumet Park	From Chicago	Evergreen Park	From Chicago
*Canton	Copperas Creek	Fairfield	Little Wabash River
*Carbondale	Pyles Fork	Fairmont City	From East St. Louis
Carlinville	Honey Creek	*Flora	Little Wabash River
Carlyle	Kaskaskia River	*Forest Park	From Chicago
Carmi	Little Wabash River	Forest View	From Chicago
Carrier Mills	South Fork-Saline River	Franklin	From Waverly
Carterville	Hurricane Creek	*Franklin Park	From River Grove
*Carthage	South Branch-Long Creek	Freeburg	Silver Creek
Caseyville	From East St. Louis	Galatia	Dry Run Creek
Central City	From Centralia	Georgetown	Vermilion River
Centralia	Morton's Branch-Racoon	Gillespie	Rocky Branch Creek
Charleston	Embarrass River Creek	Girard	From Springfield
Chatham	From Springfield	Glencoe	Lake Michigan

MUNICIPALITIES HAVING SURFACE WATER SUPPLIES (cont.)

Municipality	Source of Supply
*Glenview	From Wilmette
Golconda	Ohio River
Golf	From Morton Grove
Grafton	Illinois River
Grandview	From Springfield
Granite City	From East St. Louis
Hamilton	Mississippi River
Harrisburg	Middle Fork-Saline River
*Harvey	From Chicago
Hazel Crest	From Harvey
Herrin	Hurricane Creek-Wolf
Highland	Silver Creek Creek
Highland Park	Lake Michigan
Highwood	Lake Michigan
Hillsboro	Brush Creek
Hurst	From Royalton
*Jacksonville	Mouvisterre Creek-Sandy
Jerome	From Springfield Creek
Johnston City	Lake Creek
Kankakee	Kankakee River
Kenilworth	Lake Michigan
*Kincaid	Tributary-Sangamon River
LaGrange Park	From Westchester
Lake Forest	Lake Michigan
*Lansing	From Hammond, Indiana
Lincolnwood	From Chicago
Litchfield	Shoal Creek
Louisville	Little Wabash River
Lyons	From Chicago
McLeansboro	Branch-Big Creek
*Macomb	Lamoine River-Spring Creek
Madison	From East St. Louis
*Marion	Branch-Crab Orchard Lake
Marissa	Mud Creek
Markham	From Harvey
*Mascoutah	Silver Creek
*Maywood	From Chicago
Melrose Park	From Chicago
*Midlothian	From Chicago
Moline	Mississippi River
Monsanto	From East St. Louis
*Morton Grove	From Chicago
Mount Carmel	Wabash River
Mount Olive	Panther Creek-Sugar Creek
*Mount Sterling	Tributary-Crooked Creek
Mt. Vernon	Casey Fork
Murphysboro	Big Muddy River
Nameoki	From East St. Louis
Nashville	Tributary-Mill Creek
National City	From East St. Louis
Nauvoo	Mississippi River
New Athens	Kaskaskia River
Newton	Embarrass River
Niles	From Chicago
Norris City	Indian Creek
*Northbrook	From Glencoe
*North Chicago	Lake Michigan
Northfield	From Winnetka
North Riverside	From Berwyn
*Oakland	Tributary-Embarrass River
*Oak Lawn	From Chicago
*Oak Park	From Chicago
Odin	From Centralia
*O'Fallon	From East St. Louis
Old Marissa	From Marissa
Olney	Fox River
*Pana	Becks Creek
Paris	Sugar Creek
*Park Ridge	From Chicago
Pawnee	From Springfield
Pearl Harbor	From East St. Louis
Phoenix	From Harvey
Pinckneyville	Beaucoup Creek
*Pittsfield	Branch-Panther Creek
Plymouth	From Augusta
Pontiac	Vermilion River
Posen	From Harvey
Quincy	Mississippi River
Riverdale	From Chicago
*River Forest	From Chicago
River Grove	From Chicago
Riverton	From Springfield
Robbins	From Blue Island
Rochester	From Springfield
Rock Island	Mississippi River
Rosiclaire	Ohio River
Royalton	Big Muddy River
St. Elmo	Sugar Creek
Salem	Branch-Crooked Creek
Sandoval	From Centralia
*Schiller Park	From Chicago
Schram City	From Hillsboro
Sesser	Sandusky Creek
*Skokie	From Evanston

MUNICIPALITIES HAVING SURFACE WATER SUPPLIES (cont.)

Municipality	Source of Supply
Southern View	From Springfield
South Holland	From Harvey
South Jacksonville	From Jacksonville
*Sparta	Branch-Mary's River
*Springfield	Sugar Creek
Staunton	Cahokia Creek
Stickney	From Chicago
Streator	Vermilion River
*Summit	From Chicago
Swansea	From East St. Louis
Thayer	From Springfield
Thebes	Mississippi River
Tilton	From Danville
Towanda	From Bloomington
Valier	From Sesser
Vandalia	Kaskaskia River
Venice	From East St. Louis
Vermont	Branch-Sugar Creek
Vienna	McCorkle Creek
Virden	From Springfield
Virginia	Job's Creek
Wamac	From Centralia
Warsaw	Mississippi River
Washington Park	From East St. Louis
Waterloo	Fountain Creek
Waukegan	Lake Michigan
Waverly	Apple Creek
Westchester	From Chicago
West City	From Benton
*West Frankfort	Tilley Creek
Westville	From Danville
White Hall	Wolf Run Creek
Wilmette	Lake Michigan
Winnetka	Lake Michigan
Zeigler	Big Muddy River

MUNICIPALITIES HAVING DISTRIBUTION SYSTEMS ONLY

The following municipalities have water systems, but the water is obtained from a nearby municipality which has a ground-water supply.

Municipality	Water
Bartonville	From Peoria
Bedford Park	From Corn Products Co., Argo
Bellevue	From Peoria
Bridgeport	From Lawrenceville
Coalton	From Nokomis
Eileen	From Coal City
Mark	From Granville
Maryville	From Collinsville
Oblong	From Robinson
Palestine	From Robinson
Rock Falls	From Sterling
Sumner	From Bridgeport
Troy	From Collinsville

SEMI-PUBLIC GROUND-WATER SUPPLIES

The following semi-public ground-water supplies are described in Bulletin No. 40.

UNINCORPORATED COMMUNITIES

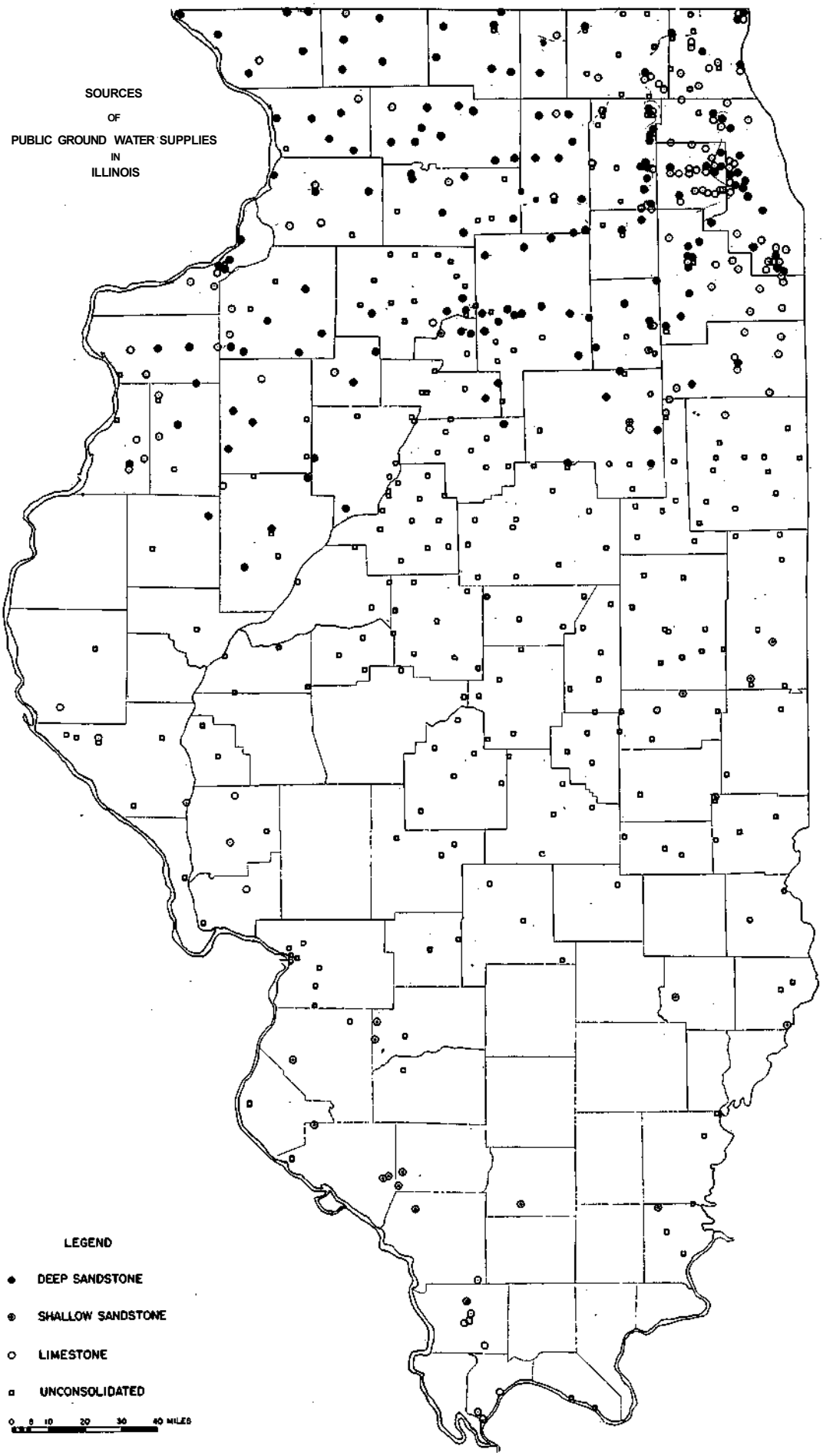
Aux Sable Lock
Belmont
Bedford Park District
Crystal Heights
(see Crystal Lake)
Glenview Countryside
Island Lake
Lidice
Lisle
Log Cabin Arbor
Lowpoint
McNabb
Marquette Heights
North Lake Village
Ophiem
Osco
Robien Subdivision
Rock Island County Home
(see Coal Valley)
Round Lake Park
Sugar Grove
Urbandale Subdivision
(see East Moline)
Van Orin
Wheaton Farms

STATE INSTITUTIONS

Anna State Hospital
East Moline State Hospital
Elgin State Hospital
Illinois Soldiers & Sailors Children's Home
Manteno State Hospital
State Penitentiary - Joliet
State Penitentiary - Stateville
State Reformatory for Women
State Training School for Boys - Sheridan Branch

STATE PARKS

Apple River
Buffalo Rock
Giant City
Pere Marquette
Starved Rock
White Pines Forest


SOURCES
OF
PUBLIC GROUND WATER SUPPLIES
IN
ILLINOIS
LEGEND
DEEP SANDSTONE
SHALLOW SANDSTONE
LIMESTONE
UNCONSOLIDATED
0 5 10 20 30 40 MILES

A public water supply was installed by the city of Abingdon (3218) in 1902.

At that time, water was obtained from a well located on the west side of the Chicago, Burlington & Quincy R. R., north of the business district (or approximately 1250 ft. N. and 2450 ft. E. of the S. W. corner of Section 33, T. 10 N., R. 1 E.).

The well was drilled by Wm. Gray and Bros., Chicago, to a depth of 1355 ft. below the pump house floor, elevation 747.5 ft., and reported to be cased with 9-in. pipe from the surface to 600 ft. and with 6-in. pipe from 600 to 1232 ft. In 1932, a test was made of the hole size by J. B. Millis, Byron. A 9-in. bucket was lowered and stopped at 530 ft. *A* 7-in. bucket was lowered and stopped at the same depth. The well was sounded and found to be 585 ft. deep.

The present pumping assembly, installed in 1945, consists of 480 ft. of 6-in. column pipe; 8-in., 20-stage, oil-lubricated, Peerless turbine pump, Serial No. 3 1747, rated at 240 gpm. against 500 ft. of head; 480 ft. of 1/4-in. galvanized-steel pipe air line; 20 ft. of 5-in. suction pipe; 40-hp. General Electric motor rated at 1765 rpm.

In 1921, A. T. Bowton stated that, when the well was being drilled, water was encountered at 400 ft. and rose to within 4 ft. of the top of the hole. Because the contract specified water from the St. Peter sandstone, this flow at 400 ft. was cased off. Below 400 ft. no water was encountered until the sandstone was reached.

Water levels have been reported in ft. below the pump house floor in Table 1.

The pumping water levels, as reported, for 1941 and 1944 were observed when the pump in Well No. 2 was not operating.

In 1928, Thorpe Bros., Des Moines, Iowa, drilled Well No. 2 to a depth of 2583 ft. at a point 50 ft. south of the old well and within the pump house.

The well was cased from the surface to 303 ft. with 16-in. od. pipe; from 300 to 1441 ft. with 10-in. pipe; from 1441 ft. to the bottom, the hole was 9 3/4 in. in diameter. At time of completion, it was planned to set 60 ft. of 8-in. liner in order to case off a caving section between 2410 and 2440 ft.

The pumping assembly consists of 250 ft. of 8-in. column pipe; 12-in., 12-stage Peerless turbine pump, Serial No. 3650, rated at 560 gpm.; overall length of the pump is 10 ft.; 276 ft. of air line; 20 ft. of 8-in. suction pipe; 40-hp., 1170 rpm. U. S. electric motor.

During the drilling of the well, when at a depth of 1441 ft., a production test was made. Test equipment consisted of a single-acting deep-well 9 3/4-in. cylinder pump attached to 302 ft. of 10-in. drop pipe. The pump was operated from the drill-rig.

The data on water levels in both wells are given in Table 2.

When the well was completed in Aug. 1928, a production test was made. The non-pumping level was 177 ft. below the floor, and the water was lowered 17 ft. while pumping at 610 gpm. In 1932, the non-pumping level was 198 ft., and the water was lowered 12 ft. while pumping at 536

TABLE 1

Date		Water Levels		Pumping Rate
		Non-pumping ft.	Pumping ft.	gpm.
Dec.	1913	Air lift pump assembly		
		130		153
Jan.	1920	170	216	130
Feb. 15,	1928	179		104
	1932	184		
	1936	New pump installed		
	1936	190		110
July 5,	1941	208	332 1/2	
Feb. 9,	1944	215	312	104
Oct. 15,	1945	New pump installed		
		216		

Sample-study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Dirt and clay"	35	35
Pennsylvanian system		
"Shale and lime"	95	130
Shale	20	150
Sandstone, incoherent from 150 to 170 ft.	40	190
Mississippian system		
Keokuk - Burlington limestone	120	310
Kinderhook shale	240	550
Devonian system		
Cedar Valley shaly limestone	60	610
Wapsipinicon limestone	20	630
Silurian system		
Niagaran - Alexandrian dolomites	90	720
Ordovician system		
Maquoketa shale and shaly dolomite	180	900
Galena - Platteville dolomites	310	1210
Glenwood sandstone, some shale at base	100	1310
St. Peter formation		
Sandstone	100	1410
Sandstone, shale, and chert fragments	5	1415
Shakopee dolomite, sandstone streaks	255	1670
New Richmond sandstone and dolomite	60	1730
Oneota dolomite, some sandstone	250	1980
Cambrian system		
Trempealeau dolomite	260	2240
Franconia sandstone and dolomite, thin beds of shale	230	2470
Galesville sandstone, part dolomitic	110	2580
Eau Claire dolomite	2	2582

gpm. In 1945, the non-pumping level was reported at 238 ft. All non-pumping levels in No. 2 were reported to be observed when No. 1 was not pumping.

The pump which was originally installed in 1928 has been repaired at least 3 times, and on Apr. 10, 1946, the entire pump assembly was out for replacement. The old assembly was inspected by the State Water Survey. The column pipe was in good condition except for 2 large holes at the lower end of the bottom section just above the bowls. There were evidences of corrosion at 16 in.,4 ft., 11 ft., 15 ft., and 17 ft. above the bowls. The affected places were all on one side, and at each point the affected area was about 3 to 5 in. in diameter. Some corrosion was found underneath the"softened, black coating" to a depth of

approximately 1/16 in. There was an oil coating on the outside of the column pipe for a distance of 30 ft. above the bowls. The turbine, which had been repaired in 1936, was found to be in good condition with the exception of considerable corrosion on the threaded coupling at the upper end of the unit. The corrosion had not affected the mechanical parts of the coupling as it has not yet extended to the threads.

TABLE 2

Water Levels (Ft. below floor)			Pumping Rate	
Non-pumping	Pumping		gpm.	
ft.	ft.			
No. 1	No. 1	No. 2	No. 1	No. 2
179			0	0
		226		216
		234		216
	208			223
	300		104	

A production test was made when the pump was replaced in 1946. Before the test started, the water level was 217 ft. The drawdown was 11 ft. after pumping 1 hr. and 20 minutes at rates of 460 to 485 gpm. After stopping the pump, the water level was 217 ft. in 1 minute.

Analysis of a sample (Lab. No. 109,796) collected Apr. 2, 1947 from the North Well (Well No. 1) after the pump had been operating about 5 minutes, showed this water to have a hardness of 20.3 gr. per gal., a residue of 1324 ppm., and an iron content of 0.7 ppm. All previous samples collected were found to have the same quality. Two samples collected Oct. 16 after longer pumping periods had temperatures of 73.5° and 73.7° F.

The same quality water was obtained from Well No. 2 excepting that the recorded temperature was 78° F. on several occasions. A pH of 7.4 was recorded Feb. 9, 1944 for water from each well.

Pumpage is approximately 250,000 gpd. The water is not treated.

LABORATORY NO. 109, 796

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.7		Silica	SiO_2	14.4	
Manganese	Mn	0.0		Fluoride	F	3.5	
Calcium	Ca	84.4	4.22	Chloride	Cl	160.0	4.51
Magnesium	Mg	33.4	2.75	Nitrate	NO_3	0.9	0.01
Ammonium	NH	1.1	0.06	Sulfate	SO_4	565.7	11.77
Sodium	Na	319.7	13.90	Alkalinity (as $CaCO_3$)		232.	4.64
Color		0		Hardness (as $CaCO_3$)		349.	6.98
Odor		0		Residue		1324.	
Turbidity		20					
Temperature 71.5° F.							

ADDISON
Du Page County
May 17, 1947

The village of Addison (819) installed a public water supply in 1925.

Water is obtained from a well drilled to a depth of 155 ft. by George A. Morris, Bensenville, in 1924. The well is located about 50 ft. south of Lake St. and 390 ft. east of Chestnut St. (approximately 1350 ft. S. and 2000 ft. W. of the N. E. corne of Section 28, T. 40 N., R. 11 E.). The ground surface elevation is 690t ft. The well is cased with 10-in. pipe to rock at a depth of 90 ft.

After the completion of the well, water was pumped for a period of 10 hr. at a rate of 150 gpm with a drawdown of 2 ft. below a non-pumping water level of 18 ft. from the surface. The pump installation is a Keystone Driller Co. 2-stroke plunger pump having a 5 3/4-in. cylinder with an 18-in. stroke set at a depth of 75 ft. A length of suction pipe is attached to the bottom of the cylinder. The pump is operated at a speed of 33 to 34 spm. and has a theoretical delivery of 133 gpm. at 33 spm. It is belt-driven by a 15-hp. Wagner electric motor. In Sept. 1943 the pump was pulled for examination and overhauling, at which time the water level was 28 ft. below the surface.

Analysis of a sample (Lab. No. 110,327) collected May 16, 1947 after 9 1/2-hr. pumping at 120 gpm. showed this water to have a hardness of 29.4 gr. per gal., a residue of 625 ppm., and an iron content of 1.4 ppm.

An older well is located on the site about 70 ft. south of the well in service. It was reported drilled to a depth of 115 ft. in 1908 and cased with 4-in. pipe to limestone at about 90 ft. The well was originally used to furnish water for fire protection and sprinkling streets. It is equipped with a Gould plunger pump, Fig. 1454, Size 20 Gould pump head No. 4840, and a 5-hp. electric motor. A cylinder is reported set at a depth of 40 ft. and the casing used as an eductor pipe. The pump is operated once a week, pumping water to waste. The distribution systemwas connected to the well in 1925 and the well can be used as an emergency public supply unit.

The average pumpage is estimated to be 57,000 gpd.

LABORATORY NO. 110,327

		ppm.	epm.			ppm.	epm.
Iron (total)	FE	1.4		Silica	SiO_2	24.0	
Manganese	Mn	Tr.		Fluoride	F	0.2	
Calcium	Ca	108.8	5.44	Chloride	Cl	6.0	0.17
Magnesium	Mg	56.7	4.66	Nitrate	NO_3	1.0	0.02
Ammonium	NH_4	0.4	0.02	Sulfate	SO_4	200.1	4.16
Sodium	Na	18.2	0.79	Alkalinity	(as $CaCO_3$)	328.	6.56
Turbidity		10 +		Hardness	(as $CaCO_3$)	505.	10.10
Color		0		Residue		625.	
Odor		0		Free CO_2 (calc.)		86.	
Temperature 52.2° F.				pH = 7.0			

ALEDO
Mercer County
July 9, 1949

A public water supply was installed for the city of Aledo (2593) in 1894.

A well was drilled by George Dickson, Little York, to a depth of 3113 ft. and was located at the northeast corner of Sixth and Walnut St. The ground surface elevation is 736± ft.

Sample-study and driller's log of Well No. 1 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Clay"	110	110
Pennsylvanian system		
"Soapstone and thin coal beds"	52	162
Mississippian system		
Kinderhook group		
"Soapstone"	138 (?)	300 (?)
Devonian system		
Cedar Valley and Wapsipincon limestone and dolomite, thin shale bed at base.	146	446
Silurian system		
Niagaran-Alexandrian dolomites	146	592
Ordovician system		
Maquoketa shale and dolomite	215	807
Galena-Platteville formations		
Dolomite, thin limestone bed at top	253	1060
Shale	10	1070
Dolomite	50	1120
Glenwood sandstone, dolomite and shale	60	1180
St. Peter sandstone	60	1240
Shakopee dolomite, some sandstone	125	1365
New Richmond sandstone, dolomitic	105	1470
Oneota dolomite, sandstone in basal portion	295	1765
Cambrian system		
Trempealeau dolomite	195	1960
Franconia shale, dolomite, some sandstone	205	2165
Galesville sandstone, thin dolomite beds at top	150	2315
Eau Claire shale	142	2457
Cambrian and Pre-Cambrian systems		
Eau Claire, Mt. Simon and Fond du Lac sandstones	657	3114

Because the water was very highly mineralized and was objectionably salty, the well was back-filled to a depth of 1450 ft. below the ground surface. It was cased with 8-in. pipe to rock, and water was pumped by air lift with a 4 1/2-in. discharge pipe. The bottom of a 1 1/2 in. air line was set at 400 ft.

An analysis of the water from the original depth, was found in the Dr. R. C. Johnston drug store in 1930 and is shown in Table 1.

TABLE 1

	Gr. per gal.
Sulfate of potassium	1.279
Chloride of sodium	269.874
Sulfate of sodium	47.785
Phosphate of sodium	Traces
Bromide of sodium	Traces
Carbonate of calcium	8.307
Sulfate of calcium	88.280
Carbonate of magnesium	16.648
Carbonate of iron	.049
Silica	.540
Alumina	.025
Organic compounds of ammonium	.025
Total	432.787

"The water also contains 31.91 cu. in. of free and loosely combined carbonic acid gas and traces of sulphuret of hydrogen."

In 1907, the water was noted to have a mineral content of 2592 ppm.

In 1912, the non-pumping water level was rer ported to be 100 ft. below the ground surface, and pumpage was estimated at 60,000 gpd.

In 1918, the water had a total mineral content of 1746 ppm. A hydrogen sulfide content of 0.4 ppm. was noted.

In 1924, the non-pumping water, level was reported to be 130 ft., and, when pumping at 200 gpm.,the drawdown was 10.4 ft. The daily pumpage averaged 148,000 gal. In Nov. 1946, this well was used only in emergency.

Analysis of a sample (Lab. No. 71846), collected Nov. 7, 1932, showed a hardness of 19.6 gr. per gal., a mineral content of 1673 ppm., and a trace of iron.

A new well was drilled in 1925 to a depth of 1172 ft. by F. M. Gray Drilling Co., Milwaukee, Wis. It is located just across Walnut St. from the old well (or approximately 400 ft. N. and 300 ft. W. of the S. E. corner of Section 17, T. 14 N., R. 3 W.).

Casing Record

16-in. from surface to 259 ft. 9 in.
12-in. liner from 541 ft. 7 in. to 635 ft.
10-in. liner from 635 to 835 ft.
8-in. liner from 984 to 1109 ft.

The well is equipped with 200 ft. of 8-in. column pipe; 11-stage Layne turbine pump; 200 ft. of air line; 10 ft. of suction pipe. Upon completion of the well, the non-pumping water level was 151 ft. below the pump floor level, and the drawdown was 21 ft.

In 1932, the pump was repaired by Layne North Central Co. The well depth was measured 1131 ft., and the water level was at 166 ft.

In July, 1949, it was reported that production had been declining during the previous year and

LABORATORY NO. 71,846

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	Tr.		Silica	SiO_2	12.	
Manganese	Mn	0.		Fluoride	F		
Calcium	Ca	87.9	4.40	Chloride	Cl	372.0	10.50
Magnesium	Mg	28.4	2.34	Nitrate	NO_3	.44	.01
Ammonium	NH_4	1.26	0.07	Sulfate	SO_4	556.0	11.57
Sodium	Na	467.4	20.27	Alkalinity	(as $CaCO_3$)	250.	
Turbidity		0		Hardness	(as $CaCO_3$)	337.0	6.74
Color		0		Residue		1705.	
Odor		V					

that the non-pumping water level had dropped from 90.0 ft. below the pump base in 1948 to 193.5 ft. on July 8, 1949. On the latter date the pump had been out of service for one week. Layne-Western Co., Chicago, was doing some repair work on the well, including the gun-perforations of the 8-in. liner between 1055 and 1080 ft., with twenty-four 1/2-in. bullets.

A geophysical log of the well was made on July 9, 1949, by Schlumberger Well Surveying Corp. The well was reported to be 1204 ft. 5 in. deep.

Analysis of a sample (Lab. No. 108,244) collected Nov. 7, 1946, after the pump had been operating several hours, showed the water to have a hardness of 13.2 gr.per gal., a residue of 1158 gpm., and an iron content of 0.1 ppm. The quality is of generally similar character to that indicated by a sample collected in 1926.

The water is chlorinated but not otherwise treated. There is some effect of line on hot water coils and considerable staining of iron on fixtures.

Pumpage in 1946 was estimated at 210,000 to 250,000 gpd.

LABORATORY NO. 108,244

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	12.2	
Manganese	Mn	0.0		Fluoride	F	2.4	
Calcium	Ca	61.5	3.08	Chloride	Cl	176.0	4.96
Magnesium	Mg	17.6	1.45	Nitrate	NO_3	0.3	Tr.
Ammonium	NH_4	1.2	0.07	Sulfate	SO_4	400.9	8.34
Sodium	Na	325.2	14.44	Alkalinity	(as $CaCO_3$)	272.	5.44
Color		0		Hardness	(as $CaCO_3$)	227.	4.54
Odor		Tr.		Residue		1158.	
Turbidity		10					
Temperature		62.5° F.					

ALEXIS
Warren County
Nov. 5, 1946

A public water works system for the village of Alexis (877) was installed in 1895.

A well was drilled to a depth of 100 ft. and operated by a steam pump. The well failed to furnish a sufficient supply, and in 1898 a new well was drilled on village property at 110 ft. south and 140 ft; east of the center of the intersection of First North and Main St. (or approximately 110 ft. S. and 1274 ft. W. of the N. E. corner of Section 1, T. 12 N., R. 2 W.).

The well was 1204 ft. deep, 10 in. in diameter at the top and 4 in. in diameter at the bottom.

The original pumping equipment is not known, but it was reported that a new McGowan deep-well pump had been installed in 1914 with a 4 1/4 in. double-action working barrel, a 24-in. stroke, 4 1/2 in. suction, and a 4-in. discharge. The working barrel was reported to be set at 140 ft. below the ground surface and operated at a rate of 70 gpm. against a head of 250 ft. Power was furnished by a 5-hp. Century motor. Non-pumping water level in 1915 was about 70 ft. below the surface with little drawdown when pumping.

Analysis of a sample (Lab. No. 48958), collected Jan. 10, 1923 after 2-hr. pumping, showed this water to have a hardness of 16.9 gr. per gal., a residue of 1077 ppm., and an iron content of 0.8 ppm.

Correlated driller's log of well drilled in 1898 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay	65	65
Pennsylvanian system		
Sandstone	40	105
Soapstone and limestone streak	5	110
Pennsylvanian and Mississippian systems		
Shale	238	348
Devonian and Silurian systems		
Limestone and dolomite	222	570
Ordovician system		
Maquoketa formation		
Shale and limestone	160	730
Galena-Platteville formations		
Limestone	326	1056
St. Peter formation		
Sandstone	144	1200

LABORATORY NO. 48958

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.8		Silica	SiO_2	14.2	
Manganese	Mn	.2		Fluoride	F		
Calcium	Ca	67.7	3.38	Chloride	Cl	85.0	2.39
Magnesium	Mg	29.8	2.45	Nitrate	NO_3	2.5	.04
Ammonium	NH_4	1.5	.09	Sulfate	SO_4	410.7	8.54
Sodium	Na	219.0	9.52	Alkalinity	(as $CaCO_3$)	274.	5.48
Potassium	K	31.5	0.81				
Color		20		Hardness	(as $CaCO_3$)	291.	5.83
Odor		E		Residue		1077.	
Turbidity		8					

In 1929 the J. P. Miller Artesian Well Co., Brookfield, rehabilitated the well. At that time, the driller reported that he cleaned the well from top to bottom and that there were 64 ft. of 8-in. surface pipe and that a 6-in. casing extended from the surface to a depth of 345 ft. The diameter of the well, below the bottom of the 6-in. casing, was 6 in. The old 6-in. casing was removed and replaced with new pipe of the same kind and diameter. The pump cylinder and rods were repaired and re-installed. The cylinder was re-set at 150 ft. below the surface instead of the 140 ft. level as originally set.

The following pump equipment is in place: 220 ft. of 4-in. column pipe; Pomona turbine pump rated at 60 gpm.; the overall length of the pump is 7 ft.; 20 ft. of suction pipe with 18-in. strainer attached; 7 1/2-hp., 1750-rpm. Westinghouse electric motor. An air line was installed but has subsequently been removed because of leaks. The pump base is about 1 ft. below a ground surface elevation of 700± ft. MSL. datum.

On Nov. 12, 1946 a series of eight samples (Analyses Nos. 108278-108285) were collected at timed intervals after the pump had been idle for a period of 15 hr. The analyses show the presence of water from two sources. The first sample was of quality indicative of that which would remain in the column pipe at the end of the previous pumping period. The second sample collected after 5-minute pumping is noted to be of very low sulfate content and the succeeding samples indicate a gradual increase in sulfate and chloride contents. The accompanying increase in temperature indicates that at the end of the pumping period the greater portion of the water was being obtained from a lower depth in the well. The low temperature water from the upper portion of the well was entering at a very low rate.

Analysis of a sample (Lab. No. 112,719) collected Nov. 26, 1947 after pumping 1 hr. at 62 gpm. showed this water to have a hardness of 17.5 gr. per gal., a mineral content of 765 ppm., and an iron content of 0.2 ppm.

Analyses. Nos. 108278-108285
November 12, 1946
(Pumping at a rate of 75 gpm.)

Pumping Period	Temp. °F.	Fe ppm.	F ppm.	SO_4 ppm.	Cl ppm.	Alk. ppm.	Hd. ppm.	Res. ppm.
1 min.	55.2	1.7		293.7	80	304	284	870
5 min.	55.5	0.9	0.4	28.0	8	432	341	485
10 min.	57.2	0.5		113.3	30	388	310	588
15 min.	57.5	0.4		111.9	30	388	310	585
30 min.	58.6	0.2		116.6	31	384	310	587
45 min.	59.0	0.2		146.5	39	376	310	623
2 hr.	59.8	0.1		284.5	76	308	284	820
3 hr. 50 min.	60.0	0.1	1.3	327.3	86	292	284	902

LABORATORY NO. 112,719

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	18.4	
Manganese	Mn	0.0		Fluoride	F	0.9	
Calcium	Ca	72.3	3.62	Chloride	Cl	56.0	1.58
Magnesium	Mg	28.6	2.35	Nitrate	NO_3	4.4	0.07
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	213.5	4.44
Sodium	Na	153.6	6.68	Alkalinity (as $CaCO_3$)		328.	6.56
Turbidity		Tr.		Hardness (as $CaCO_3$)		299.	5.97
Color		0		Residue		765.	
Odor		0					
Temperature 59° F.							

ALGONQUIN
McHenry County
July 29, 1947

A public ground water supply was installed by the village of Algonquin (926) about 1895.

Water is obtained from gravel deposits located on a hillside about a mile northeast of the village. The site was leased originally for water supply purposes for a period of 99 years but is now owned by the village.

Lines of collecting tile were laid from 4 to 5 ft. below the ground surface at the bottom of a steep hill which is about 60 ft. high. Water is collected in shallow wells, about 5 ft. in diameter and depth at the site, approximately 100 ft. N. and 750 ft. W. of the S. E. corner of Section 27, T. 43 N., R. 8 E. The ground surface elevation is 800± ft. The wells are connected to a central collecting well from which the water flows by gravity to the distribution system.

For fire protection, water is pumped from the collecting well to a storage reservoir located about 1200 ft. west on a hillside about 60 ft. higher than the collecting well.

The supply does not exceed the maximum demand. On July 5, 1947, when industry was shut down, the flow to waste was estimated as 40 gpm. On July 28, 1947, when industry was in operation, there was no flow to waste. Two fountains flow freely at the village park and one of the distribution mains at the south end of the village is opened sufficiently to avoid stagnation in the system.

Analysis of a sample (Lab. No. 110,959) collected July 5, 1947 from the collection well overflow, showed this water to have a hardness of 19.5 gr. per gal., a residue of 360 ppm., and an iron content of 3.5 ppm. No iron was found to be present in samples collected in 1915 and 1922.

Mr. A. C. Kublank, water works superintendent, reported in Nov. 1948 that during the 1948 summer, a large part of the collecting tile had been dug up and cleaned. Some large chunks of roots were removed. Mr. Kublank stated - "We now have an overflow at all times."

The largest industrial consumer is the American Ironing Machine Co. For July 1947, an approximate estimate of the metered consumption, industrial use, flowing fountains, and opened main discharge, was 100,000 gpd.

LABORATORY NO. 110,959

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	3.5		Silica	SiO_2	26.1	
Manganese	Mn	0.0		Fluoride	F	0.3	
Calcium	Ca	68.5	3.43	Chloride	Cl	4.0	0.11
Magnesium	Mg	39.5	3.25	Nitrate	NO_3	0.9	0.01
Ammonium	NH_4	0.8	0.04	Sulfate	SO_4	13.8	0.29
Sodium	Na	0.2	0.01	Alkalinity (as $CaCO_3$)		316.	6.32
Turbidity		10		Hardness (as $CaCO_3$)		334.	6.68
Color		0		Residue		360.	
Odor		0		Free CO_2 (calc.)		24.	
Temperature 50.5° F.				pH = 7.55			

ALPHA
Henry County
Dec. 18, 1946

The village of Alpha (553) installed a water supply in 1900.

Water was obtained from a well 165 ft. deep into sand and gravel and located near the center of the business district. After a short time the village obtained water from a local utility company, but this supply became inadequate, and the village drilled another well nearby on the lot on which the elevated tank was located. The well was 580 ft. deep and 5 in. in diameter. This supply became inadequate and was abandoned after 6 to 8 months use, and in 1908 the village leased the Chicago, Burlington & Quincy R. R. well, which had been drilled in 1903 by the J.P.Miller Artesian Well Co., Brookfield.

The well is located approximately 2000 ft. S. and 800 ft. W. of the N. E. corner of Section 21, T. 14 N., R. 1 E. and was reported to be 1364 ft. deep below a ground surface elevation of 802± ft.

The well was reported to be cased with 12-in. pipe to a depth of 119 ft., with 170 ft. of 10 5/8-in. pipe with the bottom set at a depth of 284 ft., and 100 ft. of 8 1/4-in. pipe with the bottom at a depth of 375 ft. The diameter of the hole at the bottom was 8 1/4 in.

Originally, the well was equipped with a single-acting deep well pump with the cylinder attached to about 220 ft. of column pipe and with 18 to 20 ft. of suction pipe attached. The pumping equipment was later changed to the air lift type with the air lift assembly consisting of 1-in. air pipe inside a 3-in. eductor pipe, set at 600 ft. It is necessary to replace the air lift about every 5 or 6 years. In Dec. 1946, the eductor pipe was set at 645 ft., and the air lift was rated at 98 gpm.

Non-pumping water levels have been reported in ft. Below the ground surface as follows:

Year	Water Level ft.
1924	210
1928	221
1939	235

Analysis of a sample (Lab. No. 108,554), collected at the reservoir, 1500 ft. from the pump, Dec. 4, 1946 after 20-min. pumping, showed this water to have a hardness of 11.7 gr. per gal., a residue of 1051 ppm., and an iron content of 0.1 ppm.

Correlated driller's log of the Chicago, Burlington and Quincy R. R. well furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene and Pennsylvanian systems		
Glacial drift, shale, limestone, sandstone and coal	350	350
Mississippian system		
Kinderhook formation		
Shale	15	365
Devonian and Silurian systems		
Limestone	325	690
Ordovician system		
Maquoketa formation		
Shale	200	890
Galena - Platteville formations		
Limestone	320	1210
Glenwood formation		
Sandstone	50	1260
Shale	10	1270
St. Peter formation		
Sandstone	70	1340
Shale	4	1344
Shakopee formation		
Limestone	20	1364

LABORATORY NO. 108.554

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.1		Silica	SiO_2	26.3	
Manganese	Mn	0.0		Fluoride	F	2.4	
Calcium	Ca	46.8	2.34	Chloride	Cl	195.0	5.50
Magnesium	Mg	20.3	1.67	Nitrate	NO_3	3.4	.05
Ammonium	NH_4	0.5	.03	Sulfate	SO_4	323.6	6.73
Sodium	Na	298.1	12.96	Alkalinity	(as $CaCO_3$)	236.	4.72
Turbidity		0		Hardness	(as $CaCO_3$)	201.	4.02
Color		0		Residue		1051.	
Odor		0					
Temperature 57.6° F.							

Pumpage is estimated to be 25,000 gpd.

The city of Amboy (1986) installed a public water supply about 1892. Water is obtained from 2 wells.

Well No. 1, or North Well, was drilled to a reported depth of 2012 ft. in 1892 by the J. P. Miller Artesian Well Co., Brookfield, and located near East Ave. between Main and Center St. (or approximately 810 ft. S. and 1450 ft. W. of the N. E. corner of Section 22, T. 20 N., R. 10 E.). The surface elevation is 750t ft.

The well was cased with 10-in. pipe to 30 1/2 ft. and a 5-in. liner was placed between 1200 and 1400 ft. depths. The hole was 10 in. in diameter from 0 to 57 ft. and 6 in. in diameter to the bottom.

In 1932 the Layne North Central Co., Forest Park, measured the well and reported the depth to be 357 1/2 ft.

The existing pump assembly, made in 1942, consists of 90 ft. of 4 1/2-in. column pipe; 4-stage American Well Works turbine pump; 20 ft. of 4 1/2-in. suction pipe; 90 ft. of 1/4-in. air line; 40-hp. U. S. electric motor.

Non-pumping water levels have been reported as follows:

Year	Depth to Water ft.	
1897	0	
1915	10	
1921	15	
1933	25	
1942	8	(well out of service)
1945	10	

On July 29, 1947, thirty-five minutes after cessation of pumping in Wells No. 1 and 2, the water level in Well No. 1 was 17.9 ft. below the top.

Analysis of a sample (Lab. No. 111,084) collected July 16, 1947 at the end of a 5-hr. quality-source test following a one-week idle period, showed the water to have a hardness of 26.7 gr. per gal., a residue of 525 ppm., and an iron content of 7.8 ppm. The data showed the early samples to be composed almost entirely of water from the drift or upper portion of the well. During the period that the No. 2 well was in use the water quality indicated that about 80 per cent of the water was from this source (having a hardness of 40 gr. per gal.). When the No. 2 well pump was stopped, the No. 1 well rate of discharge was increased and the quality approached that obtained from the No. 2 well.

Water from Well No. 1 is discharged directly to the mains. The well is maintained for emergency use only.

Well No. 2 was drilled to a depth of 1100 ft. in 1924 by E. Stephenson, Chicago, and located 77 ft. southeast of Well No. 1 on the south side of the pumping station. The well is reported to be 12 in. in diameter at the top and 6 in. in diameter at the bottom. The casing record is not known. The bottom of the suction pipe strikes an obstruction at 162 ft. The elevation at the ground surface is 750± ft.

In 1933 when pumping at 190 gpm., the drawdown was reported to be 12 3/4 ft. below a non-pumping water level of 23 1/4 ft. below the top of the casing. A production test was made by the State Water Survey on Dec. 5, and 6, 1938. After pumping 8 hr. at 265 gpm., the drawdown was 62 ft. from a non-pumping water level of 26 ft. below the pump base plate. Starting and stopping the pump in Well No. 1 during the test was immediately reflected in water levels in Well No. 2. In Nov. 1945, when pumping at 350 gpm., the drawdown was reported to be 103 ft. from a non-pumping water level of 12 ft. On Dec. 10, 1947, after 2 1/2 hr. pumping at 340 gpm., the drawdown was 103 ft. from a non-pumping water level of 5 ft.

The pump assembly, installed in 1945, consists of 140 ft. of 6-in. column pipe; 12-in., 8-stage oil lubricated American Well Works turbine pump, No. 70184, rated at 350 gpm., against 220 ft. of head operating 1150 rpm.; overall length of pump is 12 ft.; 10 ft. of 6-in. suction pipe; 140 ft. of 1/4-in. air line; 40-hp. General Electric motor, No. 4319580.

Analysis of a sample (Lab. No. 112,906) collected Dec. 10, 1947 from Well No. 2 after 2 1/2 hr. pumping at a rate of 340 gpm., showed the water to have a hardness of 22.8 gr. per gal., a residue of 421 ppm., and an iron content of 1.9 ppm.

All water from Well No. 2 is chlorinated, softened and treated for iron removal.

Analysis of a sample (Lab; No. 112,901) collected Dec. 10, 1947 showed the treated water to have a hardness of 2.9 gr. per gal., a residue of 123 ppm. and an iron content of 0.1 ppm.

Sample-study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
No record	12	12
Sand and gravel	6	18
Till	3	21
Ordovician system		
Galena-Platteville dolomites	167	188
Glenwood formation		
Sandstone, incoherent	22	210
Sandstone, partly shaly	25	235
St. Peter formation		
Sandstone, incoherent	110	345
Conglomerate of sandstone, shale and chert	10	355
Shakopee dolomite	40	395
New Richmond sandstone and dolomite, some shale	70	465
Oneota dolomite, some sandstone in basal portion	195	660
Cambrian system		
Trempealeau dolomite	185	845
Franconia sandstone and thin shale beds	105	950
Galesville sandstone, thin dolomitic beds	150	1100

LABORATORY NO. 112,906

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.9		Silica	SiO_2	20.9	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	91.4	4.57	Chloride	Cl	9.0	0.25
Magnesium	Mg	39.6	3.26	Nitrate	NO_3	Tr.	Tr.
Ammonium	NH_4	0.5	0.02	Sulfate	SO_4	41.1	0.86
Sodium	Na	6.9	0.30	Alkalinity	(as $CaCO_3$)	352.	7.04
Turbidity		5.		Hardness	(as $CaCO_3$)	392.	7.83
Color		0		Residue		421.	
Odor		0		Temperature 55° F.			

LABORATORY NO. 112,901

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Fluoride	F	0.2	
Turbidity		0		Chloride	Cl	8.0	0.23
Color		0		Alkalinity	(as $CaCO_3$)	34.	0.68
Odor		0		Hardness	(as $CaCO_3$)	50.	1.00
				Total Mineral Content		123.	

Pumpage for 1947 averaged 150,000 gpd.

ANNA
Union County
Feb. 4, 1948

The city of Anna (4092) installed a public water supply in 1912. The distribution system has always been owned by the city, but water was purchased from the Central Illinois Public Service Co. until about 1937 when the company wells were purchased by the city.

. Water was originally obtained from a well called Central Illinois Public Service Well No. 1, which was reported to have been drilled about 1896 and located about 400 ft. west of the center of Market St. and 170 ft. south of the center of Vienna St. (or approximately 2100 ft. N. and 2040 ft. E. of the S.W. corner of Section 20, T. 12 S., R. 1 W.). The well was drilled to a depth of 650 ft. below a ground surface elevation of 604.9 ft., and was 12 in. in diameter to a depth of 100 ft. and 8 in. in diameter below that depth. The well was reported to have penetrated limestone for the entire depth.

Water was pumped by airlift, having a 4 1/2-in. airpipe extending to a depth of 350 ft. In 1912, the non-pumping water level was reported to be 68 ft. below the ground surface, and the pumping level between 80 and 90 ft. The capacity of the well was reported to be 290 gpm.

It was reported that when tested in June, 1924, this well produced 440 gprn. with a drawdown of 17 ft. below a non-pumping water level of 77 ft. from the top of the well.

The non-pumping water level, Dec. 2, 1927, was 94 ft.

On May 20, 1936, the non-pumping water level was 157.65 ft. below the top of the well. During a production test on city wells 1A and 2A, (located approximately 2200 ft. northeast), the water level in C.I.P.S. Well No. 1 was lowered 10.4 ft. after the city wells had produced an average of 405 gpm. for 33 hr., and C.I.P.S. Well No. 2 had produced an average of 240 gpm. for 30 hr.

This well was seldom used after the completion of C.I.P.S. Well No. 2 in 1929, and was abandoned and sealed in 1938 when attempts to ream and straighten the hole were unsuccessful.

Analysis of a sample (Lab. No. 51935) collected July 22, 1924, showed the water to have a hardness of 17.9 gr. per gal., a residue of 424 ppm., and an iron content of 1.0 ppm.

A well, known as C.I.P.S. Well No. 2, was drilled in 1929 by the Sewell Well Co., St. Louis, Mo., and located 335 ft. west of C.I.P.S. Well No. 1. This well was reported to be 650 ft. deep below a surface elevation of 621± ft.

The hole and casing record is given in Table 1.

The well is equipped as follows: 195 ft. of column pipe; 6-in., 9-stage, Fairbanks-Morse deep well turbine pump, having an overall length of 8 ft.; 20 ft. of suction pipe; 3 ft. of screen; 30-hp. Fairbanks-Morse electric motor.

Whenthe well was completed, it was reported to yield 300 gpm. with a drawdown of 80 ft. below a non-pumping water level of 110 ft.

During a test on May 21-22, 1936, the well produced an average of 243.9 gpm. for 29.5 hr.

The non-pumping water level in 1939 was reported to be 95-100 ft.

Well No. 2 is the principal producing unit of the city supply.

Analysis of a sample (Lab. No. 113,381) collected Feb. 4, 1948 after 1 1/2-hr. pumping at 400 gpm:, showed the water to have a hardness of 17.1 gr. per gal., a residue of 389 ppm., and an iron content of 0.1 ppm.

TABLE 1

Hole Record	Casing Record
10-in. from 174 to 650 ft.	16-in. from surface to 123 ft. 12-in. from surface to 174 ft. 10-in. from surface to 167 ft. 8-in. from 167 to 252 ft. Hook wall packer from 252 to 256 ft.

LABORATORY NO. 113,381

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	17.9	
Manganese	Mn	Tr.		Fluoride	F	0.1	
Calcium	Ca	103.7	5.19	Chloride	Cl	27.0	0.76
Magnesium	Mg	8.1	0.66	Nitrate	NO_3	21.5	0.35
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	37.2	0.77
Sodium	Na	26.4	1.15	Alkalinity (as $CaCO_3$)		256.	5.12
Turbidity		Tr.		Hardness (as $CaCO_3$)		293.	5.85
Color		0		Residue		389.	
Odor		Tr.		Free CO_2 (calc.)		40.	
Temperature		59.5° F.		pH = 7.2			

In 1934, W. L. Thorne Co., Des Plaines, drilled 2 wells in the western part of the city.

Well No. 1 was drilled to a depth of 787 ft. approximately 2000 ft. N. and 2000 ft. W. of the S. E. corner of Section 19, T. 12 S., R. 1 W.

Well No. 2 was drilled to a depth of about 428 ft. and was located approximately 1000 ft. N. and 1200 ft. W. of the S. E. corner of Section 19.

These wells produced very little water and were abandoned before completion because of extremely bad drilling conditions.

City Well No. 1A was drilled in 1935 by Sewell WellCo., St. Louis, Mo., and is located about 300 ft. north of Williams St. and 80 ft. W. of the east city limits, (or approximately 2250 ft. S. and 1270 ft. W. of the N. E. corner of Section 20). This well was drilled to a depth of 1031 ft. below a ground surface elevation of 595.4 ft.

When completed, the well was reported to produce 310 gpm. with a drawdown of 200 ft. from a non-pumping water level of 85 ft. below the ground surface.

The well was cased with 16-in. pipe to a depth of 100 ft., below which the hole was 13 in. in diameter.

The State Water Survey made a production test on Feb. 20, 1936. The test pump was a Byron Jackson turbine with the bottom of the suction

Sample-study log of Well No. 1A furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
No record	24	24
Mississippian system		
Meremac group		
St. Genevieve limestone	11	35
St. Louis Limestone	245	280
Salem limestone, partly shaly	215	495
Osage group		
Warsaw, Keokuk and Burlington limestones		
Limestone, partly shaly	195	690
Limestone	310	1000
Limestone, shaly	20	1020
No record	11	1031

pipe at a depth of 335 ft. Water levels were measured by an airline extending to a depth of 338 ft. After 8-hr. pumping at a rate of 204 gpm., the drawdown was 208 ft. from a non-pumping water level of 85 ft. below the surface, and the water level was still being lowered.

A production test was made by the State Water Survey May 21-22, 1936. The well produced an average of 325 gpm. with an average drawdown of 297 ft. from a non-pumping water level of 71 1/2 ft. below the well top.

In 1937, the well was reported to be equipped as follows: 400 ft. of column pipe; 6-in. Pomona turbine pump, No. N 1469, rated at 250 gpm. against 450 ft. of head; 50-hp. General Electric motor.

The non-pumping water level in 193 7 was reported to be about 300 ft. below the ground surface.

In 1939, water was pumped at a rate of about 250 gpm.

Well No. 1A is maintained as a stand-by unit and frequently used to meet increased summer demands at a rate to 260 gpm.

Analysis of a sample (Lab. No. 77453), collected Mar. 2, 1936, showed the water to have a hardness of 17.0 gr. per gal., a residue of 343 ppm., and an iron content of 12.0 ppm.

Well No. 2A was drilled in 1936 by Sewell Well Co., and located about 550 ft. north of the center of Lincoln St. and 250 ft. west of Limekiln Road (or approximately 1580 ft. S. and 2250 ft. W. of the N.E. corner of Section 20). This well was drilled to a depth of 1038 ft. below a ground surface elevation of 581.4 ft. and was cased with 16-in. pipe from the surface to 100 ft., below which the hole was 16 in. in diameter.

The State Water Survey made a production test May 21-22, 1936. The test pump consisted of a 13-stage, 8-in. turbine pump with the bottom of the suction pipe at a depth of 408 ft. 10 in. Power was furnished by a 25-hp. electric motor, and water levels were measured with a 1/4-in. airline extending to a depth of 418 ft. The well produced an average of 80 gpm. with a drawdown of 350 ft. from a non-pumping water level of 58 ft.

The well was equipped as follows: 410 ft. of column pipe; Pomona turbine pump, No. N 3757, rated at 70 gpm. against 460 ft. of head; 15-hp. General Electric motor.

Well No. 2A is maintained for emergency use.

Analysis of a sample (Lab. No. 78083) collected May 22, 1935, showed the water to have a hardness of 19.2 gr. per gal., a residue of 420 ppm., and an iron content of 20 ppm.

Well No. 3A was drilled by Sewell Well Co. in 1938, and was located about 300 ft. southeast of C.I.P.S. Well No. 1 or about 100 ft. S. of the treatment plant laboratory. The well was drilled to a depth of 1039 ft., and no water was encountered. The well was abandoned and plugged.

All water for the public supply is aerated, softened and chlorinated. Analysis of a sample (Lab. No. 114,107) collected Feb. 4, 1948, showed the treated water to have a hardness of 4.5 gr. per gal., a mineral content of 163 ppm., and an iron content of 0.06 ppm.

LABORATORY NO. 114,107

	ppm.	epm.			ppm.	epm.
Iron (total)	Fe 0.06		Fluoride	F	0.3	
			Chloride	Cl	30.0	0.85
Turbidity	0		Alkalinity	(as $CaCO_3$)	26.	0.52
Color	0		Hardness	(as $CaCO_3$)	77.	1.54
Odor	Tr.		Total Mineral Content		163.	
Temperature 59° F.			Free CO_2 (calc.)		0.	
			pH = 9.55			

In 1947, the total metered public supply averaged 388,000 gpd.

ANNA STATE HOSPITAL
Union County
Feb. 9, 1948

The greater part of the water supply for the Anna State Hospital is obtained from an impounding reservoir on Kohler Creek.

One well has been used at various times. This well was drilled sometime prior to 1911 and is located approximately 2000 ft. S. and 2700 ft. W. of the N. E. corner of Section 17, T. 12 S., R. 1 W. The well was drilled to a depth of 460 - 500 ft. below a surface elevation of 590t ft. and was cased to rock at a depth of 30 ft. with 20-in. pipe.

The State Water Survey made a production test July 11 and 12, 1941. The well produced 47 gpm. with a drawdown of 50 ft. from a non-pumping water level of 65 ft. below the ground surface.

In Aug. 1941, it was reported that the water was being pumped at a rate of about 70 gpm.

In Aug. 1941, the old pump was removed, and the well was equipped as follows: 8-in., 14-stage Pomona deep-well turbine pump, No. S.A. 2313; bottom of the suction pipe set at a depth of 238 ft.; 20-hp. Allis Chalmers electric motor.

The State Water Survey made another production test Sept. 3, 1941. Production was started at a rate of 189 gpm., but after 8 1/2-hr. pumping, the rate had decreased to 152 gpm.; and the water level was drawn below the bottom of the suction pipe.

In Aug. 1942, it was reported that the well was not in use at that time.

Analysis of a sample (Lab. No. 91356) showed the water to have a hardness of 17.6 gr.per gal., a residue of 374 ppm., and an iron content of 1.2 ppm.

This well has been condemned by the State Health Dept. and has not been used as a source of supply since July, 1945. In Aug., 1947, the pump was operated about 1 hr.and 40 min. when 15,000 gal. was pumped to waste. The water was very turbid and had a milky color.

The surface water supply is augmented by a ground water supply obtained from a limestone cave known as the Wilson Spring. It is located about 3 1/4 mile west of the Hospital (or approximately 400 ft. S.and 2300 ft.E. of the N. W. corner of Section 14, T. 12 S., R. 2 W.). Water flows into a collection basin from which it flows by gravity through a 4-in. pipe to the water works plant located about 2/3 mile south of the spring. The metered rate of flow to the plant at 1.1:30 A.M., Feb. 9, 1948 was 175 gpm. It is reported that the rate of flow varies slightly with the seasons and that it was 180 gpm. on Jan. 10, 1948, after a heavy rain. The water flows to a filter and to the clear well at the treating plant when the plant is in operation, otherwise it is diverted to waste through a sewer. Provisions are available for chlorination.

Analysis of a sample (Lab. No. 113,441) collected Feb. 9, 1948, showed the water from Wilson Spring to have a hardness of 14.0 gr. per gal., a residue of 277 ppm., and an iron content of 0.1 ppm.

The water used at the plant from Nov. 1, 1947, to Feb. 1, 1948, averaged 213,610 gpd. The Hospital demand averages about 0.5 mgd.

LABORATORY NO. 113,441

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	27.4	
Manganese	Mn	0.0		Fluoride	F	0.2	
Calcium	Ca	83.8	4.19	Chloride	Cl	6.0	0.17
Magnesium	Mg	7.6	0.63	Nitrate	NO_3	3.9	0.06
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	15.2	0.32
Sodium	Na	4.8	0.21	Alkalinity (as $CaCO_3$)		224.	4.48
Turbidity		Tr.		Hardness (as $CaCO_3$)		241.	4.82
Color		0.		Residue		277.	
Odor		0.		Free CO_2 (calc.)		36.	
Temperature		53.5° F.		pH = 7.2			

ANTIOCH
Lake County
Aug. 31, 1946

A public water supply was installed by the village of Antioch (1093) in 1907.

Water is obtained from 2 sand and gravel wells located about 500 ft. north of Channel Lake Rd. and 300 ft. west of Main St. These wells supply the entire public demand, and pumpage averages 70,000 gpd.

Well No. 1, also known as the North well, is located about 1900 ft. N. and 1200 ft. E. of the S. W. corner of Section 8, T. 46 N., R. 10 E. The elevation of the ground sur face is 780t ft. The well was drilled in 1907 to a depth of 216 ft. by Charles Thorne, DeKalb. It is reported cased with 207 ft. of 6-in.pipe and has 9 ft. of 4 1/2-in. Johnson screen in the bottom. Fine sand was encountered below a depth of 40 ft., grading into coarser sand below a depth of 180 ft.

The following pump installation, made on Nov. 3, 1932, is still in service: 100 ft. of 4-in. column pipe; 6-in., 5-stage Sterling turbine pump, No. S-568, rated at 100 gpm. against 210 ft. of head; 30 ft. of 4-in. suction pipe; 15-hp. U. S. electric motor.

A non-pumping water level of 40 ft. below the pump base was reported Nov. 3, 1932.

This well has served as a standby unit since 1938. Water is pumped once a week to keep the pumping equipment in working condition.

Well No. 2, also known as the South well, is located about 27 ft. south of No. 1. The elevation of the ground surface is 780± ft. This well was reported drilled to a depth of 226 ft. in 1919 and cased with 10-in. diameter pipe, the bottom of which was perforated and wrapped with fine wire.

Another report states that the well is cased to a depth of 200 ft. with 10-in. pipe and the lower 26 ft. with 8-in. pipe.

The bottom 20 ft. of the well was finished in coarse gravel, which is overlain with 50 ft. of fine sand. On July 11, 1938, the non-pumping water level was reported to be 40 ft. below the pump base.

The following pump installation was made in Dec. 1937 and is still in service: 100 ft. of 5-in. column pipe; 6-in., 5-stage Sterling turbine pump, No. S-2244, rated at 200 gpm. against 200 ft. of head; the overall length of the pump is 8 ft. 1/16 in.; 20 ft. of 4-in. suction pipe; 1 ft. of 4-in. strainer; 20-h'p. U. S. electric motor.

On Aug. 30, 1946 after a 1-hr. idle period, the non-pumping water level was reported to be 39 ft.; and after 30-minute pumping at 200 gpm., the water level was 61 ft. below the pump base.

Analysis of a sample (Lab. No. 107,551) collected Aug. 30, 1946, after 30-minute pumping at 200 gpm., showed this water to have a hardness of 15.9 gr. per gal., residue of 355 ppm., and an iron content of 0.2 ppm.

LABORATORY NO. 107,551

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	32.6	
Manganese	Mg	0.0		Fluoride	F	0.8	
Calcium	Ca	38.8	1.94	Chloride	Cl	3.0	0.08
Magnesium	Mg	43.9	3.52	Nitrate	NO_3	0.0	0.0
Ammonium	NH_4	0.1	Tr.	Sulfate	SO_4	59.4	1.24
Sodium	Na	22.5	0.98	Alkalinity (as $CaCO_3$)		256.	5.12
Color		0		Hardness (as $CaCO_3$)		273.	5.46
Odor		0		Residue		355.	
Turbidity		10-		Free CO_2 (calc.)		7.	
Temperature 52.6° F.				pH = 7.8			

The source of public water supply for the village of Apple. River (461) is a well drilled in 1940 by C. H. Coad & Son, Apple River, and located 18 ft. south of Hickory St. and 150 ft. east of Third St. (or approximately 1000 ft. S. and 1625 ft. W. of the N. E. corner of Section 19, T. 29 N., R. 4 E.).

The hole and casing diameter record is given in Table 1.

The drive pipe was removed, and the annular space outside the 8-in. casing was filled with cement grout.

A production test of the well was made by a representative of the State Water Survey Division on Sept. 19, 1940. Before the test started, the water level was 46 ft. below the ground surface elevation of 1005± ft. MSL. datum. After pumping 8 1/4 hr.at 100 gpm., the drawdown was 46 ft.; and after a 45-minute shutdown period, a recovery of 36 ft. in the water level was observed. At the time of the production test, the well was cased with the 23 ft. of 12-in. pipe, which was subsequently removed. The driller reported that a sufficient amount of water for drilling operations was not encountered until a depth of 130 ft. was reached.

The following pump installation, made in Sept. 1940, is in service: 120 ft. of 4-in. column pipe; 6-in., 18-stage (porcelain enameled bowls) Fairbanks-Morse turbine pump, No. 11407, rated at a capacity of 100 gpm. against 239 ft. of head; 120 ft. of 1/4-in. black air line (now defective); 20 ft. of 4-in. suction pipe; 10-hp. Fairbanks-Morse electric motor.

A water level of 42 ft. below the pump base was observed on Sept. 9, 1944 after an idle period of 17 hr.

Analysis of a sample (Lab. No. 108,581), collected Dec. 5, 1946 after 15-min. pumping at 100 gpm. (following 3 1/2 hr. of idle period after 3 1/2 hr. of continuous pumping at the same rate), showed the water in this well to have a hardness of 15.9 gr. per gal., a residue of 292 ppm., and an iron content of 0.2 ppm. Previous samples collected in 1940 showed this water to be of similar composition.

TABLE 1

Hole Record	Casing Record
12-in. from 0 to 58 1/2 ft.	12-in. drive pipe from 0 to 23 ft.
8-in. from 58 1/2 to 355 ft.	8-in. casing from 0 to 58 1/2 ft.
6-in. from 355 to 380 ft.	

Sample-study log of well drilled in 1940 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Ordovician system		
Maquoketa shale	10	10
Galena - Platteville dolomites, some limestone	322	332
Glenwood sandstone, some shale	8	340
St. Peter sandstone	40	380

LABORATORY NO. 108,581

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	16.4	
Manganese	Mn	0.0		Fluoride	F	0.3	
Calcium	Ca	58.7	2.94	Chloride	Cl	6.0	0.17
Magnesium	Mg	30.2	2.49	Nitrate	NO_3	1.9	0.03
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	21.0	0.44
Sodium	Na	0.9	0.04	Alkalinity	(as $CaCO_3$)	242.	4.84
Turbidity		0		Hardness	(as $CaCO_3$)	272.	5.44
Color		0		Residue		292.	
Odor		0		Free CO_2 (calc.)		41.	
Temperature		50.6° F.		pH = 7.2			

The estimated average pumpage is 21,000 gpd. during the winter and 27,000 gpd. during the summer.

About 75% of the residences are serviced but not metered. A local dairy using considerable water is metered.

APPLE RIVER CANYON
STATE PARK
Joe Daviess County
Jan. 4, 1947

Two wells are located in the Apple River Canyon State Park. These are used by the public for drinking purposes.

One of these wells is located about 50 ft. south of the south bank of the South Fork of Apple River about 300 ft. west of the principal parking space on the site of historic Millville (or approximately 1000 ft. N. and 2400 ft. W. of the S. E. corner of Section 4, T. 28 N., R. 4 E.). The elevation of the ground surface at the well is nearly 5 ft. above the bank of South Fork or 805± ft.

The well was drilled to a depth of 72 ft. by Stanley Coad, Apple River, in Dec. 1938, and is cased with 6-in. diameter pipe from the surface to rock at a depth of 32 ft. below which the hole is 6 in. in diameter to the bottom. The material overlying the rock consists largely of gravel.

A water level of 8 ft. below the surface was reported when the well was completed. The well is equipped with a hand pump which has a 2 3/4-in. diameter by 16-in. cylinder set at a depth of 39 ft. with 18 ft. of 1 1/4-in. diameter suction, pipe. The well produces about 12 gpm.

Analysis of a sample (Lab. No. 88415) collected July 26, 1940 after 1-minute pumping, showed the water from this well to have a hardness of 20.2 gr. per gal., a mineral content of 381 ppm., and no iron.

The second well was drilled by Stanley Coad in May 1941 and is located on the west bank of Apple River about 1/4 mile northwest of the first well (or approximately 1700 ft. N. and 1650 ft. E. of the S. W. corner of Section 4). The elevation of the ground surface is 810± ft.

The well was drilled to a depth of 100 ft. and was cased with 6-in. diameter pipe from the surface to a depth of 3 7 ft. below which the hole is 6 in. in diameter. Rock was encountered at a depth of 8 ft. below the surface, and the distance to water was 30 ft. below the surface when the well was completed.

The well is equipped with a hand pump having a 2 1/2-in. diameter by 14-in. cylinder set at a depth of 75 ft. with 18 ft. of 1 1/4-in. suction pipe. The well produces about 10 gpm.

A spring is located about 700 ft. northwest of the principal parking space (or approximately 1630 ft. N. and 2600 ft. W. of the S. E. corner of Section 4). On July 26, 1940, the flow was estimated to be 1/2 gpm.

Analysis of a sample (Lab. No. 88469), collected July 26, 1940,- showed the water from the spring to have a hardness of 19.8 gr. per gal., and a mineral content of 377 ppm. No iron was found to be present.

LABORATORY NO. 88415

	ppm.		ppm.
Iron (total) Fe	0.1	Chloride	1.0
		Alkalinity (as $CaCO_3$)	344.0
Turbidity	0	Hardness (as $CaCO_3$)	347.0
Color	0	Total Mineral Content	381.0
Odor	0		

A public water supply was installed by the city of Arcola (1837) in 1891.

Water was first obtained from a dug well located at the pumping station at the northeast corner of Oak and Jefferson St. (or approximately 1940 ft. N. and 1665 ft. W. of the S. E. corner of Section 4, T. 14 N., R. 8 E.). The well was 12 ft. in diameter and 70 ft. deep. The dug well is still in existance, but was converted into a collection reservoir in 1894. Another dug well, not owned by the city, located in the street in front of the old light plant, caved in.

About 1894, three 6-in. tubular wells were drilled at the pumping station and in 1896, another well was drilled at the same location. All wells were 103 ft. deep, and three of the wells were 5 ft. apart. In Dec. 1912, only three wells were in service, including a 6-in. well at the ice plant, 30 ft. north of the pumping station, which was not owned by the city. The non-pumping water level was 55 to 65 ft. below the ground surface elevation of 680± ft. In 1918, there were three wells still in service, one of the wells located at the pumping station on the alley and the other two in Oak St., one about 60 ft. north and the other well 320 ft. north of the pumping station. All other wells at the pumping station site had been aban-. doned. In 1921, two more wells were drilled in Oak St. and all water was then obtained from the four wells in Oak St.

Well No. 1 (southernmost well in Oak St.), is 8 in. in diameter and 105 ft. deep, penetrating 4 ft. of sand.

On Jan. 10, 1918, the water level was 50 ft. below the surface and in the fall of 1920, after 3-days non-pumping, the water level was 70 ft. below the surface.

In Mar. 1940, the well was acidized and cleaned out and an 8-ft. length of screen, with No. 20 slot openings, was placed in the bottom. After the acid treatment, the yield rate was reported to be 7 gpm.

At the same time, the pump was removed from Well No. 4 and installed in Well No. 1. The present pumping equipment consists of an A. D. Cook 2-stroke plunger pump, No. 1108, with a 4 3/4-in. cylinder and 18-in. stroke; 3-hp. electric motor.

Well No. 1 has been out of service since 1947.

Analysis of a sample (Lab. No. 87,523) collected Mar. 25, 1940, showed this water to have a hardness of 28.3 gr. per gal., a residue of 925 ppm., and an iron content of 11.6 ppm.

Well No. 2, (320 ft. north of the pumping station), is 8 in. in diameter. In Mar. 1940, the well was acidized and later produced about 15 gpm. The Cook plunger pump, No. 1107 was disconnected and the well abandoned.

Well No. 3 was drilled in 1921 to a depth of 101 ft. and is located in Oak St. 170 ft. north of Well No. 2. The well is cased with 12-in. pipe below which was set a Cook screen, 10 ft. long, and with No. 20 slot openings. A 9-ft. stratum of coarse sand and gravel was penetrated.

On Jan. 2, 1922, the water level was 40 ft. and after pumping 24 hr. at 50 gpm., the drawdown was 13 ft. The well was surged and cleaned out in Mar. 1940.

Well No. 3 failed on Nov. 19, 1947 and has been out of service since. At that time the pumping water level was below the 90-ft. air line. On June 24, 1948 the water level was 50 ft. below the pump base.

The pumping equipment, installed in Mar. 1940 is still in place and consists of 90 ft. of 4 1/2-in. od. column pipe; 7-in., 4-stage American Well Works turbine pump, No. 63299, rated at 100 gpm. against 95 ft. of head at 1750 rpm.; the length of the[1] pump is 4 ft.; 90 ft. of 1/4-in. copper air line; 3 1/2 ft. of 4-in. suction pipe; 5-hp. U.S. electric motor, No. 176375.

Analysis of a sample (Lab. No. 87,524) collected Mar. 25, 1940, showed this water to have a hardness of 20.2 gr. per gal., a residue of 603 ppm., and an iron content of 5.6 ppm.

Well No. 4 was drilled in 1921 to a depth of 104 ft. and located 200 ft. north of Well No. 3 and 690 ft. north of the pumping station. The well was cased with 12-in. pipe below which was set 6 ft. of Cook screen with No. 2 5 slot openings. An 18-in. stratum of sand was penetrated.

The well was given an acid treatment in Mar. 1940, following which the present pumping equipment was installed: 90 ft. of 4 1/2-in. column pipe; 7-in., 4-stage American Well Works turbine pump, No. 63298, rated at 100 gpm. against 95 ft. of head at 1750 rpm.; the length of the pump is 4 ft.; 7 ft. of 4-in. suction pipe; 90 ft. of 1/4-in. copper air line; 5-hp. U. S. electric mo-

tor, No. 190091.

A production test was made of Wells 1,3, and 4 on Mar. 25, 1940 by the State Water Survey. A pump was not installed in Well No. 2 at the time. Before the test, the water level in Wells 3 and 4 was 47 1/2 ft. below the surface. With no pumping in Wells 1 and 3, water was pumped from Well No. 4 for two hours at a rate of 52 gpm. with a drawdown of 42 1/2 ft. At the same time, the water was lowered two feet in Well No. 3. With no pumping in Wells 1 and 4, water was pumped from Well No. 3 for 2 1/4 hr. at 57 gpm. with a drawdown of 38 3/4 ft. in Well No. 3 and 2 ft. in Well No. 4. Then with simultaneous pumping in Wells 3 and 4 for one hour at 56 and 49 gpm. respectively, the drawdown in Well No. 3 was 40 ft. and in No. 4 was 42 1/2 ft. Thirteen minutes after stopping the pumps, the water level in Wells 3 and 4 returned to 5 ft. below the starting level.

Well No. 4 also failed on Nov. 19, 1947 and has been out of service since. The pumping equipment is still in place and the water level on June 24, 1948 was 50 ft. below the pump base.

Analysis of a sample (Lab. No. 87,525) collected Mar. 25, 1940 showed the water in Well No. 4 to have a hardness of 19.1 gr. per gal., a residue of 618 ppm., and an iron content of4.8 ppm.

Well No. 1 A was drilled in 1947 to a depth of 104 ft. 8 in. below the top of the casing (3 ft. above normal ground level) by E. C. Baker and Sons, Sigel. The well is located about 10 ft. north of Madison St., on the east side of the alley between WalnutSt.and U.S. Highway No. 45 (or approximately 2280 ft. N. and 2150 ft. W. of the S. E. corner of Section 4). The ground surface elevation at the well-site is 680± ft.

A water-bearing formation of coarse sand and gravel was reported to be encountered at the bottom 14 ft. of the well.

The well was cased with 10-in. pipe, with a 12-ft. length of 10-in. Johnson Everdur screen having No. 100 slot openings.

The well was not equipped for pumping on June 24, 1948 but the equipment was on hand to be installed and consisted of 90 ft. of 4-in. column pipe;7-in., 10-stage Peerless oil-lubricated turbine pump, No. 50592, rated at 125 gpm. against 200 ft. of head; 100 ft. of 1/4-in. copper tubing for air line; 10-hp. General Electric motor.

On Feb. 16, 1949 the non-pumping water level was reported to be 65 ft. and after 24-hr. pumping the drawdown was 18 ft.

Analysis of a sample (Lab. No. 117,297) collected Feb. 16, 1949 showed the water from Well 1 A to have a hardness of 27.1 gr. per gal., a residue of 690 ppm., and an iron content of 10.7 ppm.

Well No. 2 A was drilled in 1945 to a depth of 128 ft. by E. C. Baker and Sons, before drilling Well No. 1 A, and was located at the north end of Walnut St., about 35 ft. south of the Pennsylvania R. R. (or approximately 2580 ft. S. and 2200 ft. W. of the N. E. corner of Section 4). This is about one block north and one-half block west of Well No. 1 A.

Correlated driller's log of Well No. 1 A furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil	2 1/2	2 1/2
Yellow Clay	9 1/2	12
Blue clay	54	66
Mud sand	4	70
Blue clay	6	76
Peat and clay	14	90
Sand, gravel	12	102
Blue clay	3	105
Peat clay	6	111
Greenish sandy clay	3	114

During drilling, water-bearing formations of sand and gravel were encountered between 67 and 72 ft. and between 95 -and 122 ft. The well was cased with 10-in. pipe and with a 21-ft. exposed length of 10-in. Johnson Everdur screen, having smaller slot openings at the top and larger slot openings at the bottom.

Well No. 2 A was placed in service Nov. 19, 1947 and the pumping installation consisted of 113 1/2 ft. of 4-in. column pipe! 7-in., 11-stage Peerless turbine pump, No. 33305, rated at 125 gpm. against 215 ft. of head; the overall length of the pump is 6 1/2 ft.; 114 ft. of 1/4-in. copper air line; 10-hp. U. S. electric motor.

A production test was made after the pump installation. After 30-min. pumping at 125 gpm. the drawdown was reported to be 14 ft. from a static water level of 54 ft. below the pump base (3 1/2 ft. above normal ground level). Equilibrium was maintained for the remainder of the 8-hr. test.

Analysis of a sample (Lab. No. 115,102) collected June 24, 1948 after 20-min. pumping at 125 gpm. showed the water from Well No. 2 A to have a hardness of 16.9 gr.per gal., a residue of 582 ppm., and an iron content of 6.0 ppm.

LABORATORY NO. 115,102

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	6.0		Silica	SiO_2	26.3	
Manganese	Mn	0.3		Fluoride	F	0.2	
Calcium	Ca	67.6	3.38	Chloride	Cl	51.0	1.44
Magnesium	Mg	29.3	2.41	Nitrate	NO_3	0.2	Tr.
Ammonium	NH_4	15.1	0.85	Sulfate	SO_4	0.6	0.01
Sodium	Na	112.5	4.89	Alkalinity (as $CaCO_3$)		504.	10.08
Turbidity		50		Hardness (as $CaCO_3$)		290.	5.79
Color		25		Residue		582.	
Odor		0		Free CO_2 (calc.)		159.	
Temperature		55.5° F.		pH = 6.9			

Pumpage is estimated to average 60,000 gpd.

The village of Arenzville (494) installed a public water supply in 1947.

An electrical earth resistivity survey was conducted by the State Geological Survey in the south and west portions of the corporate limits of the town on June 4-5, 1946.

Test Well No. 1 was drilled in Sept. 1946 by Layne-Western Co., Chicago, and located about 75 ft. south and 90 ft. east of the northwest corner of the corporation limits (or approximately 1400 ft. S. and 2300 ft. W. of the N. E. corner of Section 31, T. 17 N., R. 11 W.). The ground surface elevation is 480± ft.

The well was drilled to a depth of 60 ft. and was cased with 8-in. id. pipe from 10 in. above to 40 ft. below the ground surface, and with 6-in. id. pipe from 10 in. above to 54 ft. below the ground surface. A 6 5/8-in. diameter Keystone screen, 8 ft. 2 in. overall (6 ft. effective length), was installed with the bottom at a depth of 60 ft. The screen had No. 30 slot openings.

For test purposes, a turbine pump, driven by a gasoline engine, was installed. The bottom of the suction pipe was at a depth of 52 ft. below the ground surface. A production test was made by the State Water Survey on Oct. 3, 1946. The well produced 51 gpm. with a drawdown of 26.5 ft., and 39 gpm. with a drawdown of 24.5 ft. from a non-pumping water level of 12.5 ft. below the ground surface.

The permanent city well was completed to a depth of 60 ft. by the Layne Western Co. in Mar. 1947 at the location of Test Well No. 1.

An 8-in. od. casing and an 18-in. od. casing were installed from 3 ft. above to a depth of 50 ft. below the ground surface. The Layne-Bowler shutter, No. 6 slot screen is 10 ft. long. The upper 5 ft. is 8-in. in diameter, and the lower 5 ft. is cone-shaped, 8-in. in diameter at the top and 16 in. at the bottom.

A production test was made bythe State Water Survey on Mar. 30, 1947. The non-pumping water level was 16 ft. below the top of the casing. The following data were observed during the test:

Rate of Pumpage gpm.	Time hr.	Drawdown ft.
60	2	8
81	3	10.5
100	1	12.5

The water level in an observation well, located 100 ft. east of the city well, was lowered 0.35 ft. during the test.

Permanent pumping equipment was installed as follows: 50 ft. of 5-in. column pipe; 8-in., 7-stage, Layne Bowler turbine pump, No. 16868, 4 ft. 11 in. overall length, rated at 100 gpm. against 200 ft. of head, when operating at 1750 rpm;4-in. suction pipe; 50 ft. of 1/4-in. air line; 7 1/2 hp. U. S. electric motor, No. 526148, operating at 1800 rpm. The bottom of the turbine is 8 ft. 2 in. above the bottom of the well.

In 1947, it was reported that the drawdown was 15.7 ft. from a non-pumping water level of 13.7 ft. below the top of the casing when pumping at an estimated rate of 135 gpm. On May 5, 1948, when pumping at 100 gpm. the drawdown was 4 1/2 ft. from a non-pumping water level of 34 ft.

Analysis of a sample (Lab. No. 114,564) collected May 5, 1948 after 40-min. pumping at 100 gpm., showed the water to have a hardness of 20.6 gr. per gal., a residue of 391 ppm., and an iron content of 0.2 ppm.

LABORATORY NO. 114,564

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	23.4	
Manganese	Mn	0.1		Fluoride	F	0.1	
Calcium	Ca	88.0	4.40	Chloride	Cl	12.0	0.34
Magnesium	Mg	32.5	2.68	Nitrate	NO_3	35.8	0.58
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	53.9	1.12
Sodium	Na	0.0	0.00	Alkalinity	(as $CaCO_3$)	252.	5.04
Turbidity		Tr.		Hardness	(as $CaCO_3$)	354.	7.08
Color		0		Residue		391.	
Odor		0					
Temperature 57° F.							

Pumpage is estimated to average 10,500 gpd.

ARLINGTON
Bureau County
July 30, 1947

A public water supply was installed by the village of Arlington (258) in 1893.

The original well became clogged with sand, and two wells were drilled 3 ft. apart at a location 50 ft. north of the Chicago, Burlington, & Quincy R. R. and 150 ft. east of State Highway 89 (or approximately 1200 ft. S. and 2100 ft. W. of the N. E. corner of Section 8, T. 17 N., R. 11 E.). The elevation of the tops of the wells is 750± ft.

The wells are 6 in. in diameter and 94 ft. deep. They penetrate a sand and gravel stratum to a depth of about 6 ft. At one time, both wells were equipped with fine screens, but the fine screen was removed from one well and replaced by a 4 1/2-in. pipe perforated with 1/4-in. holes.

The wells were equipped with deep-well pumps with 3 3/4-in. cylinders attached to 4-in. drop pipe at a depth of about 40 ft. The length of the stroke was 10 in. Both pumps were operated from one crank, belt-driven from a 10-hp. electric motor.

In 1923, the non-pumping water level was reported to be about 20 ft.

The deep-well pumps have been removed recently. The East Well has been equipped with a Jacuzzi jet pump, Unit No. 130262. It is powered by a 3-hp., 1715-rpm. General Electric motor, No. TCJ 6696062. The pump is set at 74 ft., and the discharge has been throttled down to 15 to 18 gpm. to prevent over-pumping.

The non-pumping water level, when the Jacuzzi pump was installed, was 48 ft. below the pump house floor.

A smaller pump may be placed in the West Well for emergency use.

Analysis of a sample (Lab. No. 111,313), collected July 30, 1947 from a tap at the pump, after pumping 6 hr., showed this water to have a hardness of 21.0 gr. per gal., a residue of 392 ppm., and an iron content of 1.9 ppm.

LABORATORY NO. 111,313

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.9		Silica	SiO_2	22.6	
Manganese	Mn	Tr.		Fluoride	F	0.1	
Calcium	Ca	82.3	4.12	Chloride	Cl	10.0	.28
Magnesium	Mg	37.6	3.09	Nitrate	NO_3	1.1	.02
Ammonium	NH_4	0.1	.01	Sulfate	SO_4	44.6	.93
Sodium	Na	5.8	.25	Alkalinity	(as $CaCO_3$)	312.	6.24
Turbidity		10+		Hardness	(as $CaCO_3$)	361.	7.22
Color		0		Residue		392.	
Odor		0					
Temperature 53° F.							

The water is not treated.

Pumpage is estimated to be about 8000 gpd.

ARLINGTON HEIGHTS
Cook County
Feb. 3, 1949

Water works were installed by the village of Arlington Heights (5668) in 1900, primarily for fire protection. The initial supply was obtained from a 5-in. flowing well, 127 ft. deep, and located west of the intersection of Wing St. and Davis St. (or approximately 1100 ft. N. and 150 ft. E. of the S. W. corner of Section 29, T.42 N.,R. 11 E.).

With increasing water demands, additional wells were drilled close to the original well, forming a group of 4 wells drilled at this central location at a ground surface elevation of 697± ft. Three of the wells drilled in this group were productive and furnished the entire public water supply until about 1924 when their yield was insufficient to meet the demands of a growing population.

Two. additional limestone wells were then drilled. One, now known as Well No. 2, located at the southwest corner of Chestnut Ave. and Hawthorne Ave. was drilled to a depth of 251 ft.; and another, now known as Well No. 3, at the northwest corner of Douglas Ave. and Foundry Rd., was drilled to a depth of 180 ft. The productive capacities of these additional wells did not prove sufficient to meet the increasing demands. The Citizens Committee reported on Mar. 21, 1932 that the maximum capacity of all wells was then 355 gpm., which was insufficient during the summers of 1930 and 1931.

Connection was made with the Arlington Park Jockey Club well which resulted in alleviating the water shortage in the summers of 1932, 1933, and 1934. The water supply at the Club is obtained from 2 wells, 320 and 920 ft. deep, delivering 150 and 350 gpm., respectively.

In 1941, a sandstone well, now called Well No. 4, was drilled to a depth of 1555 ft. at a location 100 ft. west of Kennicott Ave. and 100 ft. north of Wing St. This well has been the principal source of the public water supply since it was placed in service in Apr. 1942.

The most recent addition to the ground water supply is a 1525-ft. sandstone well, now known as Well No. 5, located at the northwest corner of Douglas Ave. and Foundry Rd. about 10 ft. north of Well No. 3. This well was completed and put into service in May 1946.

The original 5-in. well was reported to be 127 ft. deep when drilled, but when sounded on Nov. 21, 1923, it was 118 ft. deep. In 1900 the well flowed into a collecting reservoir but ceased flowing when a second well, now called No. 1, was drilled in 1909. In July 1914 the water level was 12 ft. below the ground surface, but the yield of the well is not known.

The 5-in. well was abandoned in 1920 and fitted with a wooden plug. It was capped and sealed with concrete in 1935.

Well No. 1 is located about 40 ft. southwest of the old 5-in. well and 25 ft. north of Wing St. It is 10 in. in diameter and was drilled to a depth of 140 ft. It is cased to rock at a depth of 117 ft. and penetrates 23 ft. of limestone.

In July 1914, the water level in Well No. 1, and also the 5-in. well, was 12 ft. below the ground surface; and the yield of Well No. 1 amounted to 125 gpm. On Apr. 23, 1918, the non-pumping water level was reported to be 40 ft., and the pumping water level was 60 ft. in both wells which were then producing 130,000 gpd.

Well No. 1 is still in service as an auxiliary pumping unit. The existing pump installation con-

LABORATORY NO. 106,245

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.6		Silica	SiO_2	12.5	
Manganese	Mn	0.1		Fluoride	F	0.7	
Calcium	Ca	69.7	3.49	Chloride	Cl	9.0	0.25
Magnesium	Mg	44.6	3.66	Nitrate	NO_3	1.2	0.02
Ammonium	NH_4	0.6	0.03	Sulfate	SO_4	447.6	9.31
Sodium	Na	101.2	4.40	Alkalinity	(as $CaCO_3$)	100.	2.00
Color		0		Hardness	(as $CaCO_3$)	358.	7.16
Odor		0		Residue		751.	
Turbidity		30					
Temperature		50.7° F.					

sists of 100 ft. of 5-in. column pipe; 6-in., 10-stage American Well Works turbine pump rated at 220 gpm. against 185 ft. of head; no suction pipe; 100 ft. of airline; 20-hp. U. S. electric motor.

The elevation of the pump base is 696.8 ft. On Apr. 18, 1946, the water level was 25 ft. below the pump base, and the drawdown was 61 1/2 ft. after 1 1/2-hr. pumping at 240 gpm.

Analysis of a sample (Lab. No. 106,245) collected at the end of this period, showed the water to have a hardness of 20.8 gr. per gal., a mineral content of 751 ppm., and an iron content of 1.6 ppm. This water appears to be typical for waters from the Silurian dolomite in this vicinity.

During the years 1943, 1944, and 1945, the pumpage from Well No. 1 averaged 45,000 gpd., which varied from a winter minimum of 9200 gpd. to a summer maximum of 83,500 gpd.

Another 10-in. well was drilled in 1920 to a depth of 143 ft. at a location 3 ft. distant from the abandoned 5-in. well and about 40 ft. northeast of Well No. 1. The combined capacity of the two 10-in. wells was reported to be 225 gpm. in Nov. 1923, but pumping at this rate could not long be sustained, consequently the pumps were alternated at rates of 110 to 115 gpm. After 8-hr. operation on Nov. 21, 1923, the wooden plug was removed in the abandoned 5-in. well, and the distance to water measured 67 ft. The operation of the two 10-in. wells was continued in the same manner until 1935 when Well No. 1 was cleaned out, and the second 10-in. well was capped and sealed.

A 12-in. well was drilled in 1919 and 1920 at a location 40 ft. southeast of the 5-in. well, 80 ft. distant from well no. 1, and about 12 ft. north of Wing St. A report in 1920 stated that it was cased to rock and penetrated rock between the depths of 120 ft. 8 in. and 195 ft., below which it passed through 15 ft. of shale into red shale to the bottom at a depth of 253 ft. It was "shot" with 25 lb. of dynamite and was then found to have filled to a depth of 108 ft. The well was abandoned.

Well No. 2, (formerly known as No. 4) is located at the southwest corner of Chestnut Ave. and Hawthorne St. (or approximately 2150 ft. S. and 110 ft. W. of the N. E. corner of Section 30). The elevation of the pump base is 724.4 ft.

This well was originally 12 in. in diameter and 251 ft. deep. No data are available relative to its original construction and capacity. It was deepened by Henry Boysen, Jr., in 1934, to a total depth of 923 ft., and in July 1947, the well was deepened to 1345 ft. by Milaeger and Smyth, Milwaukee.

The hole and casing diameters are given in Table 1.

On Dec. 4, 1934 the water level was 102 ft. below the pump base after the well had been idle 36 hr. On Dec. 26, and 27, 1934, the water level was 265 ft. below the pump base after 48-hr. pumping at 450 gpm.

An accidental flushing of the well on Nov. 10, 1940, when the water from the elevated storage tank flowed back into the well after the pump was stopped, eliminated gas from the well, which had been objectionable for several months. The discharge, which had declined to 200 gpm., was increased to 270 gpm. On May 14, 1941 the non-pumping water level was 161 ft. below the pump base, and the drawdown was 95 ft. when pumping at 260 gpm.

In Dec. 1941, the pump was pulled, and a section of the column pipe at 140 ft. below the pump base was found to have a hole about 1 1/2 in. by 3/4 in. A flange bolt at this point was worn almost through. It was evident that the hole had been cut by pumping sand. The casing opposite this point had also been cut allowing clay to wash down into the well.

The well was found to be 909 ft. deep and was cleaned out to the original depth of 923 ft. The

TABLE 1

Hole Record	Casing Record
12-in. from 0 to 455 ft.	12-in. from 0 to 161 ft.
10-in. from 455 to 923 ft.	10-in. from 127 to 455 ft.
8-in. from 923 to 1345 ft.	8-in. finer from 554 to 602 ft.

column pipe was not otherwise eroded but had a very heavy coating of soft iron oxide on both the inside and outside surfaces. Two lengths of the column pipe were replaced, and the pump was re-installed at the former setting of 300 ft.

During the summer of 1942, numerous complaints were received concerning the orange and brown sludge appearing in the water, mainly from this well when the pump was first started. A mineral analysis of a sample of water collected Aug. 5, 1942 from the pump discharge at the start of pumping indicated an iron content of 4,4 ppm., and another sample taken after 10-minute pumping indicated only 0.1 ppm. The sludge from this well also showed the presence of some crenothrix(ironbacteria). These objectionable conditions were overcome to some extent by wasting the water first pumped until it cleared, flushing hydrants regularly to clear old iron deposits in the mains, and treating the well and pump with chlorine to clear up the growth of iron bacteria.

During the years 1943, 1944, and 1945, the well served mainly as an auxiliary supply unit during the summer months when the pumpage averaged about 67,000 gpd. from this well. In the summer of 1945 the following water levels in feet below the pump base were observed:

Depth to Water

Date	Non-Pumping ft.	Pumping ft.
June 2	160	
June 23		260
Aug. 6	265	

On May 3, 1946 the following pumping equipment, which was installed in Mar. 1943, was removed: 350 ft. of 6-in. od. column pipe; 8-in., 18-stage Pomona turbine, rated at 350 gpm. against 420 ft. of head; 18-in. tapered strainer; 50-hp. U. S. electric motor.

The depth to water when the pump was pulled on May 2, 1946 was 150 ft. after the well had been idle since Aug. 31, 1945.

The pumping equipment was installed for temporary use in Well No. 5, completed in Mar. 1946.

When repairing and deepening the well in May-June 1947, four shots of 50 lb. each of 100% blasting gelatin were discharged at levels of 1300, 1275, 1250 and 1225 ft. It was reported that following the shooting, 4 yd. of material was bailed from the well.

On Feb. 3, 1949, the non-pumping water level was 246 ft. and after 15-minute pumping at 445 gpm. the drawdown was 58 ft.

Well No. 3 (formerly known as Well No. 5), is located north of the Northwest Highway at the northwest corner of Douglas Ave. and Foundry Rd. (or approximately 150 ft. N. and 2585 ft. E. of the S. W. corner of Section 29). The elevation of the top of the pump base is 697.2 ft. Very little information is available concerning its original construction and productive capacity. It was reported to be drilled about 1928 to a depth of 180 ft. and has a 12-in. casing at the top. The hole is 10 in. in diameter at the bottom.

The well was equipped with 140 ft. of 5-in. column pipe; 6-in., 10-stage American Well Works turbine pump, rated at 220 gpm. against 185 ft. of head; 20-hp. U. S. electric motor. The discharge of this unit was 85 gpm.

Analysis of water samples, collected Aug. 5, 1942, showed the following iron content: the sample at the start of pumping showed 1.2 ppm., and a sample taken after 10-minute pumping showed 0.8 ppm.

A non-pumping water level of 27 ft. below the pump base was reported on Jan. 5, 1943. Due to its limited yield and high iron content, the well was seldom used and was held as an emergency unit. In July 1945 the pumping equipment was removed, and the well abandoned.

Well No. 4, (formerly known as No. 6) is located about 100 ft. west of Kennicott Ave. and 100 ft. north of Wing St. (or approximately 1100 ft. N. and 2500 ft. E. of the S. W. corner of Section 30). The elevation of the pump base is 708.8 ft.

This well was drilled by Milaeger in 1941. When the drilling had reached the base of the St. Peter sandstone at a depth of 912 ft. in May 1941, a preliminary production test was made by the driller. After 8-hr. pumping at 93 gpm., the drawdown was 127 ft. from a water level of 152 ft. Due to dissatisfaction with the yield of the well and questionable benefits to be obtained by "shooting" the St. Peter sandstone, the well was deepened to a final depth of 1555 ft.

The hole and casing diameter record is given in Table 2.

TABLE 2

Hole Record	Casing Record
13-in. from 162 1/2 to 425 ft.	16-in. od. from surface to 142 1/2 ft.
10-in. from 425 to 1555 ft.	14-in. od. from surface to 162 1/2 ft.
	10-in. id. liner from 191 to 425 ft.

A lead packer was placed at the top of the liner, and a clay seal at the bottom.

A 24-hr. test made on Oct. 27 and 28, 1941, showed a production of 300 gpm., with a drawdown of 129 ft. below a non-pumping water level of 128 ft. below the pump base. Following the production test, the well was "shot" with 7 charges, each composed of 100 lb. of 80% dynamite placed, in order of detonation, at depths of 1300, 1285, 1270, 1250, 1230, 1210, and 1165 ft.

After the "shooting" and cleaning, a second production test was made on Dec. 22 and 23, 1941. The water level before the test was 180 1/2 ft. indicating a drop of 51 1/2 ft. since the previous test in October. At the end of 24-hr. pumping at 405 gpm., the water level was 277 1/2 ft., or a drawdown of 97 ft.

The following pump installation, made in Apr. 1942, is still in service: 330 ft. of 6-in. column pipe; 10-in., 8-stage Pomona turbine pump, rated at 400 gpm. against 310 ft. of head; the overall length of the pump is 5 ft. 4 in.; 24-in. tapered strainer; 330 ft. of air line; 50-hp. Westinghouse electric motor.

The record of water levels during 1945 showed a non-pumping level of 220 ft. below the pump base and a level of 275 ft. after long pumping periods at 360 gpm. On Apr. 15, 1946 the water level, after a 4-hr. idle period, was 226 ft.; and on Apr. 17, 1946, the water level, after 56-hr. pumping at 360 gpm., was 278 ft.

TABLE 3

Hole Record

19-in. from 0 to 422 ft.
13 1/4-in. from 422 to 1000 ft.
12-in. from 1000 to 1525 ft.

Casing Record

20-in. steel casing from 0 to 111 ft.
14-in. od. steel casing from 0 to 422 ft.
10-in. steel liner from 899 to 1000 ft.

Analysis of a sample (Lab. No. 106,247) collected Apr. 17, 1946 after 56-hr. pumping at 360 gpm., showed the water from this well to have mineral content very similar to that obtained from the No. 5 well. The temperature was 57° F.

This well has been the principal source of the public supply since it was placed in service in Apr. 1942. From June 1, 1943 to Jan. 1, 1946 the metered pumpage averaged 454,400 gpd. The water is pumped directly to the distribution system.

Well No. 5 was drilled by Milaeger at the northwest corner of Douglas Ave. and Foundry Rd., 10 ft. north of Well No. 3 (or approximately 165 ft. N. and 2585 ft. E. of the S. W. corner of Section 29). This well was completed to a depth of 1525 ft. in Mar. 1946 and "shot" at depths of 1230, 1250, 1270, and 1290 ft. with 100-lb. charges of blasting gelatin. The elevation of the ground at the top of the well is 689± ft.

The driller's record of hole and casing diameters is as shown in Table 3.

The annular space outside the 14-in. casing was cement grouted.

On Mar. 6, 1946, the depth to water was 185 ft. below the top of the casing. A production test was conducted on Apr. 13 and 14, 1946. The water level before the test was 185 ft.; and after pumping 20 hr. at 870 gpm., the drawdown was 84 ft. After the test, the well was again cleaned out and all sand removed. The depth of the well was then found to be 1531 ft., and the water level was 185 ft. 4 in. below the top of the casing.

The temporary pump assembly removed from Well No. 2 was installed in Well No. 5 in May 1946. The existing pumping equipment, installed in 1947, consists of 350 ft. of 8-in. column pipe; 12-in., 7-stage Peerless turbine pump, No. 33984, water lubricated and rated at 800 gpm. against

280 ft. of head; the pump is 7 ft. long; 20 ft. of 8-in. suction pipe; 100-hp. General Electric motor; cast-iron bowls, bronze impellers and stainless steel shafting.

Analysis of a sample (Lab. No. 106,728) collected June 13, 1946 after pumping 4 1/2 hr. at 450 gpm., showed the water from this well to have a hardness of 15.8 gr. per gal., a residue of 433 ppm., and an iron content of 0.2 ppm.

Sample-study log of Well No. 5 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Clay, yellow and blue"	107	107
Silurian system		
Niagaran and Alexandrian dolomites	73	180
Ordovician system		
Maquoketa shale, some dolomite	220	400
Galena-Platteville dolomite, some limestone	310	710
Glenwood dolomite and sandstone	12	722
St. Peter formation		
Sandstone, mostly incoherent	53	775
Sandstone, incoherent	130	905
Conglomerate of sandstone, clay and chert	29	934
Oneota dolomite and sandstone	1	935
Cambrian system		
Trempealeau dolomite, thin clay bed	118	1053
Franconia sandstone, dolomite some shale and siltstone	102	1155
Galesville sandstone		
Sandstone, partly dolomitic	55	1210
Sandstone, incoherent	85	1295
Sandstone, partly dolomitic	10	1305
Eau Claire siltstone, sandstone, some shale and dolomite	220	1525

LABORATORY NO. 106,728

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	10.9	
Manganese	Mn	Tr.		Fluoride	F	1.2	
Calcium	Ca	71.2	3.56	Chloride	Cl	18.0	0.51
Magnesium	Mg	22.7	1.87	Nitrate	NO_3	2.8	.05
Ammonium	NH_4	0.8	0.04	Sulfate	SO_4	75.5	1.57
Sodium	Na	55.7	2.42	Alkalinity (as $CaCO_3$)		288.	5.76
Color		0		Hardness (as $CaCO_3$)		272.	5.44
Odor		0		Residue		433.	
Turbidity		0		Free CO_2 (calc.)		65.2	
Temperature 54.5° F				pH = 7.05			

ARTHUR
Douglas and
Moultrie Counties
July 3, 1948

A public water supply was installed by the village of Arthur (1405) in 1914.

Water was first obtained from three wells, 8-in. diameter, located at the pumping station, at the northeast corner of Cleveland and South First St. (or approximately 2500 ft. N. and 750 ft. W. of the S. E. corner of Section 25, T. 15 N., R. 6 E., in Moultrie County). The wells were cleaned in 1922 and the depths measured 67, 68, and 69 ft. The west well was then drilled from 68 ft. to a depth of 89 ft. Quicksand was encountered at 72 ft. and 2 ft. of material in the bottom was said to be gravel. The wells were not screened.

The tops of the well casings were 20 ft. below the ground surface elevation of 662± ft., and a 20-ft. diameter reservoir constructed around the tops of the wells. The top of the reservoir wall was 21 ft. 5 in. above the tops of the casings.

On June 30, 1923, the yield of the wells was calculated to be 57 gpm. When pumping from the village wells, water levels in two private wells, 150 and 350 ft. distant, were 51 and 43 in., respectively, below the ground surface elevation, which was 24 in. lower than the ground surface at the village wells. Pumping from the village wells did not lower the water in the private wells. The wells were abandoned in 1929, and the reservoir was filled.

In 1928, Meister Bros., Tuscola, drilled an 8-in. well to a depth of 329 ft. and located about 50 ft. east of the original wells. This well was abandoned about 1933 because of the salty quality of the water and pumping equipment difficulties. The well has been sealed and capped with concrete.

In 1933, Well No. 1 was drilled to a depth of 85 ft. and located about 15 ft. north of the 329-ft. well drilled in 1928. The well was cased with 8-in. pipe, with 10 ft. of screen in the bottom. Two 5-in. holes were drilled adjacent to the well and filled with 18 tons of screened gravel. When tested by the driller at a pumping rate of 70 gpm., the drawdown was 12 ft. from a static water level of 12 ft. below the surface.

In 1938, the pump started breaking suction and, in Apr. 1944, would break suction when pumping at a rate of 40 gpm. The well failed after an excessive rate of pumping during an industrial plant fire in 1942-1943. Evidently the screen became sand-clogged.

In 1936, R. E. Milaeger, Milwaukee, Wis., constructed a gravel-pack well to a depth of 85 ft. and located 50 ft. south of the 329-ft. well, or 65 ft. south of Well No. 1. The well produced 50 gpm. at first, but sand trouble and lack of water caused the abandonment of the well. The well has been sealed and capped with concrete.

In 1937, Milaeger, sub-contractor for A. D. Cook Co., Lawrenceburg, Ind., drilled two test holes in the extreme eastern part of town. New Well No. 1 was drilled in 1938 at the site of test hole No. 1, at the extreme east end of South Second St. (or approximately 2125 ft. N. and 2700 ft. E. of the S. W. corner of Section 30, T. 15 N., R. 7 E.). This location is in Douglas County.

The well was drilled to a depth of 78 ft. below a ground surface elevation of 660t ft., and was cased with 10-in. pipe from three feet above to 61 ft. 4 in. below ground level, below which was 16ft. of exposed length of 9 1/2-in. od. brass tube strainer. The upper seven feet of the screen had No. 60 slot openings and the bottom nine feet had No. 10 slots.

LABORATORY NO. 115,187

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.0		Silica	SiO_2	23.6	
Manganese	Mn	0.0		Fluoride	F	0.3	
Calcium	Ca	59.5	2.98	Chloride	Cl	8.0	0.23
Magnesium	Mg	28.6	2.35	Nitrate	NO_3	0.4	0.01
Ammonium	NH_4	1.1	0.06	Sulfate	SO_4	0.0	0.00
Sodium	Na	100.5	4.37	Alkalinity (as $CaCO_3$)		476.	9.52
Turbidity		40		Hardness (as $CaCO_3$)		267.	5.33
Color		20		Residue		517.	
Odor (at well)		H_2S		Free CO_2(calc.)		48.	
Temperature 55.7° F.				pH = 7.4			

Sample-study log of Test Hole No. 44-3 furnished by the State Geological Survey:

Formation	Thickness ft.	in.	Depth ft.	in.
Pleistocene system				
Till	20		20	
Soil	5		25	
Till	9		34	
Sand and gravel, very silty	11		45	
Till	25		70	
Sand, some gravel, silty	15		85	
Sand and gravel, fairly clean	4	4	89	4
Pennsylvanian system				
Shale	2	2	91	6

During a production test by the driller, when pumping at 198 gpm., the drawdown was 50 ft. from a static water level of 16 ft. below the surface.

In the winter of 1942-43, a fire at an industrial plant necessitated pumping at a maximum rate for 36 hr. Previously, the pump had been throttled to a rate of less than 100 gpm. About 60 days after the fire, the pump was discovered to be breaking suction. The well was acidized and the productive capacity increased to 120-150 gpm. In Nov. 1943, the non-pumping water level was 28 ft., a recession of 12 ft. since 1937. The production gradually declined and the discharge rate became erratic, fluctuating between 40 "and 70 gpm. The rate of pumping was throttled to 35 to 40 gpm.

The pumping assembly, installed Aug. 15, 1945, consists of 60 ft. of 3-in. column pipe; 6.-in., 16-stage Cook turbine pump, No. 7485, rated at a capacity of 35 gpm. against 190 ft. of head; 60 ft. of 1/4-in. gi. air line; 10 ft. of 3-in. suction pipe; 3-hp. U. S. electric motor. The pump discharges about 40 gpm. to the distribution system, against a pressure of 60 lb.

On June 1, 1948, the water level, after a 12-hr. rest, was 21 ft. below the pump base. On June 2, 1948 the water level, after 8 1/2-hr. pumping at 40 gpm., was 37 ft. below the pump base. The well is used an average of 12 hr. daily and from May 25 to June 24, 1948, contributed about 15.8% of the total supply.

Analysis of a sample (Lab. No. 115,187) collected July 2, 1948 after 8 1/2-hr. pumping at 40 gpm., showed the water to have a hardness of 15.6 gr. per gal., a residue of 517 ppm., and an iron content of 2.0 ppm.

In Sept. 1944, an electrical earth resistivity survey was made by the State Geological Survey in the vicinity of Arthur and, as a result, 14 test holes were drilled in Nov. 1944 by Hayes and Sims, Champaign.

Well No. 2, originally No. 3, was completed at a depth of 90 ft. in Mar. 1945 by Hayes and Sims and located 6 ft. southeast of test hole 44-3, about 1/4 mile northeast of town (or approximately 25 ft. S. and 775 ft. E. of the N. W. corner of Section 30). The ground surface elevation is 657± ft.

The well was cased with 16-in. od. pipe from 20 in. above to 76 ft. below ground level and with 8-in. id. pipe from 22 in. above to 90 ft. 7 1/2 in. below ground level. A Johnson Armco-iron wire-wound screen, having an overall length of 15 1/2 ft. and No. 60 slot openings, was set below the 8-in. casing. The annular spaces between the casings and outside of the screen were packed with approximately four tons of washed gravel, grading up to 1/4-in. diameter.

A production test was made by the State Water Survey on Mar. 19, 1945, using a reciprocating pump operated from the drill rig. After seven hours pumping at 102 gpm., the drawdown was 17 ft. from a non-pumping water level of 11 ft. below the ground surface. In June 1945, while well No. 3 was being tested, it was observed that the pumping level in Well No. 2 had lowered six feet.

The pumping equipment, removed from Well No. 1 in Mar. 1945, consists of 50 ft. of 5-in. column pipe; 8-in., 7-stage A. D. Cook turbine pump, No. 2285, rated at 120 gpm. against 130 ft. of head; 69 ft. 9 in. of gi. air line; 15 ft. 5 in. of 5-in. suction pipe; 15-hp. U. S. electric motor, No. 138928. Local records of this installation are missing. Reports on the depth of the turbine setting and the length of the air line are in question. The air line is defective.

Analysis of a sample (Lab. No. 102,810) collected Mar. 19, 1945 after seven-hours pumping showed the water to have a hardness of 22.8 gr. per gal., a residue of 598 ppm., and an iron content of 4.3 ppm.

Well No. 2 is normally used every other day, alternating with Well No. 3. From May 25 to. June 24, 1948 metered pumpage averaged 69,540 gpd. or 43.75% of the total public supply.

Due to leaks in the distribution, the amount of water pumped daily was from two to five times the amount needed for public supply.

Well No. 3, formerly No. 4, (ninth well drilled for the village) was completed in June, 1945 by Hayes and Sims and located 322 ft. east of Well No. 2.

The well construction consisted of a 16-in. od. black pipe outer casing from 17 in. above to 78 ft. 7 in. below ground level, and an 8-in. id. black pipe casing from 17 in. above to 91 ft. below ground, below which was set a 7 5/8-in. Johnson Everdur screen with 12-ft. 1-in. exposed length, and having No. 60 slot openings. The annular spaces between the casings and outside of the screen were packed with washed gravel of small gradation.

A production test was made by the State Water Survey on June 20, 1945, using temporary test pumping equipment operated from the drill rig. The non-pumping water level was 18 ft. 8 in. The pump in Well No. 2 was being operated and continued during the first six hours of the test. At the same time, pumping in Well No. 3 was started at a rate of 88 gpm. and, after six-hours pumping, had gradually declined to 85 gpm. with a drawdown of 12 ft. The pump in Well No. 2 was then stopped and after one-hour continued pumping in Well No. 3 the pumping rate decreased to 84 gpm. with a drawdown of 11 ft. It was observed that the static level in Well No. 3 was approximately six feet below the static level in Well No. 2 in Mar. 1945. On July 18, 1946, the water level was measured 14 ft. below the pump base. On July 2, 1948 after nine-hours intermittent pumping, the water level was 27 1/2 ft. below the pump base.

The pumping equipment, installed July 18, 1946, consists of 60 ft. of 4-in. column pipe; 8-in., 9-stage Cook turbine pump, No. 991, rated at a capacity of 100 gpm. against 213 ft. of head; 60 ft. of 1/4-in. gi. air line; 10 ft. of 4-in. suction pipe; 10-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 103,629) collected June 20, 1945 after 6 1/2-hr. pumping at 84 gpm. showed this water to have a hardness of 22.2 gr. per gal., a residue of 603 ppm., and an iron content of 3.1 ppm. Methane gas is present in the water from this well.

From May 25, to June 24, 1948 the metered pumpage from Well No. 3 averaged 64,300 gpd. or 40.45% of the total public supply.

Some progress has been made in reducing the leakage in the distribution system. About 50% of the pumpage is accounted for.

Total pumpage for the village, from **May** 25, to June 24, 1948 averaged 159,000 gpd. of which the Progress Mfg. Co. and the Farmers Cheese Co. used from 7300 to 33,000 gpd.

A public water supply was installed in 1947 by the village of Ashkum (337).

Well No. 1 was completed to a depth of 196 ft. in May 1947 by Lowell French, Ashkum, and located 50 ft. north of Lake St., 120 ft. west of Second St. (or approximately 2000 ft. S. and 2000 ft. E.of the N. W. corner of Section 28, T. 28 N., R. 14 W.). The ground surface elevation is 662t ft.

The well was cased with 8-in. pipe from 1 ft. above to 153 ft. 4 in. below ground level.

A production test was made on May 28-29, 1947 by the State Water Survey. For test purposes the pumping assembly consisted of a rig-operated cylinder pump with the bottom of the cylinder 82 ft. below the top of the casing. Before the testthe static water level was 28 ft. below the top of the casing, and after 23 1/2-hr. pumping at 75 gpm. the drawdown was 34 ft. During the test, private wells with minimum pump settings, went dry.

The pumping installation consists of 60 ft. of 3-in. column pipe; 5-in., 6-stage Pomona turbine pump, No. SH 3155, rated at 50 gpm. against 70 ft. of head; 10 ft. of 3-in. suction pipe; 2-hp. General Electric motor.

Analysis of a sample (Lab. No. 110,440) collected May 29, 1947 after 9-hr. pumping at 70 gpm., showed this water to have a hardness of 17.0 gr. per gal., a residue of 444 ppm., and an iron content of 1.2 ppm.

A water treatment plant and the distribution system are being constructed.

Correlated driller's log of Well No. 1 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay and hardpan	148	148
Gravel, dirty	3	151
Silurian system		
Limestone (water from 168' to 180')	45	196

LABORATORY **NO. 110,440**

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.2		Silica	SiO_2	12.4	
Manganese	Mn	0.1		Fluoride	F	0.4	
Calcium	Ca	55.0	2.75	Chloride	Cl	50.0	1.40
Magnesium	Mg	37.2	3.06	Nitrate	NO_3	1.1	5.50
Ammonium	NH_4	2.2	0.12	Sulfate	SO_4	76.1	1.58
Sodium	Na	50.6	2.20	Alkalinity (as $CaCO_3$)		256.	5.12
Turbidity		20		Hardness (as $CaCO_3$)		291.	5.82
Color		0		Residue		444.	
Odor		0		Free CO_2 (calc.)		33.	
Temperature 53.5° F.				pH = 7.3			

The village of Ashland (1139) installed a public water supply in 1936.

Several test wells were drilled in 1935. Test Well No. 5 was located about 2 miles southwest of the village in Morgan County in the valley of Little Indian Creek, (or approximately 2300 ft. S. and 2300 ft. W. of the N. E. corner of Section 6, T. 16 N., R. 8 W.). The ground surface elevation at the well site is 600± ft.

This well was 6 in. in diameter, 21 ft. deep, and had 10 ft. of screen exposed to gravel. The screen had No. 80 and No. 100 slot openings.

A production test was made by the State Water Survey on June 17-20, 1935.

The well produced 57 gpm. with a drawdown of 9 ft. 3 in. from a non-pumping water level of 1 ft. above the ground surface.

Test Well No. 6 was located about 150 ft. south and 55 ft. east of Test Well No. 5. This well was 17 ft. deep and 6 in. in diameter. When tested in June, 1935, it was reported that the well produced 30 gpm. with a drawdown of 17 ft. 6 in. from a non-pumping water level, which was at ground level. Such a drawdown would be 6 in. below the bottom of the well.

Test Well No. 8 was located 55 ft. south and 80 ft. east of Test Well No. 5. This well was 17 ft. deep and 6 in. in diameter. When tested in June, 1935, the production was 42 1/2 gpm. with a drawdown of 7 ft. 3 in. from a non-pumping water level of 1/2 ft. above the ground surface.

Village Well No. 1 was drilled to a depth of 21 ft. in 1935 by C. O. Robertson and Son, Campbellsburg, Ind., and was located at the site of Test Well No. 5, and 34 ft. west of the pump house. The well is of the gravel-walled type. The 36-in. od. outer casing extends from 5 ft. above to 13 ft. below the ground surface and the 18-in. inner casing extends from a depth of 4 ft. to 12-ft., and an 18-in. Cook wire-wound well screen, with an effective length of 8 ft. 2 1/2 in., is installed between the depths of 12 and 21 ft. The screen has 3/16-in. slot openings. An envelope of selected gravel, 36-in. od. was placed around the screen. The. top of the gravel was 44.4 in. below ground level.

A production test was made by the State Water Survey on Oct. 17, 1935. For test purposes, the 'well was equipped with a suction pump with the bottom of the suction pipe at a depth of 17 ft. below the top of 36-in. casing. After 8-hr. pumping at 88 gpm. the drawdown was 10 ft. 10 in. from a non-pumping water level of 7 ft. below the top of the casing.

Analysis of a sample (Lab. No. 76839) collected Oct. 17, 1935, showed the water to have a hardness of 31.4 gr. per gal., a residue of 586 ppm., and an iron content of 0.7 ppm.

Two other wells were drilled by 193 7 by C. O. Robertson. One well is located about 84 ft. north and 15 ft. west of the pump house. The other well is 70 ft. south and 84 ft. west of the pump house. The wells are reported to be drilled to the same depth and cased the same as Well No. 1. The 3 wells are connected with a common suction pipe, and water is pumped by either of two 4-in.by 6-in. Fairbanks-Morse duplex piston pattern power pumps. Each pump is connected by an enclosed chain drive to a 10-hp. Fairbanks-Morse electric motor, operating at 1800 rpm. Emergency power is furnished by a 4-cylinder Fairbanks-Morse gasoline engine. The 4-in. suction pipe enters each well at the top of the 18-in. casing and extends to near the bottom of the well. -

On May 4, 1948, the pumping water level was 12 1/2 ft. below the top of the well.

Analysis of a sample (Lab. No. 114,562) col-

Correlated driller's log of Test Well No. 5 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and mud	8	8
Sand and gravel, water	2	10
Clay	2	12
Sand and gravel, clean, water	9	21

LABORATORY NO. 114,562

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.6		Silica	SiO_2	19.2	
Manganese	Mn	0.2		Fluoride	F	0.2	
Calcium	Ca	110.0	5.50	Chloride	Cl	43.0	1.21
Magnesium	Mg	47.9	3.94	Nitrate	NO_3	1.7	0.03
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	88.5	1.84
Sodium	Na	23.0	1.00	Alkalinity (as $CaCO_3$)		368.	7.36
Turbidity		20.		Hardness (as $CaCO_3$)		472.	9.44
Color		10.		Residue		574.	
Odor		0					
Temperature 49.5° F.							

lected May 4, 1948 showed the combined water from the 3 wells to have a hardness of 27.5 gr. per gal., a residue of 574 ppm., and an iron content of 1.6 ppm.

The water is aerated and filtered for iron removal, and a softening unit is in place but was not in service on May 4, 1948. Analysis of a sample collected May 4, 1948 showed the treated water to have a hardness of 20.6 gr. per gal., a mineral content of 561 ppm. and an iron content of 0.14 ppm.

Pumpage is estimated to average 60,000 gpd.

ASHTON
Lee County
Jan. 8, 1948

The public water supply for the village of Ashton (914) was installed in 1915.

Water is obtained from a well drilled to a depth of 545 ft. in 1915 by the W. L. Thorne Co., Des Plaines, and located near Middle St. between Second and Third St. (or approximately 1950 ft. N., and 2200 ft. E. of the S. W. corner of Section 27, T. 22 N., R. 11 E.). The surface elevation is 810± ft. The well is cased with 12-in. pipe to rock at 180 ft. and the hole is 8 in. in diameter below the casing. It was reported to enter sandstone at 415 ft.

The well was originally equipped with a 7 3/4-in. by 24-in. double-acting Keystone Driller Co. deep well pump, rated at 275 gpm. with the cylinder placed at a depth of 85 ft. In 1921, it was reported that the pump cylinder had been lowered to a depth of 240 ft. and was operated with 18-in. stroke. In 1938 the pump cylinder was reported to be placed at a depth of 144 ft. The State Water Survey made a production test on Nov. 27, 1941. For this test, the pump cylinder was placed at about 150 ft. Water levels could not be measured during the test, but when pumping at 190 gpm., the water level was somewhere between 114 and 150 ft. below the pump base. On Mar. 19, 1942, the American Well Works Co. made a production test and reported that when pumping at 300 gpm. the drawdown was 147 ft. from a non-pumping water level of 39 ft.

Non-pumping water levels have been reported in ft. below the floor of the pump house which is at ground level:

Date	Water Level ft.
1915	16
Spring, 1921	20
Oct. 1921	36
1938	35
July 6, 1941	39
Mar. 19, 1942	39
Jan. 8, 1948	39

The pump assembly, installed in 1942, consists of 200 ft. of 5-in. column pipe; 13-stage, size 8 MC. American Well Works turbine pump rated at 250 gpm. against355 ft. of head at 1760rpm.; overall length of pump about 6 ft.;, 20 ft. of 5-in. suction pipe; 200 ft. of 1/4-in. air line; 30-hp. U. S. electric motor, No. 287764.

Analysis of a sample (Lab. No. 113,129) collected Jan. 8, 1948 after 1/2-hr. pumping at 275 gpm., showed this water to have a hardness of 24.4 gr. per gal., a residue of 470 ppm., and a trace of iron content.

Pumpage is estimated to average 40,000 gpd.

The Chicago & Northwestern R. R. Co. Well is located about 500 ft. west of the village well (or approximately 1950 ft. N. and 1700 ft. E. of the S. W. corner of Section 27).

This well is connected to the village distribution system.

LABORATORY NO. 113,129

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	Tr.		Silica	SiO_2	19.0	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	88.9	4.45	Chloride	Cl	18.0	0.51
Magnesium	Mg	47.7	3.92	Nitrate	NO_3	42.9	0.69
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	78.0	1.62
Sodium	Na	3.0	0.13	Alkalinity (as $CaCO_3$)		284.	5.68
Turbidity		0		Hardness (as $CaCO_3$)		419.	8.37
Color		0		Residue		470.	
Odor		0		Temperature 52.2° F.			

Log of Chicago & Northwestern Railroad Well furnished by State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Sand, gravel and clay"	14	14
Ordovician system		
Oneota dolomite, some sandstone at base	151	165
Cambrian system		
Trempealeau dolomite	84	249

ASSUMPTION
Christian County
Aug. 5, 1948

The city of Assumption (1,561) installed a public water supply in 1914.

Attempts to locate a source of supply in or near the city were unsuccessful, and all water has been obtained from wells located about 3 miles southeast of the city in the valley of Spring Creek, in the western part of Shelby County.

In 1914, six wells were drilled near Spring Creek (approximately 1100 ft. N. and 1400 ft. E. of the S. W. corner of Section 18, T. 12 N., R. 2 E.). The ground surface elevation at this location is 639± ft. The Wells were located about 25 ft. apart in two parallel east-west rows. The rows were about 25 ft. apart.

The wells were 17 ft. deep, and were cased with 4-in. iron pipe. Sand and gravel was reported to have been penetrated between 6 and 17 ft. A 5-ft. length of strainer, consisting of a perforated pipe, wrapped with a No. 20 wire screen and covered by a thin perforated metal covering, was installed.

The wells were connected to a 3-in. Fairbanks-Morse centrifugal pump and tested Aug. 11-13, 1913. The production was reported to be at a rate of 100,000 gpd. for 54-hr. continuous pumping.

Analysis of a sample (Lab. No. 25,886) collected Aug. 13, 1913, showed the water to have a hardness of 8.6 gr. per gal., a residue of 196 ppm., and an iron content of 0.3 ppm.

In 1914, three more wells were drilled 100 ft., 150 ft., and 200 ft. southeast of the original **wells.** These wells were 4 in." in diameter.

Water was pumped from the 9 wells with a 5 1/2-in. by 8-in. Goulds triplex pump, rated at about 300,000 gpd., and driven by a 6-hp. International Harvester Co. gasoline engine.

All of the original 9 wells were abandoned in 1917.

In 1917, three new wells were drilled by the city and located about 20 ft. west of the creek, and 147, 227, and 300 ft. southeast of the pumping station which is located approximately 1/4 mi. north and 1/4 mi. east of the S. W. corner of Section 18.

These 3 wells were 10 in. in diameter, and 18 1/2 ft. deep, and were equipped with brass screens 8 ft. long in two of the wells and 10 ft. long in the other well. The upper ends of the 10-in. casings were about 2 1/2 ft., below the ground surface and were capped.

The wells were connected to the pump suction by 4-in. pipes passing through the caps. In 1917, it was reported that the Gould triplex pump was available for emergency use, but that most of the pumping was by a 7-in. by 8-in. Deming triplex pump gear-connected to a 10-hp. General Electric motor. These wells have been abandoned.

In 1918-19, six additional wells were drilled near the other wells by the Illinois Central R.R. Some of the wells were 8 in., some were 10 in., and one was 12 in. in diameter. The 12-in. well and 4 of the other wells were drilled by O. H. Steigman, Roberts. <

In 1928, water was obtained from 6 wells located near the older well-group. The wells were 10-in. diameter and average d 23 3/4 ft. deep. Each casing in 3 of the wells was perforated with about 1900 holes of 5/16-in. diameter, in the area from 1 to 5 ft. above the bottom of the casing. The other 3 casings were slotted at the bottom

LABORATORY NO. 115,314

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.3		Silica	SiO_2	19.4	
Manganese	Mn	0.3		Fluoride	F	0.3	
Calcium	Ca	91.1	4.56	Chloride	Cl	7.0	0.20
Magnesium	Mg	29.4	2.42	Nitrate	NO_3	0.3	Tr.
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	124.9	2.60
Sodium	Na	8.7	0.38	Alkalinity (as $CaCO_3$)		228.	4.56
Turbidity		Tr.		Hardness (as $CaCO_3$)		349.	6.98
Color		0		Residue		412.	
Odor		0		Temperature 54.5° F.			

with 3 rows of i/4 by 10-in. slots spaced 2 in. apart. Water was pumped from the 6 wells through a common 5-in. suction pipe, by a 7-in. by 8-in. Deming triplex pump operated at 40 rpm. for about 11 hr. daily.

The water level varied only a few in. during a day, but during a long dry spell, the level receded to within about 18 in. above the bottom of the sand stratum. Three-in. drop pipes extended to within 8-in. of the bottom of the well.

One of the 10-in. wells, the center well in the west row, has recently been returned to service; after being out of service since about 1936. In a capacity test, while the pump in the dug well was operating, the yield was 50 gpm. The non-pumping water level was 7 1/2 ft. below the ground level. The well is now equipped with a Burks jet pump, operating against a pressure of 60 psi. and discharging 25 gpm. over the coke tray aerator at the treatment plant. The pump is connected to a 3-hp. Wagner electric motor.

A dug well located at the site of the southwest well of the six-well group, has been the principal source of public supply since about 1936. The well is 10 ft. in diameter, 25 1/3 ft. deep, and lined with concrete, 6 in. thick. On July 19, 1948, the depth was measured 25 ft. below top of curb, (1 1/2 ft. above ground level). Water enters the well through 744 pipes, 3/4-in. diameter and spaced 6 in. apart.

Water is pumped by a Worthington single-stage, centrifugal pump, No. 888526 originally rated at 250 gpm. against 274 ft. of head; and operated at 3510 rpm.; 30-hp. General Electric motor, No. 5317075.

Another pumping unit is available but not used because of the present limited production of the well. The unit consists of a 3-in. Type D Gradner-Denver centrifugal pump, rated at a capacity of 250 gpm.; 30-hp. General Electric Motor No. 5508710.

The yield of the well has decreased to about 125 gpm., caused by the corrosion and clogging of many of the 3/4-in. pipe openings through the concrete wall. Some of the pipes have been opened.

On June 16, 1938, the non-pumping water level was 8 ft. below the top of the well curb and after 10-min. pumping at 190 gpm., the drawdown was 18 in. Ten min. after stopping the pump, the water level returned to within 4 in. of the starting level. On July 19, 1948, after 13-hr. non-pumping, the water level was 8 ft. below the top of the curb and after 9-hr. pumping at 125 gpm. the drawdown was 11 ft.

Analysis of a sample (Lab. No. 115,314) collected July 19, 1948 after 7-hr. pumping at 125 gpm. showed this water to have a hardness of 20.3 gr. per gal., a residue of 412 ppm., and an iron content of 0.3 ppm.

A treatment plant was placed in service, Apr. 12, 1947, and is located on the west side of U. S. Highway No. 51, about 1000 ft. north of the south city limits. All water is aerated, filtered and softened. Analysis of a sample (Lab. No. 115,514) collected July 19, 1948 showed the treated water to have a hardness of 4.3 gr. per gal., a mineral content of 344 ppm., and an iron content of 0.04 ppm.

From July 18, 1947 to July 18, 1948, metered pumpage averaged 85,900 gpd.

LABORATORY NO. 115,514

	ppm.	epm.			ppm.	epm.
Iron (total) Fe	Tr.		Fluoride	F	0.1	
			Chloride	Cl	6.0	0.17
Turbidity	0		Alkalinity (as $CaCO_3$)		204.	4.08
Color	0		Hardness (as $CaCO_3$)		74.	1.48
Odor	0		Total Mineral Content		344.	
Temperature 65° F.			Free CO_2 (calc.)		5.	
			pH = 8.0			

A public water supply was installed by the city of Athens (1062) in 1938.

In 1936, ten test wells were drilled in an attempt to locate an adequate source of water for the public supply.

A production test was made by the State Water Survey on Test Well No. 1 on May 5, 1936. This well was drilled by the Layne North-Central Co. in 1936 to a depth of 73 ft. 8 in. and was located at the northeast corner of the intersection of Washington and Polk St. (or approximately 700 ft. N. and 1100 ft. E. of the S. W. corner of Section 36, T. 18 N., R. 6 W.). The ground surface elevation at the well site is 612t ft. MSL.

The well was cased to a depth of 62 ft. 8 in. with 6-in. pipe, and a 10 ft. length of 3-in., 60-mesh, well-point screen was sealed to the casing with a 1-ft. swedge nipple. The well produced 12 gpm. with a drawdown of 44 ft. 11 in. from a non-pumping water level of 17 ft. 7 in. below the top of the casing.

Analysis of a sample (Lab. No. 77943) showed the water to have a total hardness of 27.1 gr.per gal., a residue of 683 ppm., and an iron content of 2.6 ppm.

A city well was drilled to limestone at a depth of 77 ft. at the site of Test Well No. 6which was located about 175 ft. north and 125 ft. west of Washington and Polk St. (or approximately 915 ft. N. and 1050 ft. E. of the S. W. corner of Section 36).

The well was of the gravel-walled type, having a 26-in. outer casing from the surface to 62 ft. and a 12-in. inner casing from the surface to 62, ft. with a 15-ft. length of 12-in. Layne shutter screen attached. The screen had 1/8-in. slot openings.

The State Water Survey made a production test on Nov. 9-10, 1936. At the end of 20-hr. pumping, the pump broke suction at 25 gpm. The driller and engineer made a production test on Nov. 18, 1936. It was reported that after 24-hr. pumping at 23-25 gpm., the drawdown was 31 ft. from a non-pumping water level of 39 ft.

The State Water Survey made another test Nov. 30-Dec. 1, 1936. The pump broke suction after 22-hr. pumping at 25 gpm.

Analysis of a sample (Lab. No. 79131) collected Dec. 1, 1936 at the end of the test, showed the water to have a hardness of 12.8 gr.per gal., a residue of 599 ppm., and an iron content of 0.6 ppm.

This well is not in use.

A continuation of previous electrical earth resistivity surveys was made by the State Geological Survey in Jan.-Feb. 1937. Two areas were covered, one extending from the center of town to 1 mi. north and 1 mi, west, and the other extending from the center of town 2 mi. south and 2 mi. west.

Test Well No. 15 was drilled in the flood plain east of the Sangamon River, 2 mi. southwest of town (or approximately 2700 ft. S. and 800 ft. E. of the N. W. corner of Section 3, T. 17 N., R. 6 W.). The test well was 61 ft. deep below a surface elevation of 505± ft. MSL. datum.

The well was equipped with a Layne-Shutter screen of a rather coarse opening.

The State Water Survey made a 4-hr. production test on Mar. 25, 1937. For test purposes,

Sample-study and driller's log of Test Well No. 15 furnished by the State Geological Survey:

Formation	Thickness ft.	Thickness in.	Depth ft.	Depth in.
Pleistocene system				
Alluvium and dirty sand	42		42	
Gravel, clean	3		45	
"Sand, gravel and boulders"	5		50	
Gravel, sandy, dirty	9	6	59	6
"Clay, blue"	1	6	61	

LABORATORY NO. 113,545

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	8.7		Silica	SiO_2	21.4	
Manganese	Mn	0.2		Fluoride	F	0.2	
Calcium	Ca	81.6	4.08	Chloride	Cl	5.0	0.14
Magnesium	Mg	31.6	2.60	Nitrate	NO_3	0.4	0.01
Ammonium	NH_4	3.1	0.17	Sulfate	SO_4	46.5	0.96
Sodium	Na	17.0	0.74	Alkalinity	(as $CaCO_3$)	324.	6.48
Turbidity		50		Hardness	(as $CaCO_3$)	334.	6.68
Color		0		Residue		390.	
Odor		Tr.					

the well was equipped with a turbine pump with the bottom of the suction pipe at a depth of 56 1/2 ft. and 49 ft. of air line. For the last 2 hr. of the test, the well produced 88 gpm. with a drawdown of 22 ft. from a non-pumping water level of 10 2/3 ft.

The completed city well is located at the site of Test Well No. 15 and was drilled by Layne-Western Co., Chicago, to a depth of 61 ft. The well is of the gravel-pack type. A 26-in. outer casing extends from the surface to a depth of 50 ft., and a 12-in. inner casing extends from 15 ft. above to 45 ft. below the surface. A 16 ft. 1 in. length of Layne shutter screen with 15 ft. exposed to the aquifer extends to a depth of 61 ft.

A production test was made by the State Water Survey on May 16, 1938. The pump broke suction after 2 1/2-hr. pumping at 67 gpm. After 2 1/2-hr. pumping at a rate of 56 gpm., the drawdown was 36 1/2 ft. from a non-pumping water level of 12 ft. below the top of the outer casing. The well was not fully developed at the time. Another test was made May 23-24, 1938. After 24-hr. pumping at 185 gpm. the drawdown was 35 1/2 ft. from a non-pumping level of 8 ft. below the top of the outer casing. On Feb. 18, 1948, the non-pumping water level was 12 ft. below ground level.

The pumping equipment consists of 65 ft. of 5-in. column pipe; 10-in., 5-stage Layne turbine pump, rated at 165 gpm.; overall length of pump is 3 ft. 11 in.; no air line and no suction pipe; 20-hp. electric motor.

Analysis of a sample (Lab. No. 113,545) collected Feb. 18, 1948 showed the water to have a hardness of 19.5 gr. per gal., a residue of 390 ppm., and an iron content of 8.7 ppm.

All water is aerated, filtered and chlorinated. Analysis of a sample (Lab. No. 113,544) showed the treated water to have a hardness of 18.5 gr. per gal., a mineral content of 376 ppm., and an iron content of 0.16 ppm.

Well No. 2 was completed in June, 1949, to a depth of 57.5 ft. by Layne-Western Co. and located 70 ft. southeast of Well No. 1. A 26-in. outer casing was set from 2 ft. above to 48 ft. below ground level and a 12-in. inner casing extended from 3 ft. 1 in. above to 48 ft. below ground level. A 12-in. Layne No. 6 shutter screen, having 9 ft. of slot openings, was set with the bottom at 57.5 ft. below ground level. The top of the plug in the screen was 56.7 ft.

A production test was made by the State Water Survey on June 9, 1949, using temporary equipment consisting of an engine-driven Layne turbine pump with the bottom of the suction at 55.5 ft. below the top of the 12-in. casing. Before any pumping, the water level was 16.5 ft. below the top of the 12-in. casing. The pumping rate was started at 51 gpm. and over a 6 1/2 hr. period, gradually increased to 125 gpm. The drawdown at the end of the period was 27.9 ft. Pumping was continued in Well No. 2 and pumping was started in Well No. 1. After 3 min. the additional drawdown in Well No. 2 was 5.1 ft. Thirty min. after stopping both pumps the water level in Well No. 2 was 23.2 ft.

Analysis of a sample (Lab. No. 118,446) collected June 9, 1949, after 6-hr. pumping at 100 gpm., showed this water to have a hardness of 23.0 gr. per gal., a residue of 448 ppm. and an iron content of 16.4 ppm.

Pumpage in 1948 was estimated to average 35,000 gpd.

A public water supply was installed by the village of Atkinson (719) in 1915.

Water is obtained from a well drilled in 1915 to a depth of 1123 ft. by the Cambridge Driller Co. The well is located on East Exchange St. (or approximately 1100 ft. S.and 500 ft. W. of the N. E. corner of Section 34, T. 17 N., R. 4 E.). The elevation of the top of the well is 640± ft., and the AtkinsonNews of Dec. 9, 1915 stated that the well was mostly in limestone with about 100 ft. in shale. The contract specified a 12-in. casing to be set at a depth of 100 ft.; and that the bottom of the 12-in. casing should be drivenfirmly into rock; that an 8-in. hole be drilled in rock until a good supply of water was obtained.

The well was equipped with a Keystone Driller Co. No. 33, double-geared, double-acting deep well pump with the 7 3/4-in. by 7-ft. brass cylinder attached to 8-in. column pipe and set at 100 ft. There was no suction pipe.

It was reported in the Atkinson News that, during a 6-hr. test, the well produced 200 gpm. as specified in the contract. It was then cased through shale, with 3/4-in. holes drilled in several lengths of the casing, and the production was 100 gpm. The decrease was attributed in part to the closing of the 3/4-in. holes when the casing was lowered. After several days of testing, the flow increased to 230 gpm.

In 1920, the water was noted to have a temperature of 58°F., ahardness of 13.9 gr. per gal., and a total mineral content of 1513 ppm.

In 1922, the non-pumping water level was reported to be 38 ft. below the top of the well. In 1924, a sample was found to have a hardness of 5.2 gr. per gal., a total mineral content of 624 ppm., and an odor of hydrogen sulfide.

The following pump assembly is in service: 170 ft. of 5-in. column pipe; 8-in., 13-stage American Well Works turbine pump, No. 70705, rated at 200 gpm. against 250 ft. of head at 1760 rpm.; the overall length of the pump is 8 ft.; 10 ft. of 5-in. suction; 20-hp. U.S. electric motor, No. 411831.

In July 1945, the pump broke suction after 15 min. of pumping. The column pipe at the time was 140 ft. long. The non-pumping water level on July 10, 1945 was 72 ft. below the top of the well, and the breaking of suction indicated a drawdown of at least 68 ft. when pumping at a rate of 200 gpm. for 15 min. The column was extended from 140 to 170 ft. The non-pumping water level is 70 ft. below ground surface. Pumpage is estimated to be 50,000 gpd.

Analysis of a sample (Lab. No. 108,417), collected Nov. 21, 1946 after 30-min. pumping at 200 gpm., showed this water to have ahardness of 5.4 gr. per gal., a residue of 512 ppm., and an iron content of 0.2 ppm. This water is similar in character to that obtained in 1924 and also in samples collected in 1938 and in 1945.

The water is not treated.

The Midland Electric Coal Corporation has a well, No. 2, drilled in 1931 to a depth of 1257 ft. below a ground surface elevation of 637± ft. The well is located about 1 1/2 miles east of Atkinson, (approximately 2600 ft. S. and 920 ft. E. of the N. W. corner Sec. 36).

In Nov. 1946, a new pump assembly was in-

LABORATORY NO. 44,166

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.2		Silica	SiO_2	8.8	
Manganese	Mn	0.0		Chloride	Cl	470.2	13.26
Calcium	Ca	57.9	2.88	Nitrate	NO_3	3.2	0.05
Magnesium	Mg	23.2	1.90	Sulfate	SO_4	312.4	6.50
Ammonium	NH_4	5.1	0.28	Alkalinity	(as $CaCO_3$)	236.	4.72
Sodium	Na	4.9	20.18				
Turbidity		15		Hardness	(as $CaCO_3$)	239.	4.78
Color		15		Residue		1473.	
Odor		M					
Temperature 58° F.							

LABORATORY NO. 108,417

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	13.7	
Manganese	Mn	0.0		Fluoride	F	0.7	
Calcium	Ca	20.1	1.01	Chloride	Cl	9.0	0.25
Magnesium	Mg	9.9	0.82	Nitrate	NO_3	1.6	0.03
Ammonium	NH_4	1.7	0.10	Sulfate	SO_4	34.1	0.71
Sodium	Na	169.7	7.38	Alkalinity (as $CaCO_3$)		416.	8.32
Color		0		Hardness (as $CaCO_3$)		92.	1.84
Odor (at well)	H_2S			Residue		512.	
Turbidity		Tr.		Free CO_2 (calc.)			
Temperature		54.6° F.		pH =			

stalled. The pump was set at 280 ft., and the suction pipe was 20 ft. long. An air line was installed with the bottom at 280 ft. The water level was 118 ft. below the ground surface; and when pumping at 475 gpm., the water was lowered below the air line, but the pump did not break suction.

Samples collected in 1931 and 1943 showed this water to be of similar character to that obtained from the city well in 1920. (Lab. No. 44166). The 1943 samples had a temperature of 59° F. and the odor of hydrogen sulfide indicated the presence of a small amount of water from a source other than the St. Peter sandstone.

Sample-study log of the Midland Electric Coal Corporation Well furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Sand, gravel and clay"	15	15
Pennsylvanian system		
Shale, some coal, limestone and sandstone	169	184
Silurian system		
Niagaran - Alexandrian dolomites	409	593
Ordovocian system		
Maquoketa shale, some dolomite	193	786
Galena - Platteville dolomites	333	1119
Glenwood sandstone, some shale	44	1163
St. Peter formation		
Sandstone	93	1256
Shale	1	1257

The city of Atlanta (1290) installed a public water supply in 1891.

The first well was drilled in 1891 and was located on the pump station lot on Second St. between Temple and Fair St. (or approximately 2450 ft. S. and 2150 ft. E. of the N. W. corner of Section 20, T. 21 N., R. 1 W.). The ground surface elevation is 725± ft. No information is available on this well, which was abandoned.

A second well was drilled in 1893 and subsequently two additional wells were drilled, the last one in 1913. All wells were located on the pump station lot and the last two wells were each 151 ft. deep and 8 and 10 in. in diameter, respectively.

The non-pumping water level in both wells was reported to be about 100 ft. in 1913. The 8-in. well was abandoned in 1922 and in 1924 the water level was 105 ft. below the ground surface. The well is capped with concrete.

The 10-in. well, formerly called Well No. 2, was drilled in 1913 by the Ohio Drilling Co., Massillon, Ohio, and was located 10 ft. east of the original well. This well was 151 ft. deep and 10 in. in diameter with an 8-in. inner casing.

Between 1922 and 1930, this well was used as an emergency supply only. In 1930, the well was put back into service and equipped with a 7 3/4-in. by 18-in. Cook double-stroke deep-well pump. In 1937, this well produced 14,000 gpd.

The well has not been in service for a number of years. The Cook pump is in place but has no power connection.

Analysis of a sample (Lab. No. 82571) collected Dec. 6, 1937, showed the water to have a hardness of 22.5 gr. per gal., a residue of 451 ppm., and an iron content of 6.2 ppm.

In 1922, pumping equipment was installed in a mine shaft which had been abandoned in 1880, at a depth of 160 ft. This shaft was located 200 ft. north and 200 ft. east of the pumping station and water was furnished for the entire village supply until 1930, when the water became contaminated and this source was abandoned.

Analysis of a sample (Lab. No. 51791) collected July 9, 1924, showed the water to have a hardness of 26.1 gr. per gal., a residue of 530 ppm., and an iron content of 2.2 ppm.

A 6-in. test well was drilled about 1930, and located about 175 ft. north of the pump station.

Well No. 1 was drilled about 1930 by E. N. Johnson, Bloomington, and located in the pump house. This well was 10 in. in diameter, 191 ft. deep, with a 14-ft. length of Johnson screen.

The non-pumping water level, when the well was completed, was reported to be 106 ft. below

Correlated driller's log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and clay	65	65
Sand and gas	1	66
Clay	5	71
Pack sand	5	76
Clay	17	93
Sand, dirty	4	97
Clay	28	125
Gravel	1	126
Hardpan	8	134
Gravel	4	138
Hardpan	2	140
Gravel, clean	4	144
Sand and gravel, dirty	3	147
Clay	at	147

LABORATORY NO. 115,838

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	5.0		Silica	SiO_2	28.0	
Manganese	Mn	0.1		Fluoride	F	0.2	
Calcium	Ca	85.9	4.30	Chloride	Cl	1.0	0.03
Magnesium	Mg	43.1	3.55	Nitrate	NO_3	1.4	0.02
Ammonium	NH_4	7.1	0.40	Sulfate	SO_4	0.0	0.00
Sodium	Na	13.8	0.60	Alkalinity (as $CaCO_3$)		440.	8.80
Turbidity		40		Hardness (as $CaCO_3$)		393.	7.85
Color		15		Residue		455.	
Odor		Tr.		Free CO_2 (calc.)		55.	
Temperature 56° F.				pH = 7.3			

the ground surface. On June 30, 1944, when the Cook plunger pump was out, the water level was 107 ft. below the pump base.

The pump installation, made on Feb. 15, 1947, consists of 140 ft. of 5-in. column pipe; 8-in., 10-stage Aurora Pump Co., turbine pump, No. 30776, having a rated capacity of 150 gpm. against 255 ft. of head; 140 ft. of 1/4-in. gi. air line; 15-hp. U.S. electric motor.

After the Aurora pump was installed, considerable sand was pumped from the well. On Sept. 17, 1948 the non-pumping water level was 81 ft. below the pump base.

Analysis of a sample (Lab. No. 82572) collected Dec. 8, 1937, showed the water to have a hardness of 25.6 gr. per gal., a residue of 511 ppm., and an iron content of 1.0 ppm.

Well No. 1 is the sole source of supply.

Well No. 2, and fourth well drilled for the village, was drilled in 1946 to a depth of 147 ft. by WoollenBros., Wapella, andis located on the west side of Church St., between Vine St. and Elm St., (or approximately 2100 ft. S. and 1650 ft. W. of the N.E. corner of Section 20). The ground elevation at the well-site is 720± ft.

This well is cased with 10-in. pipe to a depth of 135 ft.

When completed, it was reported that after 3-hr. pumping at.a rate of 50 gpm., there was no appreciable drawdown below the non-pumping water level of 104 ft. On Sept. 17, 1948, after 18-minute pumping at an estimated rate of 200± gpm., the drawdown was 24 ft. from a non-pumping water level of 110 ft. below the pump base (1 ft. above ground level).

The well has not been put in service as yet. The pump installation, made in Oct. 1947, includes 140 ft. of 5-in. column pipe; 8-in., 10-stage Aurora Pump Co. turbine pump, No. 33740, having a rated capacity of 150 gpm. against 255 ft. of head; 140 ft. of 1/4-in. gi. air line; 5-in. strainer; 15-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 115,838) collected Sept. 17, 1948 after 18-minute pumping, showed the water to have a hardness of 22.9 gr. per gal., a residue of 455 ppm., and an iron content of 5.0 ppm.

Pumpage is estimated to average 50,000 gpd.

ATWOOD
Douglas and.
Piatt Counties
June 25, 1948

A public water supply was installed by the village of Atwood (707) in 1935.

Water is obtained from a well drilled to a depth of 97 ft. by John Bolliger and Sons, Fairbury, and located 2350 ft. S. and 200 ft. E. of the N. W. corner of Section 31, T. 16 N., R. 7E. The ground surface elevation is 672± ft.

The well was gravel-packed. A 24-in. outer casing extended from the surface to 81 ft. 4 in. and a 12-in. inner casing extended from the surface to 81 ft. 3 3/4 in. Below the inner casing was set 17 ft. 1 3/4 in. of Cook screen having No. 187 slot openings.

When the well was completed, a brief production test was made by the State Water Survey. The static water level was 11 1/2 ft. below the ground surface. When pumping at 132 gpm., the drawdown was 23 ft. and when pumping at 190 gpm., the drawdown was 32 1/2 ft. The pumping rate could not be continued at a higher speed or an extended period.

The well is equipped with 85 ft. of 6-in. column pipe; 7-in., 12-stage Fairbanks-Morse Price turbine pump, No. 23038, rated at 140 gpm. against 125 ft. of head at 1720 rpm.; defective air line; 20-hp. Fairbanks-Morse Electric motor, No. 308501.

In June, 1938, the pump was operated twice weekly for a. period of two hours each time of pumping.

Analysis of a sample (Lab. No. 115,101) collected June 25, 1948 after 18-minutes pumping showed this water to have a hardness of 24.5 gr. per gal., a residue of 514 ppm., and an iron content of 2.6 ppm.

Correlated driller's log of Well No. 1 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and clay	35	35
Sand, dirty	2	37
Clay	16	53
Gravel	4	57
Hardpan	20	77
Sand and gravel	19	96
Hardpan	1	97

LABORATORY NO. 115,101

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.6		Silica	SiO_2	29.5	
Manganese	Mn	0.0		Fluoride	F	0.2	
Calcium	Ca	111.8	5.59	Chloride	Cl	3.0	0.08
Magnesium	Mg	34.4	2.82	Nitrate	NO_3	0.2	Tr.
Ammonium	NH_4	2.2	0.12	Sulfate	SO_4	3.1	0.06
Sodium	Na	22.3	0.97	Alkalinity	(as $CaCO_3$)	468.	9.36
Turbidity		25		Hardness	(as $CaCO_3$)	421.	8.41
Color		0		Residue		514.	
Odor		Tr.		Free CO_2 (calc.)		59.	
Temperature 56° F.				pH = 7.3			

LABORATORY NO. 115,180

	ppm.	epm.			ppm.	epm.
Iron (total) Fe	0.15		Fluoride	F	0.1	
			Chloride	Cl	4.0	0.11
Turbidity	0		Alkalinity (as $CaCO_3$)		456.	9.12
Color	15		Hardness (as $CaCO_3$)		96.	1.92
Odor	0		Total Mineral Content		475.	
Temperature 59° F.			Free CO_2 (calc.)		22.	
			pH = 7.7			

The water is aerated, filtered and softened. Analysis of a sample (Lab. No. 115,180) collected June 25, 1948 showed the treated water to have a hardness of 5.6 gr. per gal., a mineral content of 475 gpm., and an iron content of 0.15 ppm.

Pumpage is estimated to average 26,700 gpd.

A public water supply was originally installed by the city of Aurora (47,170) in 1886.

Water was obtained from a well and filter gallery excavated in a gravel formation located on an island in Fox River approximately 2100 ft. north of the north city limits. This was the source of the supply until sandstone wells were drilled at the old pumping station on the east bank of the river opposite the well.

Two of these wells, No. 1 and No. 2, were drilled by the American Well Works Co. in 1892 and 1893 and located about 310 ft. apart. Records of their construction are not available. In 1898, Well No. 1, the south well, was deepened from a depth of 1381 ft. fo 2235 ft. by J. P. Miller Artesian Well Co., Brookfield, and finished as a 6-in. hole at the bottom.

Wells No. 3 and 4 were drilled by the J. P. Miller Artesian Well Co. Well No. 3 was drilled in 1893 to a depth of 2274 ft. and located about 175 ft. northwest of Well No. 1 near present Well No. 11. It was drilled 8 in. in diameter to a depth of 610 ft. and 6 in. in diameter below that depth.

Well No. 4 was drilled to a depth of 2445 ft. in 1895, and located about 90 ft. southwest of Well No. 1. This well was cased with 10-in. pipe to a depth of 76 ft. below which the hole was 8-in. diameter to 1700 ft. and 6 in. from 1700 ft. to the bottom. The well was back-filled below a depth of 2250 ft.

It is reported that all wells in this original group flowed in 1894, and that the combined flow was sufficient to meet the water demands of the city at that time.

When Wells 1, 2, 3, and 4 were tested in 1910 under simultaneous operation with air lift equipment, the production was 550, 350, 500 and 400 gpm., respectively. They supplied an average demand of 1.96 mgd. during the year of 1910.

Well No. 5 was drilled in 1911 to a depth of 2250 ft. by Timmes and Beckwith, and located at the pumping station 100 ft. south and 200 ft. east of Well No. 1 approximately 625 ft. S. and 2300 ft. W. of the N. E. corner of Section 15, T. 38 N., R. 8 E. The diameter was reported to be 18 in. at the top and 8 in. at the bottom. The elevation at the top of the casing is 646.23 ft. No record of its original productive capacity is available.

All five wells were equipped with air lifts. In Oct. 1911, the air lines for the four older wells were about 250 ft. long and were 2 in. in diameter and 2 1/2 in. for the fifth well. The combined production of these wells in a test made in 1916 was 1200 gpm. Repairs were made of the equipment of the older wells, and their production was increased. On Oct. 25, 1924, all air lines had been extended to 300 ft. and the combined production was reported to be 1700 gpm. At that time, the production from Well No. 5 was equal to the combined production of the four older wells. The air lift equipment was removed from these wells in 1928. The four original wells were abandoned and plugged.

Well No. 5 was out of service until about 1940 when it was equipped with a 12-in. Aurora Pump Co. turbine pump having 340 ft. of 8-in. column pipe and a 75-hp. Westinghouse electric motor. During 1941 and 1942, the well produced at a rate of 724 to 577 gpm., pumping to the reservoir. In Dec. 1942, when pumping at a rate of 600 gpm., the water level was about 320 ft. below the pump base. On May 1-3, 1944, some graphs were prepared to show the influence of the pumping in Wells No. 11, 12, and 12a on the water levels of Well No. 5. When pumping in Well 12a only, little interference was reflected in Well No. 5. When pumping in Well 12, the added drawdown in Well No. 5 was about 25 ft. and when pumping in Wells 11, 12, and 12a, there was a further drawdown of 9 ft. In July 1947, the average non-pumping water level was 172 ft. and when pumping at 575 gpm., the average level was 325 ft. below the pump base.

Analysis of a sample of water collected Feb. 2, 1943, after 9-hr. pumping at 600 gpm., showed this water to have a hardness of 17.7 gr. per gal., a mineral content of 562 ppm., and an iron content of 0.1 ppm.

The rapid growth of the city and the heavy consumption during the summer months of 1914 necessitated an increased supply. A system of isolated deep wells of larger diameters were adopted. The first of these wells, called No. 6, was drilled at the southeast corner of Talma and Binder St. (approximately 180 ft. N. and 2540 ft. W. of the S.E. corner of Section 27, T. 38 N., R. 8 E.). This well was drilled in 1915 to a depth of 2185 ft. by S. B. Geiger, Chicago. The diameter at the top was 18 in. and at the bottom 15 in. It was reported cased to a depth of 400 ft. The elevation at the top of the casing is 662.12 ft.

After the completion of the well, it was equipped with a turbine pump set at a depth of 325 ft. with 40 ft. of 9-in. suction pipe attached. A production of 750 gpm. was reported in 1916, but the

well was not used extensively and furnished a total of only 10.6 mg. for that year. In 1923, when pumping at 600 to 650 gpm., the drawdown was 220 ft. from a non,-pumping water level of 50 ft. below the pump base. Daily operating periods of 8 to 9 hr.at average production rates of 650 gpm. were reported in Sept. 1925 and Nov. 1930. In July 1947, when pumping at 500 gpm., the drawdown was 203 ft. from a non-pumping water level of 70 ft. below the pump base.

The existing pump installation includes 350 ft. of 8-in. column pipe; 12-in. Aurora Pump Co. turbine pump; 75-hp. U. S. electric motor.

Water from this well in 1930 and in 1933 was found to have a chloride content of 32 and 30 ppm. and a hardness of 12.7 gr. per gal. A sample collected Feb. 1, 1943 after 9-hr. pumping at 360 gpm. showed this water to have a hardness of 27.6 gr. per gal., a mineral content of 652 ppm., and an iron content of 0.3 ppm. This quality appears to be largely typical of water from the Silurian system in this vicinity.

The River St. Well, called No. 7 was drilled in 1915 to a depth of 2262 ft. by S. B. Geiger and located about 40 ft. west of River St. and 135 ft. north of the Elgin, Joliet, & Eastern R. R. (approximately 2650 ft. N. and 2530 ft. W. of the S. E. corner of Section 28). The elevation at the top of the casing is 619.02 ft. This well had a diameter of 18 in. at the top and 15 in. at the bottom. It was cased from the surface to a depth of 300 ft. or through the shale. The well had an estimated flow of 150 gpm. at 2 ft. above the surface when drilled. Upon completion, it was equipped with a turbine pump set at a depth of 250 ft. and the discharge was 900 to 1000 gpm. The metered record of water pumped from the well in 1916 showed an average pumpage of 664,573 gpd.

On Oct. 25, 1924, the non-pumping water level was 50 ft. below the pump base and in Nov. 1930, pumping periods were 7 hr. daily at a rate of 1000 gpm. The well was reported in use about 6 hr. daily in Sept. 1938.

A production of 1200 gpm. was obtained from the well in Jan. 1941 which declined to about 800 gpm. in Dec. 1942. On Oct. 31, 1944, the water was found to have a chloride content of 21 ppm., a hardness of 400 ppm., a mineral content of 596 ppm., and a temperature of 53° F. indicating that practically all of the water was of origin in the Silurian formation.

The well was repaired in Nov. 1944. Bridges found in the well at depths of 700 and 1200 ft. and filling below 1700 ft. were removed, and the well was cleaned out to a depth of 2221 ft. Fourteen-in. casing was installed from the surface to a depth of 291 ft., and the annular space was cement grouted. Twelve-in. liners were placed between depths of 721 and 1198 ft. and between 1395 and 1895 ft.

The following pump was re-installed about June 1945: 270 ft. of 10-in. column pipe; 12-in., 10-stage Aurora Pump Co. turbine pump having a rated capacity of 500 gpm. against 430 ft. of head; the overall length of the pump is 10 ft. 4 in.; 20 ft. of 10-in. suction pipe; 270 ft. of air line; 150-hp. General Electric motor. A production test was reported on June 4 and 5, 1945. When pumping a* 400 gpm., the drawdown was 145 ft. from a non-pumping water level of 75 ft. below the pump base. A chloride content of 160 ppm., and an iron content of 1.6ppm., and a temperature of 64° F. was recorded on June 6, 1945. In July 1947, the non-pumping water level was 90 ft. below and when pumping at 500 gpm., the level was 245 ft.

Analysis of a sample (Lab. No. 108,029) collected Oct. 19, 1946 shows this water to have a hardness of 19.2 gr.per gal., a total mineral content of 885 ppm., and an iron content of 1.2 ppm. The high chloride content indicates that much of

LABORATORY NO. 108,029

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.2		Chloride	Cl	340.0	9.59
Calcium	Ca	83.4	4.17	Nitrate	NO_3	0.2	Tr.
Magnesium	Mg	28.8	2.37	Sulfate	SO_4	44.8	0.93
Sodium	Na	203.8	8.86	Alkalinity (as $CaCO_3$)		244.	4.88
Turbidity		10		Hardness (as $CaCO_3$)		329.	6.54
Color		0		Total Mineral Content		885.	
Odor		0					

the water is being obtained from the bottom of the hole.

The Stolps Island Well, called No. 8, was drilled in 1916 to a depth of 2280 ft. by S. B. Geiger and located about 225 ft. South of Fox St. and 100 ft. East of Stolp Island Ave. (approximately 1730 ft. N. and 1300 ft. E. of the S. W. corner of Section 22). -The elevation of the top of the casing is 627.92 ft. The well is 18 in. in diameter at the top, 15 in. at the bottom, and was cased to a depth of about 400 ft. The well flowed when drilled. On Oct. 25, 1924, the standing water level was 60 ft. below the top of the casing. The turbine pump was set at 200 ft. with 30 ft. of suction pipe attached. At that time, the pump discharge was throttled to about 980 gpm. and the pumping water level remained constant. In Sept. 1938, the well was used about 4 hr. daily.

The existing pump installation consists of 300 ft. of 10-in. column pipe; 14-in., 12-stage Aurora Pump Co. turbine having a rated capacity of 950 gpm. against 500 ft. of head; the overall length of the pump is 12 ft. 1 in.; 20 ft. of 10-in. suction pipe; 300 ft. of air line; 150-hp. General Electric motor.

A quality source test (Lab. Nos. 95952-95959) made on Apr. 27, 1943 after a 17-hr. idle period showed the following tabulated water quality while pumping at a rate of about 850 gpm.:

LABORATORY NOS. 95,952 - 95,959

Time	Temp. °F.	Cl ppm.	SO_4 ppm.	Alk. ppm.	Hd. (as $CaCO_3$)
8:20 A.M.	Start				
8:25	62	220	136.5	352	533
8:35	63	740	109.9	304	736
8:45	65	1230	82.5	248	908
8:55	65.5	1260	83.3	280	930
9:05	66	1170	80.2	260	891
9:15	66	1120	82.9	280	845
9:45	66	1150	77.2	280	845
10:20	66	1130	80.7	270	865

The mineral content and temperature changes indicate that after 45-minute pumping practically all of the water produced by this well is from the Mt. Simon sandstone from a depth of about 2100 ft. Naturally this specified depth is result of a blend of waters from about 1800 to 2280 foot depths.

The pump discharges to the mains at an average rate of about 1000 gpm. Non-pumping water levels have been reported as: 106 ft. from Sept. 1942 to Jan. 1943; 112 ft. on Oct. 24, 1944, Oct. 30, 1945, and Feb. 5, 1946.

Well No. 9 was drilled in 1923 to a depth of 2285 ft. by S. B. Geiger and located about 160 ft. west of Wood St. and 440 ft. north of Solfisburg Ave. (approximately 500 ft. S. and 1300 ft. E. of the N. W. corner of Section 23). The elevation at the top of the casing is 662.73 ft. The well is 18 in. in diameter at the top, 15 in. at the bottom, and is cased to a depth of 325 ft. A liner was reported placed between depths of 795 and 865 ft.

A production test was made upon completion of the well in 1923. While pumping at 1400 gpm. to free discharge at ground level, the water level was 167 ft. below the surface. At that time, the turbine pump was set at 220 ft. with 40 ft. of suction pipe attached. The pump had been placed first at a depth of 300 ft. and the discharge was 1500 gpm. On Oct. 25, 1924, the non-pumping water level was 50 ft. below the surface. In 1930, daily pumping periods were 8 hr. and the discharge rate was 1000 gpm. By 1942, production declined.

From Dec. 28, 1942 to May 19, 1943, the well was repaired under a contract with the Layne-Western Co., Chicago. The Mt. Simon sandstone was "shot" at depths of 2185, 2135, 2085, 2035, 1984, 1935, 1885, and 1833 ft. The well was cleaned out and bottom sounded at depth 2220 ft. New 16-in. steel casing was installed from the surface to a depth of 350 ft. 4 in., and the annular space between it and the old 18-in. casing was cement grouted to a depth of 150 ft. A new 10-in. id. steel liner was placed to a depth of 1755 ft. and suspended by a connection with the 16-in. casing. Various portions of the liner were slotted to provide inlets from the water-bearing formations of the St. Peter sandstone, Trempealeau limestone crevices, and the Galesville sandstone.

A production test was made May 24-26, 1943 by the State Water Survey. The standing water level before the test was 145 ft. below the top of the casing. After 12-hr. pumping at a uniform rate of about 900 gpm., apparent equilibrium was attained with a drawdown of 81 ft. Pumping was continued for another 16 hr. at about the same rate and then increased to about 1300 gpm. for 5 hr. The rate of pumping was then increased to 1400-1425 gpm. and after 12-hr. pumping at this rate, the total drawdown was 143 ft. After a 5-hr. shutdown period, the water level was 130 3/4 ft. below the top of casing and after 16 hr., it was

LABORATORY NOS. 99,427 - 99,434

Time	Temp. °F.	G.P.M.	Water Elev. MSL.	Fe ppm.	Cl ppm.	SO_4 ppm.	Alk. ppm.	Hd. (as $CaCO_3$)
8:34 A.M.			523					
8:35	64	748	461	12.1	405	39.1	230	403
8:37	61.5	1122	456	6.1	400	38.9	232	402
8:42	52	600	451	4.2	405	43.8	232	402
8:52	62.5	1047	449	2.1	390	40.9	232	395
9:22	63.5	1047	442	1.1	320	39.9	226	360
11:22	64	1001	440	1.2	325	37.2	224	371
1:22 P.M.	63.5	993	437	1.1	330	36.4	224	371
3:22	63.5	997	435					
5:22	64	991	431	1.1	335	35.4	226	375

124 1/2 ft., or 20 1/2 ft. above the former non-pumping level

A water level recorder was installed by the State Water Survey from July 20, 1943 to Nov. 23, 1943. Water levels below the top of casing were: 116 1/2 ft. on July 20; 119 ft. on Aug. 14, and Sept. 3; 118 ft. on Oct. 30.

The existing pump installation, made in Dec. 1943, consists of 248 ft. of 10-in. column pipe; 14-in., 12-stage Aurora Pump Co. turbine pump having a rated capacity of 950 gpm. against 400 ft. of head at 1150 rpm.; the overall length of the pump is 12 ft. 1 in.; 20 ft. of 10-in. suction pipe; 248 ft. of 1/4-in. air line; 200-hp. General Electric motor. On Dec. 20, 1943, after 30-minute pumping at 1120 gpm., the drawdown was 115 ft. from a non-pumping water level of 118 ft. below the pump base. On the following day after 3 1/2-hr. pumping at 1120 gpm., the drawdown was 111 ft. from a non-pumping water level of 122 ft. below the pump base.

On Aug. 19, 1947, this well contributed 876,750 gal.

A quality-source test (Lab. Nos. 99427-99434) was conducted on Mar. 7, 1944 after a 154-hr. idle period.

The temperature and high chloride content indicates that a considerable proportion of the water obtained from this well is of Mt. Simon origin. The chlorides in 1930 were 222 ppm., in 1933 were 235 ppm., and in 1943 were 370 ppm.

An iron removal plant is under construction near the site of the well about 100 ft. E. of Wood St.

Well No. 10 was drilled in 1924 in the northwest part of the city at southeast corner of Russell and West Park Ave. (approximately 800 ft. S. and 2300 ft. W. of the N. E. corner of Section 21). The elevation at the top of the casing is 673.23 ft. This well was drilled to a depth of 2299 ft. by S. B. Geiger and cased with 18-in. pipe to a depth of 400 ft. with a 17-in. uncased hole to 935 ft. where 106 ft. of 16-in. liner was set. Below the liner, the hole was finished 16-in. diameter to the bottom.

The well was equipped for pumping in 1925 and produced 1200 gpm. Some sand was discharged with the water which clogged service connections and meters on the mains near the station, and the well was reported out of service in Sept. 1925. After the completion of a reservoir constructed with baffles late in 1925, pumping was resumed discharging to the reservoir.

From 1941 to 1946, the well produced at average rates of 1200 to 1000 gpm. discharging into the surface reservoir. Non-pumping water levels below the pump base were reported as shown in Table 1. *

TABLE 1

Date	Water Level ft.
Aug.-Sept. 1942	137-141
Jan.-Feb. 1943	131-133
Aug.-Nov. 1943	142-146
Dec. 1943-May 1944	138-143
June-Nov. 1944	153-160
Dec. 1944-Mar. 1945	143-159
June, July, & Nov. 1945	161
Dec. 1945 & Feb. 1946	159

The pump installation was overhauled from June to Aug. 1947 and reinstalled: 272 ft. of 10-in. column pipe; 17-in., 9-stage American Well Works turbine; 200-hp. Westinghouse electric motor.

Well No. 11 was drilled in 1928 to a depth of 2250 ft. by S. B. Geiger and located at the Aurora Ave. pumping station about 2200 ft. north of the north city limits and 325 ft. W.of Aurora Ave. (approximately 450 ft. S. and 2600 ft. W. of theN. E. corner of Section 15). The elevation at the top of the casing is 635.0 ft.

The well was cased with 18-in. od. pipe from the surface to a depth of 405 ft.

The standing water level in 1929 was 80 ft. below the pump base, and in 1938, it was 130 ft. A production of 900 gpm. when discharging to the surface reservoir was reported in Sept. 1938. At that time, the pump was operated 14 hr. daily.

A decrease in the productive capacity of the well occurred in the summer of 1941. The well was rehabilitated during the following winter. Caving conditions and bridging were found in the well starting at a depth of about 1350 ft. and extending to 1687 ft. The Mt. Simon sandstone was "shot" at depths of 2159, 2077, 2030, 1950, 1894, 1848, and 1800 ft. The well was cleaned out to a depth of 2253 ft. and a 12 3/4-in. od. slotted liner was installed between depths of 1370 and 1770 ft.

Following the rehabilitation work, a production test was made by the State Water Survey Feb. 28-Mar. 2, 1942. Before the test, the standing water level was 132 1/2 ft. below the pump base, and the pumps at wells No. 5 and No. 12a were in operation. After 24-hr. pumping at a uniformly declining rate from 1000 to 950 gpm., the drawdown was 99 ft. The pumping rate was then increased to 1300 gpm. and continued for 24 hr. at this rate. The total drawdown was 132 ft. and the pumps in Wells No. 5 and No. 12a had been operating throughout the test period. After an additional 5-hr. pumping at an increased rate to 1440 gpm. the total drawdown was 157 ft. The pumps at Wells No. 5, 12, and 12a were all in operation, during the 5-hr. period. All pumps were then shut down except in Well No. 11 and after 1 1/2-hr. at an average rate of 1450 gpm., the drawdown was 139 ft. or a rise in the pumping level of 18 ft. after the other wells were shut down

The well was again placed in active service in Apr. 1942, and the pumpage records for the balance of the year show average production rates of 1450 to 1500 gpm. Water levels, in ft. below the pump base, are shown in Table 2.

TABLE 2

Date	Water Level	
	Non-Pumping ft.	Pumping ft.
Dec. 1942	125-136	241-246
1943	125-148	241-265
Feb. 7, 1944	133	
Aug. 27, 1944	155	

The existing pump installation includes 320 ft. of 10-in. column pipe; 17-in. American Well Works, turbine pump; 200-hp. Westinghouse electric motor.

This well is in daily service, and in 1946, the metered pumpage from Well No. 11 averaged 760,000 gpd.

Analysis of a sample (Lab. No. 92,485), collected Mar. 2, 1942 after 51-hr. pumping at 1400

LABORATORY NO. 95,186

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.6		Silica	SiO_2	9.5	
Manganese	Mn	0.0		Chloride	Cl	307.5	8.67
Calcium	Ca	93.1	4.66	Nitrate	NO_3	0.9	0.01
Magnesium	Mg	31.8	2.61	Sulfate	SO_4	39.3	0.82
Ammonium	NH_4	0.6	0.04	Alkalinity	(as $CaCO_3$)	258.	5.16
Sodium	Na	169.0	7.35				
Turbidity		Tr.		Hardness	(as $CaCO_3$)	363.5	7.27
Color		0		Residue		828.	
Odor		0					

gpm., showed this water to have a hardness of 18.8 gr. per gal., a total mineral content of 534 ppm., and an iron content of 0.6 ppm. The temperature was 61.4° F., and the chloride content was 136 ppm.

In 1930, the water was found to have a chloride content of 235 ppm., in 1933, 200 ppm., and a sample (Lab. No. 95,186) collected in Feb. 1943 was found to have a hardness of 21.2 gr. per gal., a mineral content of 828 ppm., and an iron content of 0.6 ppm.

Well No. 12 was drilled in 1929 to a depth of 2253 ft. by Wm. H. Cater, Chicago and located at the Aurora Ave. pumping station about 200 ft. north of the north city limits and 110 ft. southwest of Aurora Ave. The elevation at the top of the casing is 644.18 ft. The well is reported cased with 18-in. od. pipe to a depth of 400 ft. below which the hole is finished 17 in. in diameter.

On Mar. 15, 1930, the standing water level was 100 ft. below the pump base and when pumping at 1307 gpm., the drawdown was 234 ft. In Sept. 1938, the well was in service 15 hr. daily, and the pumping rate was 1150 gpm. In the winter of 1942-1943, the non-pumping water level was about 138 ft., and the drawdown was about 212 ft. when pumping at 1050 gpm.

The well was equipped for service with a 17-in. American Well Works turbine pump having 360 ft. of 10-in. column pipe and a 200-hp. Westinghouse electric motor. This installation was pulled in Aug. 1947. A bridge was found at a depth of about 1625 ft. and a back-fill of 32 ft. at the bottom.

A 14-in. slotted liner is to be placed between the depths of 1300 and 1700 ft.

Sample-study log of Well No. 12a furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Silt, sand and pebbles	10	10
Gravel, silty	5	15
Silurian system		
Niagaran - Alexandrian dolomites	85	100
Ordovician system		
Maquoketa shale, some limestone and dolomite	158	258
Galena - Platteville limestone and dolomite	332	590
Glenwood dolomite and sandstone	10	600
St. Peter formation		
Sandstone	185	785
Sandstone, shale and chert	35	820
Oneota dolomite some sandstone	160	980
Cambrian system		
Trempealeau dolomite	120	1100
Franconia sandstone and shale	90	1190
Galesville formation		
Sandstone, some dolomite	120	1310
Sandstone, incoherent	20	1330
Sandstone, dolomitic	35	1365
Eau Claire sandstone, siltstone, shale and dolomite	365	1730
Cambrian and Pre-Cambrian systems		
Mt. Simon - Fond du Lac sandstones	521	2251

TABLE 3

Hole Record				Casing and Liner Record			
22-in.	from 31.7	to 455	ft.	22-in.	from 6.5	to 31.7	ft.
17-in.	from 455	to 1633	ft.	18-in.	from 6.5	to 455	ft.
15-in.	from 1633	to 2251	ft.	16-in.	from 771	to 838.6	ft.
				16-in.	from 1333	to 1633	ft.

Well No. 12a was drilled in 1936 to a depth of 2251 ft. by the Layne-Western Co., Chicago, and located east of the Aurora Ave. pumping station, about 700. ft. east of Aurora Ave. (approximately 200 ft. S. and 1800 ft. W. of the N. E. corner of Section 15). The elevation of the pump base is 669.14 ft. and is about 2 1/2 ft. above the top of casing.

The driller's hole, casing and liner record is given in Table 3.

Upon the completion of the well, a production test was made by the State Water Survey on Sept. 24, 1936. Before the test, water level was 128 ft. 8 in. below the top of the casing.

After 4-hr. pumping at 1100 gpm., the drawdown was 98 ft. The rate was then increased to 1325 gpm. and after 12-hr. pumping, apparent equilibrium was attained with a drawdown of 124 ft. Pumping was continued at an average rate of 1310 gpm. and at the end of 25 hr.the total drawdown was 132 1/2 ft. During this test, Well No. 11 pump was operating at the start and continued pumping at a rate of 1000 gpm. for nearly 23 hr. of the test. Well No. 12 pump was operated at a rate of 1400 gpm. during the last 7 hr.of the test.

The existing pump installation consists of 350 ft. of 10-in. column pipe; 14-in., 13-stage Aurora Pump Co. turbine, No. 8209, having a rated capacity of 1300 gpm. against 440 ft. of head; the overall length of the pump is 13 ft. 11 1/4 in.; 10 ft. of 10-in. suction pipe; 200-hp. General Electric motor.

Non-pumping water levels during 1943 were reported to be 157 to 178 ft. below the pump base and pumping levels were 268 to 298 ft. The extremes denoting winter and summer conditions respectively. In 1944, the non-pumping water levels varied from 161 ft. on Jan. 18 to 188 ft. on Sept. 19. In 1945, the variations were about the same as 1944. On Feb. 25, 1946, the non-pumping water level was 166 ft.

Analysis of a sample collected Feb. 2, 1943, after 12-hr. pumping at 1300 gpm., showed the water to have a chloride content of 212 ppm., a hardness of 14.9 gr. per gal., a total mineral content of 667 ppm., and an iron content of 0.2 ppm.

Water from the well is aerated.

The Phillips Park Well, now called No. 14, was drilled to a depth of 2460 ft. in 1909 and located about 340 ft. east of the south end of Smith Boulevard about 90 ft. northeast of the center of N. Circle Drive (approximately 200 ft. S. and 2200 ft. E. of the N. W. corner of Section 35). The elevation at the top of the casing is 704.94 ft.

The well was reported to be cased with 10-in. pipe from the surface to a depth of 133 ft. 8 in.- A 6 1/4-in. liner, was placed between depths of 934 and 1015 ft. and a 5-in. liner between depths of 1715 and 2015 ft. below which the hole was 5-in. diameter to the bottom.

In 1915, a sample of water from this well was found to have a hardness of 52 gr. per gal. and a total mineral content of 2.992 ppm. This is typical of waters from the greater depths in the Mt. Simon-Fond du Lac sandstones.

The pump installation consists of 110 ft. of 5-in. column pipe; 8-in. American Well Works turbine pump; 30-hp. U. S. electric motor which is operated from 18 to 24 hr. daily.

From Mar. to Nov. 1945, the non-pumping water levels varied between 47 1/2 and 51 ft. below the pump base. On Feb. 25, 1946, the non-pumping level was 48 ft.

A sample collected Feb. 2, 1943 after 18-hr. pumping at 280 gpm. was found to have a chloride content of 8.0 ppm., a hardness of 26.8 gr. per gal., a residue of 551 ppm., and an iron content of 0.2 ppm. The general character was typical for waters from the Silurian system in this vicinity.

Total metered pumpage for the public supply in 1945 and 1946 averaged 4.4 mgd. for each year.

LABORATORY NO. 31,105

		ppm.	epm.			ppm.	epm.
Calcium	Ca	274.0	13.70	Chloride	Cl	1300.0	36.70
Magnesium	Mg	50.0	4.11	Nitrate	NO_3	1.1	0.02
Sodium	Na	605.0	26.23	Sulfate	SO_4	98.0	2.04
				Alkalinity (as $CaCO_3$)		264.	5.28
Turbidity		0		Hardness (as $CaCO_3$)		890.	17.81
				Residue		2992.	

Total metered pumpage for each municipal well in operation during the year 1946 is shown in Table 4.

TABLE 4

Well No.	Total Pumpage mg.
5	139.4
6	29.4
7	88.7
8	12.9
9	152.8
10	168.2
11	279.5
12	209.5
12a	403.2
14	130.6
Total mg. for year	1614.2
Average mgd.	4.4

AUX SABLE LOCK -
I. & M. CANAL STATE PARK
Grundy County
Nov. 20, 1947

The W. J. Fulton Engineering Co., Waukegan, drilled a well for the I. & M. Canal State Park in 1942 and located 4 ft. east of the custodian's residence and 58 ft. south of the center of Aux Sable Lock (or approximately 2600 ft. S. and 910 ft. E. of the N. E. corner of Section 29, T. 34 N., R. 8 E.).

The well is 185 ft. deep below a surface elevation of 512± ft.

The well is cased with 8-in. pipe to a depth of 83 ft. and the hole is 6 in. in diameter from 83 to 185 ft.

The State Water Survey made a production test July 15, 1938. The water level before the test was started, was 14 ft. below the top of the casing; and when pumping at 30 gpm., the drawdown was 77 ft.

Analysis of sample (Lab. No. 93438) collected July 15, 1942, after 32 1/2-hr. pumping at 31 gpm., showed the water to have a hardness of 15.1 gr. per gal., a residue of 358 ppm., and an iron content of 0.9 ppm.

The Aux Sable Lock, I. and M. Canal State Park was abandoned about 1943.

The well had never been used. The well flowed over the top of the casing (about 2 ft. above ground) shortly after it was completed, and 5 ft. of casing was placed above the original casing and sealed at the top.

The canal is maintained between Marseilles and Channahon. The depth of water in the canal below Aux Sable Lock is 3 1/2 ft. and is maintained as a source of water supply for the Morris Paper Mills and to farmers for irrigation purposes.

Correlated driller's log of Well No. 1 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Drift	18	18
Marl	4	22
Pennsylvanian system		
Sandstone	4	26
Gravel and shale	4	30
Ordovician system		
Galena formation		
Limestone	155	185

LABORATORY NO. 93438

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.9		Silica	SiO_2	6.5	
Manganese	Mn	0.0		Chloride	Cl	14.0	.39
Calcium	Ca	61.1	3.05	Nitrate	NO_3	0.2	Tr.
Magnesium	Mg	29.4	2.42	Sulfate	SO_4	29.6	0.62
Ammonium	NH_4	1.5	0.08	Alkalinity	(as $CaCO_3$)	290.	5.80
Sodium	Na	29.0	1.26	Hardness	(as $CaCO_3$)	274.5	5.47
Turbidity		0		Residue		358.	
Color		0		Free CO_2 (calc.)		43.	
Odor (at well)		H_2S		pH = 7.1			
Temperature 53.3° F.							

AVA
Jackson County
Apr. 6, 1948

The city of Ava (821) installed a public water supply in 1938.

Water was originally obtained from a well owned by the Randolph Milling Co. and leased to the city. This well was located near the east end of Mill St. and was reported to have been drilled about 1907 to a depth of 550 ft.

The well was equipped as follows: 300 ft. of 4-in.od. column pipe; 37-stage, Size 6 Fairbanks-Morse turbine pump No. 30926, rated at 50 gpm. against 315 ft. of head; 20 ft. of suction pipe; 7 1/2-hp. Fairbanks-Morse electric motor No. 322325, operating at 1740 rpm.

Analysis of a sample (Lab. No. 75864), collected Mar. 30, 1935, showed the water to have a hardness of 28.8 gr. per gal., a residue of 654 ppm., and an iron content of 2.4 ppm.

This well was abandoned about 1940 after the production rate had decreased to 8 gpm. The pump has been removed but the well is available for pumping.

Well No. 1 was drilled in 1940 to a depth of 207 ft. by Albert Crawford, Ava, and is located about 170 ft. south and 40 ft. west of the milling company well, (or approximately 2500 ft. S. and 1135 ft. E. of the N. W. corner of Section 25, T. 7 S., R. 4 W.). The ground surface elevation is 600± ft.

The well is cased with 52 ft. 5 in. of 8-in. id. pipe, below which the hole is 6 in. in diameter.

In 1941, it was reported that the non-pumping water level was about 132 ft. below the ground surface and that the drawdown was small after 24-hr. pumping at 25 gpm.

The well is equipped with 186 ft. of 4-in. drop pipe; Deming plunger pump, No. 60227, with a 3 3/4-in. by 36-in. cylinder having a 10-in. stroke operating at 42 spm.; 6 ft. of 4-in. suction pipe; 5-hp. Louis Allis Co. electric motor.

Analysis of a sample (Lab. No. 113,844), collected Mar. 16, 1948 after 8-hr. pumping at 15 gpm. showed the water to have a hardness of 25.9 gr. per gal., a residue of 580 ppm., and an iron content of 0.7 ppm.

Correlated driller's log of Well No. 1 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil	35	35
Gravel	15	50
Pennsylvanian system		
Yellow sandstone	3	53
Limestone and shale	122	175
White sandstone	30	205
Shale	2	207

LABORATORY NO. 113,844

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.7		Silica	SiO_2	15.8	
Manganese	Mn	0.2		Fluoride	F	0.1	
Calcium	Ca	98.1	4.91	Chloride	Cl	7.0	0.20
Magnesium	Mg	48.3	3.97	Nitrate	NO_3	2.0	Tr.
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	137.0	2.84
Sodium	Na	35.0	1.52	Alkalinity (as $CaCO_3$)		368.	7.36
Turbidity		10-		Hardness (as $CaCO_3$)		444.	8.88
Color		0		Residue		580.	
Odor		0		Free CO_2 (calc.)		72.	
Temperature 57.5° F.				pH = 7.1			

Well No. 2 was drilled in 1942 to a depth of 214 ft. by Albert Crawford and deepened in Dec, 1947 to 308 ft. The well is 10 ft. north and 80 ft. east of Well No. 1. It was originally cased with 8 1/2-in. pipe to a depth of 55 ft. When deepened, the hole was finished 6 in. in diameter. In the 1942 drilling, water was encountered at a depth of 194 ft., and upon completion, the non-pumping water level was 65 ft. below the ground surface. After 1-hr. pumping at 6 gpm., the drawdown was 90 ft. In Dec, 1947, when bailing at a rate of 35 to 40 gpm., the drawdown was 90 ft. below a static level of 80 ft. from the top of the casing.

A temporary pump installation in service, consists of: 180 ft. of 4-in. drop pipe; Myers bulldozer pump having a 2 3/4-in. by 36-in. cylinder; a 21-in. stroke operating at 25 spm., or a discharge of about 6 1/2 gpm.

Water from both wells is aerated, filtered and softened.

Analysis of a sample (Lab. No. 114,785) collected Apr. 17, 1948, showed the treated water to have a hardness of 12.9 gr. per gal., a mineral content of 541 ppm., and a trace of iron.

From Mar. 1 to 15, 1948, total pumpage averaged 15,000 gpd.

LABORATORY NO. 114,785

	ppm.	epm.			ppm.	epm.
Iron (total) Fe	Tr.		Fluoride	F	0.2	
			Chloride	Cl	14.0	0.39
Turbidity	0		Alkalinity (as $CaCO_3$)		380.	7.60
Color	0		Hardness (as $CaCO_3$)		221.	4.42
Odor	Tr.		Total Mineral Content		541.	
Temperature 58.7° F.			Free CO_2 (calc.)		15.	
			pH = 7.8			

AVON
Fulton County
Jan. 30, 1948 '

The water works for the village of Avon (803) was installed by the Avon Milling Co. about 1899 and used mainly for fire protection.

At that time water was obtained from two dug wells located in the northwestern part of the village. Well No. 1 was 8 ft. in diameter and 38 ft. deep. Well No. 2 was located 100 ft. distant from Well No. 1 and was dug 52 ft. deep with a diameter of 10 ft. at the top and 8 ft. at the bottom. Both wells were walled with brick with lime plaster joints. It was reportedthat a sand stratum was entered at a depth of about 22 ft. When no water was withdrawn for several days, the water level was 10 to 15 ft. below the surface; but during pumping, the water level receded rapidly. Use of the wells was discontinued about 1918. In 1924, the water level in the wells was 10 ft. below the surface.

Several years prior to 1915, a source of supply was developed in the southern part of town by constructing a dam across a small slough. The deepest part of the pond was 6 ft., and the capacity was about 1,000,000 gal. The water was used for fire protection. Use of the pond was abandoned about 1922.

In 1918, water was being used from the Chicago, Burlington, & Quincy R. R. pond, located about 3/4 mile east of the village. Several fire hydrants were connected to the railroad's 6-in. pipe line, feeding the elevated tank at the depot.

In 1922, the village was obtaining the entire water supply from the railroad's reservoir.

In Apr. 1929, Thorpe Well Drilling Co., Des Moines, Iowa, completed a well for the village, located on the south side of Clinton St., 100 ft. east of the Chicago, Burlington, & Quincy R. R. tracks (or approximately 2190 ft. N. and 2430 ft. E. of the S. W. corner of Section 19, T. 8 N., R. 1 E.).

The well is 1170 ft. deep below a ground surface elevation of 640± ft.

The well was originally cased as follows: 12-in. casing from surface to 167 ft.; 10-in. liner from 272 1/2 to 580 ft.; and an 8-in. liner from 667 to 829 ft.

In 1936, in an effort to obtain water of better quality, the well was plugged at a depth of 667 ft. However, analysis of a sample (Lab. No. 78,688) showed a residue of 2601 ppm., as against 2708 ppm. for the water obtained, prior to plugging the well. The production from the well at 667 ft. depth was 7 gpm. as against 170 gpm. at the 1170 ft. depth.

The plug was removed, and the well cased with 8-in. pipe from the surface to 350 ft. and with 6-in. pipe from 350 to 650 ft.

At that time the following pumping equipment

Sample study log of well drilled in 1929 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay, clayey sand and till	40	40
Pennsylvanian system		
Shale	90	130
Mississippian system		
Keokuk - Burlington limestone and dolomite	155	285
Kinderhook shale	285	570
Devonian system		
Limestone, shaley at top	30	600
Silurian system		
Niagaran - Alexandrian dolomite	72	672
Ordovician system		
Maquoketa shale, some dolomite	138	810
Galena - Platteville dolomite	325	1135
St. Peter sandstone	35	1170

was installed: 200 ft. of 4-in. column pipe; 4-in., 16-stage A. D. Cook deep-well turbine pump, No. 2383, rated at 75 gpm.; the overall length of the pump is 7 1/2 ft.; 20 ft. of 4-in. suction pipe; 7 1/2-hp., 1800-rpm. U. S. electric motor, No. 132509.

On Apr. 22, 1938, the non-pumping water level was reported to be about 80 ft. below ground surface, and the drawdown about 20 ft. when pumping at 75 gpm.

In June, 1943, while replacing several sections of corroded oil shaft tubings, the water level was reported to be 112 ft. The replacement of corroded tubing had been an annual event for several years.

Analysis of a sample (Lab. No. 113,349), collected Jan. 30, 1948 after 3 1/2-hr. pumping, showed the water to have a hardness of 51.7 gr. per gal., a residue of 2656 ppm., and an iron content of 0.7 ppm.

Pumpage is estimated to average 12,000 gpd.

The village has purchased the C. B. & Q. R. R. reservoir located 3/4 mile east of Avon, and is constructing a treating plant. The well supply is to be abandoned as soon as the filtration plant is in operation.

LABORATORY NO. 113,349

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.7		Silica	SiO_2	13.7	
Manganese	Mn	0.0		Fluoride	F	3.5	
Calcium	Ca	214.4	10.72	Chloride	Cl	305.0	8.60
Magnesium	Mg	85.6	7.04	Nitrate	NO_3	Tr.	Tr.
Ammonium	NH_4	1.6	0.09	Sulfate	SO_4	1333.8	27.75
Sodium	Na	522.1	22.70	Alkalinity	(as $CaCO_3$)	210.	4.20
Turbidity		Tr.		Hardness	(as $CaCO_3$)	888.	17.76
Color		0		Residue		2656.	
Odor		0					
Temperature		67 1/2° F.					

The system of water works was established by the Village of Barrington (3560) in 1898.

Two limestone wells have furnished the public water supply since that date. The first well, drilled in 1898 to a depth of 305 ft., is located about 95 ft. west of Hough St. and 80 ft. south of Station St. (approximately 425 ft. S. and 1200 ft. E. of the N. W. corner of Section 1, T.42 N., R. 9 E.). The elevation of the pump house floor is 819.06 ft. The present pump base and the approximate ground surface are at floor level. A second well was constructed in Oct. 1929, and is located on Station St. about 210 ft. west of Hough St. and 130 ft. northwest of the older well. The elevation of the pump base is 811.13 ft. It is about 4.5 ft. below the ground surface.

Well No. 1 is cased with 200 ft. of the 12-in. pipe to rock, below which the hole is 10 in. in diameter to the bottom of the well at 305 ft. The non-pumping water level, observed on Nov. 9, 1922 after an idle period of 12 hr.,was 56 ft. below the pump house floor (3 1/2 ft. above top of casing.). The pumping water level was 61 ft. after 9-hr. of operation at a rate of 270 gpm. On June 21, 1928 a drawdown of 16 ft., from a non-pumping water level of 61 ft., was observed when pumping at a rate of 380 gpm.

On July 20, 1943 the non-pumping water level in Well No. 1 was 66.1 ft. below the existing pump base with pump in Well No. 2 operating, and the pumping level was 75.4 ft. with Well No. 2 idle.

The following pumping equipment, installed in 1935, is still in place: 80 ft. of 6-in. column pipe; a 12-in., 3-stage American Well Works turbine pump rated at 600 gpm. against 115 ft. of head; 20 ft. of 6-in. suction pipe; 80 ft. of air line, and 25-hp. U.S. electric motor.

Well No. 2 was drilled by W. L. Thorne & Co., Des Plaines, in 1929, to a depth of 310 ft. The lower 100 ft. was filled with gravel and sealed. The well is cased with 16-in. pipe to 192 ft., below which the hole is 16 in. in diameter to 210 ft.

Upon completion of the well the pump was operated successive days from Oct. 30 to Nov. 1, 1929 until the water cleared. On Nov. 1, 1929, after 4-hr. pumping at a rate of 540 gpm., the drawdown was 13.75 ft. below a non-pumping water levelof 53.45 ft. below the present pump base. When the pump in No. 1 was operating, the non-pumping water level in No. 2 was 57.85 ft.

OnNov. 6 to 8, 1933, a series of tests (Table 1) were made by the State Water Survey to determine the yield and drawdown of both wells. On Nov. 7, 1933 after both pumps had been out of operation for 7 hr., the pump in Well No. 1 was operated alone for 4 hr. 25 min. No. 1 was then shut down and No. 2 was operated for 2 hr. On Nov. 8, 1933 after an idle period of 19 hr. for pump No. 1, and 9 1/2 hr. for No. 2, the pump in No. 2 was then operated alone for 1 hr. The pumps in both wells were then operated simultaneously; and after 2 hr. the production from No. 1 had decreased from 350 to 285 gpm. After 4 hr. the production from No. 1 had decreased to 200 gpm. The production from No. 2 was uni-

Sample-study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Till	85	85
Gravel, Clayey	35	120
Gravel, clean	10	130
Sand, some pebbles in upper part	25	155
Clay	5	160
Sand	10	170
Silurian system		
Niagaran-Alexandrian dolomites, little crevice sand	60	230
Ordovician system		
Maquoketa shale and dolomite	80	310

TABLE 1

Date	Non-operating Period		Non-pumping Water level		Pumping period		Pumping Rate		Drawdown	
	Well 1 (hr.)	Well 2 (hr.)	Well 1 (ft.)	Well 2 (ft.)	Well 1 (hr.)	Well 2 (hr.)	Well 1 (gpm.)	Well 2 (gpm.)	Well 1 (ft.)	Well 2 (ft.)
Nov. 7 1933	168.0	8.5	60.77	51.95	4.5	--	350	0	3.65	3.12
Nov. 7 1933	0	13.0			---	2.0	0	700		11.73
Nov. 8 1933	19.0	9.5	61.62		---	1.0	0	635	5.15	
Nov. 8 1933	20.0	0			2.0	2.0	285	635	9.72	
Nov. 8 1933	0	9.0		50.83	4.0	5.0	200	635	9.95	14.57

form at 635 gpm.

All water level measurements were made from the surface of the pump house floor.

The following pumping equipment, installed in 1929, is still in place: 80 ft. of 8-in. column pipe; a 15-in., 3-stage American Well Works turbine pump, rated at 600 gpm., against 91 ft. of head; the overall length of the pump is 5 ft.; 30 ft. of 8-in. suction pipe; 80 ft. of air line and a 20-hp. Westinghouse electric motor.

Analysis of a sample (Lab. No. 106,280), collected on Apr. 26, 1946 after 6-hr. pumping at an estimated rate of 400 gpm., showed this water to have a hardness of 18.5 gr. per gal., a mineral content of 385 ppm.,and general character which is not unusual for waters from wells of this depth in this vicinity.

The average metered pumpage from these 2 wells for the period from May 1, 1942 to May 1, 1945 was 347,600 gpd. The pumpage varied from a winter average of 306,000 gpd. to a summer average of 460,000 gpd. A small amount of aeration is provided at the reservoir to eliminate a slight hydrogen sulfide odor. No other treatment is provided.

LABORATORY NO. 106,280

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.3		Silica	SiO_2	23.5	
Manganese	Mn	0.1		Fluoride	F	0.4	
Calcium	Ca	58.1	2.90	Chloride	Cl	2.0	0.06
Magnesium	Mg	41.9	3.45	Nitrate	NO_3	1.1	.02
Ammonium	NH_4	0.4	.02	Sulfate	SO_4	75.9	1.58
Sodium	Na	13.1	0.57	Alkalinity	(as $CaCO_3$)	264.	5.28
Color		0		Hardness	(as $CaCO_3$)	318.	6.36
Odor		0		Residue		385.	
Turbidity		10					
Temperature		51.3° F.					

The city of Barry (1545) installed a public water supply, chiefly for fire protection, about 1880.

Water was obtained originally from a well drilled about 1880 by the J. P. Miller Artesian Well Co., Chicago, and located near the north edge of the city park (or approximately 1500 ft. S. and 2000 ft. E. of the N. W. corner of Section 25, T. 4 S., R. 6 W.). This well was drilled to a total depth of 2510 ft. below a ground surface elevation of 730t ft. The well was cased with 7-in. pipe to a depth of 300 ft., and the hole diameter was successively reduced to 2 in. at the bottom.

It was reported that during drilling operations water was encountered at depths of 65, 700, 1300, and 1700 ft. When the well was completed the water level was reported to be 135 ft.

The pump cylinder was originally set at a depth of 300 ft. but was later raised to 160 ft. In 1914, the pump cylinder was set at a depth of 300 ft. and, when tested, the well produced 35 gpm. for 40 hr. This well was abandoned in 1916, but is still in existence.

Analysis of a sample (Lab. No. 22152) collected July 10, 1911, showed the water to have a hardness of 59.2 gr. per gal., a residue of 5047 ppm. and an iron content of 0.7 ppm.

The supply is now obtained from 3 sources: A spring, a dug well, and a group of sand points. Water from the 3 sources is discharged into a concrete underground reservoir and thence pumped to the city distribution system.

The spring, which has been in use since 1916, is located at the pumping station about 70 ft. west of the reservoir at the foot of the bluff, 1 mile west of the city (approximately 600 ft. S. and 1400 ft. E. of the N. W. corner of Section 26). The ground surface elevation at the spring is 640t ft.

In 1918 water flowed from the spring into a reservoir at a rate of between 20 and 50 gpm., depending on weather conditions and on Jan. 5, 1925, the flow was reported to be 25 gpm.

Analysis of a sample (Lab. No. 114,129) collected Apr. 8, 1948 at the reservoir showed the water to have a hardness of 9.6 gr. per gal., a residue of 192 ppm., and an iron content of 0.2 ppm.

The dug well was constructed in 1931 by George Cook, and is located in the rear of the pump station, 25 ft. south of the reservoir. This well is 10 1/2 ft. in diameter, about 19 ft. deep to bedrock and is walled with brick. Water enters the well just above the bedrock.

The supply from this well has always been small. Water is pumped by a Dayton-Dowd centrifugal pump, operated at 100 gpm. against 20 ft. of head, with a 2-in. suction pipe extending 14 ft. below the pump base. Power is furnished by a 1 1/2-hp. Fairbanks-Morse electric motor operating at 1740 rpm. W. G. McNeal, Water Works - Superintendent, stated that in 1947 when installing a new pump pit between the reservoir and the p'umping station, it was necessary to keep the dug well dewatered. The well was pumped dry in 1 hr. 40 min. and he estimated the amount of water pumped was 10,000 gal. The capacity of the well is 5,000 gal. and the inflow rate was calculated at 50 gpm.

Since that time there has been a strong flow into the well.

Analysis of a sample (Lab. No. 114,124) collected Apr. 8, 1948 at the reservoir showed the water to have a hardness of 9.4 gr. per gal., a residue of 201 ppm. and an iron content of 0.1.

In 1934, eight 1 1/4-in. sand point wells, located in a group about 200 ft. north of the reservoir, were installed by jetting 6-in. holes, and placing the sand points and casings. The annular space outside the casings and screens was back-filled with gravel. Water is pumped to the reservoir from the sand points by a Deming duplex pump, estimated to deliver 40 gpm. (soon to be replaced by a 1 1/2-in. Fairbanks-Morse centrifugal pump.). Power is furnished by a 1 1/2-hp. Emerson electric motor.

Analysis of a sample (Lab. No. 114,125) collected Apr. 8, 1948 at the pump showed the water to have a hardness of 11.3 gr. per gal., a residue of 256 ppm. and an iron content of 0.1 ppm.

Total pumpage for Mar. 1948 averaged 60,000 gpd. and for Aug. 1947 averaged 85,000 gpd.

Three 2-in. -sand-point wells were jetted-in in Apr. 1948 at a location near the 8 sand-points. Each new one is 42 in. long and the bottom of one is 23 ft. below ground level. The others are 30 ft. below ground level. The annular space outside the casings was back-filled with pea gravel. On Apr. 21, 1948, the water level outside the casings was 3 ft. below ground level.

LABORATORY NO. 114,125

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	18.4	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	65.1	3.26	Chloride	Cl	12.0	0.34
Magnesium	Mg	7.3	0.60	Nitrate	NO_3	15.8	0.25
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	30.0	0.62
Sodium	Na	9.0	0.39	Alkalinity	(as $CaCO_3$)	152.	3.04
Turbidity		0		Hardness	(as $CaCO_3$)	193.	3.86
Color		0		Residue		256.	
Odor		0					
Temperature 49° F.							

The water is chlorinated.

When the new wells will be connected to the pump, the 8 older wells are to be abandoned.

BARTLETT
Cook County
Apr. 24, 1946

A public water supply system was installed by the village of Bartlett (608) in 1924.

Water is obtained from a well 200 ft. deep located on the west side of Main St. about 500 ft. south of the Chicago, Milwaukee & St. Paul R. R. (or approximately 1100 ft. N. and 400 ft. W. of the S. E. corner of Section 34, T. 41 N., R. 9 E.). The elevation of the ground surface is 810± ft. The well was completed by W. L. Thorne, Des Plaines, in Nov. 1923. It is cased with 155 ft. of 8-in. diameter pipe extending 9 ft. into limestone below which the hole is 8 in. in diameter.

During a production test, when the well was completed, the drawdown was 4 ft. from a non-pumping water level of 33 ft. below the pump base after pumping 3 1/2 hr. at 265 gpm.

The following pumping unit was installed in 1936: 100 ft. of 6-in. screwed column pipe; 8-in., 10-stage Cook turbine rated at 200 gpm. against a pressure of 52 psi.; the overall length of the pump is 7 ft. 3 in.; 10 ft. of 5-in. suction pipe; 20-hp. U. S. electric motor. The distance to water at the time of this installation was 37 ft.

Analysis of raw water sample (Lab. No. 106,281) collected on Apr. 22, 1946 at 3:00 p.m. after 2-hr. pumping at 200 gpm., showed this water to have a hardness of 24.8 gr.per gal., a residue of 435 ppm., and an iron content of 1.0 ppm.

All water has been chlorinated since 1938, and iron bacteria have been reported to be effectively eliminated. Liquid chlorine is employed.

LABORATORY NO. 106,281

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.0		Silica	SiO_2	21.2	
Manganese	Mn	0.0		Fluoride	F	0.3	
Calcium	Ca	83.1	4.15	Chloride	Cl	4.0	0.11
Magnesium	Mg	53.0	4.36	Nitrate	NO_3	0.3	Tr.
Ammonium	NH_4	0.5	.03	Sulfate	SO_4	40.7	0.85
Sodium	Na	0.5	0.02	Alkalinity	(as $CaCO_3$)	380.	7.60
Color		0		Hardness	(as $CaCO_3$)	426.	8.52
Odor		0		Residue		435.	
Turbidity		10					
Temperature	51° F.						

Correlated driller's log of well drilled in 1945 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil, yellow and blue clay	48	48
Gravel, dirty (water-bearing)	50	98
Quicksand	28	126
Stony blue clay	5	131
Lake sand (water-bearing)	12	143
Sand and gravel (water-bearing)	8	151
Silurian system		
Niagaran series		
Limestone (water)	49	200

A second well, located 15 ft. east of the first well, was drilled by Henry Boysen, Jr., Libertyville, in Nov. 1945. It is 200 ft. deep and is cased with 8-in. pipe to a depth of 151 ft. below which the hole is 8 in. in diameter.

The distance to water below the top of the casing is 3 7 ft. when the older well is idle. This well is to serve as an emergency supply unit. No pumping equipment was installed on Apr. 22, 1946.

The pumpage is not metered but is estimated to average 28,000 gpd. including the flushing of mains and hydrants. During dry summer months, the maximum pumpage is estimated to be 35,000 gpd.

BATAVIA
Kane County
Sept. 5, 1947

A public water supply was installed by the city of Batavia (5101) in 1894.

Water has always been obtained from sandstone wells. The initial supply was from a single well until 1915 when a second well was drilled. A third well was added in 1941. These wells were all drilled by the J. P. Miller Artesian Well Co.

The original well, now called No. 1, was drilled to a depth of 1279 ft. and located about 255 ft. south of Wilson St. and 78 ft. east of Island Ave. (approximately 2000 ft. S. and 1700 ft. W. of the N.E. corner of Section 22, T. 39 N., R. 8 E.). The well was cased with 10-in. pipe to a depth of 40 ft. below which hole diameters of 8 and 4 in. were reported. A 6-in. liner was installed between depths of 800 and 860 ft. Sandstone formations were penetrated between depths of 520 and 825 ft. and 1110 and 1270 ft. The well flowed when completed in 1894.

The elevation at the top of the casing is 665± ft.

Water was pumped by suction or air lift discharging into a surface collecting reservoir. In 1911, the pumping water levels below the top of casing varied from 16 ft. for the winter, spring, and fall to 40 ft. during the longer summer pumping periods. When pumping by air lift the production averaged 800 gpm. in 1911, and 600 gpm. in 1918.

This well furnished the entire public supply until the second well was placed in service in 1915. Since then it has served as an emergency supply unit. In 1945 the production rate was 600 gpm.

Well No. 2 was originally drilled to a depth of 2000 ft. in 1915 and is located about 290 ft. south of Wilson St. and 100 ft. east of Island Ave. (approximately 2050 ft. S. and 1680 ft. W. of the N. E. corner of Section 22). The elevation of the top of casing is 667.4± ft.

The production rates and water levels have been reported in Table 1.

The well was rehabilitated by the J. P. Miller Artesian Well Co., Brookfield, May to Dec, 1945. Before work was started the well was sounded and found filled to a level of 1547 ft. The old casing and liner were removed. The well was reamed to a larger diameter, drilled 200 ft. deeper and recased. The hole sizes and casing record were reported as follows in Table 2.

After the work was completed a 24-hr. production test was made by the State Water Survey on Oct. 2-3, 1945. The water level before the start of the test was 125 ft. The discharge was irregular during periods of the test and varied from 615 to 365 gpm. Well No. 3 was operated intermittently during the test. After breaking suction several times, a constant rate of 475 gpm. was established with a drawdown of 81 ft. Well No. 3 was not in operation.

Following this production test the 12-in. liner between depths of 1260 and 1670 ft. was removed and the well was "shot" at depths of 1250, 1239, 1229, and 1224 ft. During cleanout operations a bridge was found at a depth of 1290 ft. and no sand had fallen below that depth. No change in the water level was observed at any time.

A 24-hr. production test was made by the State Water Survey on Nov. 30 and Dec. 1, 1945. The water level before the start of the test was 128 1/2 ft. below a floor elevation of 667.4 ft. Water was pumped at rates of: 850 gpm. during the first 4 1/2 hr.; 1000 gpm. for the next 17 1/2 hr.; 1250 gpm. for the next hr.; and 1430 gpm. during the last hr. of the test. Well No. 3 was operated intermittently during the test. At the end of 24 hr. the total drawdown was 81 1/2 ft. and the pump in Well No. 3 was not operating.

TABLE 1
Water Levels Below Pump Base

Year	Production gpm.	Non-Pumping ft.	Pumping ft.	Remarks
1918	1140	6	40	
1924	1143	40	83	
1936	740	*85	*105	*Observed in Well No. 1
1942		*92		
1945	600±	113	132	Before rehabilitation

TABLE 2

Hole Record				Casing Record			
28-in.	from	0 to	50 ft.	*26-in.	from	0 to	50 ft.
24-in.	from	50 to	234 ft.	*20-in. od.	from	0 to	233 ft.
19 1/4-in.	from	234 to	940 ft.	16-in.	from	790 to	940 ft.
15 1/4-in.	from	940 to	1670 ft.	12-in.	from	1260 to	1670 ft.
12-in.	from	1670 to	2201 ft.	*Annular space cement grouted.			

The existing pump installation, made in Dec. 1945, consists of 230 ft. of 10-in. column pipe; 14-in., 8-stage Aurora Pump Co. turbine pump, No. 27904, having a rated capacity of 1000 gpm. against 243 ft. of head at 1150 rpm.; the overall length of the pump is 9 ft. 2 in.; 10 ft. of 10-in. suction pipe with strainer; 240 ft. of 1/4-in. gi. air line; 75-hp. Westinghouse electric motor.

On Aug. 13, 1947 the non-pumping water level was 145 ft. below the pump base after a 4-hr. idle period and a pumping level of 198 ft. after 45-minute pumping at 1350 gpm. Well No. 3 was not in operation during these observations.

Pump operations were alternated with Well No. 3.

Sample-study log of Well No. 3 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil	1	1
Silurian system		
Niagaran-Alexandrian dolomites	69	70
Ordovician system		
Maquoketa formation		
Dolomite	100	170
Shale	40	210
Galena-Platteville dolomites	314	524
Glenwood sandstone and dolomite	13	537
St. Peter formation		
Sandstone	303	840
Shale	2	842
Oneota dolomite, chert and some sandstone	78	920
Cambrian system		
Trempealeau dolomite, some shale at 945'	100	1020
Franconia sandstone, some shale	85	1105
Galesville sandstone		
Sandstone, dolomitic	95	1200
Sandstone, incoherent, dolomitic from 1230' to 1250'	70	1270
Eau Claire shale, sandstone, siltstone and dolomite	392	1662
Mt. Simon sandstone	23	1685
Pre-Cambrian system		
Fond du Lac sandstone	515	2200

TABLE 3

Hole Record				Casing Record			
24 in.	from	0 to	40 ft.	20-in. from	0 to	41.75	ft.
19 1/4-in.	from	40 to	925 ft.	16-in. from	0 to	273.75	ft.
15 1/4-in.	from	925 to	1606 ft.	16-in. from	765 to	866	ft.
12 1/4-in.	from	1606 to	2200 ft.	13-in. from	824 to	925	ft.
				13-in. from	1250 to	1606	ft.

Well No. 3 was drilled in 1941 to a depth of 2200 ft. and located about 585 ft. south of Wilson St. and 45 ft. east of Island Ave. (approximately 2350 ft. S. and 1735 ft. W. of the N. E. corner of Section 22). The elevation of the pump base is 666.8 ft.

The hole and casing record is as shown in Table 3.

The 20-in. casing was cemented in place. The annular space between the 20-in. and 16-in. casings was filled with "Bentonite."

A 24-hr. production test was reported to be made on Apr. 2-3, 1941. Before the start of the test the water level was 91 ft. 4 in. below the top of casing. Pumping was at rates from 1250 to 800 gpm. allowing sufficient time to obtain conditions of equilibrium. After 14 hr. of pumping at 1000 gpm. the drawdown was 85 1/2 ft.

The following pump installation was made in Aug. 1941: 200 ft. of 10-in. column pipe; 12-in., 3-stage Aurora Pump Co. No. 12019 turbine pump having a rated capacity of 1000 gpm. against 215 ft. of head; the overall length of the pump is 4 ft.; 30 ft. of 9-in. suction pipe; 230 ft. of 1/4-in. gi. air line; 75-hp. Westinghouse electric motor.

The water levels in this well are reported to be the same as for Well No. 2 since it was rehabilitated. Pump operations were alternated with No. 2 during the summer of 1947.

Analysis of a sample (Lab. No. 111,562) collected Aug. 13, 1947 after 3/4-hr. pumping at 1250 gpm. showed this water to have a hardness of 13.6 gr. per gal., a residue of 339 ppm., and an iron content of 0.4 ppm.

Combined metered pumpage for the years of 1945 and 1946 averaged 545,500 gpd.

LABORATORY NO. 111,562

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.4		Silica	SiO_2	14.9	
Manganese	Mn	0.0		Fluoride	F	1.1	
Calcium	Ca	55.7	2.79	Chloride	Cl	31.0	0.87
Magnesium	Mg	22.6	1.86	Nitrate	NO_3	2.7	0.04
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	32.5	0.68
Sodium	Na	38.0	1.65	Alkalinity (as $CaCO_3$)		236.	4.72
Turbidity		Tr.		Hardness (as $CaCO_3$)		233.	4.65
Color		0		Residue		339.	
Odor		0		Free CO_2 (calc.)		25.	
Temperature		60.6° F.		pH = 7.35			

A public water supply was installed by the Beardstown (6505) Water Co. in 1892, and was purchased by the City in that year.

Water was obtained first from a group of 16 wells located on the pumping station property bounded by 11th, 12th, Bay and Edwards St. (or approximately 2000 ft. N. and 800 ft. E. of the S. W. corner of Section 14, T. 18 N., R. 12 W.). The ground surface elevation at the site is 440± ft.

Each well was 6 in. in diameter and was bored to a depth of about 100 ft. The tops of the wells were in a pit about 30 ft. in diameter and 8 ft. deep. About 1903, the pit was extended to cover an area of about 25 ft. by 75 ft., and seventy-two 2-in. wells were drilled, each to a depth of 40 ft. Five-foot lengths of perforated well points, lined with brass wire gauze, were used. The screens became clogged and were replaced in about half the wells each year. All of the wells were connected to one of the two 10-in. suction lines connection to the pump station.

In 1913, eight of the 6-in. wells and seventy-two 2-in. wells were in use. The 6-in. wells were equipped with 16-ft. strainers.

In 1920, the casings in 10 of the wells were pulled and the wells drilled to a depth of 72 ft. Two of the other 6 original wells were also in use. Water was pumped with the 16-in. by 12-in. by 12-in. Gardner duplex steam pumps.

All of these wells were abandoned about 1920.

In 1924, a well known as Kelly Well No. 1 was drilled to a depth of 84 ft. by the Kelly Well Co., Grand Island, Nebraska, and was located near the southeast corner of the water works property.

A 32-in. id. by 38-in. od. solid concrete casing extended to a depth of 33 ft., and porous concrete pipe screen was installed from 33 ft. to the bottom of the well.

It was reported that the well yielded 400 gpm. with a drawdown of 4 ft.

The well is reported to be equipped as follows: 50 ft. of 8-in. column pipe; American Well Works water-lubricated turbine pump No. 40343, rated at 750 gpm.; 5 ft. of 8-in. suction pipe; 50-hp. General Electric motor No. 4011175 operating at 1150 rpm.

A production test was made by the State Water Survey on Nov. 18, 1940. The well produced 780 gpm. for 4 hr., with a drawdown of 26 1/3 ft. from a non-pumping water level of 21 ft. In June, 1947, the non-pumping water level was 15.75 ft. and the pumping level 32 ft. below the pump base. The well is maintained as an emergency unit and is operated 2 hr. daily.

Analysis of a sample (Lab. No. 89420) collected Nov. 25, 1940, showed the water to have a hardness of 19.0 gr. per gal., a residue of 485 ppm., and an iron content of 1.3 ppm.

The major portion of the supply has been from 2 wells known as West 16-in. Well and East 16-in. Well.

The West Well was drilled by A. D. Cook Co., Lawrenceburg, Indiana, in 1928, and is located on the water works property, about 240 ft. northwest of the Kelly Well No. 1. The well was originally about 74 ft. deep, but in 1940 was cleaned out and a new screen was installed by Charles S. Wise, St. Louis, Mo. The well is now 87 ft. deep and is cased with 16-in. pipe to a depth of 61 ft. A 26-ft. length of 12-in. Cook Screen is installed below the casing. The screen has No. 30 slot openings.

A production test was made by the State Water Survey on Sept. 30, 1940. The well produced 725 gpm. with a drawdown of 17 1/2 ft. from a non-pumping water level of 20 ft. below the well curb. When the pump in the East Well, 25 ft. distant, was operated, the production in the West Well decreased to 700 gpm., and the drawdown increased to 18 1/2 ft. In 1947, the non-pumping water level was 13.6 ft. and the pumping level 46.1 ft. below the pump base.

The pumping equipment consists of: 50 ft. of 9-in. column pipe; 12-in. 3-stage, Fairbanks-Morse turbine pump, No. 9604, rated at 750 gpm.; 50 ft. of 1/4-in. copper air line; 5 ft. of 8-in. suction pipe; 50-hp. Fairbanks-Morse electric motor No. 376428, operating at 1765 rpm.

Analysis of a sample (Lab. No. 114,561) collected May 5, 1948, after 3 1/2-hr. pumping showed the water to have a hardness of 18.7 gr. per gal., a residue of 437 ppm., and an iron content of 1.1 ppm.

The East Well was drilled in 1928 by A. D. Cook Co., and is located about 25 ft. east of the West Well. The original depth was about 74 ft. but the well was also rehabilitated in 1940, and is identical in construction and depth to the West Well. On Sept. 30, 1940, when pumping in the

LABORATORY NO. 114,561

		ppm.	epm.			ppm.	epm.
Iron (total	Fe	1.1		Silica	SiO_2	21.6	
Manganese	Mn	0.4		Fluoride	F	0.4	
Calcium	Ca	80.3	4.02	Chloride	Cl	32.0	0.90
Magnesium	Mg	29.2	2.40	Nitrate	NO_3	2.4	0.04
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	99.6	2.07
Sodium	Na	20.9	0.91	Alkalinity	(as $CaCO_3$)	216.	4.32
Turbidity		Tr.		Hardness	(as CaC_{03})	321.	6.42
Color		0		Residue		437.	
Odor		0					
Temperature 57° F.							

West Well at a rate of 725 gpm. the water level in the East Well was 3.3 ft. In June, 1947, the well was reported to produce 100-150 gpm., and the pumping water level was 43.8 ft.

The well is equipped with a Fairbanks-Morse turbine pump No. 9672. The pump assembly is identical to that in the vVest Well.

A third 16-in. well was reported to have been drilled by A. D. Cook Co. at the same time the East and West Wells were drilled. The screen and casing were damaged when cleaning the well*, and it was abandoned.

A well was constructed in 1930, by Thorpe Concrete Well *Co.,* Alton, and was located about 15 ft. north and 100 ft. east of the West Well.

This well was 78 ft. deep, and was cased with 20 ft. of 30-in. concrete pipe and with 58 ft. of porous concrete pipe screen. In 1940, the top section of the porous concrete screen failed and was repaired. Following the repairs, a production test was made by the State Water Survey on Nov. 19, 1940. The well produced 580 gpm. with a drawdown of 24.5 ft. from a non-pumping water level of 18.5 ft. below the well curb. The porous concrete screen failed again sometime prior to 1945, and the well was abandoned.

Analysis of a sample (Lab. -No. 89419) collected Nov. 19, 1940, showed the water to have a hardness of 19.4 gr. per gal., a residue of 507 ppm., and an iron content of 0.9 ppm.

Kelly Well No. 2 was constructed in 1947 by Kelly Well Co., and is located about 100 ft. north of Sixth St., and 60 ft. east of Jefferson St. (or approximately 2050 ft. S. and 1100 ft. W. of the N. E. corner of Section 15, T. 18 N., R. 12 W.). The well was completed at a total depth of 78 ft. below a ground surface elevation of 445± ft.

The well was drilled 42 in. in diameter to a depth of 65 ft. and 40 in. in diameter from 65 to 78 ft. A 27-in. id. by 32-in. od. concrete casing and screen were installed as follows:

Solid casing from 2 ft. to 30 ft. below the surface.
Porous screen from 30 ft. to 70 ft.
Solid casing from 72 ft. to 80 ft.

A 1-ft. base section was installed between 78 and 79 ft. The annular space outside the casing and screen was filled with gravel to 15 ft. below the ground surface.

Correlated driller's log of Kelly Well No. 2 furnished by the State Geological Survey

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Cinders, sand, and clay	8	8
Sand	20	28
Sand and gravel	20	48
Gravel and cobblestones	23	71
Quicksand	7	78

A production test was made by the State Water Survey June 6-7, 1947. For test purposes the well was equipped with a turbine pump, belt-driven by a gasoline engine. The non-pumping water level before the test was 9.3 ft. below the top of the casing. The data in Table 1 were observed during the test:

TABLE 1

Rate of Production gpm.	Pumping Period hr.	Drawdown ft.
1550	4	14.4
1790-1805	4	17.0
2080	3	19.9

Kelly Well No. 2 was not yet in service on May 5, 1948. The pumping equipment consists of: 55 ft. of 10-in. column pipe; 12-in., 4-stage Fairbanks-Morse Pomona water lubricated turbine pump, rated at 1200 gpm.; 10 ft. of 10-in. suction pipe; 100-hp. General Electric motor, No. WD 6637503 operated at 1765 rpm. There is no air line, and the overall length of the pump is not known.

Before the pump was installed the water level was 12 ft. below the top of the well.

Analysis of a sample (Lab. No. 110,549) collected June 7, 1947, showed the water to have a hardness of 26.4 gr. per gal., a residue of 592 ppm., and an iron content of 0.4 ppm.

Pumpage is estimated to average 1.6 mgd.

BEDFORD PARK DISTRICT
Cook County
July 30, 1946

The Bedford Park District which was incorporated on May 15, 1939, owns a well located about 2550 ft. S. and 1800 ft. E. of the N. W. corner of Section 24, T. 38 N., R. 12 E. The elevation of the ground surface is 615± ft.

This well was originally drilled in 1940 to a depth of 334 ft. by R. B. Hartman, Congress Park, and was deepened to a total depth of 1519 ft. by S. B. Geiger & Co., Chicago in 1941 and 1943.

A record of the hole, casing, and liner diameter is given in Table 1.

When the well was completed, a 24-hr. production test was made on Mar. 29, and 30, 1943. After 9-hr. pumping at 147 gpm., the drawdown was 10 ft. from a non-pumping water level of 359 ft. below the pump base. The drawdown was constant for the remaining period of the test.

The following non-pumping water levels have been reported:

375 ft. at 10:30 a.m., Oct. 23, 1943, when Corn Products Refining Co. Well No. 12 was operating.

370 ft. at 10:30 a.m., Oct. 24, 1943, when Corn Products Refining Co. Well No. 12 was idle.

373 ft. at 10:00 a.m., Oct. 25, 1943, when Corn Products Refining Co. Well No. 12 was operating.

Other non-pumping water levels have been reported as follows: 413.3 ft. on Apr. 13, 1945, and 409.'0 ft. on May 10, 1945. On July 13, 1945, when the pump was but, the water level was 425.5 ft. below the top of the casing. Well No. 12 and Well No. 13 were operating at the Corn Products Refining Co. when the measurements were made.

Sample-study log of well drilled in 1940 furnished by the State Geological Survey

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and till	20	20
Silurian system		
Niagaran and Alexandrian series		
Dolomite	230	250
Dolomite, shaly	84	334
Ordovician system		
Maquoketa dolomite and shale	113	447
Galena-Platteville dolomites	313	760
St. Peter formation		
Sandstone, incoherent	127	887
Shale	1	888
Oneota dolomite, sandstone and thin shale beds	172	1060
Cambrian system		
Trempealeau dolomite little crevice sand	180	1240
Franconia sandstone, dolomite and thin shale beds	100	1340
Galesville sandstone		
Sandstone, partly dolomitic	80	1420
Sandstone, incoherent	84	1504
Eau Claire dolomite, sandstone and shale	15	1519

TABLE 1

Hole Record	Casing Record
10-in. from 0 to 477 ft.	10-in. casing from surface to 20 ft.
8-in. from 477 to 980 ft.	8-in. liner from 332 to 477 ft.
6-in. from 980 to 1519 ft.	6-in. liner from 875 to 980 ft.

The following pump installation, made in Mar. 1946, is in service: 600 ft. of 5-in. od. column pipe; 8-in., 31-stage Pomona turbine pump rated at 150 gpm. against 600 ft. of head; 10 ft. of 5-in. od. suction pipe; 40-hp. General Electric motor.

Analysis of a sample (Lab. No. 107,219) collected July 24, 1946, showed this water to have a hardness of 36.2 gr. per gal., a residue of 1007 ppm., and an iron content of 1.0 ppm.

A previous analysis on Mar. 30, 1943 showed the water to have 0.8 ppm. iron and 31.6 gr. per gal. hardness. The temperature of the water from the well was 54° F. These analyses indicate the water to originate largely in the Niagaran dolomite.

The well supplies water used for the field house, swimming pool, skating rink, and sprinkling.

The maximum pumpage for the period from June 1 to Sept. 15 is estimated at 36,000 gpd.

A connection is provided to Bedford Park in case of emergency need by that village.

LABORATORY NO. 107,219

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.0		Silica	SiO_2	16.0	
Manganese	Mn	0.0		Fluoride	F	0.5	
Calcium	Ca	115.6	5.78	Chloride	Cl	28.0	0.79
Magnesium	Mg	80.6	6.63	Nitrate	NO_3	1.3	0.02
Ammonium	NH_4	0.3	0.02	Sulfate	SO_4	516.1	10.74
Sodium	Na	82.9	3.60	Alkalinity	(as $CaCO_3$)	224.	4.48
Color		0		Hardness	(as $CaCO_3$)	621.	12.42
Odor		0		Residue		1007.	
Turbidity		Tr.					
Temperature		58.6° F.					

BEECHER
Will County
Oct. 22, 1946

The village of Beecher (742) installed a public water supply system in 1911.

Water was first obtained from a well located at the southeast corner of Penfield and Woodward St. (about 592 ft. N. and 660 ft. E. of the S. W. corner of Section 16, T. 33 N., R. ME.). The elevation at the ground surface is 705t ft. This well is reported to have a depth of 164 ft. and to be cased to rock with 80 ft. of 10-in. black pipe below which the hole is 10-in. in. diameter to the bottom.

On June 19, 1923, the well was equipped with a Goulds single-acting 7-in. by 8-in. triplex plunger pump, No. 2064, having a theoretical displacement of 4 gal. per revolution of crank shaft, with 4-in. suction and 4-in. discharge. On Oct. 22, 1946, it was operated at a rate of 45 spm., equivalent to a displacement of 180 gpm. When pumped for 9 minutes, the drawdown was 2 ft. 3 in. from a water level of 14 ft. 8 in. below the top of the casing.

Power is furnished by a 15-hp. Western Electric Co. motor and there is a 20-hp. International Harvester Co. gasoline engine for a standby power unit. The well and pumping equipment is maintained in operating condition and 'was being used about once a week in Oct. 1946.

In 1930, the village constructed another well located 12 ft. south of the original well. It was reported to be drilled by J. O. Heflin, Joliet, to a depth of 230 ft. and was cased to rock at a depth of 91 ft. with 10-in. pipe.

The existing pump installation, made in 1938, consists of 50 ft. of 6-in. column pipe: 8-in., 12-stage Pomona turbine pump, Serial No.G 9109, rated at a capacity of 300 gpm. against a head of 220 ft.; the overall length of the pump is 6 ft. 9 3/4 in.; 10 ft. of 6-in. suction pipe; 30-hp. Westinghouse electric motor. A non-pumping water level of 26 ft. below the pump base and a pumping water level of 28 1/2 ft. were reported Apr. 27, 1944.

Analysis of a sample (Lab. No. 107,893), collected Oct. 7, 1946 after 10 min. of pumping at 300 gpm., showed this water to have a hardness of 35.4 gr. per gal., a residue of 870 ppm., and an iron content of 0.4 ppm.

All water used for the public supply has been chlorinated since 1942.

The estimated average pumpage for the public supply is 50,000 gpd. which is increased 50% duringthe period from May 1 to Nov. 1 when furnishing water to the Golf Club.

LABORATORY NO. 107,893

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.4		Silica	SiO_2	12.6	
Manganese	Mn	0.0		Fluoride	F	0.7	
Calcium	Ca	162.1	8.11	Chloride	Cl	3.0	0.08
Magnesium	Mg	49.0	4.03	Nitrate	NO_3	0.0	0.0
Ammonium	NH_4	0.8	0.04	Sulfate	SO_4	456.2	9.49
Sodium	Na	50.4	2.19	Alkalinity	(as $CaCO_3$)	240.	4.80
Color		0.		Hardness	(as $CaCO_3$)	607.	12.14
Odor		Tr.		Residue		870.	
Turbidity		10.		Free CO_2 (calc.)		39.	
Temperature		52.5° F.		pH = 7.2			

BELLWOOD
Cook County
May 25, 1949

A public water supply system was installed by the village of Bellwood (5220) in 1908. Water was obtained from wells owned by the village of Melrose Park until June 11, 1914 when a well supply was developed in Bellwood.

A well, known as the East Well, was drilled to a depth of 1538 ft. by Gray Brothers, Chicago, in 1913. It is located at the southeast corner of 30th and Grant Ave. (or approximately 1400 ft. S. and 1500 ft. W. of the N. E. corner of Section 9, T. 39 N., R. 12 E.). The elevation of the pump base is 632± ft. This well, deepened to 1956 ft. in 1935 by the J. P. Miller Artesian Well Co., Brookfield, is still in service.

Another well, 1966 ft. deep, known as the West Well, was drilled by W. H. Cater, Chicago, as a private venture in 1928 and 1929. It is located at the southwest corner of St. Charles Place and Eastern Ave. (or approximately 1750 ft. S. and 2750 ft. W. of the N. E. corner of Section 9). The elevation atthe top ofthe concrete pump base is 634 ft. This well supplied water to the village under a contract for a number of years. It was purchased by the village in 1936 and is still in service.

These 2 wells, in addition to supplying an increasing public demand, furnished water to a number of manufacturing plants during the war.

The East Well, as originally drilled, had a diameter of 12 in. at the top and 8 in. at the bottom. Upon its completion, the water level was 75 ft. below th'e ground surface; and during a 75-hr. test, produced 200 gpm. The drawdown during this test was not reported.

During a test conducted on Apr. 4, 1935 after the well had been deepened to 1956 ft., the production was 560 gpm. The non-pumping water level was 250 ft. below the surface.

By July 1943 the production rate had decreased to 300 gpm., and on Dec. 22, 1943, the turbine pump, which had a setting of 450 ft., was shut down because it was pumping air. The pump assembly was pulled on June 28, 1944, and the column pipe showed considerable corrosion and a 3/4-in. hole in the second section of the column pipe above the pump bowls. On June 30 the distance to water measured 360 ft. below the top of casing, and the well was found to be bridged at a depth of 1649 ft.

The well was "shot" at 8 uniformly spaced levels in the Galesville sandstone formation between depths of 1526 and 1384 ft. The cleaning of the hole and surging, slushing, and bailing out sand and replacement of the 8-in. liner was completed on Sept. 2, 1944. On Oct. 23, 1944 the distance to water level measured 3 66 ft.

The driller's hole and casing diameter record is given in Table 1.

Water was pumped for a period of 11 hr. on Dec. 9 and 8 hr. on Dec 10, 1944 to clear up the well. The reported production rates were 780 and 810 gpm. respectively, with pumping levels falling to or below the bottom of a 452-ft. airline.

On Jan. 9, 1945, a permanent pump installation was made, consisting of 300 ft. of new 8-in. column pipe at the top followed by 200 ft. of old 7-in. column pipe; a new 10-in. 15-stage (all bronze bowls) Peerless turbine pump designed for a capacity of 900 gpm.against 465 ft. of head and having an overall length of 10.1 ft.; 10 ft. of old 7-in. suction pipe; 500 ft. of 1/4-in. airline; 150-hp. U. S. electric motor.

A production test of 4 hr. 15 min. duration was conducted on Jan. 9, 1945 starting at a rate of 875 gpm. and ending with a stabilized rate of 837 gpm. The drawdown was 70 ft. from a non-pumping water level of 3 77 ft. below the pump base.

On Aug. 7, 1945, after the pump had been operated at a rate of about 850 gpm. for 2 1/2 hr., the water level was 43 7 ft. Water had been pumped daily since June 10, 1945 at a rate of about a million gpd., and the temperature of the water was 59.3° F., showing an increase of 3° since Jan. 9,

TABLE 1

Hole Record	Casing Record
12-in. from surface to 315 ft.	12-in. from surface to rock at 88 ft.
10-in. from 315 to 908 ft.	10-in., 35-lb. welded liner from 315 to 520 ft.
8-in. from 908 to 1956 ft.	8-in. liner from 913 to 974 ft.

LABORATORY NO. 106,337

	ppm.		ppm.
Iron (total) Fe	0.1		
		Chloride Cl	25.0
Turbidity	0	Alkalinity (as $CaCO_3$)	272.
Color	0	Hardness (as $CaCO_3$)	390.
Odor	0	Total Mineral Content	543.
Temperature 58.8° F.			

Correlated driller's log of the East Well furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Glacial drift	66	66
Silurian system		
Niagaran-Alexandrian series		
Limestone, white and brown	204	270
Ordovician system		
Maquoketa formation		
Shale	225	495
Galena-Platteville formations		
Limestone, brown and white	320	815
St. Peter formation		
Sandstone	185	1000
Ordovician and Cambrian systems		
Oneota and Trempealeau formations		
Limestone	220	1220
Cambrian system		
Franconia formation		
Shale	85	1305
Galesville formation		
Limestone, sandy	105	1410
Sandstone	85	1495
Eau Claire formation		
Shale, streak of limestone	250	1745
Sandstone	20	1765
Limestone	35	1800
Eau Claire and Mt. Simon formations		
Sandstone	160	1960

TABLE 2

Hole Record	Casing Record
19-in. from 75 ft. 4 in. to 500 ft.	24-in. od. drive pipe from surface to 50 ft.
15-in. from 500 to 1032 ft.	20-in. od. from surface to 75 ft. 4 in.
12-in. from 1032 ft. to bottom	18-in. liner from 260 to 500 ft.
	12 1/2-in. from 975 to 1032 ft.

1945 and indicating that a larger percentage of the water was coming from the sandstone aquifers.

The daily pumping period has been considerably reduced due to the operation of the West Well. On Apr. 29, 1946, the water level, after an idle period of 3 hr., was 377 ft. The water level was 413 ft. after 45 min. of pumping at 850 gpm.

Analysis of a sample (Lab. No. 106,337), collected Apr. 29, 1946, showed this water to have a hardness of 22.7 gr. per gal., a mineral content of 543 ppm., and an iron content of 0.1 ppm.

The West Well, sometimes called the Cater Well, is reported by the driller to have a hole and casing diameter record as in Table 2.

Vulcanite was placed in the annular space outside the 20-in. casing and the 18-in.and 12 1/2-in. liners.

After the village purchased the well in 1936, it was "shot" and cleaned by C. W. Varner, Dubuque, Iowa. Itis reported that two 200-lb. charges were exploded, one in the Galesville sandstone and one in the St. Peter sandstone, and that very little sand was bailed out but that considerable sand was pumped up later.

In May 1946 the well was equipped with 460 ft. of 10-in. column pipe; 14-in., 14-stage Peerless turbine pump rated at 1000 gpm.; the length of the pump is 12 ft. 10 in.; 470 ft. of 1/4-in. airline; 31 ft. of 10-in. suction pipe; 200-hp. Ideal electric motor.

The following water levels below the base of the pump were reported: 364 ft. on Feb. 25, 1944 after 3-hr. idle period; 394 ft. on Sept. 25,1944 after 21 days of pumping at a rate of about 625 gpm.

A sample of water (Lab. No. 95364), collected on Feb. 23, 1943 after 1 hr. and 20 min. of pumping, was found to have a temperature of 64° F., a hardness of 11.4 gr. per gal., a mineral content of 492 ppm., and an iron content of 0.2 ppm., indicating the major source of water at this time to originate near the bottom of the well.

In Dec. 1946, the pump which had been in Well No. 2 about 7 years was working poorly and was removed. Several joints of the shaft tubing were found to be unscrewed. It was decided to rehabilitate the well at the time. A new pump was ordered. A 12 1/2-in. liner was removed from between 990 and 1047 ft.

On Jan. 3, 1947 a geophysical log was made by the Halliburton Oil Well Cementing Co. for the J. P. Miller Artesian Well Co.

LABORATORY NO. 95364

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	10.0	
Manganese	Mn	Tr.		Chloride	Cl	49.0	1.38
Calcium	Ca	50.4	2.52	Nitrate	NO_3	3.3	0.05
Magnesium	Mg	16.9	1.39	Sulfate	SO_4	101.6	2.11
Ammonium	NH_4	0.1	Tr.	Alkalinity (as $CaCO_3$)		260.	5.20
Sodium	Na	111.1	4.83				
Color		0		Hardness (as $CaCO_3$)		195.	3.90
Odor		0		Residue		492.	
Turbidity		0		Temperature 64° F.			

LABORATORY NO. 110,624

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.4		Silica	SiO_2	14.9	
Manganese	Mn	0.2		Fluoride	F	0.9	
Calcium	Ca	88.2	4.41	Chloride	Cl	33.0	0.93
Magnesium	Mg	41.8	3.44	Nitrate	NO_3	1.8	0.03
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	207.3	4.31
Sodium	Na	73.1	3.18	Alkalinity (as $CaCO_3$)		288.	5.76
Color		0		Hardness (as $CaCO_3$)		393.	7.86
Odor		0		Residue		639.	
Turbidity		100					
Temperature 57° F.							

On Jan. 14, 1947, a 15-ft. container of 350 lb. nitroglycerine gelatin was exploded, the bottom of the "shot" at 1486 ft. depth. Upon attempting to clean out the sand, a caving began at 1070 ft.

On Jan. 28, 1947 a 12 1/2-in. liner, 65 ft. 9 in. long, had been set with the top at a depth of 980 ft.

On Feb. 5, 1947, a 13-ft. container of 150-lb. nitroglycerine gelatin was exploded, the bottom of the "shot" at 1455 ft., and on Feb. 7 the well had been cleaned out to 1700 ft. No more shale was being removed. On Feb. 11, 1947 the well had been cleaned out to 1950 ft.

On June 11, 1947 the new pump was installed, and after pumping 21 hr. a't 860 gpm., the draw-down was 280 ft. from a non-pumping water level of 216 ft. After a 2-hr. shut-down of the pump, the water level was at a depth of 356 ft.

Analysis of a sample (Lab. No. 110,624) collected June 11, 1947 after 20-hr. pumping at 925 - 850 gpm., showed this water to have a hardness of 22.9 gr. per gal., a mineral content of 639 ppm., and an iron content of 0.4 ppm. The temperature was 57° F. The temperature and composition indicate that an appreciable amount of water from the top limestone was present in the sample due to the long rehabilitation period prior to the date of collection.

Well No. 3 was completed to a depth of 1951 ft. in Mar. 1949 by S. B. Geiger Co., Chicago, and located near the northwest corner of Madison and Eastern Ave. (or approximately 100 ft. N. and 2400 ft. E. of the S. W. corner of Section 9). This location is about 5/8 mile south of the West Well. The ground elevation is 630t ft.

The well was "shot" as described in Table 3.

TABLE 3

Between Depths	Charge
1880 to 1930 ft.	800 lb. 100% nitrogen gel.
13 74 to 1430 ft.	850 lb. 100% nitrogen gel.
1374 to 1430 ft.	600 lb. 100% nitrogen gel.
1374 to 1430 ft.	400 lb. 100% nitrogen gel.

TABLE 4

Hole Record				Casing Record
24-in.	from surface to	551	ft.	24-in. casing from 0 to 72 ft.
17 1/2-in.	from	551 to 1010	ft.	18-in. od. casing from 0 to 551 ft.
13 1/4-in.	from	1010 to 1710	ft.	13-in. liner, 47 1/2 ft. long.
10.-in.	from	1710 to 1951	ft.	at base of St. Peter sandstone.

The driller reported that comparatively little sand was bailed from the well, following the shooting. The hole and casing record were reported to be as given in Table 4.

The 18-in. casing was pressure grouted, using 620. bags of cement, from 551 ft. to the ground surface.

Three production tests were made, using State Water Survey calibrated measuring equipment. During the first test, made on Mar. 29, 1949, several cu. yd. of sand were discharged and, following the test, the driller estimated that 25 to 30 cu. yd. of sand were removed from the well. In the second production test the top of the test-pump was set at 500 ft. or 80 ft. lower than in the first test. On May 4, 1949, before the test; the water level was 360 ft. below the pump base (3 1/2 ft. above ground level). After 24-hr. pumping at a rate of 870 gpm., the drawdown was 118 ft. One hour and thirty minutes after stopping the pump the water level was 400 ft. Pumping was resumed, and after 4 hr., at a final rate of 890 gpm., the drawdown was 112 ft. One hour and fifteen minutes after stopping the pump the water level was 399 ft.

In an attempt to get a sustained yield of 1000 gpm. the pump was rebuilt and a third production test was made on May 24-25, 1949. Before the test was started the water level was 360 ft. below the pump base. Pumping was started at 810 gpm. and at 20 hr. the rate was 940 gpm. and the water level had become stabilized at 486 ft. or a drawdown of 126. ft. The specific capacity was 7.6 gpm. per ft. of drawdown. At the end of 24-hr. pumping in the previous production test on May 5, the specific capacity was 7.4.

Analysis of a sample (Lab. No. 118,152) collected May 4, 1949 after 19 1/2-hr. pumping at 890 gpm. showed this water to have a hardness of 8.2 gr. per gal., a residue of 655 gpm. and an iron content of 0.5 ppm.

All water has been chlorinated since 1936.

Total metered pumpage averages 850,000 gpd. ranging from 710,000 gpd. in winter to 1 mgd. in summer.

BELMONT
Du Page County
June 14, 1947

A subdivision known as McIntosh & Co.'s Highwood Addition to Belmont (500) is located south of Chicago, Burlington & Ouincy Railroad and east of Belmont Road to Cornell Avenue. A water supply was installed under private ownership which has been leased and operated by the Suburban Water Co.

Water is obtained from a well drilled to a depth of 143 ft. by O. K. Hawkyard, Downers Grove, in 1924 and located about 530 ft. south of the center line of the Chicago, Burlington & Quincy Railroad and 230 ft. east of Belmont Road (approximately 2400 ft. N. and 1000 ft. W. of the S. E. corner of Section 12, T. 38 N., R. 10 E.).

The well is reported to be cased with 5-in. pipe to limestone at a depth of 58 1/2 ft. The ground surface elevation is 690± ft. MSL. datum. In June 1947 the estimated pumpage was 15,000 gpd. The existing pump installation, made in 1936, is: 90 ft. of 3 1/2-in. od. column pipe; 4-in., 16-stage Pomona turbine pump, No. N2353, having a rated capacity of 80 gpm. against a head of 190 ft. at 3500 rpm.; the overall length of the pump is 74 in.; 7 1/2-hp. Westinghouse electric motor. The airline is defective.

Analysis of a sample (Lab. No. 110,602) collected June 9, 1947 after several hours of intermittent pumping at 80 gpm. showed this water to have a hardness of 24.4 gr.per gal., a residue of 471 ppm., and an iron content of 0.2 ppm.

LABORATORY NO. 110,602

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	19.4	
Manganese	Mn	0.1		Fluoride	F	0.2	
Calcium	Ca	97.6	4.88	Chloride	Cl	7.0	0.20
Magnesium	Mg	42.2	3.47	Nitrate	NO_3	0.5	0.01
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	127.5	2.65
Sodium	Na	4.1	0.18	Alkalinity	(as $CaCO_3$)	284.	5.68
Turbidity		Tr.		Hardness	(as $CaCO_3$)	418.	8.35
Color		0		Residue		471.	
Odor		0		Free CO_2		19.	
Temperature 50.3° F.				pH = 7.6			

BELVIDERE
Boone County
Feb. 25, 1947

The original water supply was installed by the city of Belvidere (8094) in 1891 when water was obtained from a well drilled to a depth of 1950 ft. The city water supply is now furnished by 4 deep wells, including the original well, which range in depth from 1800 to 1950 ft., and a fifth well having a depth of 610 ft. which was completed in Oct. 1945.

Well No. 1, the original well, is located about 60 ft. south of Meadow St. and 20 ft. east of Whitney St. (or approximately 1170 ft. N. and 320 ft. E. of the S. W. corner of Section 25, T. 44 N., R. 3 E.). The elevation of the ground surface is 763 ± ft.

It was reported originally drilled to a depth of 1950 ft. in 1891, cased to rock at a depth of 50 ft., below which the hole was 8 in. in diameter to a depth of 1000 ft., and 6 in. in diameter below 1000 ft. At a later date the 6-in. hole was reamed to 8 in. in diameter, and in 1930 the upper 100 ft. of the well was reamed to 16 in. in diameter and 16-in. od. casing was placed from the surface to a depth of 70 ft.

The well flowed over the top of the casing when completed and supplied demands for about a year when a suction pump was installed. The water was pumped to a collecting reservoir at the site, and the production of the well was estimated to be 400 gpm. The water level in 1896 was 6 ft. below the surface. In 1899 the water was found to have a hardness of 19.4 gr.per gal., a mineral content of 336 ppm., and an iron content of 0.15 ppm. The nitrate, chloride, and sulfate contents were 1.6,7.0, and 11.6 ppm., respectively, indicating the absence of any leakage from the drift and indicating the major portion of the water to be from the St. Peter sandstone or below at that time.

The suction pump was abandoned in 1918 when air lift equipment was installed. During a 1-hr. test on Dec. 7, 1921, after the pump had been idle for 1 hr., a discharge of 540 gpm. was computed from reservoir levels. Before the test, the water level was 17 ft. below the top of the casing while Well No. 2, located 630 ft. northeast, was operating.

In 1930 the following pump installation was made which is still in service: 70-ft. of 6-in. column pipe; 8-in., 5-stage Fairbanks Morse-Price turbine pump, No. 21569, rated at 450 gpm., the overall length of the pump is 5 ft. 6 1/2 in; 10 ft. of 6-in. suction pipe; 20-hp. Fairbanks Morse electric motor.

After the installation of the turbine pumps in Wells No. 1 and 3, they could not be operated simultaneously without breaking suction, except when throttled down to a combined discharge of 600 gpm., which was not considered practical. Consequently, their operating periods were adjusted to meet existing well conditions.

The passage of water between the wells through a creviced limestone formation was inadvertently verified on an occasion when the check valve failed at Well No. 1, permitting the flow of water from the reservoir to the well. Water was pumped from Well No. 3 during this interval and increased its normal production 100 gpm.

A non-pumping water level of 15 ft. below the pump base was observed in Sept. 1942 when Well No. 3, located 60 ft. northeast was also idle.

A decrease in the production from Well No. 1 became quite apparent by 1945 when the pump could no longer be operated at a rate of 400 gpm.

LABORATORY NO. 108,333

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.7		Silica	SiO_2	19.2	
Manganese	Mn	Tr.		Fluoride	F	0.0	
Calcium	Ca	111.2	5.56	Chloride	Cl	25.0	.71
Magnesium	Mg	49.9	4.10	Nitrate	NO_3	18.5	.30
Ammonium	NH_4	0.1	.01	Sulfate	SO_4	124.0	2.58
Sodium	Na	9.2	.40	Alkalinity	(as $CaCO_3$)	324.	6.48
Turbidity		Tr.		Hardness	(as $CaCO_3$)	483.	9.66
Color		0.		Residue		559.	
Odor		0.		Free CO_2	(calc.)	83.	
Temperature		53.5° F.		pH = 7.0			

LABORATORY NO. 108,334

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.2		Silica	SiO_2	17.4	
Manganese	Mn	0.1		Fluoride	F	0.2	
Calcium	Ca	117.6	5.88	Chloride	Cl	27.0	.76
Magnesium	Mg	50.7	4.17	Nitrate	NO_3	8.9	.14
Ammonium	NH_4	0.1	.01	Sulfate	SO_4	141.7	2.95
Sodium	Na	8.1	.35	Alkalinity (as $CaCO_3$)		328.	6.56
Turbidity		Tr.		Hardness (as $CaCO_3$)		503.	10.06
Color		0		Residue		582.	
Odor		0					
Temperature 52° F.							

without breaking suction. Decreasing the rate of pumpage to 300 gpm. has permitted the use of the well as an auxiliary supply unit. For the period from Nov. 1 to 15, 1946 it contributed 2 1/4% of the total pumpage.

Analysis of a sample (Lab. No. 108,333), collected Nov. 14, 1946 after 20-minute pumping at 280 gpm., showed the water from Well No. 1 to have a hardness of 28.2 gr. per gal., a residue of 559 ppm., and an iron content of 0.7 ppm.

Well No. 2 is located at the foot of Caswell St. about 49 ft. north of the south line of Meadow St. and 15 ft. east of the west line of Caswell St. (or approximately 1630 ft. N. and 760 ft. E. of the S.W. corner of Section 25.) The elevation of the ground surface is 763 ft.

It was originally drilled in 1901 to a reported depth of 1861 ft. and cased to rock, below which the hole was 8 in. in diameter to the bottom. In 1937 the top 100 ft. was reamed to 15 in. in diameter and 50 ft. of 12-in. diameter casing was placed below the bottom of an 8-ft. pump pit.

When the well was originally completed, the water level was 3 ft. below the surface. Water was drawn from the well by suction pump placed at the ground surface until 1916 when the suction pump was placed in a pit 8 ft. deep. Pumping by suction was discontinued in 1922, and the well was out of service until 1929 when the following pump installation was made which is still in service: 70 ft. of 6-in. column pipe; 8-in., 7-stage American Well Works turbine pump, Shop No. 54628, rated at a capacity of 450 gpm. against a head of 85 ft.; the overall length of the pump is 4 ft. 6 1/4 in.; 6 ft. of 6-in. suction pipe; 20-hp. General Electric motor.

In 1941 the non-pumping water level was 10 ft. below the pump base or 15 ft. below the ground surface, and the drawdown was 20 ft. when pumping at 425 gpm.

Analysis of a sample (Lab. No. 108,334) collected Nov. 15, 1946 after 30-minute pumping at 370 gpm., showed the water in Well No. 2 to have a hardness of 29.3 gr. per gal., a residue of 582, and an iron content of 0.2 ppm.

Well No. 3 is located about 60 ft. south of Meadow St. and 80 ft. east of Whitney St. (or approximately 1210 ft. N. and 370 ft. E. of the S. W. corner of Section 25). The elevation of the ground surface is 765± ft.

This well was drilled in 1908 by J. P. Miller Artesian Well Co., Brookfield, to a depth of 1803 ft. and cased with 10-in. diameter pipe to rock at a depth of 50 ft. below which the hole was 8 in. in diameter to the bottom. In 1930 the upper 100 ft. was reamed to 16 in. in diameter and 16-in. od. casing placed from the surface to a depth of 70 ft.

When the well was completed in 1908, the water level was 8 ft. below the surface. Water was pumped with a suction lift pump until 1921 when it was replaced by air lift.

Wells No. 1 and 3 had a combined production of 800 to 850 gpm. in 1921. When pumped daily for 112 days in 1923, their combined production averaged 630 gpm.

In May 1924 the pump in Well No. 3 was operated continuously and furnished the entire supply. On May 26 when the compressor was running 72 rpm., the discharge was 490 gpm.; and when operating at a rate of 56 rpm., the discharge was 418 gpm. The air line was 185 ft. long.

LABORATORY NO. 108,335

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.1		Silica	SiO_2	18.5	
Manganese	Mn	Tr.		Fluoride	F	0.0	
Calcium	Ca	109.4	5.47	Chloride	Cl	26.0	.73
Magnesium	Mg	49.4	4.06	Nitrate	NO_3	16.2	.26
Ammonium	NH_4	.1	.01	Sulfate	SO_4	125.7	2.62
Sodium	Na	12.7	.55	Alkalinity	(as $CaCO_3$)	324.	6.48
Turbidity		Tr.		Hardness	(as $CaCO_3$)	477.	9.54
Color		0		Residue		557.	
Odor		0		Free CO_2 (calc.)		83.	
Temperature 53.1° F.				pH - 7.0			

The following pump installation, made in 1930, is in service: 80 ft. of 6-in. column pipe (10 ft. of additional column pipe is included, which was placed in Mar. 1941); 10-in., 3-stage Fairbanks, Morse-Price turbine pump, No. 22263, rated at 600 gpm.; the overall length of the pump is 3 ft. 3 in.; 10 ft. of 6-in. suction pipe; 20-hp. Fairbanks-Morse electric motor.

On Sept. 14, 1942 a water level of 90 ft. below the pump base was observed after 4 1/2-hr. pumping at an average rate of 497 gpm. Well No. 1 served as a standby unit, Well No. 3 served as an auxiliary supply unit, and Well No. 4 was in use during a production test.

In Feb. 1944 a non-pumping water level of

Sample-study log of Well No. 4 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Sand	45	45
Ordovician system		
Galena-Platteville dolomites	273	318
Glenwood dolomite and sandstone	27	345
St. Peter formation		
Sandstone, incoherent	210	555
Conglomerate of sandstone, chert and shale	45	600
Cambrian system		
Trempealeau dolomite	43	643
Franconia sandstone, dolomite, and thin shale beds	87	730
Galesville sandstone		
Sandstone, partly dolomitic	95	825
Sandstone, incoherent	45	870
Eau Claire formation		
Shale, siltstone, sandstone, some dolomite	380	1250
Mt. Simon sandstone	65	1315
Pre-Cambrian system		
Fond du Lac sandstone, thin shale beds	486	1801

LABORATORY NO. 108,336

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.4		Silica	SiO_2	15.2	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	81.2	4.06	Chloride	Cl	7.0	.20
Magnesium	Mg	30.6	2.51	Nitrate	NO_3	3.9	.06
Ammonium	NH_4	0.5	.03	Sulfate	SO_4	31.4	.65
Sodium	Na	10.8	.47	Alkalinity (as $CaCO_3$)		308.	6.16
Turbidity		0		Hardness (as $CaCO_3$)		329.	6.58
Color		0		Residue		361.	
Odor		0		Free CO_2 (calc.)		57.	
Temperature 52° F.				pH = 7.15			

17 ft. below the pump base was reported in Well No. 3; and 4 hr. after pumping at a rate of 400 to 425 gpm., the pump would break suction. The pump is now operated at night as an auxiliary supply unit and will maintain a pumping rate of 380 gpm. without breaking suction. For the period from Nov. 1-15, 1946, Well No. 3 contributed 19 1/2% of the total pumpage.

Analysis of a sample (Lab. No. 108,335), collected Nov. 14, 1946 after 12-min. pumping at 350 gpm., showed the water from Well No. 3 to have a hardness of 27.8 gr. per gal., a residue of 557 ppm., and an iron content of 0.1 ppm.

Well No. 3 was electrically logged on Apr. 28, 1944 by the Halliburton Oil Well Cementing Co.

Well No. 4 is located about 70 ft. south of East Madison St. and 45 ft. east of North Main St. (or approximately 2310 ft. S. and 460 ft. W. of the N. E. corner of Section 26). The elevation of the top of the casing is 778± ft.

The well was drilled by S. B. Geiger & Co., Chicago, in Sept. 1942, to a depth of 1800 ft. It was drilled to a diameter of 24 in. from the surface to a depth of 152 ft. and cased with 152 ft. of 16-in. od. wi. casing, the annular space outside of which was cement grouted. Below the 152-ft. depth, the hole is 16 in. in diameter to the bottom.

A production test was reported on Sept. 14-15, 1942. The water level was 30 ft. below the top of the casing when drilling was completed; and, after 21-hr. pumping at 1275 gpm., the drawdown was 73 1/2 ft.

The following pump installation, made about May 1, 1943, is in service: 100 ft. of 8-in. column pipe; 12-in., 3-stage American Well Works turbine pump, No. 66400, rated at a capacity of 1000 gpm. against 150 ft. of head; the overall length of the pump is 4 ft. 5 9/16 in.; 100 ft. of air line; 10 ft. of 8-in. suction pipe; 50-hp. U. S. electric motor.

After the above equipment was installed, a production test was made by the State Water Survey on May 4, 1943. When pumping at a rate of 1285 gpm. the water level was lowered below the 100-ft. air line, and the pump broke suction after 4-hr. pumping at this rate.

This well was placed in service in May 1943 with intermittent pumping until Dec. 1945. Since then pumping has been daily, and from Nov. 1 to 15, 1946 has averaged 403,700 gpd.,or 52 3/4% of the total pumpage for this period. Pumping is at a rate of 1150 gpm. against 20 psi. pressure, and the discharge is into a ground reservoir at the site. At this rate of pumping, the pumping water level cannot be observed with the 100-ft. air line. On Nov. 22, 1946 a water level of 33 ft. below the pump base was reported after a 14-hr. idle period.

Analysis of a sample (Lab. No. 108,336) col-

TABLE 1

Hole Record	Casing Record
18-in. from 0 to 152 ft.	18-in. od. from +2in. to 44 ft. 10 in.
12-in. from 152 to 610 ft.	12-in. id. from +3 in. to 151 ft. 9 in.

LABORATORY NO. 104,558

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	13.5	
Manganese	Mn	Tr.		Fluoride	F		
Calcium	Ca	75.8	3.79	Chloride	Cl	5.0	0.14
Magnesium	Mg	30.8	2.53	Nitrate	NO_3	2.4	0.04
Ammonium	NH_4	0.2	0.01	Sulfate	SO_4	26.9	0.56
Sodium	Na	2.1	0.09	Alkalinity	(as $CaCO_3$)	284.	5.68
Turbidity		Tr.		Hardness	(as $CaCO_3$)	316.	6.32
Color		0		Residue		340.	
Odor		0		Free CO_2 (calc.)		59.	
Temperature		51.2° F.		pH = 7.1			

lected from the pump discharge on Nov. 15, 1946 after 2-hr. pumping at 1000 gpm., showed the water in Well No. 4 to have a hardness of 19.2 gr. per gal., a residue of 361 ppm., and an iron content of 0.4 ppm.

Well No. 5 is located about 25 ft. south of West Fifth St. and 145 ft. east of Union Ave. (or approximately 1980 ft. S. and 315 ft. W. of the N.E. corner of Section 35, T. 44 N., R. 3 E.). The elevation of the top of the casing is 800± ft.

This well was drilled by S. B. Geiger & Co. to a depth of 610 ft. and completed in Oct. 1945.

The driller's hole and casing diameter record is given in Table 1.

The annular space on the outside of the 12-in. casing was cement grouted.

A production test was conducted by the State Water Survey on Oct. 15-16, 1945. Before the test, the water level was 50 ft. below the top of the casing; and after 20-hr. pumping at 735 gpm., the drawdown was 31 1/2 ft.

Analysis of a sample (Lab. No. 104,558) collected Oct. 16, 1945 after 24-hr. pumping at 755 gpm., showed the water in Well No. 5 to have a hardness of 18.4 gr. per gal., a residue of 340 ppm., and an iron content of 0.2 ppm.

On, Nov. 15, 1946 the concrete pump foundation and the pump house were completed. The top of the concrete pump foundation is about 2 ft. above the ground surface.

The following pumping equipment is in service: 110 ft. of 8-in. column pipe; 3-stage, 12-in. American Well Works all-bronze turbine pump, No. 71841, rated at 600 gpm. against a total head of 225 ft.; 110 ft. of 1/4-in. black-iron pipe air line; 20 ft. of 8-in. suction pipe; 60-hp. U. S. electric motor.

All water for the public supply has been chlorinated since 1941.

Pumpage has been metered since Apr. 1,1931, and the records show:

Year (May 1 to May 1)	Pumpage Ave. gpd.
1931 - 1932	597,548
1945 - 1946	761,138
May 1 to Nov. 1, 1946	899,354

The maximum pumpage in any one month was for July 1946 when the average was 974,145 gpd. In the same month, the 4 wells supplied water as given in Table 2.

TABLE 2

Well No.	Total Gal. for the Month	% of Total
1	633,600	2.1
2	7,776,000	25.75
3	10,862,400	36.00
4	10,926,500	36.15
	30,198,500	100.00

A public water supply was installed by the village of Bement (1466) in 1894.

Water was obtained originally from 2 wells, each 6 in. in diameter, and 137 and 140 ft. in depth. The wells were located at the pumping station on Bodman St., east of Champaign St. (or approximately 100 ft. N. and 2800 ft. W. of the S. E. corner of Section 18, T. 17 N., R. 5 E.). The ground surface elevation is 680± ft. The pumping equipment consisted of double-acting pumps with 3 1/4-in. cylinder and 24-in. stroke. In 1917, with the cylinders set at 119 ft., the water level in one well was 70 ft., when operating the pump in the other well. Water was not drawn to the bottom of the cylinder, when pumping at the maximum rate, which was probably 50 gpm., from each well.

One of the wells was abandoned about 1930 and the other (west) well about 1938. Both wells have been capped and sealed with concrete.

Analysis of a sample (Lab. No. 39683) collected June 27, 1918 showed this water to have a hardness of 17.7 gr. per gal., a mineral content of 505 ppm., and an iron content of 1.5 ppm.

Several wells have been drilled into sand and gravel, some on the same lot with the old wells. One was drilled near the center of the village, and 3 or 4 were drilled along the north side of the Wabash Railroad, about 900 ft. west and north of the old wells. One of these wells was used for a time. The casings of all wells have been pulled, and the wells filled and partly plugged with concrete.

In 1917, a well was drilled, near the old wells, to a depth of 275 ft. When drilling reached 140 ft., in sand, a screen was installed. During a production test, sand flowed into the well and the yield was small. When drilled to 275 ft., rock was encountered at 209 ft. The well was cased with 12-in. pipe to 140 ft., and with 6-in. pipe from 140 to 211 ft. below which the hole was finished in rock at 6-in. diameter.

In 1917, the non-pumping water level was 26 ft. and when pumping at 70 gpm. the drawdown was 38 3/4 ft.

The well was repaired in 1936 but was not returned to service. It was capped with concrete and sealed.

Correlated driller's log of well drilled in 1924 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and clay	8	8
Sand, muddy	20	28
Clay and hardpan	17	45
Sand	5	50
Hardpan	10	60
Sand, some water	5	65
Hardpan and boulders	35	100
Sand	15	115
Hardpan	25	140
Sand, 15 gal. fresh water per minute	10	150
Clay	50	200
Sand, some water	20	220
Pennsylvanian system		
Shale, some limestone, thin coal beds	875	1095
Limestone, with artesian salt water	30	1125
Shale	28	1153
Sandstone, salt water	30	1183
Mississippian system		
Chester series		
Shale	1	1184

Analysis of a sample (Lab. No. 37776) collected Aug. 11, 1917 showed this water to have a hardness of 32.2 gr. per gal., a mineral content of 1545 ppm., and an iron content of 2.7 ppm.

In 1910, the village entered into a 10-hr. pumping contract with the local electric light company, to supply water to the village. The light company pumped water to the village for a few years and then the village took charge of the plant. The well was abandoned and the casing removed.

In 1924, a well was drilled to a depth of 1184 ft. by Meister Bros., Tuscola, and located about 40 ft. east of the old well used by the light company when it supplied water to the village, (approximately 350 ft. N. and 1800 ft. E. of the S. W. corner of Section 18). During drilling, water from the lowest sand stratum, between depths of 1153 and 1180 ft. raised about 800 ft. When the drilling reached 1184 ft. water from a sandstone stratum flowed over the top of the casing, 18 in. above ground, but was too salty and was cased out before drilling continued. Later the casing was removed and the hole filled. The ground elevation is 680± ft.

A well was then drilled to a depth of 208 ft. by Meister Bros., and located in the southeast corner of the pumping station, about 30 ft. southeast of the old west well, drilled in 1894. The well was repaired and deepened to 215 ft. in 1936 by L.R. Burt, Decatur. When repairs were completed, the well was reported to be cased with 184 ft. of 6-in. pipe, 21 ft. of 4 7/8-in. pipe and 10 ft. of Johnson screen, having No. 40 slot openings. Inability to remove some of the old casing was explained as the reason for the 4 7/8-in. casing.

The well was used until Well No. 5 was placed in service. It has been capped and sealed with concrete.

Well No. 5 was drilled in 1937 to a depth of 139 ft. by Layne-Western Co., Chicago, and located on the east side of Macon St. between Bond and Fremont St. (or approximately 1320 ft. S. and 1320 ft. E. of the N. W. corner of Section 19).

The well was gravel-packed with a 28-in. diameter outer casing and an 18-in. inner casing. The latter casing was set from 0 to 109 ft. below which was 30 ft. of Layne shutter screen, the upper 15 ft. being Layne No. 7 and the lower 15 ft. being No. 5. Large boulders and clam shells were removed from the hole during the construction of the well.

A production test was made by the driller on Sept. 14, 1937. After 10-hr. pumping at 550 gpm. the drawdown was 49 ft. from a static water level of 32 1/2 ft. below the top of the inner casing. On Sept. 3, 1948 the water level was 39 ft. and after 30-minutes pumping at 475 gpm. the drawdown was 42 ft.

Well No. 5 is the sole source of public supply. In Sept. 1947, a new bowl assembly was installed. The pumping equipment now consists of 114 ft. of 6-in. column pipe; 10-in., 6-stage Layne turbine pump, rated at 500 gpm. against 158 ft. of head; the overall length of the pump is 5 ft. 4 1/2 in.; 129 ft. of 1/4-in. copper tubing air line; 10 ft. of 6-in. suction pipe; 40-hp., 1765 rpm., General Electric motor No. 5416625. The pump base is 2 ft. above ground level and the top of the air line is 10 in. above pump base.

Analysis of a sample (Lab. No. 115,722) collected Sept. 3, 1948 after 30-minutes pumping at 475 gpm., showed this water to have a hardness of 18.7 gr. per gal., a residue of 444 ppm., and an iron content of 0.4 ppm.

Pumpage is estimated to average 127,000 gpd.

LABORATORY NO. 115,722

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.4		Silica	SiO_2	22.6	
Manganese	Mn	0.1		Fluoride	F	0.3	
Calcium	Ca	69.4	3.47	Chloride	Cl	22.0	0.62
Magnesium	Mg	35.9	2.95	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	2.3	0.12	Sulfate	SO_4	2.1	0.04
Sodium	Na	48.8	2.12	Alkalinity (as $CaCO_3$)		400.	8.00
Turbidity		10		Hardness (as $CaCO_3$)		321.	6.42
Color		10		Residue		444.	
Odor		0		Temperature 55.2° F.			

BENSENVILLE
Du Page County
June 14, 1947

A public water supply was installed by the village of Bensenville (1869) in 1925.

The initial supply was obtained from a well drilled to a depth of 1445 ft. by W.L. Thorne Co., Des Plaines, and located about 50 ft. east of York Road and 400 ft. north of the Chicago, Milwaukee & St. Paul R.R. main line (approximately 2530 ft. S. and 80 ft. E. of the N. W. corner of Section 13, T. 40 N., R. 11 E.). The elevation at the pump base is 676.9 ft.

The driller's record of hole and casing diameters is given in Table 1.

TABLE 1

Hole Record

12-in. from 114 to 334 ft.
8-in. from 785 to 1060 ft.
6-in. from 1269 to 1445 ft.

Casing Record

12-in. from 0 to 114 ft.
10-in. liner from 2i8 to 334 ft.
8-in. liner from 328 to 785 ft.
7-in. liner from 1060 to 1163 ft.
6-in. liner from 1163 to 1269 ft.

After completion of the well and the installation of a plunger pump some production tests were made. Before the tests, the water level was 168 1/2 ft. below the pump base and when pumping at 147 gpm., the drawdown was 23 1/2 ft. and when pumping at 176 gpm., the drawdown was 35 1/2 ft.

After the well had been in service for several years, considerable pump trouble was experienced necessitating repeated shutdowns and the well was used only occasionally between the period of 1929 and 1938.

In Mar. 1938, the existing plunger pump was removed, and the well was sounded. The distance to water was 234 1/2 ft. below the pump base, and the hole was found bridged at a depth of 1091 ft. The well was reported cleaned to a depth of 1440 ft. At this time, a new turbine pump was set at a depth of 330 ft. and on May 23-24, a production test was conducted by the State Water Survey. While pumping at 145 gpm. against a pressure of 53 psi., the drawdown was 67 1/2 ft. from a non-pumping water level of 234 ft. below the pump base. After an additional 17 1/2-hr. pumping at a rate of nearly 200 gpm., apparent equilibrium was attained with a drawdown of 96 ft.

Following the installation, the well was in daily service until about 1946. During this interval, the non-pumping water level showed a steady recession. In July 1943, the non-pumping water level was 290 ft. below the pump base, and in May and June, 1944, the non-pumping water level showed a steady recession. In July 1943, the non-pumping water level averaged 295 ft. below the pump base. On Aug. 7 and 8, 1945, after identical idle periods of 8 hr. each, the non-pumping water level was 305 ft.

The well was out of service during the greater part of 1946 due to pumping difficulties. The pump was pulled in Nov. 1946 and the depth was found to be 1430 ft. The following installation was made at 'that time: 450 ft. of 5-in. column pipe, 7-in., 26-stage Peerless turbine pump, Serial No. 33302, all bronze bowls having a rated capacity of 250 gpm. against 425 ft. of head; the overall length of the 'pump is 15 ft. 9 in.; 30 ft. of 4-in. suction pipe, and strainer; 450 ft. of air line (lower 120 ft. brass pipe and upper 330 ft.

LABORATORY NO. 108,416

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.7		Silica	SiO_2	12.4	
Manganese	Mn	Tr.		Fluoride	F	1.0	
Calcium	Ca	73.3	3.67	Chloride	Cl	10.0	0.28
Magnesium	Mg	21.8	1.80	Nitrate	NO_3	1.7	0.03
Ammonium	NH_4	0.5	0.03	Sulfate	SO_4	90.3	1.88
Sodium	Na	36.1	1.57	Alkalinity (as $CaCO_3$)		244.	4.88
Turbidity		Tr.		Hardness (as $CaCO_3$)		274.	5.47
Color		0		Residue		400.	
Odor		0		Free CO_2 (calc.)		30.	
Temperature 59.5° F.				pH = 7.2			

iscopper tubing); 50-hp. General Electric motor.

A production test of 2 hr. duration was made on Nov. 26, 1946 with no other pumping. During this period when pumping at 245 gpm. to free discharge the drawdown was 96 ft. from a non-pumping water level of 317 1/2 ft. below the pump base. The pump in Well No. 2 was then started and, during simultaneous operation, an additional drawdown of 5 ft. was observed in Well No. 1, but no appreciable decrease in discharge. On May 15, 1947, with no pumping in either well, the water level in No. 1 was 313 ft. and after pumping 2 hr. at 225 gpm. in Well No. 1 only, the drawdown was 84 1/2 ft. With no pumping in Well No. 1 and after 3-hr. pumping at 300 gpm. in Well No. 2, the water level in No. 1 was 327 1/2 ft.

Analysis of a sample (Lab. No. 108,416) collected Nov. 19, 1946 after 6-hr. pumping showed this water to have a hardness of 16.0 gr. per gal., a mineral content of 400 ppm., and an iron content of 0.7 ppm. The general character indicates the presence of some water from the Silurian system.

Well No. 2 was drilled to a, depth of 1442 ft. by W. L. Thorne Co. in 1929 and located about 25 ft. south and 75 ft. east of Well No. 1. The elevation at the pump base is 675.6 ft.

The hole and casing record is given in Table 2.

TABLE 2

Hole Record

22-in. from surface to 106 ft.
20-in. from 106 to 322 ft.
15-in. from 322 to 622 ft.
12-in. from 622 to 1300 ft.
10-in. from 1300 to 1442 ft.

Casing Record

20-in. from surface to 108 ft.
17-in. from 98 to 322 ft.
12-in. from 301 to 622 ft.
10-in. liner from 1083 to 1165 ft.
10-in. liner from 1244 to 1300 ft.

Sample-study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Soil and gravel"	110	110
Silurian system		
Niagaran--Alexandrian series		
"Limestone"	127	237
Ordovician system		
Maquoketa formation		
"Shale and limestone"	233	470
Galena-Platteville dolomites	307	777
Glenwood sandstone and some shale	58	835
St. Peter formation		
Sandstone	235	1070
Chert, shale and sandstone	5	1075
Cambrian system		
Trempealeau dolomite	80	1155
Franconia sandstone, some shale	75	1230
Galesville sandstone		
Sandstone, partly dolomitic	110	1340
Sandstone, incoherent	85	1425
Eau Claire sandstone, some dolomite	17	1442

The well was placed in service shortly after the installation of a turbine pump in Feb. 1930. The pump had a rated capacity of 300 gpm. against 325 ft. of head and was attached to 300 ft. of 6-in. id. column pipe. It remained in service until 1943 when it began to pump air. It was replaced in May 1944 as follows: 354 ft. of 6-in. column pipe;.10-in., 10-stage Peerless turbine pump (all bronze bowls) having a rated capacity of 350 gpm. against 385 ft. of head; the overall length of the pump is 7 ft. 5 in.; 20 ft. of 6-in. suction line and 18-in. length of tapered strainer; 354 ft. of 1/4-in. brass air line;50-hp. General Electric motor.

Two production tests of 6 hr. each were made on May 16 and 17, 1944. After 4 1/2 hr. of pumping from Well No. 2 only on May 16, 1944 at an average rate of 325 gpm., the drawdown was 43 1/2 ft. from a non-pumping water level of 304 ft. below the pump base. Continuing the test for 1 1/2 hr. and with simultaneous pumping from both wells, there was an additional drawdown of 5 ft. and a reduction-in rate to 300 gpm. On May 15, 1947, with no pumping in either well for 2 hr.,the water level in No. 2 was 320 ft. After 2-hr. pumping in Well No. 1 only, the water level in Well No. 2 was 327 ft. With no pumping in Well No. 1, after 3-hr. pumping in Well No. 2, the drawdown was 30 1/2 ft.

Analysis of a sample (Lab. No. 110,309) collected May 15, 1947, after 3-hr. pumping, showed this water to have a hardness of 14.7 gr. per gal., a residue of 378 ppm., and an iron content of 0.4 ppm. The general character is typical for waters from the St. Peter-Galesville sandstone in this vicinity.

The metered pumpage from May 1, 1946 to May 1, 1947 averaged 151,100 gpd. varying from a winter average of 137,000 gpd. to a summer average of 170,000 gpd.

LABORATORY NO. 110,309

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.4		Silica	SiO_2	11.7	
Manganese	Mn	0.0		Fluoride	F	1.2	
Calcium	Ca	71.4	3.57	Chloride	Cl	13.	0.37
Magnesium	Mg	17.9	1.47	Nitrate	NO_3	0.7	0.01
Ammonium	NH_4	0.4	0.02	Sulfate	SO_4	57.4	1.19
Sodium	Na	44.9	1.95	Alkalinity	(as $CaCO_3$)	272.	5.44
Turbidity		20		Hardness	(as $CaCO_3$)	252.	5.04
Color		0		Residue		378.	
Odor		0		Free CO_2		41.	
Temperature 60° F.				pH = 7.2			

BENSON
Woodford County
Mar. 4, 1947

A public water supply for the village of Benson (358) was installed in 1889.

A well, located in the west part of town, was dug and bored to a depth of 50 ft. and equipped with a steam pump and boiler.

In 1900, the water supply became inadequate. A new well, called No. 2, was dug on a village-owned plot at the south corner of Linn and Pleasant St. (or approximately 1200 ft. S. and 175 ft. E. of the N. W. corner of section 33, T. 28 N., R. 1 E.). The elevation of the ground surface is 760± ft.

The well is 80 ft. deep and constructed as follows: 20 ft. dug to a diameter of 20 ft.; 20 to 50 ft. dug to a diameter of 14 ft.; and from 50 to 80 ft. two holes were bored and cased with 2-in. pipe. Gauze strainers were placed on the bottom of the casing in sand and gravel. The walls of the dug portion were 13 in. in thickness and constructed with brick laid in lime plaster.

The well was equipped with an American Well Works deep-well double-acting pump with a 5 3/4-in. by 10-in. cylinder placed at a depth of 48 ft. In 1915, it was reported that the non-pumping water level, during rainy seasons, was 6 to 8 ft. below the top of the well, and during dry weather periods, the water level receded to within 6 or 8 ft. of the bottom of the dug portion of the well.

In 1938, three test wells, 4 in. in diameter, were drilled by Barnes Bros., Metamora. One testwell, located justwest of the pumping station, was reported to penetrate 4 ft. of water-bearing stratum at a depth of 80 ft. and to encounter soapstone at 100 ft. A second test well, near the elevated tank, was abandoned because of lack of water. The third test well, located one block east and one block north of the tank, showed some promise of an adequate water supply.

In 1939, a-well was drilled by Chris Ebert, Washington, near the location of the third test well. Fine sand was encountered, and the yield was low. The casing was pulled, and Well No. 3 was dug at the same location on the north side of the railroad tracks at the southwest corner of Front and Greene St. (or approximately 700 ft. S. and 1225 ft. E. of the N. W. corner of Section 33). The well is 72 ft. deep and 8 ft. in diameter at the top. It is lined with reinforced concrete, 6 in. in thickness to a depth of 60 ft. Steel rings, which would pass inside the concrete curb, were placed in the bottom part of the well, and a wall of brick was laid up inside the rings.

When Well No. 3 was placed in operation, all other wells were abandoned, and the pump from Well No. 2 was placed in Well No. 3. The cylinder is set at 65 ft., and power is furnished by a 5-hp. Century electric motor.

When Well No. 3 was completed, the non-pumping water level was reported to be 27 ft. below the top, and the production was 100 gpm. At present, the non-pumping water level is estimated to be 32 ft. below the top of the well.

Analysis of a sample (Lab. No. 109,421) collected Mar. 4, 1947, showed the water from Well No. 3 to have a total hardness of 30.7 gr. per gal., a residue of 610 ppm., and an iron content of 7.1 ppm.

Pumpage is estimated at 4800 gpd.

LABORATORY NO. 109,421

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	7.1		Silica	SiO_2	21.1	
Manganese	Mn	0.2		Fluoride	F	0.2	
Calcium	Ca	118.9	5.95	Chloride	Cl	25.0	.71
Magnesium	Mg	55.8	4.59	Nitrate	NO_3	0.2	Tr.
Ammonium	NH_4	0.6	.03	Sulfate	SO_4	144.0	3.00
Sodium	Na	9.7	.42	Alkalinity (as $CaCO_3$)		364.	7.28
Turbidity		50+		Hardness (as $CaCO_3$)		527.	10.54
Color		0		Residue		610.	
Odor		0					

BERKELEY
Cook County
April 27, 1946

A public water supply was installed by the village of Berkeley (724) in 1914. Two limestone wells have constituted the principal source of the water supply.

Well No. 1, which is reported to be 205 ft. deep, is located near the center of Lot 36, Block 2 (or approximately 3500 ft. S. and 1650 ft. E. of the N. W. corner of Section 7, T. 39 N., R. 12 E.). It is reported to be cased to rock with 65 ft. of 10-in. pipe. The elevation of the pump base is 678± ft.

This well serves as an auxiliary supply unit and is equipped with: 180 ft. of 4 1/2-in. column pipe; 5 1/2-in., 14-stage Pomona turbine pump, rated at 80 gpm. against a head of 180 ft.; the pump is 71 in. iong; 10 ft. of 4 1/2-in. suction pipe; 7 1/2-hp. Westinghouse electric motor. An air line, 180 ft. long, was installed but it is defective. No water levels are available.

An older well, concerning which little information is available, was located about 15 ft. south of Well No. 1. It is now abandoned and plugged.%

Well No. 2 is 151 ft. deep and is located on Lot 9, Block 4 (or approximately 3 70 ft. S. and 730 ft. E. of the N. W. corner of Section 18, T. 39 N.,R. 12 E.). The ground surface elevation is 685± ft. This well was drilled by A. D. Cook Co. of Lawrenceburg, Indiana in 1930, and is cased to rock with 103 ft. of 10-in. pipe. A 1-hr. pumping test, made after the completion of the well, indicated a capacity of 150 gpm. with a drawdown of 8 ft. below a non-pumping water level of 44 ft. The following pumping equipment, installed in Dec. 1935, is still in place: 8-in., 9-stage Pomona turbine with a rated capacity of 200 gpm., and at a setting of 90 ft.; a regular strainer but no suction line; 90 ft. of air line; 15-hp. U. S. electric motor.

A non-pumping water level of 50 ft. below the pump base was reported in Dec. 1935, and 60 ft. on Jan. 9, 1944 and Feb. 6, 1944. During July 1944 when the pump was in continuous operation the water level was 72 ft.

Analysis of sample (Lab. No. 106,311), collected on Apr. 27, 1946 after 4-hr. pumping at 200 gpm. showed the water from this well to have ahardness of 27.2 gr.per gal., a mineral content of 578 ppm., and general character which is not unusual for waters from wells of this depth in this vicinity. A previous sample, collected Nov. 30, 1937, was shown to have an iron content of 0.4 ppm., a hardness of 23.6 gr. per gal., and a mineral content of 481 ppm.

The combined metered pumpage for the year 1943 averaged 178,000 gpd., which included an average metered consumption of 51,500 gpd. by the City Fuel & Ice Co. The water is not treated.

LABORATORY NO. 106,311

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.6		Silica	SiO_2	12.5	
Manganese	Mn	0.0		Fluoride	F	0.4	
Calcium	Ca	94.3	4.72	Chloride	Cl	4.0	.11
Magnesium	Mg	56.2	4.62	Nitrate	NO_3	2.8	0.05
Ammonium	NH_4	0.7	0.04	Sulfate	SO_4	163.7	3.41
Sodium	Na	26.5	1.15	Alkalinity	(as $CaCO_3$)	348.	6.96
Color		0		Hardness	(as $CaCO_3$)	467.	9.34
Odor		0		Residue		578.	
Turbidity		Tr.		Free CO_2 (calc.)		59.1	
Temperature		50.6° F.		pH = 7.2			

BETHALTO
Madison County
Nov. 22, 1948

A public water supply was installed in 1942 for the village of Bethalto (1207).

Well No. 1 was completed in Mar. 1942 to a depthof 94 ft. by Thorpe Concrete Well Co., Alton, and was located about 2 miles southwest of Bethalto, (or approximately 1595 ft. N. and 1227 ft. W. of the S.E. corner of Section 22, T. 5 N., R. 9 W.). The ground elevation at the well site is 440± ft.

The well was cased from the ground surface to 48 ft. with blank concrete pipe and from 48 to 92 ft. with porous concrete pipe. The concrete pipe was 30-in. id. and 40-in. od. A concrete plug and cutting shoe was placed from 92 to 94 ft.'

A production test was made by the State Water Survey on Mar. 11-12, 1942. The static water level before the test was 41 1/2 ft. below the top of the casing, and after 10-hr. pumping at 305 gpm., the drawdown was 4 1/4 ft. Frequent observations in a 6-in.test hole, about 50 ft. southwest from Well No. 1 failed to show any effect of pumping in Well No. 1.

The pumping equipment consists of 70 ft. of 5-in. id. column pipe;.8-in., 13-stage American Well Works turbine pump, No. 66066, rated at 200 gpm. against 300 ft. of head at 1760 rpm.; overall length of pump is 8 1/2 ft.; 70 ft. of air line; 10 ft. of 5-in. id. suction pipe; 20-hp., 1800 rpm., U. S. electric motor, No. 282690.

The pump was cleaned recently and a leak repaired at the pump-head base.

Well No. 2 was completed in Mar. 1942 to a depth of 95 1/2 ft. by Thorpe Concrete Well Co. and located 125 ft. north of Well No. 1. The well was cased from the ground surface to 40 ft. with blank concrete pipe and from 40 to 93 1/2 ft. with porous concrete pipe. A cutting-shoe filled with concrete was placed from 93 1/2 to 95 1/2 ft.

On Mar. 24, 1942 a production test was made by the State Water Survey. Before the test, the static water level was 43 1/2 ft. from the top of the casing and after 24-hr. pumping at 320 gpm. the drawdown was 5 ft. 2 in. Twenty minutes after stopping the pump, the water level was 44 ft. 3 in. and 2 hr. later the water level was 44 ft. While pumping in Well No. 2 the water level in Well No. 1 was lowered 0.4 ft.

The pumping equipment consists of 70 ft. of 5 1/2-in. id. column pipe; 8-in., 13-stage American Well Works turbine pump, No. 66065, rated at 200 gpm. against 300 ft. of head at 1760 rpm.; overall length of pump is 8 1/2 ft.; 70 ft. of air line; 10 ft. of 5 1/2-in. id. suction pipe; 20-hp. 1800 rpm. U. S. electric motor. No. 27482. The pump discharges at a rate of 170 gpm.

The North and South Well pumps are usually alternated monthly.

Analysis of a sample (Lab. No. 116,545) collected Nov. 22, 1948 showed the water in Well No. 2 to have a hardness of 23.8 gr. per gal., a residue of 473 ppm., and an iron content of 0.2 ppm.

Chlorine is used occasionally at the elevated tank.

Pumpage is estimated to average 163,000 gpd.

LABORATORY NO. 116,545

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	28.7	
Manganese	Mn	0.3		Fluoride	F	0.2	
Calcium	Ca	101.3	5.07	Chloride	Cl	5.0	0.14
Magnesium	Mg	37.6	3.09	Nitrate	NO_3	6.1	0.10
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	99.6	2.07
Sodium	Na	3.2	0.14	Alkalinity (as $CaCO_3$)		300.	6.00
Turbidity		2		Hardness (as $CaCO_3$)		408.	8.16
Color		0		Residue		473.	
Odor		0		Temperature 56° F.			

BETHANY
Moultrie County
July 5, 1948

The village of Bethany (819) installed a public water supply in 1936.

In the search for a satisfactory source of supply, seven test wells were drilled in 1934 and 1935. An electrical earth resistivity survey was made by the State Geological Survey in 1935, following which four more test wells were drilled.

Test Well No. 5 was drilled to a depth of 73 ft. in 1934 by C. S. Cumming, Gardner, and was located about 100 ft. north and 100 ft. east of the intersection of Main and St. John St. (or approximately 2940 ft. N. and 1200 ft. W. of the S. E. corner of Section 22, T. 14 N., R. 4 E.). The ground surface elevation is 655t ft.

This well was four inches in diameter, with a four-inch diameter sand-point screen.

A production test was made by the State Water Survey on Dec. 15, 1934, using a rig-operated plunger pump. After 3 hr. 45 min. pumping at a rate of 57 gpm., the drawdown was 35.0 ft. from a non-pumping water level of 23.6 ft. below the ground surface. During the test, the water level in Test Well No. 1 located 70 ft. southwest, was lowered 19 ft. The rate of recovery of the water level was reported to be very slow.

Analysis of a sample (Lab. No. 75,492) collected Dec. 15, 1934, showed the water to have a hardness of 18.3 gr. per gal., a residue of 437 ppm., and an iron content of 3.0 ppm.

Test Well No. 7 was located at the western end of Robinson St. (or approximately 2180 ft. N. and 2300 ft. W. of the S. E. corner of Section 22).

This well was six inches in diameter, and was originally drilled to a depth of 104 ft. However, a caving formation was encountered between the depths of 68 and 71 ft., and when a production test was made by the State Water Survey on Jan. 14, 1935, the well had filled to a depth of 65 ft. The well at that time produced 68 gpm. for 1 1/2 hr. with a drawdown of 36 ft. from a non-pumping level of 27 ft. below the ground surface.

Test Well No. 8 was located 1680 ft. west of Well No. 7, (or approximately 2250 ft. N. and 1300 ft. E. of the S. W. corner of Section 22).

This well was 6 in. in diameter, 41 ft. deep, and equipped with a 6-in. Cook screen from 31 to 41 ft. The screen had No. 100 slot openings. Sand and gravel was encountered between 33 1/2 and 38 ft.

A production test was made by the State Water Survey on Mar. 9, 1935. The well produced 30 gpm. with a drawdown of 36 1/2 ft. from a non-pumping level, which was at the ground surface.

Analysis of a sample (Lab. NO. 75,771) collected Mar. 11, 1935 showed the water to have a hardness of 19.3 gr. per gal., a residue of 450 ppm., and an iron content of 5.0 ppm.

Test Well No. 11 was drilled to a depth of 101 ft. and located at the water works site about 300 ft. west of Test Well No. 7 (or approximately 2180 ft. N. and 2600 ft. W. of the S. E. corner of Section 22).

The well was cased with six-inch pipe from the ground surface to a depth of 66 1/2 ft. An A. D.

Sample-study log of Test Well No. 11 furnished by the State Geological Survey:

Formation	Thickness ft.	Thickness in.	Depth ft.	Depth in.
Pleistocene system				
Soil, silt and till	68		68	
Sand and gravel, Silty	5		73	
"Gravel, clean, water"	3	6	76	6
No record	1	6	78	
Till	12		90	
Pennsylvanian system				
Sandstone, partly coherent	5		95	
Shale	6		101	

LABORATORY NO. 115,188

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.7		Silica	SiO_2	26.1	
Manganese	Mn	0.2		Fluoride	F	0.3	
Calcium	Ca	77.0	3.85	Chloride	Cl	9.0	0.25
Magnesium	Mg	33.2	2.73	Nitrate	NO_3	10.1	0.16
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	0.0	0.00
Sodium	Na	42.1	1.83	Alkalinity (as $CaCO_3$)		400.	8.00
Turbidity		40		Hardness (as $CaCO_3$)		329.	6.58
Color		15		Residue		432.	
Odor		Tr.		Free CO_2 (calc.)		63.	
Temperature		55.5° F.		pH = 7.2			

Cook brass screen, with No. 100 slot openings, was set below the bottom of the casing.

A production test was made by the State Water Survey on June 21, 1935, using a gasoline engine-driven drill rig. The well produced 103 gpm. with a drawdown of 23.8 ft. from a non-pumping water level of 23.8 ft.

Permanent Well No. 1 was located at the site of Test Well No. 11.

This well is of the gravel-pack type. A 24-in. outer casing extends from one foot above to 67 ft. 7 in. below the ground surface and a 12-in. inner casing extends from 2 ft. 4 in. above to 66 ft. 3 in. below the ground surface. A 10-ft. section of 12-in. Cook wire-wound screen, with 3/16-in. slot openings, is attached to the bottom of the inner casing.

A production test was made by the State Water Survey on Oct. 23, 1935. For the first four hours and thirty minutes of the test, the pumping rate was 150 gpm., after which it was reduced to 125 gpm. At the end of eight hours, the production was 117 gpm. with a drawdown of 40 ft. 2 in. from a non-pumping water level of 29 ft. 10 in.

The well is equipped as follows: 69 ft. of 5-in. column pipe; 7-in. od. 8-stage A. D. Cook turbine pump, No. 1884, 42 3/8-in. overall length, and rated at 120 gpm. against 200 ft. of head; 10 in. of 4-in. suction pipe; 15-hp. U. S. electric motor.

In 1938, it was reported that the pump was operated about 1 1/2 hr. per day.

Analysis of a sample (Lab. No. 76,874) collected Oct. 23, 1935, showed the water to have a hardness of 23.2 gr. per gal., a residue of 449 ppm., and an iron content of 2.7 ppm. Methane gas was present in the water in a concentration of 4.1 cu. ft. per 1000 gal. Hydrogen sulfide was also present.

The following air line readings have been reported:

Jan. 1944, non-pumping altitude gauge = 38 ft. after an. overnight rest period.

Jan. 1944, pumping altitude gauge = 28 1/2 ft. after 7-hr. pumping.

June 30, 1948, non-pumping altitude gauge = 38 ft. overnight recovery. Well No. 2 in service.

July 1, 1948, non-pumping altitude gauge = 36 1/2 ft. Wells 2 and 3 operating.

Well No. 1 is maintained as an emergency stand-by unit.

Wells No. 2 and 3 were drilled, each to a depth of 76 1/2 ft., by Cyrus Stevens, Findlay, and were placed in service in Dec. 1947.

Well No. 2 is located 10 ft. south and 4 ft. east of Well No. 1 and was cased with 2 1/2-in. pipe, with five feet of brass screen at the bottom.

Well No. 3 is located 14 ft. south of Well No. 2 and was cased with 3-in. pipe, with five feet of brass screen at the bottom.

Wells No. 2 and 3 are equipped, each with identical Burks jet pumps and 1 1/2-hp. Wagner electric motors, operating at 3600 rpm. The pressure pipes are 1 1/4-in. diameter and the eductor pipes are 1 1/2-in. diameter. Both

pumps discharge at a rate of 22 gpm. to the aerator at the site, and both pumps are in daily service.

Analysis of a sample (Lab. No. 115,188) collected July 1, 1948 from Well No. 3, after 24-hr. pumping, showed the water to have a hardness of 19.2 gr. per gal., a residue of 432 ppm., and an iron content of 1.7 ppm.

All water is aerated, filtered and softened. Analysis of a sample (Lab. No. 115,176) collected July 1, 1948 showed the treated water to have a hardness of 4.2 gr. per gal., a mineral content of 470 ppm., and an iron content of 0.2 ppm.

From July 1, 1947 to July 1, 1948 the metered treated water averaged 31,875 gpd.

LABORATORY NO. 115,176

	ppm.	epm.		ppm.	epm.
Iron (total) Fe	0.19		Chloride Cl	12.0	0.34
Turbidity	0		Alkalinity (as $CaCO_3$)	424.	8.48
Color	15		Hardness (as $CaCO_3$)	74.	1.48
Odor	M		Total Mineral Content	470.	
Temperature 57.8° F.			Free CO_2 (calc.)	21.	
			pH = 7.7		

BIGGSVILLE
Henderson County
Nov. 16, 1946

A public water supply was installed by the village of Biggsville (344) in 1902 or 1903.

A well, having a diameter of 2 in., was drilled to a depth of 193 ft. and was equipped with a cylinder pump. Power was furnished by a windmill. The location of the well was reported to be "near the center of the village." This well, known to be available for use in 1921, is abandoned but not filled in.

In 1914, a well was drilled "one block east of the business district," in the S. E. 1/4 N. W. 1/4 S. W. 1/4 of Section 16, T. 10 N., R. 4 W. It was reported to be 192 ft. deep and 4 in. in diameter. In 1921 the 2 1/2-in. cylinder was reported to be set at 180 ft., and the rate of production averaged 3 gpm. with a maximum yield of 5 to 8 gpm. The non-pumping water level was 40 ft. below the ground surface. The water at that time was found tp have a hardness of 21.2 gr.per gal., a mineral content of 507 ppm., and an iron content of 0.7 ppm. The chloride content was 0.8 ppm.- and the sulfate content was 23.2 ppm.

The well is now abandoned but not filled in.

Water is now obtained from a Well No. 2, drilled in 1936 by Ellis Jones, Burlington, Iowa, under a W. P. A. water works improvement project for the village of Biggsville. It is located at the rear of the Biggsville Township high school building (or approximately 250 ft. N. and 250 ft. W.of the S.E. corner of Section 17). The well is 891 ft. deep and cased with 8-in. pipe from the surface to 65 ft., below which the hole is 8 in. in diameter to 775 ft. and 4 1/4 in. in diameter from 775 ft. to the bottom.

The well is equipped with: 210 ft. of 5-in. column pipe; 7-in., 17-stage A. D. Cook turbine pump, No. 2669, rated at 100 gpm. against 279 ft. of head; the overall length of the pump is 86 1/4 in.; there is no suction pipe; 15-hp. U. S. electric motor operating at 1800 rpm. At the time of installation, the non-pumping level was 130 ft. below the ground surface.

In 1944 when the pump was not operating for a 2 or 3-day period, the water level was reported to be 65 ft. below the top of the well. After pumping was resumed, the water level was reported to be 170 ft.

The pumpage is estimated to be 10,000 gpd. At present the pump is operated every other day.

Analysis of a sample (Lab. No. 108,143), collected Oct. 29, 1946, showed this water to have a hardness of 42.7 gr. per gal., a residue of 2287 ppm., and an iron content of 0.3 ppm.

Aquality-source test (Analyses Nos. 108,343-108,350) in Dec. 7, 1946 showed water to be entering the wellfrom two distinct sources.

The. lower but gradually increasing temperature of the first four samples indicate this lower

Sample-study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Loess and glacial till	57	57
Mississippian system		
Keokuk - Burlington limestones	143	200
Kinderhook shale	260	460
Devonian system		
Cedar Valley formation		
Limestone, dolomite at top	100	560
Shale and dolomite	7	567
Dolomite	13	580
Ordovician system		
Maquoketa shale, some dolomite	180	760
Galena dolomite	131	891

LABORATORY NO. 108,143

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.3		Silica	SiO_2	14.3	
Manganese	Mn	Tr.		Fluoride	F	5.5	
Calcium	Ca	178.8	8.94	Chloride	Cl	195.0	5.50
Magnesium	Mg	69.2	5.69	Nitrate	NO_3	0.2	Tr.
Ammonium	NH_4	1.8	.10	Sulfate	SO_4	1191.8	24.80
Sodium	Na	453.8	19.73	Alkalinity (as $CaCO_3$)		208.	4.16
Color		0		Hardness (as $CaCO_3$)		732.	14.64
Odor		0		Residue		2287.	
Turbidity		Tr.					
Temperature		65° F.					

mineral content water to be Keokuk-Burlington water which had accumulated in the well bore during the 38-hr. idle period prior to starting the pump.

After 30-minute pumping little or no such water was obtained and the quality of the last four highly mineralized samples appears to be typical of such water as may be obtained from a lower formation in this section of the State

The water is not treated.

Analyses Nos. 108,343 - 108,350

Pumping Period	Temp. °F.	Fe ppm.	Cl ppm.	SO_4 ppm.	Alk. ppm.	Hd. ppm.	Res. ppm.
1 min.	54.2	1.1	5	35.0	492	341	561
5 "	57.0	0.2	5	28.4	492	341	545
10 "	59.5	0.7	6	30.6	488	329	545
15 "	61.5	1.0	6	34.4	488	322	558
30 "	64.1	0.4	195	1133.6	228	695	2294
45 "	64.6	0.4	200	1168.9	216	695	2366
2 hr.	65.2	0.3	205	1202.3	212	695	2398
4 " 25 min.	65.5	0.1	210	1200.1	208	711	2420

BLUE MOUND
Macon County
Aug. 28, 1948

A public water supply was installed by the village of Blue Mound (811) about 1882. The first installation was primarily for fire protection.

A 16-ft. diameter dug well was constructed to a depth of 50 ft. and located under the pumping station floor. The well was cased with brick, but, later, due to fine sand filling in from underneath the brick wall, a second brick wall was constructed within the original wall and to a greater depth. In 1914 the depth was reported to be 40 ft., and in the same year static water levels ranged from 10 or 12 ft. to 25 ft. In 1914 the pump, rated at less than 100 gpm. could dewater the well in 1 1/2 hr. The well is filled and all evidences of a well have been obliterated.

In 1917, two 6-in. wells were drilled to a depth of 55 ft. each, by W. H. Long, Decatur, and located south and east of the high school, and 1850 ft. south and 1000 ft. east of the old wells. The wells were spaced 35 ft. apart, and an 8-ft. length of screen was placed in the bottom of each well, in a stratum of gravel.

Each well was equipped with a Cook double-stroke deep-well pump, having an 18-in. stroke and 5 3/4-in. cylinder set at 35 ft. The drop pipe was 6 in. in diameter.

The casing of the west well was removed in 1935 and the well abandoned, capped and sealed.

In 1938, the east well was reported to be maintained as a stand-by unit and was operated occasionally at 23 spm. or 50 gpm. This well has been abandoned.

In 1935, a 6-in. well now known as West Well was drilled to a depth of 55 ft. at a location 77 ft. west of the old east well, 205 ft. east of Lewis St., (or approximately 1650 ft. S.and 205 ft. E. of the N. W. corner of Section 5, T. 14 N., R. 1E.). The well is equipped with 50 ft. of 3-in. column pipe; 4-in., 9-stage Fairbanks-Morse turbine pump, No. 28956 operated at 3600 rpm.; 5-hp., Fairbanks-Morse electric motor.

In Jan. 1948, the production rate had decreased to about 15 gpm. After an acid treatment, the production rate was 50 gpm., which is the present discharge to the aerator at the well site.

Analysis of a sample (Lab. No. 115,619) collected Aug. 18, 1948 showed the water to have a hardness of 18.8 gr. per gal;, a residue of 365 ppm., and an iron content of 0.7 ppm.

All water is aerated, filtered and softened. Analysis of a sample (Lab. No. 115,782) collected Aug. 18, 1948 showed the treated water to have a hardness of 5.0 gr. per gal., a mineral content of 369 ppm., and an iron content of 0.06 ppm.

The new East Well was drilled in 1944 to a depth of 58 ft. by L. R. Burt, Decatur, and located 5 ft. north and 60 ft. east of the West Well. The ground elevation at the well-site is 610± ft. The well was cased with 8-in. pipe with a 10-ft. length of screen.

The pumping e quipment, installed in 1945, includes 45 ft. of 2-in. pressure and 3-in. eduction pipes, Burks jet pump, No. I-44368, having a rated capacity of 50 gpm.; suction strainer with bottom set at 49 1/2 ft.; 5-hp. Wagner electric motor.

The yield decreased to about 15 to 18 gpm.

LABORATORY NO. 115,619

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.7		Silica	SiO_2	21.8	
Manganese	Mn	0.2		Fluoride	F	0.3	
Calcium	Ca	74.4	3.72	Chloride	Cl	19.	0.54
Magnesium	Mg	33.3	2.74	Nitrate	NO_3	0.7	0.01
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	81.0	1.69
Sodium	Na	6.0	0.26	Alkalinity (as $CaCO_3$)		224.	4.48
Turbidity		0		Hardness (as $CaCO_3$)		323.	
Color		0		Residue		365.	
Odor		0					
Temperature 55° F.							

LABORATORY NO. 115,782

	ppm.	epm.			ppm.	epm.
Iron (total) Fe	0.06		Fluoride	F	0.2	
			Chloride	Cl	19.0	0.54
Turbidity	0		Alkalinity	(as $CaCO_3$)	232.	4.64
Odor	0		Hardness	(as $CaCO_3$)	85.	1.70
Color	0		Total Mineral Content		369.	
Temperature 57.5° F.						

After an acid treatment, by Wollen Bros., Wapella, on Aug. 11, 1948, the production rate was 60 gpm. The non-pumping water level, on Aug. 11, 1948, was 40 ft. below the pump base, which is 2 ft. above ground level. The West Well was in operation at the time.

The West and East Well operations are alternated.

From July 18, to Aug. 17, 1948, pumpage was estimated to average 35,350 gpd.

The village of Bluffs (839) installed a public water supply in 1936.

Well No. 1 was constructed in 1935-36 to a depth of 58 ft. by Thorpe Concrete Well Co., Alton, and is located in the pump house near the western limits of the village and north of the Wabash Railroad (or approximately 40 ft. S. and 800 ft. W. of the N.E. corner of Section 16, T. 15 N., R. 13 W.). The ground surface elevation at the site is 460± ft.

The well was originally cased with 26-in. id. by 36-in. od. solid concrete casing from 3 ft. above to 14 ft. below the ground surface, and with porous concrete casing of the same dimensions from 14 to 58 ft. A 54-in. steel shell surrounded the gravel envelope around the concrete casing between the depths of 5 and 35 ft.

A short production test was made on Jan. 21, 1936. After 3 3/4-hr. pumping at 168 gpm. the drawdown was 7.1 ft. from a non-pumping water level of 15.5 ft. below the ground surface. Operation of the pumps in the Wabash Railroad Wells, located 60 and 75 ft. south and southwest of the village well, lowered the water level in the village well 2.9 ft. in 30 minutes.

Another production test was made by the State Water Survey on Feb. 13, 1936. For test purposes, the well was equipped with a turbine pump driven by a gasoline engine. The well produced 178 gpm. with a drawdown of 9 ft. 9 in. from a non-pumping water level of 14 ft. 11 in.

The existing pump installation is: 50 ft. of 4-in. column pipe; 7 1/2-in., 3-stage Johnson turbine pump No. 6365, rated at 100 gpm., against 70 ft. of head; the overall length of the pump is 3 ft.; 3 ft. of 4-in. suction pipe; 50 ft. of 1/4-in. air line; 3-hp. General Electric motor No. 5375892, operating at 1720 rpm.

In Feb., 1940, it was reported that the casing was raised to 4 ft. above ground surface and that the non-pumping water level was 25 ft. below the top of the casing. When pumping at 60 gpm., the drawdown was 27 1/2 ft. In Nov., 1940, the non-pumping water level was reported to be 26 or 27 ft. below the top of the casing, and the production was reported to be about 40 gpm. In Feb., 1946, the well was reported to produce 62 gpm. with a drawdown of 40 ft. below the non-pumping water level of 18 ft.

The screen and impellers become corroded and the pump has been pulled frequently.

Well No. 1 is maintained for emergency use.

Analysis of a sample (Lab. No. 113,729) collected Mar. 12, 1948 showed the water to have a hardness of 33.7 gr. per gal., a residue of 788 ppm., and an iron content of 1.8 ppm.

Due to the lowering of pumping water levels and the reduced supply from Well No. 1, an effort was made to locate an additional water supply for the village. In May 1946, an electrical earth resistivity survey was made by the State Geological Survey. The survey covered the area 1 1/2 miles west of and 1/2 mile north of the village.

Well No. 2 was drilled in 1947 to a depth of 57 ft. by R. R. Long, Jacksonville, and is located about 25 ft. north and 120 ft. west of Well No. 1.

Well No. 2 is cased with 8-in. pipe from 3 ft. above to 45 ft. below the ground level. An 8-in. screen with No. 16 slot openings is installed from 45 to 57 ft.

When the well was completed the non-pumping water level was reported to be about 17 ft. below the top of the casing. After pumping at 90 gpm. for 7 hr. the drawdown was 7 ft. and after pumping for 24 hr. at 220 gpm. the drawdown was 16 ft. On Mar. 5, 1948, after pumping 4 hr. at an average rate of 140 gpm. the pumping water level was 24

Sample-study log of Well No. 1 furnished by the State Geological Survey:

Formation	Thickness ft.	Thickness in.	Depth ft.	Depth in.
Pleistocene system				
Silt and sand	28		28	
Sand, silty	7		35	
Sand, medium to granular	23		58	
"Hardpan"		6	58	6

LABORATORY NO. 113,692

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.8		Silica	SiO_2	18.6	
Manganese	Mn	0.2		Fluoride	F	0.3	
Calcium	Ca	127.9	6.40	Chloride	Cl	24.0	0.68
Magnesium	Mg	53.8	4.43	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	0.2	0.01	Sulfate	SO_4	224.0	4.67
Sodium	Na	19.1	0.83	Alkalinity	(as $CaCO_3$)	316.	6.32
Turbidity		20.		Hardness	(as $CaCO_3$)	542.	10.83
Color		0.		Residue		662.	
Odor		0.					
Temperature 55° F.							

ft. below the top of the well.

The existing pump installation is 40 ft. of 4-in. column pipe; 6-in., 5-stage Fairbanks-Morse Pomona turbine pump No. SH 2942 rated at 200 gpm. against 70 ft. of head; overall length of pump is 4 ft.; 10 ft. of 4-in. suction pipe; 47 ft. of 1/4-in. air line; 5-hp. General Electric motor No. SD5653 operating at 1735 rpm.

Analysis of a sample (Lab. No. 113,692) collected Mar. 5, 1948 after 24-hr. pumping at 220 gpm. showed the water to have a hardness of 31.6 gr. per gal., a residue of 662 ppm., and an iron content of 1.8 ppm.

The water is aerated, softened and chlorinated.

Analysis of a sample (Lab. No. 113,691) collected Mar. 5, 1948 showed the treated water to have a hardness of 12.6 gr. per gal., a mineral content of 474 ppm. and an iron content of 0.2 ppm.

Pumpage is estimated to average 35,000 gpd.

LABORATORY NO. 113,691

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Fluoride	F	0.2	
				Chloride	Cl	27.0	0.76
Turbidity		0.		Alkalinity	(as $CaCO_3$)	140.	2.80
Color		0		Hardness	(as $CaCO_3$)	216.	4.32
Odor		0		Total Mineral Content		474.	

A public water supply was installed by the village of Bourbonnais (771) in 1900.

Water was obtained from a well drilled in 1900 and located on the campus of Olivet Nazarene College, formerly St. Viator College (or approximately 2400 ft. S. and 50 ft. E. of the N. W. corner of Section 20, T. 31 N., R. 12 E.).

The well was drilled 10 in. in diameter to a depth of 181 ft. below a surface elevation of 670± ft. and was equipped in 1911 with a 4 3/4-in. by 24-in. American Well Works pump rated at 72 gpm. and operating at 30 spm., with the cylinder set at a depth of 100 ft.

The non-pumping water level in 1917 was 16 ft. below the top of the well. In Dec. 1923, while the pump was removed, the water level was 80 ft. below the top of the well.

Analysis of a sample (Lab. No. 39360), collected Apr. 22, 1918, showed the water to have a hardness of 27.4 gr. per gal., a residue of 548 ppm., and no iron.

The existing pump installation, made in Feb. 1943, is: 100 ft. of 4 1/2-in. column pipe; 6-in., 18-stage Pomona turbine pump, No. S.B. 3240, having a rated capacity of 100 gpm. against 220 ft. of head; 10 ft. of 4 1/2-in. suction pipe; 10-hp. Westinghouse electric motor.

At the time of the pump installation, the water level was 20 ft. below the pump base after an idle period of 10 hr.

The water supply for the College is entirely furnished by this well. Pumpage is estimated at 27,000 gpd.

In 1918 a second well was drilled to a depth of 185 ft. and located 14 ft. south of the first well. This well produced little water and was not in use in 1923. When the pump in the old well was being operated, the water level in this well was 92 ft. In Dec. 1923, while the pump was removed, the water level was 80 ft. The well is not equipped for service.

These 2 wells were sold to St. Viator College in 1924 and do not now furnish water to the public supply.

In 1923 Adam Heidenrich, Kankakee, drilled a well for the village to a depth of 230 ft. and located on Union St. about 180 ft. west of Roy Ave. (or approximately 1600 ft. S. and 300 ft. W. of the N. E. corner of Section 19). The surface elevation is 670± ft. The well is 10 in. in diameter and is cased with 10-in. pipe to a depth of 32 ft.

The well was originally equipped as follows: 140 ft. of 6-in. column pipe; 4 3/4-in. by 24-in. American Well Works double-acting cylinder pump operating at 20-21 spm.; 18 ft. of 5-in. suction pipe; 10-hp. electric motor. This pump was originally in the old village well.

The well flowed when it was completed. In 1924 it was reported that the non-pumping water level of 4 ft. was not lowered when the pump was operated for 24 hr. In 1927 it was reported that the well had a small free flow, and that when pumping the water level was lowered to 6 ft.

In Feb. 1943 the following pump assembly was installed: 100 ft. of 4 1/2-in. column pipe; 6-in., 18-stage Pomona turbine pump, No. S.B. 3225, rated at 100 gpm. against 220 ft. of head; 10 ft. of 4 1/2-in. suction pipe and strainer; 10-hp. Westinghouse electric motor.

Analysis of a sample (Lab. No. 112,688) collected Nov. 24, 1947 after 2-hr. pumping at 100 gpm. showed this water to have a hardness of

Correlated driller's log of well drilled in 1923 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Drift	17	17
Silurian system		
Niagaran - Alexandrian series		
Limestone	103	120
Flint	82	202
Soft Rock	28	230

21.8 gr. per gal., a residue of 401 ppm., and an iron content of 0.9 ppm.

From Mar. 31 to July 1, 1947 metered pumpage averaged 66,200 gpd.

LABORATORY NO. 112,688

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.9		Silica	SiO_2	16.8	
Manganese	Mn	0.1		Fluoride	F	0.0	
Calcium	Ca	83.4	4.17	Chloride	Cl	3.0	0.08
Magnesium	Mg	39.9	3.29	Nitrate	NO_3	2.4	0.04
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	43.2	0.90
Sodium	Na	2.5	0.11	Alkalinity	(as $CaCO_3$)	328.	6.56
Turbidity		20.		Hardness	(as $CaCO_3$)	373.	7.46
Color		0		Residue		401.	
Odor		Tr.					
Temperature		52.7° F.					

The village of Bowen (619) does not have a public water supply.

In an attempt to locate a suitable source of supply, three wells were drilled in 1946 by the Plymouth Well Co., Plymouth.

Well No. 1 was located one block west of Worrell St., between 4th and 5th St. (or approximately 2440 ft. S. and 300 ft. W. of the N. E. corner of Section 22, T. 3 N., R. 6 W.). The ground surface elevation is 680± ft. This well is 402 ft. deep.

The hole and casing record is given in Table 1.

A production test was made by the State Water Survey on Nov. 10, 1947. After pumping at a rate of about 16 gpm. for 6 1/2-hr.,the drawdown was 19 ft. from a non-pumping water level of 24.15 ft. below the top of the casing. Analysis of a sample (Lab. No. 112,472), collected Nov. 10, 1947, after 13-hr. pumping showed the water to have a hardness of 19.4 gr. per gal., a residue of 434 ppm., a fluoride content of 0.3 ppm., and an iron content of 81.6 ppm. The exceptional iron content was the result of the presence of a considerable amount of turbidity in the sample.

Well No. 2 was located about 600 ft. northwest of Well No. 1.

This well is 155 ft. deep, and is cased from 1 1/2 ft. above to a depth of 44 1/2 ft. below the ground surface with 12 1/2-in. id. pipe. Below the casing the hole is 10 in. in diameter.

The driller reported that after bailing at a rate of 8 gpm. for 1 hr.,the drawdown was 49 1/2 ft. from a non-pumping water level of 20 1/2 ft. A production test was made by the State Water Survey on July 7-8, 1948. For test purposes the pumping equipment included a Fairbanks-Morse jet pump, operated at a discharge pressure of 38 psi. /Before the test the water level was 20.0 ft. below the top of the casing. After 41 1/2-hr. pumping at 5.4 gpm. the drawdown was 19.6 ft. Twenty hr. after the pumping was stopped, the water level was 21.6 ft. For the next 3 days the non-pumping water level varied from21.0 to 21.7 ft.

Analysis of a sample (Lab. No. 112,468) collected in Nov., 1947, showed the water to have a hardness of 15.8 gr. per gal., a residue of 354 ppm., a fluoride content of 0.3 ppm., and an iron content of 9.0 ppm. The exceptional iron content was the result of the presence of a considerable amount of turbidity in the sample.

Well No. 3 is located about 1050 ft. southeast of Well No. 1, (or approximately 1910 ft. N, and 175 ft. E. of the S. W. corner of Section 23).

This well is 407 ft. deep and the hole and

Sample-study log of Well No. 1 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Till and silt	48	48
Pennsylvanian system		
Sandstone, silty incoherent	42	90
Shale and siderite	7	97
Mississippian system		
Salem limestone and dolomite, thin bed of siltstone	23	120
Warsaw shale, some limestone and dolomite, thin sandstone beds	93	213
Keokuk - Burlington limestone and dolomite	182	395
English River siltstone	10	405

TABLE 1

Hole Record	Casing Record
12-in. from surface to 52 ft.	12-in. from surface to 52 ft.
10-in. from 100 to 214 ft.	8-in. from surface to 214 ft.
	8-in. casing slotted between 52 and 62 ft.

casing record is shown in Table 2.

A production test was made by the State Water Survey Nov. 6-7, 1947. For test purposes, the well was equipped with a rig-operated 5-in. cylinder pump with the bottom of suction 122 ft. below the top of casing. The well produced about 18.6 gpm. with a drawdown of about 50 ft. from a non-pumping water level of 25.75 ft. below the top of the casing. From Dec. 3, 1948 to Jan. 11, 1949 water was pumped from Well No. 3 at a rate gradually reduced from 12.2 to 8.1 gpm. After 39 days the drawdown was 24.7 ft. from a non-pumping water level of 25.1 ft. below the top of the 8-in. casing.

The production from the 3 wells drilled in 1946 was not adequate. The optimum yield rate from Wells No. 1, 2 and 3 was summarized as 5, 1, and 5 gpm., respectively.

In July 1948, three shallow wells, No. 4, 5, and 6 were drilled into the sandstone by Weldon Well Drilling Co., Cape Girardeau, Mo. Well No. 4 was drilled to a depth of 57 ft. and located in the southwest corner of the village, about 800 ft. southwest of Well No. 1, (or approximately 2270 ft. N. and 870 ft. W.of the S. E. corner of Section 22). The top of the sandstone was reported at 45 ft. depth. The well was cased with 44 ft. of 6-in. steel pipe and 10 ft. of 4-in. Johnson Everdur screen, having No. 18 slot openings.

A production test was made on July 9, 1948, using State Water Survey calibrated measuring equipment. For 48 hr. preceding the start of the test, the water level was observed to fluctuate from 21.4 to 22.7 ft. below the top of the casing. The pumping rate was started at 3 gpm., and after 20 hr., the rate was 1.9 gpm. with a drawdown of 27.6 ft. from a water level of 22.4 ft. Two and one-half hours after stopping the pump the water level was 26.1 ft. and 7 hr. later the water level was 23.1 ft.

Analysis of a sample (Lab. No. 115,252) collected July 10, 1948 after 5-hr. pumping at 2 gpm. showed this water to have a hardness of 16.0 gr. per gal., a mineral content of 331 ppm., and an iron content of 4.9 ppm.

Well No. 5 was drilled to a depth of 75 ft. and located about 870 ft. northeast of Well No. 4, 1100 ft. northwest of Well No. 3, and 100 ft. east of Well No. 1 (which was 402 ft. deep.). The top of the rock was reported to be 47 ft. The well was cased with 50 ft. of 6-in. steel pipe and 24 ft. exposed of Johnson Everdur screen having No. 35 slot openings.

A production test was made on July 12, 1948 using State Water Survey calibrated measuring equipment. Water level observations were made during the five days preceding the test. During the period the water level fluctuated from 20.5 to 27.7 ft. below the top of the casing. The pumping rate at the start of the test was 7.4 gpm. After 3-hr. pumping at a rate gradually decreased to 6.2 gpm. the pump broke suction. The drawdown, at the time, was 22.2 ft. from a water level of 23.3 ft. Two hours after the shut-down the water level was 27.6 ft. Pumping was then resumed at a rate of 6.4 gpm. and after 6-hr. pumping at a rate gradually decreased to 4.5 gpm. the drawdown was

TABLE 2

Hole Record	Casing Record
12-in. from surface to 80 ft.	12 1/2-in. id. from 2 ft. above to 47 1/2 ft. below ground level
10-in. from 80 to 220 ft.	8-in. id. from 1 1/2 ft. above to 221 1/2 ft. below ground level
8-in. from 220 to **407** ft.	8-in. casing slotted between 54 and 74 ft., and between 106 and 126 ft.

35.6 ft. One and one-half hours after this shutdown, the water level was 25.5 ft.

Analysis of a sample (Lab. No. 115,253) collected July 12, 1948 after 1 3/4-hr. pumping at 7 gpm. showed this water to have a hardness of 19.4 gr. per gal., a mineral content of 426 ppm., and an iron content of 5.2 ppm.

Well No.'6 was drilled to a depth of 65 ft. and located about 165 ft. northeast of Well No. 1 and 1240 ft. northwest of Well No. 3. The Well No. 6 was cased with 35 ft. of 6-in. steel pipe to sandstone.

A production test was made on July 12, 1948 using State Water Survey calibrated measuring equipment. Water level observations were made during the five days preceding the test. During the period the water level fluctuated between 21.1 and 25.9 ft. below the top of the casing. Pumping was started at a rate of 2.1 gpm. and after 9 hr. the pumping rate had decreased to 1.8 gpm. with a drawdown of 21.9 ft. from a water level of 24.3 ft. Seven hours after stopping the pump, the water level was 23.3 ft.

Analysis of a sample (Lab. No. 115,254) collected July 13, 1948 after 3-hr. pumping at 2 gpm. showed this water to have a hardness of 17.7 gr. per gal., a mineral content of 388 ppm., and an iron content of 2.8 ppm.

The production rates from the six shallow and deep wells did not hold much promise for a sustained adequate ground-water supply. From the data recorded during the well tests, the State Water Survey made some calculations on future water levels, however too many assumptions had to be made, particularly those of coefficients of transmissibility and storage. A long time pumping record from one well with observations in other wells was set up as a special project.

Well No. 3 was equipped, at the time, with a jet pump with the jet reportedly set at a depth of 60 ft. below the top of the 8-in. casing. Automatic water level recorders were installed by the State Water Survey in Wells No. 1 and 2, and depths to water in Wells No. 4, 5 and 6 were measured daily by tape line. During the pumping from Well No. 3,-several measurements were made of water levels in near-by private wells.

Pumping was started in Well No. 3 on Dec. 3, 1948 and after several hours the pumping rate was observed at 11 1/4 gpm. For several days following, the rate gradually decreased from 12.2 and 9.4 gpm. On Dec. 21, the discharge valve was partly closed and for the remainder of the test, until Jan. 11, 1949, the rate gradually decreased from 9.0 to 8.1 gpm. The gradual drop in production was due largely to the performance characteristics of a jet pump.

The actual drawdowns in Wells No. 1 and 2, located 1160 and 1770 ft. respectively from Well No. 3, were 4.2 and 2.4 ft. respectively after 1 month, when corrected for a discharge rate of 5 gpm. The theoretical recession was computed for a continuous discharge rate of 5 gpm. from one well. The coefficients of transmissibility and storage were determined from the shape of the cone of depression after 29-days pumping. The theoretical recessions were very close to the actual drawdowns for one. month at 1160 and 1770 ft. In the vicinity of the well the theoretical recession was much larger than the actual drawdown at the end of one-month pumping. The actual drawdown, corrected to a pumping rate of 5 gpm., was 14.5 ft. The theoretical recession, calculated for the end of one month's pumping, was 30.6 ft.

From the data collected during the extended production test of Well No. 3, and assuming that Wells No. 1, 2 and 3 will be equipped with pumps operating continuously at 5 gpm., the theoretical water levels after 10 years would be:

LABORATORY NO. 117,011

	ppm.	epm.			ppm.	epm.
Iron (total) Fe	0.6		Fluoride	F	0.3	
			Chloride	Cl	3.0	0.08
Turbidity	2		Nitrate	NO_3	0.2	Tr.
Color	0		Alkalinity	(as $CaCO_3$)	428.	8.56
Odor	0		Hardness	(as $CaCO_3$)	373.	7.46
Temperature 54.5° F.			Total Mineral Content		441.	

For Well No. 1	Depth in Feet Below Dec. 1948 Non-Pumping Water Level
1	39.1
2	38.2
3	36.8

Analysis of a sample (Lab. No. 117,011) collected Jan. 6, 1949 after one-month's pumping at 8.4 gpm., showed the water in Well No. 3 to have a hardness of 21.7 gr. per gal., a mineral content of 441 ppm., and an iron content of 0.6 ppm.

BRADFORD
Stark County
Dec. 30, 1946

The public water supply for the village of Bradford (907) is obtained from 2 wells.

Well No. 1, East, was drilled in 1898 to a depth of 2082 ft. and located in the Town Hall (or approximately 400 ft. N. and 530 ft. W. of the S.E. corner of Section 23, T. 14 N., R. 7 E.).

Ground surface elevation is 800± ft. The casing record, as reported by Mr. Prouty, was as follows: 10-in. casing from surface to 121 ft.; 8-in. casing from surface to 509 ft.; 6-in. casing from 509 to 709 ft.; 5-in. casing from 709 to 1612 ft.

The well is equipped with 360 ft. of 6-in. wrought iron column pipe; a Downey double-acting deep well pump with a 5 3/4-in. cylinder rated at 150 gpm.; 15-hp. General Electric motor.

In 1898 the non-pumping water level was reported to be 150 ft. below the ground surface; in 1917 it was 160 ft.; in 1926 it was 247 ft.

Analysis of a sample (Lab. No. 73807), collected Nov. 16, 1933, showed this water to have a hardness of 16.6 gr. per gal., a residue of 1392 ppm., and an iron content of 2.4 ppm.

Well No. 1 is maintained for emergency use only.

Sample-study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and till	70	70
Pennsylvanian system		
Shale, thin beds of sandstone, limestone and coal	435	505
Mississippian system		
Kinderhook shale	10	515
Devonian system		
Cedar Valley limestone and shale	35	550
Wapsipinicon limestone	65	615
Silurian system		
Niagaran-Alexandrian series		
Dolomite, thin shale bed at base	30	645
Dolomite	370	1015
Ordovician system		
Maquoketa shale, dolomite and limestone	215	1230
Galena-Platteville limestone and dolomite	340	1570
Glenwood sandstone, incoherent	35	1605
St. Peter sandstone, incoherent	55	1660
Shakopee dolomite, thin shale and sandstone beds	280	1940
New Richmond formation		
Sandstone, dolomitic and dolomite	40	1980
Sandstone, incoherent	20	2000
Sandstone, dolomitic	15	2015
Oneota dolomite and thin sandstone beds	37	2052

LABORATORY NO. 108,719

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.4		Silica	SiO_2	10.5	
Manganese	Mn	0.0		Fluoride	F	1.4	
Calcium	Ca	76.0	3.80	Chloride	Cl	500.0	14.10
Magnesium	Mg	31.0	2.55	Nitrate	NO_3	3.9	0.06
Ammonium	NH_4	1.0	0.06	Sulfate	SO_4	248.9	5.18
Sodium	Na	398.6	17.33	Alkalinity	(as $CaCO_3$)	220.	4.40
Turbidity		10		Hardness	(as $CaCO_3$)	318.	6.36
Color		0		Residue		1428.	
Odor		Tr.					
Temperature		68.5° F.					

Because of the necessity of continuous repairs to Well No. 1, the village had Well No. 2, West Well, drilled in 1936 by the Sewell Well Co., St. Louis, Mo. It is located 70 ft. west of the East Well (or approximately 400 ft. N. and 600 ft. W. of the S. E. corner of Section 23).

The well was cased as follows: 12-in. casing from 0 to 146 ft. 7 in.; 10-in. casing from 131 ft. to 525 ft. 11 in.; 8-in. casing from 507 ft. 11 in. to 1439 ft. 5 in.; 8-in. bore hole to 1681 ft.

The well is equipped with 300 ft. of column pipe; 12-stage Johnston deep well turbine pump, No. 5971, rated at 150 gpm. at 300 ft. of head; the overall length of the pump is 7 1/2 ft.; 35 ft. of suction pipe (increased from 20 ft. after July 1936); power is furnished by a 20-hp., 1760-rpm. General Electric induction motor.

When the well had been finished at a depth of 1681 ft., a production test was made by the State Water Survey on July 28, 1936. Before the test, the water level was 236 ft. below the pump base, or about 234 ft. below the top of the casing. A rate of pumping of 51 gpm. was maintained for 1 hr. with a drawdown of 85 ft. An increase to 54 gpm. caused the pump to break suction after 33 minutes with a drawdown of 91 1/2 ft. The bottom of the air line was 20 ft. above the bottom of the suction pipe making it impossible to obtain **the** drawdown for higher rates of pumping.

Analysis of a sample (Lab. No. 78488) collected July 28, 1936, showed this water to have a hardness of 9.3 gr. per gal., a residue of 1293 ppm., and an iron content of 0.6 ppm.

In an attempt to obtain a greater production capacity, the well was deepened to 2052 ft.; and, with no change in the pumping equipment except the lengthening of the suction pipe to 35 ft., the well was tested by the State Water Survey on Oct. 7-8, 1936. Before the test, the water level was 234.3 ft. below the top of the 12-in. casing. During the course of the test, specific capacities of 1.32, 1.20, and 1.03 gpm. per ft. of drawdown were calculated for pumping rates of 64, 79, and 94 gpm. respectively.

The column pipe was then extended 40 ft., placing the bottom of the suction pipe at 382 1/2 ft. below the pump base, and on Feb. 1, 1937 the rate of discharge was 137 gpm. after pumping continously for 1 week.

Analysis of a sample (Lab. No. 108,719) collected Dec. 20, 1946 after 1 1/2-hr. pumping, showed the water in Well No. 2 to have a hardness of 18.6 gr.per gal., a residue of 1428 ppm., and an iron content of 0.4 ppm.

Pumpage is estimated at 40,000 gpd.

The village of Bradley (3689) installed a public water supply in 1905.

Well No. 1 was drilled in 1905 to a depth of 337 ft. by Martin & Kahler, Manteno, and was located about 150 ft. south of Broadway and 70 ft. west of Michigan St. (or approximately 2950 ft. N. and 2650 ft. W. of the S. E. corner of Section 29, T. 31 N., R. 12 E.). The surface elevation is 652± ft. The well was cased with 12-in. pipe to a depth of 200 ft. below which the hole was finished 10 in. in diameter.

The well was originally equipped with a deep-well pump driven by a 15-hp. Fairbanks-Morse gasoline engine. In 1913 the pumping equipment consisted of 100 ft. of 5-in. column pipe; 4 3/4-in. by 24-in. American Well Works double-acting pump operating at 22 spm.; 10-hp. Wagner Electric Co. motor operating at 850 gpm.

In 1916 the non-pumping water level was about 30 ft. below the ground surface; and in 1918 the non-pumping water level was 52 ft. The water level was lowered below the pump setting when the pump was operated, so the cylinder was lowered to a depth of 184 ft. and 4 ft. of 5-in. strainer was attached below the cylinder. In 1927 the non-pumping water level was 22 ft. In 1928 it was reported that this well was producing about 80 gpm. and was operated 24 hr. per day. In 1943 Well No. 1 had been taken out of rervice and capped with concrete.

Analysis of a sample (Lab. No. 36022), collected Nov. 27, 1916, showed the water to have a hardness of 21.3 gr. per gal., a residue of 490 ppm., and an iron content of 0.1 ppm.

Well No. 2 was drilled in 1918 to a depth of 340 ft. by Adam Heidenrich, Kankakee, and located 28 ft. northwest of Well No. 1. This well is cased to a depth of 20 ft. with 10-in. pipes.

In 1927 the non-pumping water level was reported to be 22 ft. and in 1928, when a broken pump was removed, the water level was 34 ft. In 1933, the well was reported to be seldom used.

The existing pumping installation, made in 1935, is: 300 ft. of 5-in. column pipe; 8-in., 17-stage Pomona deep well turbine, No. J 189, rated at 125 gpm. against 300 ft. of head; 10 ft. of suction pipe; 20-hp. Westinghouse electric motor operating at 1760 rpm.

This pump had previously been installed in Well No. 3.

The well is in daily service and is operated about 15 hr. daily during the winter and 20 hr. daily in the summer.

Analysis of a sample (Lab. No. 112,690), collected. Nov. 25, 1947 after 2-hr. pumping at an estimated rate of 100 gpm. showed this water to have a hardness of 21.9 gr. per gal., a residue of 580 ppm., and an iron content of 0.2 ppm.

Well No. 3 was drilled in 1927 by the J. P. Miller Artesian Well Co., Brookfield, and located about 100 ft. north of Broadway and 10 ft. east of Prairie St. (or approximately 3450 ft. N. and 4000 ft. W. of the S. E. corner of Section 29). The well was drilled to a depth of 1043 ft. below a surface elevation of 657t ft.

The diameter of the well was: 16-in. from surface to 391 ft.; 12-in. from 391 to 547 ft.; 10-in. from 547 to 1042 ft.

The well was originally equipped with an Amer-

LABORATORY NO. 112,690

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	12.9	
Manganese	Mn	0.0		Fluoride	F	0.2	
Calcium	Ca	82.9	4.15	Chloride	Cl	43.0	1.21
Magnesium	Mg	41.0	3.37	Nitrate	NO_3	23.3	0.38
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	178.1	3.71
Sodium	Na	48.1	2.09	Alkalinity	(as $CaCO_3$)	216.	4.32
Turbidity		10-		Hardness	(as $CaCO_3$)	376.	7.52
Color		0		Residue		580.	
Odor		Tr.					
Temperature		53.5° F.					

Sample-study log of Well No. 3 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Silurian system		
Niagaran - Alexandrian series		
Dolomite	290	290
Shale	20	310
Ordovician system		
Maquoketa formation		
Shale	50	360
Dolomite	70	430
Shale	80	510
Galena - Platteville dolomite, some limestone	360	870
St. Peter sandstone	160	1030
Shakopee dolomite	10	1040

ican Well Works double-acting pump, No. J-2941, with the cylinder placed at a depth of 350 ft.

In 1930 when the pump was repaired, the cylinder was at a depth of 375 ft., with 20 ft. of suction pipe attached below the cylinder.

In 1935, thewell was "shot" with 9 charges, or 250 lb., of nitroglycerine. Before starting this work, the water level was reported to be 73 ft.; and immediately after the shooting, it was 110 ft. The well was then equipped as follows: 200 ft. of 6-in. column pipe; 9-stage, 10-in. Pomona turbine pump, No. L-3071, having an overall length of 10 ft.; 30 ft. of 6-in. suction pipe; 25-hp. Westinghouse electric motor.

The production rates and drawdowns in ft. below ground level have been reported as given in Table 1.

In 1943, the pump was operating 23 hr. daily and additional water was being purchased from Kankakee. In 1947 water was purchased from Kankakee at an average rate of 153,700 gpd.

In 1947, the pump was operated 20 to 22 hr. daily during the winter months and 23 hr. a day during the summer.

Analysis of a sample (Lab. No. 112,689) collected Nov. 25, 1947, after pumping at 63 gpm. for 30 hr., showed this water to have a hardness

TABLE 1

Date	Pumping Rate gpm.	Water Levels		
		Period hr.	Non-pumping ft.	Pumping ft.
Oct. 1927	190		35	273
Apr. 30, 1928	144	1 1/4		230
May 10, 1928	175	2		350
	150			325
June 27, 1928	131		90	242
1930			100	
1935	110			
1942	90			250+
Apr. 1943	78			
Nov. 1947	63			

LABORATORY NO. 112,689

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	11.0	
Manganese	Mn	0.0		Fluoride	F	1.4	
Calcium	Ca	116.3	5.82	Chloride	Cl	270.0	7.61
Magnesium	Mg	59.3	4.88	Nitrate	NO_3	13.3	0.21
Ammonium	NH_4	0.7	0.04	Sulfate	SO_4	445.8	9.28
Sodium	Na	256.7	11.16	Alkalinity	(as $CaCO_3$)	240.0	4.80
Turbidity		Tr.		Hardness	(as $CaCO_3$)	535.	10.70
Color		0		Residue		1354.	
Odor		0		Free CO_2	(calc.)	30.	
Temperature 58° F.				pH = 7.3			

of 31.2 gr. per gal., a residue of 1354 ppm., and an iron content of 0.2 ppm.

The water is chlorinated at each well.

In 1947 the estimated pumpage from both wells was 180,000 gpd.

BRAIDWOOD
Will County
Oct. 21, 1946

The system of water works at Braidwood (1354) is owned by the city and was installed about 1883 when water was obtained from 4 driven wells. Subsequent to the original installation, additional driven wells, a dug well, and a deep sandstone well were added to the public supply.

These wells are all located on the village property about 100 to 235 ft. north of Main St. and 150 to 300 ft. west of Center St. (the middle of the group is approximately 1350 ft. N. and 2200 ft. E. of the S. W. corner of Section 8, T. 32 N., R. 9 E.). The elevation of the ground surface at these wells is 575± ft.

The driven wells, which derive their water from a sand stratum, have been the principal source of the public water supply. Seven of these wells were originally 12 ft. in depth below the surface of the ground and cased with 3-in. pipe with 3-ft. length strainers at the bottom. They were located in pits 4 ft. square and about 4 ft. deep with the tops of the casings about 3 ft. below the ground surface.

Two additional wells were driven in 1920 which were 2 in. in diameter and 16 1/2 ft. in depth with 3-ft. strainers. At that time, the other 7 wells were also driven to a depth of 16 1/2 ft. The strainers wer e frequently replaced on account of corrosion. The production of the 9 driven wells, determined from tank measurements made on Apr. 17, 1924, was about 75 gpm. The wells continued in service until 1943 but are now abandoned, and the pits filled.

Seven new driven wells were placed in service in 1943. These wells are located in pits 4 ft. square and 4 ft. deep and subsequently filled with gravel, with the tops of the casings about 3 ft. below the ground surface.

The wells are 14 ft. in depth below the ground surface and cased with 2-in. pipes having 3-ft. strainers at the bottom. A combined production of 50 gpm. was reported from these wells until the spring of 1945. Since then they have been held as an emergency supply.

The dug well was the source of a considerable portion of the public water supply until 1924. It was 6 ft. by 10 ft. in plan and 14 ft. deep with side walls of concrete. The water was obtained from a sand and gravel stratum near the bottom of the well. It was abandoned and is now filled.

For pumping the water from the wells into the distribution system and elevated tank, the following pump installation is in place: a Fairbanks-Morse 5-in. by 6-in. duplex pump and a 10-hp. Westinghouse electric motor. The pump has a 4-in. suction and a 3-in. discharge and operates at a rate of48 spm. The casings of the driven wells are connected underground to a main suction pipe that leads to the service pump.

Mr. James K. Steen, City Clerk, gave the following information concerning an old city well. The well was located on city property a little north and west of the present sandstone well. It was drilled jointly by the city and a coal company about 1888 as a test hole to locate coal deposits. A diamond drill was used, and the core was approximately 2 in. in diameter. The depth of the well was 900 ft. Samples of the drill cuttings were on exhibit in the Illinois Building at the Chicago World's Fair in 1893 and should still be available in Springfield. It was a flowing well having a 1/2-in. diameter stream and furnished water for a public drinking fountain and water trough until about 1900.

The deep sandstone well is located 183 ft. south of the center line of Main St. and 257 ft. west of the center line of Center St. (or approximately 1350 ft. N. and 2200 ft. E. of the S. W. corner of Section 8). The well was drilled to a depth of 1410 ft. by C. W. Varner, Dubuque, Iowa, in 1936 and 1937 when the work was stopped.

W. L. Thorne Co.,Des Plaines, continued the drilling in 1937 to a depth of 1647 ft. The hole and casing record were reported as given in Table 1.

The elevation at the top of the casing is 577 ft.

TABLE 1

Hole Record	Casing Record
19-in. from surface to 32 ft.	16-in. od. from surface to 32 ft.
15-in. from 32 to 61 ft.	12 1/2-in. od. from surface to 61 ft.
12-in. from 61 to 143 ft.	10-in. from surface to 143 ft.
10-in. from 143 to 1647 ft.	

Sample-study log of Braidwood Well No. 1 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Sand	10	10
Till	5	15
Sand, silty	5	20
Till	25	45
Pennsylvanian system		
Shale, thin limestone, coal and sandstone beds	100	145
Ordovician system		
Maquoketa limestone and shale	115	260
Galena-Platteville limestone and dolomite	385	645
Glenwood and St. Peter formations		
Sandstone, some dolomite	10	655
Sandstone	195	850
Sandstone, some shale and dolomite	12	862
Shakopee dolomite	83	945
New Richmond shale and sandstone	45	990
Oneota dolomite, some sandstone at base	220	1210
Cambrian system		
Trempealeau dolomite	175	1385
Franconia sandstone, some shale and dolomite	165	1550
Galesville formation		
"Sandstone"	32	1582
"Lime"	4	1586
"Sandstone"	61	1647

The non-pumping water level in the completed well was 70 ft. below the top of the casing. During a test for production with a pump setting of 200 ft., the well produced only 50 gpm. The well was not permanently equipped with a pump and was capped. The sandstone was reported to be very hard and compact.

On Dec. 4, 1941, the water level was 85.4 ft. below the top of the casing.

A 24-hr. production test was run on Apr. 22 and 23, 1943. At the end of 20 hr., the production was 84 gpm. with a drawdown of 250 ft. below a water level of 109 ft. below the pump base. This rate of production had been maintained for 16 hr. with a loss of 4 ft. in head during that period. At the completion of the test, the total drawdown was 251 ft., or a specific capacity of 1/3 gal. per ft. of drawdown. The temperature of the water observed during the test varied from 54.5° F. at the start to 60° F. at the end of the test.

During the fall and winter of 1944 and 1945, the well was "shot" and rehabilitated. An effort was made to deepen the well to completely penetrate the Galesville sandstone, but after penetrating about 8 additional ft., the drilling was stopped because the formation was so hard that only 1 ft. of hole could be made per shift. The St. Peter sandstone was then "shot" at 3 different levels of the formation. After the first "shot", the hole was cleaned; but the original bore below the St. Peter was never located, consequently

an 8-in. liner was set between depths of 764 and 844 ft. and a new 8-in. diameter hole drilled to a depth of 1025 ft. The well was cased from the surface to a depth of 300 ft. with an 8-in. pipe having a 5-ft. rubber packer on the bottom.

A production test was made by the State Water Survey on Feb. 14 and 15, 1945. At the end of 20 hr., the well was producing 138 gpm. with a drawdown of 213 ft. from a water level of 140 ft. below the top of casing.

At this time, the water was found to have a temperature of 58.4° F., a mineral content of 1376 ppm., and a hardness of 2.3 gr. per gal. The water had an alkalinity of 900 ppm., and a sulfate content of 6 ppm.

The pump installation, made in Feb. 1945, is still in service and consists of 400 ft. of 5-in. column pipe; 7-in., 22-stage Peerless turbine pump, Serial No. 22854, rated at a capacity of 100 gpm. against 500 ft. of head; the overall length of the pump is 11 ft. 5 in.; 30 ft. of 4-in. suction pipe; 431 ft. of air line; 20-hp. U. S. electric motor.

The non-pumping water levels observed since Feb. 1945 show a steady recession. On Dec. 6, 1945, the distance to water below the pump base after an idle period of 1 3/4 hr. was 166 ft. The pumping water level was 304 ft. below the pump base.

Analysis of a sample (Lab. No. 107,909), collected Oct. 9, 1946 after 1 hr. of pumping at 100 gpm., showed this water to have a hardness of 23.4 gr. per gal., a residue of 1199 ppm., and an iron content of 0.2 ppm. This quality of water is not unusual for water from the St. Peter sandstone in this vicinity.

This well has furnished the entire public water supply since Feb. 1945 and has averaged an estimated 25,000 gpd.

All water for the public supply has been chlorinated since 1945.

LABORATORY NO. 107,909

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	11.2	
Manganese	Mn	Tr.		Fluoride	F	1.2	
Calcium	Ca	86.7	4.34	Chloride	Cl	250.0	7.05
Magnesium	Mg	44.8	3.68	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	1.0	0.06	Sulfate	SO_4	361.8	7.53
Sodium	Na	267.3	11.62	Alkalinity	(as $CaCO_3$)	256.	5.12
Turbidity		Tr.		Hardness	(as $CaCO_3$)	401.	8.02
Color		0		Residue		1199.	
Odor (at well)		H_2S		Free CO_2	(calc.)	25.	
Temperature 58.6° F.				pH = 7.4			

BROOKPORT
Massac County
Jan. 31, 1948

The city of Brookport (1247) installed a public water supply in 1907.

Water was first obtained from a 8-in. well drilled to a reported depth of 208 ft. in 1907 and located about 27 ft. south of Elizabeth St. and. 65 ft. west of Ohio St. In attempting to make repairs to the well in 1917, a swedge block dropped into the well cutting off the supply. The block lodged in an inverted position and could not be removed. A 2-in. hole was drilled through the block and the well then furnished about 20 gpm. until 1921 when an attempt was made to dislodge the block with dynamite but the casing broke about 65 ft. below the surface and the well was abandoned.

The city water supply was interrupted for about 6 months until another well, now called East Well, was drilled in 1921 by W. W. Elwood, Bay City, and located about 30 ft. south of Elizabeth St. and 30 ft. west of Ohio St. (approximately 2950 ft. S. and 1950 ft. W. of the N. E. corner of Se ction 14, T. 16 S.,R. 5 E.). The elevation of the top of the well is 333± ft. This well was reported drilled to a depth of 207 ft., and cased with 6-in. pipe to a depth of 189 ft. with 18 ft. of 5 1/4-in. diameter special Cook screen at the bottom. The lower 60 ft. of the well was reported to be in fine white sand.

When drilling was completed the water level was reported to be 20 ft. below the surface."Subsequent observations indicate the same water level. During the Ohio River flood of 1937, the standing water level was 20 ft. below the surface until the flood stage exceeded the elevation at the top of the well and water entered the well at the top of the casing.

The following pump installation is in service: an A. D. Cook double-acting plunger pump, Size 10 PH. No. 2367, having a 4 1/4-in. diameter cylinder and 15-in. stroke. The pump is powered by a 10-hp. Fairbanks-Morse electric motor and is operated at a speed of 29 rpm. A pump discharge of 65 gpm. was obtained by test in 1937 but the present discharge is estimated to be 50 gpm. The normal operating period is about 8 hr. a day.

The West Well was drilled to a depth of 208 ft. in 1923 and located about 50 ft. south and 80 ft. west of the East Well. The West Well was cased with 8-in. pipe to a depth of 145 ft. where fine white sand was encountered and the driller stopped work. The work was completed by A.D. Cook by building two sections of special screen (18 ft. total screen length) around a 6-in. perforated pipe of the same length and sinking the pipe as the sand was baled out to a depth of 208 ft. The 6-in. casing extended from 135 ft. below the surface to a depth of about 190 ft. below which the special screen surrounding the 6-in. perforated section was set. In 1946, the depth of the well was measured 207 ft. 9 in. below the top of the casing which extends about 16 in. above ground level.

The standing water level was reported to be the same as in the East Well. The existing pump installation is: an A. D. Cook double-acting plunger pump, Size 15 PH. No. 2213, having a 6-in. cylinder and 15-in. stroke. The pump is powered by a 15-hp. Fairbanks-Morse electric motor and is operated at a speed of 27 rpm. In a test in 1937, the pump discharge was reported to be 133 gpm. At present, the rate is estimated to be 100 gpm. The normal operating period is about 8 hr. a day.

Analysis of a sample (Lab. No. 113,289), collected Jan. 26, 1948, after 1-hr. pumping at an estimated rate of 100 gpm., showed this water to have a hardness of 11.9 gr. per gal., a residue of 238 ppm., and an iron content of 0.4 ppm.

Total pumpage is estimated at 72,000 gpd.

LABORATORY NO. 113,289

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.4		Silica	SiO_2	14.9	
Manganese	Mn	0.1		Fluoride	F	0.3	
Calcium	Ca	66.9	3.35	Chloride	Cl	4.0	0.11
Magnesium	Mg	8.9	0.73	Nitrate	NO_3	Tr.	Tr.
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	21.8	0.45
Sodium	Na	3.5	0.15	Alkalinity	(as $CaCO_3$)	184.	3.68
Turbidity		Tr.		Hardness	(as $CaCO_3$)	204.	4.08
Color		0		Residue		238.	
Odor		0					
Temperature 60° F.							

The village of Brownstown (825) installed a public water supply in 1942.

A well was drilled in 1939 to a depth of 100 ft. by Mr. Orr, Casey, at the village school on Poplar St., between College and First St. (or approximately 1600 ft.S. and 600 ft. E. of the S. W. corner of Section 2, T. 6 N., R. 2 E.). The ground surface elevation at the we 11 site is 590± ft.

The well was drilled to a diameter of 10 in. and a 6-in. casing was installed to a depth of about 100 ft. The space outside the casing was filled with gravel. The casing was slotted between 40 and 60 ft., and between 80 and 92 ft.

A production test was made by the State Water Survey on Apr. 24, 1939. The well produced 8.5 gpm. with a drawdown of 25 ft. from a non-pumping water level of 14 ft. below the top of the casing.

Analysis of a sample (Lab. No. 85538) collected Apr. 24, 1939, showed the water to have a hardness of 18.5 gr. per gal., a residue of 616 ppm. and an iron content of 0.34 ppm.

The well was used by the school until the public supply was installed in 1942. In May 1948, the well was not equipped for pumping.

An electrical earth resistivity survey was made by the State Geological Survey in Apr. 1939. Areas within the village and within one mile north, south, and west of the village limits were included in the survey.

Three test wells were drilled in 1940 by E. W. Franke, Batchtown. These test holes produced very little water and all were filled in.

. In 1940, Sewell Well Co., St. Louis, Mo., drilled 6 test holes at various locations in and near the village.

Village Well No. 1 was drilled by L. R. Burt, for Sewell Well Co., in Nov. 1940 at the site of Test Hole No. 1, about 50 ft. south of the center of Elm St. and about 470 ft. west of the center of First St. (or approximately 2250 ft. S. and 500 ft. E. of the N. W. corner of Section 2). The ground surface elevation at the well site is 590± ft. MSL.

The hole was drilled to a depth of 70 ft. but the well was finished at a depth of 38 ft. An 8-in. Cook screen, having 1/8-in. slot openings, was placed between 28 and 38 ft., and is gravel packed.

A production test was made by the State Water Survey on Jan. 7, 1941. Equilibrium conditions were not reached, but after 3-hr. pumping at a rate of 12 gpm. the drawdown was 18.75 ft. from a non-pumping water level of 12 1/2 ft. below the top of the casing.

A second production test was made by the State Water Survey on Jan. 27-28, 1941.

After 22-hr. pumping at 10 1/2 gpm. the drawdown was 19 1/4 ft. from a non-pumping water level of 11 1/2 ft. below the top of the casing.

The well is equipped with a Pomona turbine pump, No. 3A 1662. Power is furnished by a 3-hp. electric motor.

Analysis of a sample (Lab. No. 114,770) collected May 18, 1948 after 7-hr. pumping at 8 gpm. showed the water to have a hardness of 20.5 gr.per gal., a residue of 678 ppm. and a trace of iron.

Sample-study log of Well No. 1 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Till	13 1/2	13 1/2
"Sand"	1 1/2	15
Till	10	25
Sand, dirty	2	27
Sand, clean	3	30
Gravel, slightly dirty	5	35
Gravel, clean	2	37
Till	28	65
Pennsylvanian system		
Shale	5	70

Well No. 2 was drilled in Dec. 1940, to a depth of 33 ft. by L. R. Burt, for Sewell Well Co. at the site of Test Hole No. 6, located about 300 ft. south of U. S. Route No. 40 (approximately 2100 ft. N. and 270 ft. W. of the S. E. corner of Section 3).

An 8-in. Cook screen, with 1/8-in. slot openings, was placed between 23 and 33 ft. and was gravel packed.

A production test was made by the State Water Survey on Jan. 7, 1941. The well produced 16-17 gpm. for 12 hr. with a drawdown of 16.5 ft. from a non-pumping water level of 6 ft. below the ground surface, which is about 5 ft. lower than the surface at Well No. 1.

The well is equipped with a Pomona turbine pump, No. SA 1661 which is in daily operation at an estimated rate of 8 gpm. Power is furnished by a 1 1/2-hp. electric motor.

Analysis of a sample (Lab. No. 89615) collected after 7-hr. pumping on Jan. 7, 1941, showed the water to have a hardness of 27.1 gr. per gal., a residue of 821 ppm., and an iron content of 3.3 ppm.

Test Hole No. 7 was drilled in 1941 to a depth of 27 ft. by L.R. Burt for Sewell Well Co. and was located about 400 ft. south of U. S. Route No. 40 and 300 ft. east of the road going south from the center of the village (or approximately 2860 ft. S. and 1500 ft. E. of the N. W. corner of Section 2).

The test hole was cased with 6-in. pipe to a depth of 16 1/2 ft. and with 10 1/2 ft. of 6-in. Johnson screen having No. 40 slot openings.

A production test was made by the State Water Survey on Mar. 24, 1941. Equilibrium conditions were not obtained, but after 6-hr. pumping, the well produced 19.7 gpm. with a drawdown of 8 3/4 ft. from a non-pumping water level of 5 ft. below the ground surface.

Well No. 3 was constructed in 1941 at the site of Test Hole No. 7 by L. R. Burt. This well was finished at a depth of 25 ft. and was cased as follows: 16 ft. of 10-in. pipe from 1 1/2 to 17 1/2 ft. below the ground surface; 16 ft. of 6-in. casing from 8 in. above to 15 ft. 4 in. below the ground surface; 10 ft. 10 in. of 5 1/2-in. od. Johnson screen, swedged into the 6-in. casing and with the bottom set at a depth of 25 ft. The screen had No. 125 slot openings. The annular space between the casings was packed with 1/4-in. gravel.

A production test was made by the State Water Survey on Apr. 18, 1941. For test purposes, a small deep-well centrifugal pump, driven by a gasoline motor, was installed. The well produced 10.5 gpm. with a drawdown of 4 ft., and 25 gpm., with a drawdown of 11 ft. from a non-pumping water level of 4 ft. below the top of the casing.

Well No. 3 is equipped with a Pomona turbine pump, No. SA 1664 and a 1 1/2-hp. electric motor. The pump is in daily service and discharges at a rate of 10 1/2 gpm.

Analysis of a sample (Lab. No. 114,769) collected May 18, 1948 showed the water from Wells No. 1, 2 and 3 to have a hardness of 15.7 gr. per gal., a mineral content of 445 ppm. and an iron content of 0.2 ppm.

All water is aerated, filtered, and chlorinated. Analysis of a sample (Lab. No. 114,788) collected May 18, 1948 showed the treated water to have a hardness of 15.7 gr. per gal., a mineral content of 439 ppm. and a trace of iron.

Pumpage is estimated to average 38,000 gpd.

LABORATORY NO. 114,770

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	Tr.		Silica	SiO_2	23.2	
Manganese	Mn	Tr.		Fluoride	F	0.1	
Calcium	Ca	85.7	4.29	Chloride	Cl	45.0	1.27
Magnesium	Mg	33.0	2.71	Nitrate	NO_3	0.3	0.05
Ammonium	NH_4	0.2	0.01	Sulfate	SO_4	177.9	3.70
Sodium	Na	114.3	4.97	Alkalinity	(as $CaCO_3$)	348.	6.96
Turbidity		Tr.		Hardness	(as $CaCO_3$)	350.	7.00
Color		0		Residue		678.	
Odor		0					
Temperature 58° F.							

A public water supply was installed by the village of Buckingham (149)- in 1902.

At that time a well was drilled to a depth of 150 ft. and located about 450 ft. southwest of the Illinois Central R. R. depot. The well was 4 1/2 in. in diameter and penetrated 94 ft. of drift which was cased off. This well has since been plugged.

In 1935 George Berns, Chebanse, drilled a well; now called Well No. 2, 25 ft. west of the old well (or approximately 2450 ft. N. and 1100 ft. W. of the S. E. corner of Section 27, T. 30 N., R. 9 E.). The well was drilled to a depth of 150 ft. below a surface elevation of 652± ft.

The well is cased to a depth of 97 ft. with 6-in. pipe, below which the hole is 6 in. in diameter.

The existing pump installation, made in Mar. 1940, is: 60 ft. of 3-in. column pipe; 6-in., 18-stage Deming turbine pump, No. 1218, having an overall length of about 10 ft. and a rated capacity of 50 gpm. against 215 ft. of head; 10 ft. of 4-in. suction pipe; 5-hp. U. S. electric motor.

At the time when the turbine pump was installed in Mar., 1940, the distance to water measured 35 ft. below the pump base (2 ft. above ground) after 24 hr. of idle period.

Analysis of a sample (Lab. No. 112,780) collected Dec. 4, 1947 after pumping 20 min. at 50 gpm., showed the water to have a hardness of 9.4 gr. per gal., a residue of 398 ppm., and an iron content of 0.5 ppm.

Well No. 2 has been abandoned as a source of supply, but was used during the production test of Well No. 3, as an observation hole.

Well No. 3 was completed in April, 1949, to a depth of 240 ft. by Ira French and Son, Fairbury, and located 9 ft. south of Well No. 2. The well was cased" with 8-in. id. pipe from 3 ft. above to 91.5 ft. below ground level. When the drilling of the well had reached 150 ft. depth in Jan. 1949, a production test was made by the State Water Survey. The pumping equipment from Well No. 2 was installed in Well No. 3 and water levels were observed in Well No. 2 as well as in No. 3. Water levels in both wells were measured below a horizontal plane through the top of the 6-in. casing in Well No. 2. This reference plane was 0.5 ft. above ground level at Well No. 3. Before the test the water level was 31.1 ft. below the plane level and after 6 1/2-hr. pumping at a final rate of 40 gpm. the drawdown in Well No. 3 was 43.4 ft. and in Well No. 2 was 42.6 ft. When extrapolating the test data on a semi-log plot, it was indicated that at the end of 12-hr. pumping at a continuous rate of 30.6 gpm. the water level would have dropped enough to cause the pump to break suction. Twelve hr. after stopping the pump, the water level recovered to 37.6 ft. or 6.5 ft. below the level before starting the test.

The well was then deepened by French to 240. ft. The formation from 150 to 240 ft. was reported to be limestone.

On Apr. 19, 1949, a short production test was made by the State Water Survey. Before the test the water level was 40.0 ft. and after 3-hr. pumping at 55 gpm. the drawdown was 38.2 ft. Thirteen min. after stopping the pump the water level was 51.6 ft. or 11.6 ft. below the level before pumping.

Analysis of a sample (Lab. No. 117,922) collected Apr. 18, 1949, after 3-hr. pumping at 55 gpm., showed this water to have a hardness of 9.2 gr. per gal., a residue of 422 ppm. and an iron content of 0.4 ppm.

In Dec. 1947, pumpage was estimated to average 7500 gpd.

Correlated driller's log of well drilled in 1935 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Glacial drift	58	58
Silurian system		
Niagaran-Alexandrian series		
Limestone	92	150

LABORATORY NO. 112,780

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.5		Silica	SiO_2	14.6	
Manganese	Mn	0.1		Fluoride	F	0.6	
Calcium	Ca	33.2	1.66	Chloride	Cl	22.0	0.62
Magnesium	Mg	18.7	1.54	Nitrate	NO_3	Tr.	Tr.
Ammonium	NH_4	0.4	0.02	Sulfate	SO_4	51.0	1.06
Sodium	Na	97.1	4.22	Alkalinity	(as $CaCO_3$)	288.	5.76
Turbidity		10.		Hardness	(as $CaCO_3$)	160.	3.20
Color		0.		Residue		398.	
Odor		0.		Free CO_2	(calc.)	15.	
Temperature 53.3° F.				pH = 7.7			

BUCKLEY
Iroquois County
Nov. 17, 1948

A public water supply was installed in 1889 by the village of Buckley (457).

Water was first obtained from a well dug to a depth of about 35 ft. In 1893, Well No. 1 was drilled to a depth of 147 ft. and located on village-owned property on the east side of Railroad Ave. about midway between First and Illinois St. When drilled, Well No. 1 flowed into a brick collecting reservoir, made out of the old dug well. Well No. 1 has not been in service since Sept. 1948 due to a hole in the casing. The Deming plunger pump, No. 4168 is in place.

Well No. 2 was drilled in 1912 to a depth of 147 ft. and located in the pumping station about 10 ft. south of Well No. 1. Both wells were cased with 4-in. pipe to 142 ft. and with 5 ft. of Cook screen.

In June 1915, the non-pumping water level in both wells was reported to be about 10 ft. below the ground surface (elev. 698± ft.) and when pumping, the drawdown was very small. In Jan. 1922 the water level was 16 ft. and in 1934, it was 18 ft.

Well No. 2 is equipped with a Deming 3 1/2-in. cylinder pump, No. 7957, set at 40 ft. with 24-in. stroke and operated at 30 spm.

The pumps in Well No. 1 and 2 are belt-connected to a 10-hp., 865 rpm. General Electric motor.

Well No. 2 has not been used since Sept. 1948.

Analysis of a sample (Lab. No. 109,574) collected Mar. 19, 1947 showed this water to have a hardness of 45.5 gr. per gal., a residue of 1097 ppm., and an iron content of 1.3 ppm.

Well No. 3 was completed in Apr. 1948 to a depth of 152 ft. by John Bolliger and Sons, Fairbury, and located 50 ft. west of Wells No. 1 and 2 (or approximately 2630 ft. N. and 1500 ft. E. of the S. W. corner of Section 26, T. 25 N., R. 10 E.).

The well was cased with 8-in. black pipe from 1 1/2 ft. above to 142 ft. below ground level and 12 ft. of exposed length of Johnson Everdur screen, the upper 6 ft. having No. 20 slot openings and the lower 6 ft. having No. 40 slot openings.

A production test was made by the State Water Survey on Apr. 20, 1948. For test purposes the pump assembly consisted of 50 ft. of 4-in. column pipe; turbine pump and short length of suction pipe, with the bottom of the suction pipe at 56 ft.; 55.3 ft. of 1/4-in. gi. air line; electric motor. Before the test the static water level was 18.3 ft. below the top of the casing and after 4-hr. pumping at 192 gpm., with no pumping in Wells No. 1 and 2 the drawdown in Well No. 3 was 9.9 ft. When pumping in Well No. 3 and with simultaneous pumping in No. 1 and No. 2 at a combined yield of 40 gpm., the additional drawdown in Well No. 3 was 1.1 ft.

The pumping equipment consists of 80 ft. of 3-in. column pipe; 6-in., 8-stage Pomona turbine pump, No. S. F. 2049, rated at 55 gpm. against 60 ft. of head; 80 ft. of air line, with no gauge; 15 ft. of 3-in. suction pipe; 1 1/2-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 116,414) collected Nov. 9, 1948 after 20-minutes pumping, showed this water to have a hardness of 45.0 gr. per gal., a residue of 1149 ppm., and an iron content of 1.4 ppm.

All water is aerated, filtered and softened. Analysis of a sample (Lab. No. 116,648) collected Nov. 9, 1948 showed the treated water to have a hardness of 1.2 gr. per gal., a mineral content of 1088 ppm., and an iron content of 0.1 ppm.

Pumpage is estimated to average 16,500 gpd.

Correlated driller's log of Well No. 3 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and clay	40	40
Sand, some water	2	42
Hardpan and clay	95	137
Sand	8	145
Sand and gravel	7	152

LABORATORY NO. 116,414

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.4		Silica	SiO_2	25.6	
Manganese	Mn	0.2		Fluoride	F	0.3	
Calcium	Ca	188.4	9.42	Chloride	Cl	4.0	0.11
Magnesium	Mg	73.2	6.02	Nitrate	NO_3	0.4	0.01
Ammonium	NH_4	3.3	0.19	Sulfate	SO_4	531.1	11.05
Sodium	Na	55.7	2.42	Alkalinity	(as $CaCO_3$)	344.	6.88
Turbidity		12		Hardness	(as $CaCO_3$)	772.	15.44
Color		0		Residue		1149.	
Odor		0		Free CO_2 (calc.)		70.	
Temperature 54.3° F.				pH = 7.1			

LABORATORY NO. 116,648

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Fluoride	F	0.2	
				Chloride	Cl	6.0	0.17
Turbidity		5		Alkalinity	(as $CaCO_3$)	340.	6.80
Color		0		Hardness	(as $CaCO_3$)	21.	0.42
Odor		0		Total Mineral Content		1088.	
Temperature 55° F.				Free CO_2 (calc.)		27.	
				pH = 7.5			

A public water supply was installed by the village of Buda (784) in 1896.

At that time, Well No. 1, located in the pumping station, was drilled on Lot 30 of Murphy's Addition, 70 ft. north of Washington St. and 120 ft. west of Hill St. (or approximately 1480 ft. N. and 1805 ft. E. of the S. W. corner of Section 34, T. 16 N., R. 7 E.). The well was drilled to a depth of 1612 ft. The top 336 ft. of the hole was reported to be 8 in. in diameter, and the lower part to be 6-in. diameter. The well was cased to a depth of 483 ft. The elevation of the top of the well is 770± ft.

It was reported that when the drilling was at a depth of 45 ft., boulders were encountered, and that at between 100 and 200 ft. depth there was an offset in the bore hole. The pump rods frequently broke at this depth. It was believed that the casing was ruptured at this depth because at times of pump repair, gravel stones were found lodged on the couplings of the column pipe.

During the drilling, a strong vein of water was encountered at 290 ft., and a strong sulphur odor was present at 450 ft.

Leverett, in "Illinois Glacial Lobe," published in 1899, stated" that the water level in this well was 125 ft. below the top.

Water levels and discharge rates have been reported as follows:

Date	Non-pumping Water Level ft.	Discharge gpm.
1896	125	120
1915	160	
1920	167	91
1927		90
1945	223	

On June 14, 1945, a quality-series test was run by the State Water Survey. The pump had

Sample-study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and till	10	10
Gravel, sandy	5	15
Till, some very silty, sand	230	245
Soil and till	20	265
Gravel and interbedded clay	25	290
Gravel and sand, silty	15	305
Pennsylvanian system		
Shale, thin limestone and coal beds	170	475
Silurian system		
Niagaran-Alexandrian dolomites	435	910
Ordovician system		
Maquoketa shale and dolomite	200	1110
Galena-Platteville dolomites	340	1450
Glenwood-St. Peter formations		
Sandstone, dolomitic	5	1455
Sandstone, incoherent	80	1535
Sandstone, dolomitic, and shale	10	1545
Sandstone, incoherent	60	1605
Shale and chert	26	1631

LABORATORY NO. 111,403

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.9		Silica	SiO_2	16.0	
Manganese	Mn	Tr.		Fluoride	F	1.4	
Calcium	Ca	48.8	2.44	Chloride	Cl	350.0	9.87
Magnesium	Mg	22.6	1.86	Nitrate	NO_3	7.2	.12
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	203.2	4.23
Sodium	Na	345.9	15.04	Alkalinity	(as $CaCO_3$)	256.	5.12
Color		0.		Hardness	(as $CaCO_3$)	215.	4.30
Odor		0.		Residue		1143.	
Turbidity		Tr.		Temperature 62° F.			

been idle five days before the test. The non-pumping water level was 5, ft. above the cylinder and on starting the pump, it was approximately 5 min. before water was discharged. Well No. 1 was abandoned June 1947 and has been capped and covered with concrete.

Well No. 2 was drilled in 1926 to a depth of 1630 ft. by P. E. Millis, Byron, and located in the pump house 21 ft. north and 7 ft. east of Well No.

It was cased with a 12-in. cast iron screw-jointed pipe to a depth of 482 1/2 ft. Below the casing, the hole is 10 in. in diameter.

The pumping installation consists of 282 ft. of 8-in. drop pipe; Downie double-acting, deep-well plunger pump, No. 34, rated at 270 gpm. but has been slowed down to 27 spm. and delivers 100 gpm.; the length of the working barrel is 7 ft. 9 in.; 10 ft. of 8-in. suction pipe; 25-hp. Westinghouse electric motor.

After the well was completed in 1926, a production test was attempted, using the well rig to operate the pump. When the production reached 300 gpm., the rods were broken.

In July, 1927, the non-pumping water level in this we 11, 2 1/2 hr. after the pump in Well No. 1 had been shut down, was 187 ft. On May 14, 1945, when the pump was out because of broken rods, the water level was 218 ft.

At present Well No. 2 supplies the entire demand of Buda.

Analysis of a sample (Lab. No. 111,403) collected Aug. 6, 1947, from a tap at the well after pumping 50 min., showed the water in Well No. 2 to have a hardness of 12.5 gr. per gal., a residue of 1143 ppm., and an iron content of 0.9 ppm.

The water is not treated.

Pumpage is estimated at 30,000 gpd.

Well No. 3 was completed in Aug., 1945 to a depth of 134 ft. by A. J. Pierson, Manlius. It is located 12 ft. north and 44 ft. east of Well No.',2, and was cased with 127 ft. of 8-in. pipe and 7 ft. of 8-in., No. 60 slot Johnson Armco-iron screen, exposed to sand and gravel. The top of the casing is 2 ft. above ground level.

In Sept., 1945, a cylinder pump was rigged up by the driller, and operated for a few hours when sand cut out the pump leathers. No data of the pumping were reported but a recommendation was made that the well was capable of producing 100 gpm. An effort was made to locate a turbine test pump to clean out the well and obtain a more reliable production test. The water level in Aug., 1945, was reported to be 55 ft. 9 in. below the ground surface.

Pumping equipment was installed about June, 1946, and consisted of 100 ft. of 4 1/2-in. column pipe (oil lubricated); 5 1/2-in., 20-stage Aurora turbine pump, No. 29043, rated at 100 gpm. against 260 ft. of head. The length of the pump is 9 ft. 1 1/4-in.; 10 ft. of 4 1/2-in. suction pipe; 10-hp. 1750 rpm. electric motor.

On Oct. 11, 1946, the pump was operated intermittently for a few hours, and then, after an hour shut-down, the pump was operated for 37 hr. at 20 gpm. The drawdown was 12 ft. from a non-pumping water level of 50 ft. below the top of the casing. The pumping rate was then increased to 50 gpm. for 1 hr. with a drawdown of 30 ft. During the entire pumping period, the water had a rusty color and contained silt or very fine sand. In Feb.-, 1947, the well was not in service because of the high content of sand in the discharge.

Well No. 3 is not in use, and the pump has been removed.

An electrical earth resistivity survey was made by the State Geological Survey in Aug. 1947. The area covered in the survey included: Sections 27 and 34, and fractional east portions of Sections 28 and 33, all in T. 16 N., R. 7 E. and north of Buda.

In Jan. 1948, test holes were being drilled in a search for a drift supply by Hayes and Sims, Champaign.

BUFFALO ROCK STATE PARK
La Salle County
June 27, 1947

The original water supply for Buffalo Rock State Park was from a well at the base of the rock near its easterly end, on land owned by James O'Meara, and located approximately 1700 ft. N. and 1500 ft. E. of the S. W. corner of Section 17, T. 33 N., R. 3 E. The well was drilled about 1882 or 1887 and was reported to be 697 ft. deep. The well is enclosed at the top in a brick manhole with a cast-iron cover. Originally, this was a flowing well, but later a pump was installed and the water lifted to the top of the bluff. When the well on top of the bluff was drilled in 1926, this well was no longer used but was piped to a stock tank. Rate of flow was 4 gpm. Diameter and casing record are not known.

Analysis of a sample (Lab. No. 71482) collected Aug. 11, 1932 showed the water to be moderately mineralized (426 ppm.) but hard (323 ppm.). The iron content was 0.4 ppm.

In July, 1926, a well was drilled on top of the rock, at the east end, by John C. Schomas, Ottawa, and located 1700 ft. N. and 1100 ft. E. of the S. W. corner of Section 17. The well is 480 ft. deep and is cased with 6-in. pipe to 180 ft. and a 4-in. pipe from 180 ft. to 422 ft. The horizontal distance between the two wells is about 200 ft.

The pumping equipment consists of 150 ft. of 4-in. column pipe; 6-in., 4-stage American Well Works turbine pump, No. 59242, rated at 35 gpm. against 250 ft. of head at 3500 rpm.; overall length of pump is 2 ft. 4 in.; 10 ft. of 3 1/2-in. suction pipe; 7 1/2-hp. U. S. electric motor, No. 111517.

Partial analysis of a sample (Lab. No. 110,855) collected June 27, 1947 after 15-minute pumping showed this water to have a hardness of 25.5 gr. per gal., a mineral content of 514 ppm., and an iron content of 0.2 ppm.

Pumpage is estimated to be 6000 gpd.

Correlated driller's log of well drilled in 1926 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene and Pennsylvanian systems		
No record	24	24
Pennsylvanian system		
Soapstone and thin bed of coal at base.	35	59
Ordovician system		
St. Peter formation		
Sandstone	133	192
Soapstone	6	198
Shakopee formation		
Limestone	150	348
New Richmond formation		
Sandstone, water	12	360
Sandstone, some limestone	120	480
Oneota formation		
Limestone	165	645
Lime and sandstone	5	650
Ordovician and Cambrian systems		
Oneota and Trempealeau formations		
No record	47	697

LABORATORY NO. 110,855

	ppm.	epm.			ppm.	epm.
Iron (total) Fe	0.2		Chloride	Cl	59.0	1.66
Turbidity	0		Sulfate	SO_4	77.5	1.61
Color	0		Alkalinity	(as $CaCO_3$)	316.	6.32
Odor	0		Hardness	(as $CaCO_3$)	437.	8.74
Temperature 53.2° F.			Total Mineral Content		514.	

A public water supply was installed by the village of Bureau (483) about 1899.

Since that time, water has been obtained from 4 wells.

Water was first obtained from a well on the Chicago Rock Island and Pacific R. R. depot grounds. Water flowed from the well directly into the distribution system. The well was 305 ft. deep below a ground surface elevation of 485± ft. and was cased with 4-in. pipe. It was the joint property of the village and the railroad, the latter using the water for drinking purposes only. The well was abandoned in 1934 and was presumably sealed.

A question arose about 1938 as to the effectiveness of the seal, but in June, 1946, the railroad reported to the village that the seal was holding and there was no indication of leakage.

Analysis of a sample (Lab. No. 52930) collected Dec. 2, 1924, showed the water from this well to have a hardness of 3.3 gr. per gal., a mineral content of 2008 ppm., and no iron.

In 1910, Well No. 2 was drilled in the parking on the west side of Kansas St. about 3 1/2 blocks from the railroad well, (or approximately 500 ft. S. and 1000 ft. E. of the N. W. corner of Section 17, T. 15 N., R. 10 E.).

The well was reported to be 305 ft. deep below a ground surface elevation of 497i ft., and cased with 5-in. pipe. The water flowed directly into the distribution system. According to Leverett in "Illinois Glacial Lobe" published in 1899, "approximately 135 ft. of drift was penetrated and below that the wells enter coal measures and probably derive their supply from limestone." In 1915, it was reported that the water had a natural pressure at the ground level of about 30 psi. and apparently had decreased but little since the wells were first drilled.

In 1934, this well was recased with 3 1/2-in. pipe set within the 5-in. casing. Water flows from this well directly into the distribution system.

An artesian well owned by a Mr. Jensen and located on the north side of the railroad about 1 1/4 blocks northeast of the depot, was drilled prior to 1920. The well was 342 ft. deep below a ground surface elevation of 490± ft., and cased with 4-in. pipe.

In 1920, it was reported that water flowed freely from a faucet on the first floor of the residence about 50 ft. above the top of the well. Water had formerly flowed on the second floor of the residence.

In 1934, this well was recased by Ludwig and Hutchinson, Ohio. New 2 1/2-in. pipe was placed within the old 4-in. casing. After the repairs, the shut-in. pressure was 24 psi.

Cost of the repair work was liquidated by the

Sample-study log of Well No. 4 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Till	15	15
Gravel, silty and clayey	15	30
Till	75	105
Gravel and sand, silty and clayey	10	115
Pennsylvanian system		
Shale, thin siltstone, sandstone, and coal beds	134	249
Silurian system		
Niagaran dolomite, little crevice clay	87	336

TABLE 1

Hole Record	Casing Record
12-in. from surface to 254 ft.	13-in. od. from surface to 157 ft.
8-in. from 254 to 336 ft.	8-in. id. from surface to 254 ft.

village which thereby acquired title to the well, and the Jensen property was supplied with water without charge. The well did not continue to produce sufficiently and was subsequently abandoned.

Well No. 4 was completed by J. P. Miller Artesian Well Co., Brookfield, in Oct. 1946. It is located 467 ft. north of Rock Island St. and 24 ft. west of Kansas Ave., and 350 ft. southeast of Well No. 2 (or approximately 750 ft. S. and 1100 ft. E. of the N. W. corner of Section 17). The elevation of the ground surface is 490± ft.

The well was drilled to a depth of 334 ft. below the ground level, with the top of the 8-in. casing 2 ft. above ground level.

The hole and casing diameter record is given in Table 1.

The annular space outside the 8-in. casing was cemented in, using 13 7 sacks of cement.

During the drilling, a small flow of sulphur water was obtained from a coal vein at 155 ft. The flow at ground level was estimated at 25 to 30 gpm., and the probable shut-in pressure at 25 psi.'

After the 8-in. casing was cemented, the hole remained dry to 259 ft. when a small flow started, and then increased until a depth of 325 ft. was reached. No change in flow was observed with deeper drilling.

On Nov. 1, 1946, a flow measurement, with calibrated instruments, was made by the State Water Survey. Well No. 3 (Kansas St.) was flowing continuously.

The observations made during the test are given in Table 2.

Water flows from this well directly into the distribution system.

The business district and the residences in the lower part of the village are supplied by the artesian pressure. A booster pump is used to supply water to consumers located on higher ground.

Analysis of a sample (Lab. No. 108,163) collected Nov. 1, 1946 after pumping for 2 hr. 50 min. at a rate of 135 gpml, showed the water to have a hardness of 3.2 gr. per gal., a mineral content of 2062 ppm. and an iron content of 0.4 ppm. The quality is of generally similar charac-

TABLE 2

Time	Flow gpm.	Pressure Head Well 4 ft.	Well 3 ft.	Remarks
11:10 AM	0	61		Opened valve
11:30	230	8.5	32	Temp. 55 1/2° F.
12:30 PM	230	8.5	32	
12:45				Rate reduced
12:45	190	21.5		
1:10	185	22.5	34	
1:15				Rate reduced
1:30	142	33.5		
1:50	134	38.5	32.36	
2:00	134	36.0		Temp. 55 1/2° F.
2:13	134	36.0		Valve closed
2:14		58.5		
2:18		59.1		
2:30		59.5		

LABORATORY NO. 108,163

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.4		Silica	SiO_2	11.4	
Manganese	Mn	0.0		Fluoride	F	5.5	
Calcium	Ca	13.5	0.68	Chloride	Cl	770.0	21.71
Magnesium	Mg	4.7	0.39	Nitrate	NO_3	0.0	0.0
Ammonium	NH_4	0.2	Tr.	Sulfate	SO_4	176.1	3.66
Sodium	Na	783.4	34.06	Alkalinity	(as $CaCO_3$)	488.	9.76
Color		0		Hardness	(as $CaCO_3$)	54.	
Odor		0		Residue		2062.	
Turbidity		100		Free CO_2 (calc.)		12.3	
Temperature 55.5° F.				pH = 8.0			

ter to that obtained from the other wells. The water is not treated, and is not metered.

BURLINGTON
Kane County
Aug. 28, 1947

A public water supply was installed by the village of Burlington (235) in 1941.

Water is obtained from a well drilled to a depth of 111 ft. by Hayes and Sims, Champaign, and located about 120 ft. south of Center St. and 50 ft. east of South St. (approximately 1000 ft. S. and 50 ft. W. of the N. E. corner of Section 9, T. 41 N., R. 6 E.). The elevation of the ground surface is 920± ft.

The pump base is 2 ft. above ground level. The well is cased with 6-in. pipe and has a 35 slot Armco-iron screen with an overall length of 14 ft. 8 in.

A production test was made on July 7, 1941. While pumping at 40 gpm. the drawdown was 5 ft. from a non-pumping water level of 33 ft. below the ground surface.

The existing pump installation, made in May 1941, is: 50 ft. of 4-in. column pipe; 6-in., 4-stage Aurora Pump Co. turbine pump, No. 12504, having a rated capacity of 50 gpm. against 57 ft. of head; the overall length of the pump is 29 in.; 10 ft. of 4-in. suction pipe with strainer; 50 ft. of 1/4-in. gi. air line; 2-hp. General Electric motor.

The distribution system was completed in Nov, 1943. In July 1947 the average estimated pumpage was 7500 gpd.

Analysis of a sample (Lab. No. 111,400) collected Aug. 6, 1947 after 1/4.-hr. pumping at 50 gpm., showed this water to have a hardness of 19.7 gr. per gal., a residue of 385 ppm., and an iron content of 3.1 ppm.

The municipality owns an iron removal plant.

LABORATORY NO. 111,400

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	3.1		Silica	SiO_2	3400	
Manganese	Mn	0.0		Fluoride	F	0.3	
Calcium	Ca	78.2	3.91	Chloride	Cl	5.0	0.14
Magnesium	Mg	34.7	2.85	Nitrate	NO_3	10.8	0.17
Ammonium	NH_4	0.4	0.02	Sulfate	SO_4	4.1	0.09
Sodium	Na	11.5	0.50	Alkalinity	(as $CaCO_3$)	344.	6.88
Turbidity		20		Hardness	(as $CaCO_3$)	338.	6.76
Color		0		Residue		385.	
Odor		M		Free CO_2	(calc.)	29.	
Temperature 51° F.				pH = 7.5			

The city of Bushnell (2906) installed a public water supply in 1889.

Water was originally obtained from about six tubular wells into a sand and gravel stratum. These wells were about 6 in. in diameter and 120 ft. deep. Because of the low yield, all of these wells were abandoned.

Well No. 1 (West Well) was drilled in 1897 to a depth of 1352 ft. by C. F. Sturdevant, Chicago Junction, Ohio, and located on the east side of Dean St., north of the right-of-way of the Chicago, Burlington, and Quincy Railway and the Toledo, Peoria, and Western Railway (or approximately 2300 ft. S. and 2400 ft. W. of the N. E. corner of Section 33, T. 7 N., R. 1 W.). The ground surface elevation is 651± ft. The hole and casing diameter record is given in Table 1.

During the drilling, water was encountered at depths of 121, 326, 725, and 1350 ft. When the well was completed, the driller reported that the non-pumping water level was 25 ft. below the ground surface, and that the well would produce an average of 190 gpm. for 24 hr. with a drawdown of 60 ft. The well was recased in 1914 by Warwick, Hagerty, and Shag, Keokuk, Iowa, and 15 or 20 ft. were left open at a depth of 120 ft. to admit water from sand and gravel. The water level was 52 ft. In 1923, the non-pumping water level was 65 ft. In 1931, the well had filled in to a depth of 500 ft. In 1932, the well was reamed and deepened to a total depth of 1509 1/2 ft. by J. B. Millis, Byron. The well was cased as follows:

16-in. od. drive pipe from surface to 140 ft.
12-1/2-in. id. casing from 1 1/2 ft. above surface to 410 ft. 10 in.
10-in. id. casing from 410 ft. 10-in. to 1054 ft.

The uncased hole below 1054 ft. was 10 in. in diameter.

Air lift pumping was replaced by the followring: 150 ft. of 5-in. column pipe; 7 5/8-in., 13-stage Fairbanks-Morse turbine pump rated at 350 gpm.; 20 ft. of 5-in. suction pipe; 163 ft. of 1/4-in. air line; 30-hp. Fairbanks-Morse electric motor, operating at 1760 rpm.

Upon completion of this work, a production test was made by the contractor. The well yielded 160 gpm. with a drawdown of about 80 ft. from a non-pumping water level of 94 ft. below the top of the 12 1/2-in. casing. Following the test, the water level rose to 93 ft. The column pipe was then changed to 250 ft. of 5-in. A test then showed the well to produce about 200 gpm. with a drawdown of 164 ft. from the non-pumping water level of 93 ft. This pump was overhauled in 1937 and in 1941 the pump was overhauled and rebuilt by Clyde Bradley, Lewiston.

A production test was made by the State Water Survey Mar. 2 and 3, 1944. The well produced 185 gpm. with a drawdown of 99 ft.; and 220 gpm. with a drawdown of 137 ft. from a non-pumping water level of 131 ft. Pumping from Well No. 2 caused an additional drawdown of about 5 ft.

The existing pump installation consists of: 130 ft. of 5-in. od. column pipe; 7-stage, 7 3/4-in. od. Fairbanks-Morse turbine pump; 20 ft. of 5-in. suction pipe; 110 ft. of 1/4-in. air line. The pump head and motor are those installed in 1932.

Analysis of a sample (Lab. No. 113,767), collected Mar. 9, 1948 after 10-min. pumping at 125 gpm., showed the water to have a hardness of 24.9 gr. per gal., a residue of 1878 ppm., a fluoride content of 3.5 ppm., and an iron content of 0.3 ppm.

Well No. 2 (East Well) was drilled in 1915 to a depth of 1355 ft. by Frank Fogel, and is located about 60 ft. east of Well No. 1.

The well was reported to be cased as follows: 12 1/2-in. casing from surface to 136 ft.; 10-in. casing from 136 to 450 ft.; 8-in. casing from surface to 903.5 ft.

The non-pumping water level when the well

TABLE 1

Hole Record	Casing Record
12-in. diameter from surface to 135 ft.	Casing to depth of 900 ft.
10-in. diameter from 135 to 415 ft.	
8-in. diameter from 415 to 900 ft.	
6-in. diameter from 900 to 1352 ft.	

LABORATORY NO. 113,767

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.3		Silica	SiO_2	14.0	
Manganese	Mn	0.0		Fluoride	F	3.5	
Calcium	Ca	101.3	5.07	Chloride	Cl	400.0	11.28
Magnesium	Mg	41.9	3.45	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	1.3	0.07	Sulfate	SO_4	662.6	13.79
Sodium	Na	483.9	21.04	Alkalinity	(as $CaCO_3$)	228.	4.56
Turbidity		10		Hardness	(as $CaCO_3$)	426.	8.52
Color		0		Residue		1878.	
Odor		0					

was completed was reported to be 85 ft. below the top of the well.

Some time prior to 1931, air lift pumping equipment was installed in the well replacing a cylinder pump and in 1931 a turbine pump was installed. At that time, the non-pumping water level was reported to be 97 ft. and the well had filled in to a depth of 1306 ft.

The well was tested shortly after this pump was installed and found to yield 350 gpm. A test made on Jan. 26, 1932, showed the yield to be 150 gpm. The pump was overhauled in 1937, and the non-pumping water level was reported to be 98 ft.

In 1943, the non-pumping water level was reported to be 130 ft., and when pumping at 300 gpm., the drawdown was 33 ft.

A production test was made by the State Water Survey on Mar. 24, 1945. When pumping at 297 gpm., the drawdown was 20 ft. from a non-pumping water level of 127 ft. below the pump

Sample-study log of Well No. 3 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil, clay and till	55	55
Sand	3	58
Till	62	120
Pennsylvanian system		
Shale, siltstone, and sandstone	18	138
Mississippian system		
St. Louis limestone and dolomite	16	154
Salem sandstone, some limestone	13	167
Warsaw shale, thin dolomite beds	73	240
Keokuk-Burlington limestone and dolomite	170	410
Kinderhook shale	250	660
Devonian system		
Cedar Valley dolomite and limestone, thin sandstone bed at top	48	708
Silurian system		
Kankakee dolomite	29	737
Ordovician system		
Maquoketa shale and dolomite	168	905
Galena-Platteville dolomites	295	1200
St. Peter sandstone	270	1470
Shakopee dolomite, some shale and sandstone	40	1510

TABLE 2

Hole Record	Casing Record
16-in. from surface to 137 ft.	16-in. od. pipe from surface to 137 ft.
15-in. from 137 to 909 ft.	15-in. od. pipe from surface to 909 ft.
10 5/8-in. from 909 to 1510 ft.	

base. When operating the pump in Well No. 1, there was an additional drawdown of about 6 ft.

The existing pumping equipment consists of: 200 ft. of 5-in. column pipe; 7 1/2-in., 12-stage, od. Fairbanks-Morse oil lubricated turbine pump; the overall length of the pump is 8 ft.; 200 ft. of 1/4-in. air line; 20 ft. of 5-in. suction pipe; 173 ft. of 1/4-in. air line; 30-hp., 1760 rpm. Fairbanks-Morse electric motor, No. 290791.

Analysis of a sample (Lab. No. 113,768), collected Mar. 9, 1948, after 1/2-hr. pumping at 150 gpm., showed the water to have a hardness of 21.7 gr. per gal., a residue of 1791 ppm., and an iron content of 0.4 ppm.

Well No. 3 was drilled in 1945 to a depth of 1510 ft. by the Thorpe Well Co., Des Moines, Iowa, and is located about 300 ft. south of Wells No. 1 and 2.

The hole and casing diameter record is as shown in Table 2.

A production test was made by the State Water Survey on Feb. 16, 1945. For test purposes, the well was equipped with a 12-in., 13-stage turbine pump with the bottom of the suction pipe at a depth of 285 ft. 1 in. With a production of 275 gpm., the drawdown was 76 ft. and with a production of 325 gpm., the drawdown was 103 ft. below a non-pumping water level of 123 ft. Operation of the pumps in Wells No. 1 and 2, had a noticeable effect on water levels in Well No. 3.

The well was "shot" with 500 lb. of 50% dynamite and 600 lbs. of 40% dynamite in shots of 50 lb. each. Following the shooting, a production test was made. When pumping at 243 gpm., the drawdown was 135 ft. from a nonrpumping water level of 123 ft.

The pump installation is: 300 ft. of 6-in. column pipe; 10-in. 9-stage, Fairbanks-Morse turbine pump No. AF-44339; 8 ft. overall length, rated at 300 gpm. against 360 ft. of head when operating at 1760 rpm.; 20 ft. of 6-in. suction pipe; 300 ft. of 1/8-in. air line; 40-hp. Fairbanks-Morse electric motor No. 530897, operating at 1765 rpm.

A production test was made on Aug. 23, 1946 by the State Water Survey and the Fairbanks-Morse Co. Equilibrium conditions were not obtained, but after 2-hr. 20-min. pumping at a rate of 370 gpm., the drawdown was 159 ft. from a non-pumping water level of 137 ft. On Mar. 9, 1948, while pumping at 200 gpm., the drawdown was 95 ft. from a non-pumping water level of 130 ft.

Analysis of a sample (Lab. No. 113,769) collected Mar. 9, 1948 after 25-min. pumping at 200 gpm., showed the water to have a hardness of 24.6 gr. per gal., a residue of 1874 ppm., and an

LABORATORY NO. 113,769

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.3		Silica	SiO_2	14.0	
Manganese	Mn	0.0		Fluoride	F	3.5	
Calcium	Ca	100.8	5.04	Chloride	Cl	400.0	11.28
Magnesium	Mg	41.2	3.39	Nitrate	NO_3	0.2	Tr.
Ammonium	NH_4	1.3	0.07	Sulfate	SO_4	648.6	13.49
Sodium	Na	505.8	21.99	Alkalinity	(as $CaCO_3$)	236.	5.72
Turbidity		0		Hardness	(as $CaCO_3$)	422.	8.43
Color		0		Residue		1874.	
Odor (at well)		H_2S					

iron content of 0.3 ppm. The character is similar to that from the No. 1 and No. 2 wells. Temperatures of 69.6° to 72° F. have been recorded.

The water is chlorinated.

Water is pumped alternately from Wells No. 3 and 1 or 3 and 2.

In Mar. 1948, pumpage was estimated to average 427,000 gpd.

The city of Byron (1113) established a municipal water supply in 1900.

Water is obtained from 2 wells located 10 ft. apart south of Main St. between Union and Walnut St. (or approximately 2600 ft. S. and 700 ft. E. of the N. W. corner of Section 32. T. 25 N., R. 11 E.). The ground elevation at the wells is 720± ft.

Well No. 1 was drilled by W. H. Gray and Bros., Chicago, in 1900 to a depth of 2000 ft. The hole diameter record is: 12-in. from surface to 213 ft.; 10-in. from 213 to 1000 ft.; 8-in. from 1000 to 1600 ft.; 5-in. from 1600 to 2000 ft.

The well was cased with 213 ft. of 12-in. pipe into rock. A 10-in. casing was set within the larger casing and the space between the casings filled with grout.

Water is pumped with 100 ft. of 6-in. column pipe; 8-stage Peerless turbine pump, No. 62902, having an overall length of 7 ft.; 66 ft. of air line; 15-hp. 1750 rpm. General Electric motor. No. 6528129.

In 1900, this well was reported to flow. In Nov., 1947, the non-pumping water level was 32 ft. below the pump base and the drawdown was 62 ft. This pump is operated only when No. 2 cannot supply the demand.

Analysis of a sample (Lab. No. 112,653) collected Nov. 20, 1947 showed the water to have a hardness of 15.6 gr. per gal., a residue of 286 ppm., and an iron content of 0.3 ppm. The quality is very similar to that obtained from the No. 2 well excepting that the temperature was recorded as 57.5° F.

Well No. 2 was drilled in 1929 to a depth of 673 ft. by Paul E. Millis, Byron, and located about 10 ft. south of Well No. 1. It was cased to 212 ft. with 8-in. pipe.

The well is equipped with 60 ft. of 6-in. column pipe; 5-stage Fairbanks-Morse turbine pump, overall length about 6 ft.; 46 ft. of air line; 5-hp. Fairbanks-Morse electric motor, No. 237712, operating at 1735 rpm.

Analysis of a sample (Lab. No. 112,656) collected Nov. 20, 1947 after 3-hr. pumping, showed the water to have a hardness of 15.4 gr.per gal., a residue of 256 ppm., and an iron content of 0.4 ppm.

The water is chlorinated but not otherwise treated.

Sample-study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil	15	15
Sand and gravel	185	200
Ordovician system		
St. Peter formation		
Sandstone, incoherent	160	360
Sandstone, chert and thin shale beds	80	440
Cambrian system		
Trempealeau dolomite and chert	55	495
Franconia sandstone, shale and some dolomite	85	580
Galesville sandstone		
Sandstone, partly dolomitic	50	630
Sandstone, incoherent	43	673

LABORATORY NO. 112,656

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.4		Silica	SiO_2	11.9	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	50.2	2.51	Chloride	Cl	2.0	0.06
Magnesium	Mg	33.6	2.76	Nitrate	NO_3	0.4	0.01
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	15.6	0.33
Sodium	Na	0.2	0.01	Alkalinity (as $CaCO_3$)		244.	4.88
Turbidity		Tr.		Hardness (as $CaCO_3$)		264.	5.27
Color		0		Residue		256.	
Odor		Tr.		Temperature 55° F.			

Pumpage for 1947 is estimated to average 205,000 gpd.

CABERY
Ford County
Oct. 30, 1948

The public water supply was installed by the village of Cabery. (299) in 1885.

The installation included a well 8 in. in diameter and 200 ft. deep, located on the west side of Ames St. between Chester and Main St. In 1920, a hole had been eaten in the casing and mud was drawn into the well. Shortly after, the well was abandoned.

About 1907, a well known as the Park Well was drilled to a depth of 330 ft. and located north of Norton St. and East of Wagner St., extended, (or approximately 650 ft. N. and 830 ft. E. of the S. W. corner of Section 9, T.29 N., R. 9 E. in Kankakee County). Rock was encountered at 200 ft. and the water was reported to have a hardness of 1 1/2 gr. per gal. The well was not used for the public supply because of its limited capacity.

In June 1940, the well was cleaned out to a depth of 342 ft. by Geo. Berns, Chebanse, who reported the well to be cased with 6 in. black pipe to 196 ft. and a 4 1/2-in. liner from about 196 to 277 ft. At that time a production test was made. Static water level was 33 ft. below the surface. After bailing for 10 minutes at a rate of about 16 gpm., the drawdown was 54 ft. During the next 15 minutes water was bailed out at a rate of 12 gpm. and the water was drawn down to 180 ft., the limiting depth to which the bailer could reach. Continued bailing at 7 gpm. kept the water level at 185 ft., a total drawdown of 151 ft. After stopping the bailing, the water level recovered to 142 ft. within 15 minutes.

The Park Well is equipped with a hand-pump and is used by nearby residents.

Still in hope of obtaining an adequate supply of soft water, a well was drilled to a depth of 370 ft. by Berns, in 1941 and located 8 ft. from the old Park Well. The well was cased with 8-in. pipe to 220 ft. and with 6-in. pipe from 220 to 280 ft. When completed it was reported that an insufficient supply of water was obtained; the exact amount is not known. A representative sample was not made available for analysis. The 8-in. casing has been pulled to a position about 12 ft. above ground level. A wood plug is driven in the top of the casing.

A well was drilled to a depth of 233 ft., by Lars Jense, Clifton, in 1920 and located on the west side of Ames St., 120 ft. north of Chester St. (or approximately 250 ft. S. and 320 ft. E. of the N. W. corner of Section 16). The ground surface elevation is 703± ft.

The well was cased to 200 ft. with 6-in. pipe. Soft lime rock was encountered at 192 ft. and water at 233 ft. Upon completion of the well the driller reported a static water level at 33 ft. and pumping for a long period at a rate of 60 gpm. Upon increasing the rate to 70 gpm. air was pumped within 10 minutes.

A production test was made by the State Water Survey on Mar. 9, 1942, using a temporary pump installation. Before the test was started and after a 1 1/2-hr. quiet period, the water level was 39 1/2 ft. below the top of the casing, which is in a pit 2 1/2 ft. below ground level. After 5-hr. pumping at 19 gpm. the drawdown was 11 ft. Then after a 20-minute shut-down, pumping was resumed and after 3 1/2-hr. pumping at 30 1/2 gpm. the drawdown was 19 1/2 ft.

The pumping equipment, recently installed, consists of a Deming-Mueller minuturb pump, No.MT 2259 and a 3-hp. General Electric motor. The pump is mounted on a concrete base about 2

LABORATORY NO. 116,366

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.4		Silica	SiO_2	14.3	
Manganese	Mn	Tr.		Fluoride	F	1.0	
Calcium	Ca	171.5	8.58	Chloride	Cl	21.0	0.59
Magnesium	Mg	67.5	5.55	Nitrate	NO_3	5.4	0.09
Ammonium	NH_4	1.4	0.08	Sulfate	SO_4	1059.8	22.05
Sodium	Na	278.8	12.12	Alkalinity	(as $CaCO_3$)	180.	3.60
Turbidity		Tr.		Hardness	(as $CaCO_3$)	707.	14.13
Color		0		Residue		1744.	
Odor		0		Free CO_2	(calc.)	11.	
Temperature 55° F.				pH = 7.6			

ft. above ground level.

Analysis of a sample (Lab. No. 116,366) collected Oct. 26, 1948 after 7-hr. pumping at 30 gpm., showed this water to have a hardness of 41.0 gr.per gal., a mineral content of 1744 ppm., and an iron content of 1.4.

Pumpage is estimated to average 18,000 gpd.

A water supply was installed by the village of Cambridge (1312) in 1896.

Water is obtained from 2 wells located at the water works plant near the center of town.

Well No. 1, the East Well, is located at approximately 2325 ft. S. and 1900 ft. W. of the N.E. corner of Section 7, T. 15 N., R. 3 E. The elevation of the ground surface is 810± ft.

The well was drilled by H. W. Carter in 1896 to a reported depth of 1380 ft. In 1913, the depth was reported to be 1329 ft. Originally, the well was cased with 250 ft. of 10-in. pipe, and below this depth the casing diameters were 6 in. and 4 in. In 1923, the well was recased by Fred Carlson, Cambridge, with 332 ft. of 9-in. diameter pipe and 931 ft. of 6-in. pipe. At that time it was reported that limestone was encountered at 342 ft. and sandstone was penetrated from 1268 to 1329 ft.

When the well was completed, it was equipped with a Deming double-acting deep well pump with a 5 3/4-in. cylinder and 24-in. stroke. The following pumping assembly, installed in Nov. 1940, is in service: 325 ft. of 4 1/2 od. column pipe; 6-in., 31-stage Pomona turbine pump, SU-1785 rated at 125 gpm. against a 350-ft. head; 325 ft. of air line; 30 ft. of 4 1/2 od. suction pipe with strainer; 20-hp., 1760-rpm. Westinghouse electric motor. It was planned to use a bowl assembly having a 7-in. diameter, but an obstruction in the well limited the diameter to 6 in.

In 1945, the Standard Power Equipment Co. made some repairs to the drive shaft, couplings, and bearings.

A record of water levels and drawdown in Well No. 1 is given in Table 1.

TABLE 1

Year	Non-pumping Water Level ft.	Drawdown	Pumping Rate gpm.
1897	145		
1912	150		
1921	180		
1938	242		
1943	250	19	125
1944	252	18	125

Well No. 2, the West Well, is located about 30 ft. west of Well No. 1 and was drilled in 1913 by

Correlated driller's log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene - Pennsylvanian systems		
Glacial drift, shale and some coal	307	307
Devonian - Silurian systems		
Limestone	128	435
Slate	10	445
Limestone	300	745
Ordovician system		
Maquoketa formation		
Shale and limestone	205	950
Galena - Platteville formations		
Limestone	327	1277
Glenwood formation		
Sandstone	49	1326
Shale	9	1335
St. Peter formation		
Sandstone	40	1375
Shale and red marl	2	1377

TABLE 2

Date	1897	1912	1923	No. 2 1943	No. 1 1943
Cl ppm.	161	166	180	62	103
SO_4 ppm.	354	323	291	158	195
Alk. (as $CaCO_3$) ppm.	241	252	260	382	336
Hd. (as $CaCO_3$) ppm.	180	190	180	175	190
Res. ppm.	1037	1044	1080	696	798
Temp. °F.			64-65	59.1	60.5

the J.P.Miller Artesian Well Co., Brookfield, to a depth of 1377 ft.

The well was cased with 142 ft. of 15-in. od. pipe and with 288 ft. of 10-in. pipe with the bottom set at 442 ft. The bore hole below the casing was 8 in. in diameter. The well was equipped with a Keystone, deep-well, double-acting pump with a 6 3/4-in. working barrel and 36-in. stroke. The cylinder was set at 300 ft.

In 1945, the Standard Power Equipment Co. installed the following pump assembly, which is nowin service; 350 ft. of 5-in. column pipe; 6-in., 40-stage Pomona turbine pump, SE 232, rated at 200 gpm. against a 350-ft. head; 350 ft. of air line; 30 ft. of 5-in. suction pipe; 25-hp., 1750-rpm. Westinghouse electric motor mounted on a combination drive gear head arranged for emergency belt drive.

The quality of the water obtained at these wells has changed since 1897 as indicated in Table 2. It appears that lesser proportions of water from the lower section of the wells is being obtained possibly due to a receding pressure from the St. Peter sandstone.

On Mar. 9, 1944, a quality source test (Table 3) was made on Well No. 1 and it was noted that the chloride content had dropped to 87 ppm.

Analysis of a sample (Lab. No. 109,415) collected from Well No. 2 On Nov. 21, 1946 after 30-minute pumping, showed this water to have a hardness of 11.0 gr. per gal., a residue of 640 ppm., and an iron content of 0.2 ppm. The chloride concentration was 50 ppm. and the temperature 59.7° F.

In 1943, pumpage was estimated at 65,000 gpd.

TABLE 3

Time	Feet to Water	Water Temp. F°	G.P.M.	Fe	Cl	SO_4	Alk.	Hd.
9:27 AM	252	59	125	0.9	87	183.9	312	190
9:35	269	59.2	125	0.4	88	184.1	310	194
10:00	270	59.5	125	0.4	90	183.1	312	194
11:00	270	60.4	125	0.4	90	185.5	310	194
1:45 PM	270	60.0	125	0.4	95	196.2	304	186
2:00	270	60.1	125	0.4	94	199.9	298	186

LABORATORY NO. 108,415

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	12.7	
Manganese	Mn	0.0		Fluoride	F	.8	
Calcium	Ca	45.2	2.26	Chloride	Cl	50.0	1.41
Magnesium	Mg	18.8	1.54	Nitrate	NO_3	1.7	.03
Ammonium	NH_4	3.2	.18	Sulfate	SO_4	138.8	2.89
Sodium	Na	168.1	7.31	Alkalinity	(as $CaCO_3$)	348.	6.96
Color		0		Hardness	(as $CaCO_3$)	190.	3.80
Odor		0		Residue		640.	
Turbidity		Tr.					
Temperature		59.7° F.					

CAMPBELL HILL
Jackson County
March 16, 1948

The village of Campbell Hill (401) has not completed the installation of a public water supply.

Originally, a well was drilled for the village in Apr., 1942, to a depth of 320 ft. by Glenn E. Clark, Fredericktown, Mo., and located on the west side of Cherry St. about 300 ft. north of the intersection of Cherry and Front St. (or approximately 700 ft. N. and 2300 ft. E. of the S. W. corner of Section 9, T. 7 S., R. 4 W.). The ground surface elevation is 580± ft.

The well was cased with 8-in. pipe from the surface to a depth of 61 ft. with 6-in. pipe from the surface to a depth of 250 ft., and the hole was 6 in. in diameter below the depth.

A production test was made by the State Water Survey on Apr. 24, 1942. A pump, set at a depth of 166 ft., was operated from the well rig. The non-pumping water level was 71 1/2 ft. below the top of the casing, but pumping levels were not available. After 3 1/2 hours the production had decreased from 40 gpm. to 26 gpm. At the end of 16 hours after the test, the water level was still 6 ft. below the initial non-pumping level.

Analysis of a sample (Lab. No. 92852), collected Apr. 24, 1942, showed the water to have a hardness of 27.3 gr. per gal., a residue of 596 ppm., and an iron content of 4.7 ppm.

After the production test, the well was capped and further work was postponed for the duration of the war.

In 1946, the well was deepened to 442 ft. by L. W. Gwin, Percy.

The well is cased with 8-in. pipe from the surface to 60 ft., with 7-in. od. pipe from the surface to 250 ft., and the hole is 6 in. in diameter below 250 ft.

When tested by the driller the well produced 54 gpm., for 48 hours with a drawdown of 102 ft. from a non-pumping water level of 72 ft. below the ground surface. A production test was made by the State Water Survey on Dec. 9, 1946. For test purposes, the well was equipped with a turbine pump with the bottom of the suction pipe set at a depth of 225 ft. The well produced 54 gpm. for 1 hour with a drawdown of 71 ft. from a non-pump-

Correlated driller's log of well drilled in 1942 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay	25	25
Pennsylvanian system		
Shale, some lime and sandstone	185	210
Sandstone, white	110	320
Shale, some sandstone, thin bed of lime	65	385
Sandstone, white	57	442

LABORATORY NO. 108,603

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.1		Silica	SiO_2	17.1	
Manganese	Mn	0.1		Chloride	Cl	9.0	0.25
Calcium	Ca	142.0	7.10	Nitrate	NO_3	1.0	0.02
Magnesium	Mg	41.9	3.44	Sulfate	SO_4	166.8	3.47
Ammonium	NH_4	0.7	0.04	Alkalinity	(as $CaCO_3$)	380.	7.60
Sodium	Na	17.5	0.76				
Turbidity		20		Hardness	(as $CaCO_3$)	525.	10.54
Color		0		Residue		617.	
Odor		0		Temperature 60.1° F.			

ing water level of 100 ft. below the top of the casing. As the pump was idle for only 35 minutes before the test, the non-pumping water level may-have been lower than normal.

Analysis of a sample (Lab. No. 108,603) collected Dec. 9, 1942, after 6-hr. pumping at 54 gpm., showed the water to have a hardness of 30.6 gr. per gal., a residue of 617 ppm., and an iron content of 2.1 ppm.

On Mar. 16, 1948, the pumping equipment on hand but not installed, consisted of: 190 ft. of 4-in. id. column pipe; 6-in., 23-stage American Well Works turbine pump, rated at 50 gpm. against 275 ft. of head; 10 ft. of 3 1/2-in. suction pipe and gi. strainer; 190 ft. of 1/4-in. gi. air line; 10-hp. U. S. electric motor.

CAMP POINT
Adams County
Mar. 26, 1948

The village of Camp Point (1084) installed a public water supply in 1942.

In 1945, part of the supply was being obtained from the Chicago, Burlington and Quincy Railroad reservoir, and part from an old dug well.

This well was dug years before for Producers Creamery Co., to a depth of 41 ft., and is located to the rear of the village water treatment plant at the southwest corner of Ohio and Wood St. (U. S. Highway No. 24) or approximately 1980 ft. N. and 1300 ft. E. of the S. W. corner of Section 26, T. 1 N., R. 6 W. The ground surface elevation at the well site is 720t ft. The well was constructed 24 ft. in diameter from the surface to 12 ft., 12 ft. diameter from 12 to 23 ft. and 8 ft. diameter from 23 to 41 ft.

In 1945, it was reported that after about 3 weeks rest, the yield would decrease from about 12,000 gal. the first day, to about 4000 gal. the sixth day, after which a rest was required. The pumping equipment consists of 6-stage Pomona oil-lubricated turbine pump attached to 3-in. column pipe with the bottom of the pump set at 4 ft. above the bottom of the well. A 2-ft. strainer is attached below the pump. There is no air line. Power is furnished by a 2-hp. General Electric motor.

This well is maintained for emergency use.

Analysis of a sample (Lab. No. 88129) collected June 18, 1940 showed this water to have a hardness of 50.9 gr. per gal., a mineral content of 978 ppm. and an iron content of 2.8 ppm.

In 1947, the supply from the dug well and the railroad reservoir became inadequate and water was hauled to the village from Quincy by railroad tank cars. At that time 3 test wells were drilled by Henry Schuster, Golden. One of the test wells was 34 ft. deep and located at the east end of Jefferson St. about 1300 ft. east and 250 ft. north of the dug well. The test hole was cased with 6-in. pipe and with a 3-ft. length of Johnson screen.

When the well was completed the static water level was 5 ft. below the top of the well but after 4 or 5 months usage, at about 10,000 gpd., the non-pumping water level was only 2 ft. above the bottom of the well. The well has hot been used since Dec. 1947 and the pump has been removed.

In 1940, an attempt was made by the village to locate an additional source of water supply. Several electrical earth resistivity surveys had been made by the State Geological Survey. A site was selected for test drilling on the west side of Figley Branch, about 1 mile southwest of town. A pit, 5 ft. wide and 6 ft. long, was constructed to a depth of 11 ft. and cribbed with 2-in. oak lumber. A clean coarse sand formation of 4 1/2 ft. thickness was penetrated in the bottom and, by sounding-rod, the coarse sand was estimated to extend about 4 1/2 ft. below the bottom of the pit, or a total thickness of the formation of about 9 ft. Water flowed from springs, and then was pumped for 3 hr. at a rate of 25 gpm. with a drawdown of 8 ft. from the surface. After dewatering the pit, the rate of inflow was calculated at 14 gpm.

Analysis of a sample (Lab. No. 87365) collected from the surface of the pit, Feb. 22, 1940, showed the water to have a hardness of 44.5 gr. per gal., a residue of 993 ppm. and an iron content of 1.2 ppm.

All water is now obtained from a well drilled in Dec. 1947 by Calhoun Drilling Co., Batchtown, and located at the site of the pit constructed in

LABORATORY NO. 113,932

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.9		Silica	SiO_2	25.1	
Manganese	Mn	0.6		Fluoride	F	0.3	
Calcium	Ca	229.2	11.46	Chloride	Cl	6.0	0.17
Magnesium	Mg	74.1	6.20	Nitrate	NO_3	Tr.	Tr.
Ammonium	NH_3	1.3	0.07	Sulfate	SO_4	373.4	7.77
Sodium	Na	30.6	1.33	Alkalinity	(as $CaCO_3$)	556.	11.12
Turbidity		30		Hardness	(as $CaCO_3$)	883.	17.66
Color		0		Residue		1096.	
Odor		0					
Temperature		52.5° F.					

1940 (or approximately 2600 ft. N. and 2500 ft. W. of the S.E. corner of Section 34). The surface elevation at the well site is 680± ft. A 20-in. casing was set within the pit to shale at an unreported depth. A 12-in. casing and 7 ft. of 12-in. Johnson screen was set, within the 20-in. casing, with the bottom of the screen at a depth of 24 ft. 9 in. below ground level. The 5 by 6-ft. pit was cleaned out and back-filled with gravel to within 2 1/2 ft. of the top of the casing. Clay was back-filled on top of the gravel to the top of the well. The 20-in. casing and 2-in. cribbing were removed.

After completion of the well, water was pumped for 8 hr. at an average rate of 100 gpm. The drawdown was 16 ft. 9 in. from a static level of 2 ft. below the top of the well. Later water was pumped for 72 hr. at 48 gpm. but no water levels were reported.

Pumping equipment consists of a 3-in. column pipe; 6-stage, oil-lubricated Fairbanks-Morse, Pomona turbine pump, No. SJ 140 rated at 75 gpm. with the bottom of the pump set at 2 ft. above the bottom of the well; 3-hp. General Electric motor, No. pCS 6642687. There is no air line, suction pipe or strainer installed. On Mar. 26, 1948 the pumping rate was estimated at 66 gpm.

Water is pumped to the treatment plant in town a distance of about 1 1/4 mile. At times when water is pumped for railroad usage, the reservoir and well water become mixed.

Analysis of a sample (Lab. No. 113,932) collected at the well, Mar. 26, 1948 after 1 1/2-hr. pumping, showed this water to have a hardness of 51.5 gr. per gal., a residue of 1096 ppm., and an iron content of 2.9 ppm.

The water is treated for iron removal, softened and chlorinated. Analysis of a sample (Lab. No. 113,931) collected Mar. 26, 1948 showed the treated water to have a hardness of 18.0 gr. per gal., a mineral content of 882 ppm. and a trace of iron.

Pumpage is estimated to averaged 20,000 gpd.

LABORATORY NO. 113,931

	ppm.	epm.			ppm.	epm.
Iron (total) Fe	Tr.		Fluoride	F	0.1	
			Chloride	Cl	7.0	0.20
Turbidity	Tr.		Alkalinity	(as $CaCO_3$)	408.	8.16
Color	0		Hardness	(as $CaCO_3$)	310.	6.20
Odor	0		Total Mineral Content		882.	

CAMPUS
Livingston County
May 5, 1947

The public water supply for the village of Campus (169) was installed about 1896.

Water was obtained from a 2-in. well located at the southeast corner of Center and Elm St. Later a well was drilled 1/2 block south and 1/2 block east (or approximately 870 ft. N. and 300 ft. W. of the S. E. corner of Section 33, T. 30 N., R. 8 E.).

The well has 6-in. casing to a depth of 130 ft. below a ground surface elevation of 647± ft., with the bottom of the well in sand and gravel. The well is equipped with a Gould single stroke, double-acting pump with a 5 1/2-in. cylinder and 24-in. stroke operating at 28 or 29 spm. The cylinder is set at approximately 88 ft. Power is furnished by a 10-hp. Wagner electric motor operating at 860 rpm.

In 1926 the water level was reported to be 23 ft.below the surface; and, when pumping, the water level was lowered 40 to 50 ft. In May 1947 the non-pumping water level was estimated to be about the same as in 1926.

Analysis of a sample (Lab. No. 110,183), collected May, 1947 from a tap at a garage about 1000 ft. from the well, showed this water to have a hardness of 14.6 gr. per gal., a residue of 692 ppm., and an iron content of 1.0 ppm.

Pumpage is estimated at 12,000 gpd.

LABORATORY NO. 110,183

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.0		Silica	SiO_2	15.3	
Manganese	Mn	0.0		Fluoride	F	0.5	
Calcium	Ca	59.1	2.96	Chloride	Cl	82.0	2.31
Magnesium	Mg	25.0	2.06	Nitrate	NO_3	0.2	Tr.
Ammonium	NH_4	2.7	.15	Sulfate	SO_4	211.3	4.40
Sodium	Na	140.3	6.10	Alkalinity	(as $CaCO_3$)	228.	4.56
Color		Tr.		Hardness	(as $CaCO_3$)	251.	5.02
Odor		0		Residue		692.	
Turbidity		Tr.					

CAPRON
Boone County
Dec. 30, 1946

The village of Capron (487) installed a public water supply in 1900.

The source of this supply is a well drilled to a depth of 680 ft. and located about 105 ft. south of Main St. and 25 ft. east of Fourth St. (or approximately 500 ft. S. and 1250 ft. E.of the N. W. corner of Section 11, T. 45 N.,R.4 E.). The elevation at the ground surface is 912± ft.

It is reported that the well was cased from the surface with 8-in. pipe to a depth of 200 ft., followed by 6-in. casing to rock at a depth of 400 ft., below which the hole was 5 in, in diameter for the remaining 280 ft.

Non-pumping water levels below the old pump base (about 5 ft. below ground surface) were reported to be 10 ft. in 1900; 15 ft. in 1917; and 26 ft. in Sept. 1945.

A new pump was installed about Oct. 1, 1945 with its base set 5 ft. above the old pump base, or about ground surface elevation. The installation consists of 80 ft. of 5-in. galvanized wrought iron column pipe; 7-in., 10-stage American Well Works turbine pump, No. 71473, rated at 150 gpm. against 200 ft. of head; 80 ft. of 1/4-in. air line; 10 ft. of 5-in. suction pipe and brass strainer; 10-hp. U. S. electric motor. Provisions were also made to operate the pump with a right angle Johnson Drive powered by a 4-cylinder Continental gasoline engine.

On Nov. 21, 1946 the water level was 32 ft. below the pump base after an idle period of 1 hr., and the drawdown was 12 ft. after 17-minute pumping at a rate of nearly 200 gpm.

Analysis of a sample (Lab. No. 108,435) collected from the pump discharge on Nov. 21, 1946 after 10-min. pumping at a rate of nearly 200 gpm., showed the water in this well to have a total hardness of 20.6 gr. per gal., a residue of 376 ppm., and an iron content of 0.9 ppm.

A Sparling 4-in. tube meter was installed Oct. 1, 1945 and on Nov. 21, 1946 showed a total pumpage of 11,912,600 gal., or an average of 28,566 gpd. during that period.

LABORATORY NO. 108,435

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.9		Silica	SiO_2	27.1	
Manganese	Mn	0.0		Fluoride	F	0.2	
Calcium	Ca	80.1	4.01	Chloride	Cl	2.0	0.06
Magnesium	Mg	37.1	3.05	Nitrate	NO_3	1.1	0.02
Ammonium	NH_4	0.4	0.02	Sulfate	SO_4	4.9	0.10
Sodium	Na	1.4	0.06	Alkalinity	(as $CaCO_3$)	348.	6.96
Color		0		Hardness	(as $CaCO_3$)	353.	7.06
Odor		Tr.		Residue		376.	
Turbidity		20		Free CO_2 (calc.)		56.	
Temperature		51.2° F.		pH = 7.2			

CARBON HILL
Grundy County
Nov. 20, 1947

The public water supply was installed by the village of Carbon Hill (141) about 1893.

Water was obtained from a well drilled in 1893 to a depth of 1787 1/2 ft. and located at the northwest corner of 3rd and Lacey St. (or approximately 2100 ft. S. and 1600 ft. E. of the N.W. corner of Section 34, T. 32 N., R. 8 E.). The ground elevation is 560± ft.

All available physical and chemical data, prior to 1941, may be found in Bulletin No. 34.

In the summer of 1942 the water level in this well had lowered so that the daily demand could not be supplied with the existing pump setting. An attempt, by C.J. Anderson, Morris, to lower the pump setting was unsuccessful due to an obstruction, (apparently part of an old pump), in the well. After this attempt, the water level was approximately 100 ft. below the surface, and it was decided to abandon the well.

The pump has been removed, and the well has not been used since the new well was placed in service in the fall of 1942. The distance to water below the top of the casing, (1 ft. above ground), was 26 1/2 ft. on Nov. 17, 1947 after the new well, located 18 ft. east, had been pumping 5 hr. at about 20 gpm.

Analysis of a sample (Lab. No. 91936) collected Dec. 4, 1941, showed water from this well to have a hardness of 24 gr. per gal., a residue of 1286 ppm., and an iron content of 0.6 ppm.

In the fall of 1942, J: T. Anderson, Morris, drilled a well, located about 18 ft. west of the old well, to a depth of 650 ft.

The well was cased with 8-in. pipe from the surface to 65 ft. and with 6-in. pipe from the surface to 185 ft. Below the 6-in. casing, the hole was finished 6 in. in diameter to the bottom.

The well is equipped as follows: 120 ft. of 2 3/4-in. drop pipe;, Gould cylinder pump, operating with 20-in. stroke at 28 spm. rated at 20 gpm.; 20 ft. of 2-in. suction pipe; 2-hp. Century electric motor.

It was reported in 1942 that when pumping at 20 gpm. the drawdown was 30 ft. below the non-pumping water level of 93 ft. In 1942,. the pump was operated from 5 to 10 hr. daily. In 1947 the daily operation of the pump varied from 6 hr. during the winter months to 12 hr. for the summer months. When the pump was pulled in the spring of 1947 the non-pumping water level was 30 ft., as found in 1942.

Partial analysis of a sample of raw water (Lab. No. 112,612) collected at the pump discharge Nov. 17, 1947 after 5-hr. pumping at 20 gpm. showed this water to have a hardness of 24.6 gr. per gal., a mineral content of 1224 ppm., and an iron content of0.3 ppm. The quality is similar to that obtained in a series of eight samples collected over a two hour period on Sept. 19, 1944 and quite similar to that obtained from the 1787 ft. well in 1914, 1925, and in 1941. The general character appears to be typical for waters from the St. Peter and Galena-Platteville formations in this vicinity.

All water used for the public supply is chlorinated.

Pumpage from Jan. 1 to Oct. 1, 1947 was estimated to average 5400 gpd.

Correlated driller's log of well drilled in 1942 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Glacial drift	40	40
Pennsylvanian - Ordovician systems		
Pennsylvanian - Maquoketa formations		
Shale	145	185
Ordovician system		
Galena-Platteville formations		
Limestone	379	564
St. Peter formation		
Sandstone	86	650

LABORATORY NO. 112,612

	ppm.	epm.			ppm.	epm.
Iron (total) Fe	0.3		Chloride	Cl	272.0	7.67
Turbidity	10-		Sulfate	SO_4	341.5	7.10
Color	0		Alkalinity (as $CaCO_3$)		244.	4.88
Odor (at well)	H_2S		Hardness (as $CaCO_3$)		421.	8.42
Temperature 56.6° F.			Total Mineral Content		1224.	
Free CO_2 (calc.)	30.		pH = 7.3			

CARPENTERSVILLE
Kane County
Aug. 30, 1947

A public water supply was installed by the village of Carpentersville (1289) in 1914.

The initial supply was obtained from a dug well 20 ft. in diameter and 17 ft. deep located about 210 ft. south of Cleveland Ave. and 25 ft. west of Grove St. (approximately 900 ft. S. and 2400 ft. W. of the N. E. corner of Section 23, T. 42 N., R. 8 E.). The well penetrated 5 ft. of black earth and clay, below which coarse gravel was encountered. The well overflowed at ground level during construction. A 6-in. overflow pipe was laid from a point 6 ft. below the top to a branch of Fox River and the well was curbed with a concrete wall of 8 in. thickness, extending from about 16 in. above ground to the bottom. The elevation at the top of the well was 728± ft.

In 1915, the well was reported to have a productive capacity of 250 gpm. with a maximum drawdown to within 4 ft. of the bottom.

On June 28, 1923 the water level was drawn down to a depth of 9.4 ft. below the top of the well by pumping for 33 minutes and the pump was stopped. The rate of inflow was 141 gpm. when the water level was 9.1 ft. below the top and decreased to 43 gpm. when the water level was 7 ft. Continuous pumping operations were limited to about 5 hr. duration.

The depth of the well was increased to 23 ft. without increasing the supply.

This well was the source of the entire public supply until 1941 when another well was placed in service.

All pumping equipment has been removed but the well is maintained as a source of emergency supply.

The 6-in. overflow pipe is still in place and at 10 a.m. on Aug. 4, 1947 the well flowed to waste at an estimated rate of 75 gpm. Analysis of a sample (Lab. No. 111,397) having a temperature of 50.5° F., collected Aug. 2, 1947 from the end of the overflow pipe showed this water to have a hardness of 31.6 gr. per gal., a mineral content of 599 ppm., and an iron content of 0.2 ppm.

A new well was drilled in 1941 to a depth of 1140 ft. by Ray Feuerborn, Batavia, and located about 40 ft. south of Cleveland Ave. and 20 ft. west of Grove St. (approximately 730 ft. S. and 2400 ft. W. of the N. E. corner of Section 22). The elevation of the ground surface is 728± ft.

The well is reported cased with 10-in. pipe from the surface to a depth of 254 ft. and from 748 3/4 ft. to 789 ft. The annular spaces of both pipes are reported to be cement grouted.

A production test was made on May 8, 1941. Before the test the water level was 107 ft. below the top of the casing. While pumping at 275 gpm. for 4 hr. the drawdown was 144 ft. The pumping rate was then reduced to 150 gpm. and after 3-hr. pumping at that rate the drawdown was 62 ft. under apparent conditions of equilibrium.

The existing pump installation, made in July 1941, is: 300 ft. of 4-in. column pipe; 8-in., 10-stage Pomona turbine pump, S.A. 1937, having a rated capacity of 150 gpm. against 200 ft. of head; the overall length of the pump is 8 ft.; a tapered strainer; 15-hp. Westinghouse electric motor.

Analysis of a sample (Lab. No. 111,396) collected Aug. 2, 1947, after continuous pumping at an estimated rate of 150 gpm., showed this water to have a hardness of 12.4 gr. per gal., a residue of 309 ppm., and a trace of iron.

LABORATORY NO. 111,396

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.04		Silica	SiO_2	14.0	
Manganese	Mn	0.0		Fluoride	F	0.8	
Calcium	Ca	51.8	2.59	Chloride	Cl	10.0	0.28
Magnesium	Mg	20.2	1.66	Nitrate	NO_3	0.6	0.01
Ammonium	NH_4	0.5	0.03	Sulfate	SO_4	14.4	0.30
Sodium	Na	40.3	1.75	Alkalinity (as $CaCO_3$)		272.	5.44
Turbidity		0		Hardness (as $CaCO_3$)		213.	4.25
Color		0		Residue		309.	
Odor		0		Free CO_2 (calc.)		43.	
Temperature 55.7° F.				pH = 7.2			

The water is treated for removal of iron and hydrogen sulfide, noted at the start of pumping.

Analysis of a sample (Lab. No. 112,420) collected, Aug. 2, 1947 showed the treated water to have a hardness of 12.1 gr.per gal., a total mineral content of 302 ppm., an iron content of 0.05 ppm., and a free CO_2 of 6 ppm.

Pumpage is estimated to average 115,000 gpd.

CARROLLTON
Greene County
Nov. 8, 1948

The city of Carrollton (2,285) installed a public water supply about 1888.

The original source of supply was located in the central part of the city. The well was about 1330 ft. deep, and was reported to penetrate St. Peter sandstone. It was reported that the water level in 1890 was 50 ft. below the ground surface elevation of 610± ft. This well was abandoned in 1900 due to the poor mineral quality of the water.

Since 1900, all water has been obtained from springs located 3 miles west and about 1 3/4 miles north of the center of the city (or approximately 1200 ft. S. and 10 ft. E. of the N. W. corner of Section 8, T. 10 N., R. 12 W.). The ground surface elevation is 480t ft.

It was reported that there were 17 springs located within an area about 20 ft. by 40 ft. Concrete walls 15 ft. high were erected to enclose the springs.

In 1917, it was reported that the total yield of the springs was about 600,000 gpd. and in 1934, the springs were reported to produce about 3 75,000 gpd. The flow has not been measured recently, but there is a strong flow.

Analysis of a sample (Lab. No. 116,393) collected Nov. 8, 1948 showed the water to have a hardness of 18.3 gr. per gal., a residue of 355 ppm., and an iron content of 0.1 ppm.

All water is chlorinated but not otherwise treated.

Pumpage is estimated to average 175,000 gpd.

LABORATORY NO. 116,393

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	20.2	
Manganese	Mn	Tr.		Fluoride	F	0.2	
Calcium	Ca	82.7	4.14	Chloride	Cl	5.0	0.14
Magnesium	Mg	25.9	2.13	Nitrate	NO_3	11.5	0.19
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	31.7	0.66
Sodium	Na	3.7	0.16	Alkalinity (as $CaCO_3$)		272.	5.44
Turbidity		3		Hardness (as $CaCO_3$)		314.	6.27
Color		0		Residue		355.	
Odor		0		Temperature 58° F.			

CARY
McHenry County
July 23, 1947

The village of Cary (707) installed a public water supply in 1913.

Water is obtained from a well located at the rear of the village hall on Railroad St. (approximately 1200 ft. S. and 400 ft. W. of the N. E. corner of Section 13, T. 43 N., R. 8 E.). The elevation at the ground surface is 810± ft.

The well is 300 ft. deep and is reported to be cased with 10-in. pipe to limestone at a depth of 154 ft. below which the hole is 10-in. in diameter to the bottom. After the completion of the well the distance to water below the surface was 12 ft. and when pumped for 30 hr. at 110 gpm. air was drawn into the pump cylinder which had been set at a depth of 80 ft.

On Nov. 8, 1922 the following water levels were reported below the pump base: 22 ft. after a 12-hr. idle period; 68 ft. after 1 hr. and 40 min. pumping at 118 gpm. and 74 ft. after 3-hr. pumping at the same rate. Subsequent water levels have been reported: 28 ft. on Apr. 10, 1940, after a 2-day idle period; 30 ft. on July 3, 1947 after a 30-min. idle period; 100 ft. on July 22, 1947 after 6-hr. pumping at 113 gpm.

The following pump installation was made on Apr. 10, 1940: 130 ft. of 4-in. od. column pipe; 6-in., 14-stage American Well Works turbine pump Shop No. 63348 rated at 100 gpm. against 129 ft. of head at 1750 rpm; 130 ft. of 1/4-in. copper tubing air line; 10 ft. of 3 1/2-in. suction pipe; 7 1/2-hp. U. S. electric motor. Mr. Benjamin Frisch, Village Clerk, writes that in May 1948 a new pump was installed. The pump number is 39523 and the pump is rated at 100 gpm. against 180 ft. of head.

Analysis of a sample (Lab. No. 110,886) collected July 3, 1947 after 5 1/2-hr. pumping at 113 gpm. showed this water to have a hardness of 15.2 gr. per gal., a residue of 334 ppm., and an iron content of 0.1 ppm.

Pumpage is estimated at 50,000 gpd.

LABORATORY NO. 110,886

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	23.4	
Manganese	Mn	0.0		Fluoride	F	0.7	
Calcium	Ca	43.4	2.17	Chloride	Cl	5.0	0.14
Magnesium	Mg	37.1	3.05	Nitrate	NO_3	0.8	0.01
Ammonium	NH_4	0.6	0.03	Sulfate	SO_4	7.6	0.16
Sodium	Na	29.9	1.30	Alkalinity (as $CaCO_3$)		312.	6.24
Turbidity		10+		Hardness (as $CaCO_3$)		261.	5.22
Color		0		Residue		334.	
Odor		0		Free CO_2 (calc.)		13.	
Temperature 52° F.				pH = 7.8			

The city of Casey (2543) installed a public water supply in 1900.

Water was originally obtained from a small reservoir located in the southwestern part of the city. Water from the reservoir is now used for cooling Diesel engines at the municipal light plant.

In 1914, a test well was drilled beside the Embarrass River about 10 1/2 mile southwest of Casey and 2 mile north of Greenup. The well was 6 in. in diameter and 52 1/2 ft. deep, and was reported to have produced 50 gpm. with no apparent drawdown.

This supply was never developed.

Since about 1916, water has been obtained from wells located in the valley of the North Fork, 5.3 mile- east of the city, and 1.8 mile south of U. S. Highway No. 40. Well No. 1 was drilled about 1916, and is located about 70 ft. from the North Fork (or approximately 2500 ft. S. and 65 ft. E. of the N.W. corner of Section 19, T. 10 N., R. 13 W.). The normal ground surface elevation at the well-site is 580± ft. When the well was cleaned out, in 1935, it was found to be 89 ft. deep, and cased with 8-in. pipe from 4 ft. below to 89 ft. below ground level. The lower part of the casing was perforated.

When the well was completed the non-pumping water level was 18 in. below the ground surface. Gas was reported to be present.

A production test was made on Oct. 2, 1916, using a cylinder pump with the bottom of the suction pipe at a depth of 69 ft. From the rated capacity of the pump, it was estimated that the well produced more than 200 gpm. The water level was not drawn below the bottom of the suction pipe. The non-pumping water level in 1919 was at the ground surface.

Analysis of a sample (Lab. No. 35380) collected Oct. 3, 1916, showed the water to have a hardness of 17.1 gr. per gal., a residue of 542 ppm., and an iron content of 4.0 ppm.

Well No. 2 was drilled in 1916 and is located about 15 ft. west of Well No. 1. The well was drilled originally to 131 ft. with 12 ft. of Cook screen, having No. 40 slot openings. When cleaned out in 1935, it was found to be 89 ft. deep, and cased with 8-in. pipe from 5 ft. below to 70 ft. below ground level, with 14 ft. of screen below the casing.

When the well was completed, the non-pumping water level was 9 ft. below the ground surface. During a production test made Sept. 30-Oct. 3, 1916, the pump discharged at an average rate of 133 gpm. The water was reported to contain considerable gas. On Oct. 4, 1916 the water level was 11 ft.

In 1928, it was reported that this well was not in use, due to the taste and odor of the water, and to the fact that the water level was lower than in the other wells.

Analysis of a sample (Lab. No. 35355) collected Oct. 2, 1916, showed the water to have a hardness of 12.1 ppm., a residue of 1020 ppm., and an iron content of 4.0 ppm.

Correlated driller's log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Silt and soil	15	15
Gravel	13	28
Gravel, some mud	4	32
Coarse sand to gravel, no water	48	80
Sand with mud	27	107
Sand with gas	2	109
Mud	3	112
Sand with buried wood	2	114
Mud	3	117
Fine sand to coarse gravel	14	131

Well No. 3 was drilled between 1916 and 1919, and is located 14.7 ft. west of Well No. 2. When the well was cleaned out, in 1935, it was found to be 91 ft. deep below ground level and cased with 8-in. pipe from 6 ft. below ground level to the top of a 6-in. diameter perforated liner of unknown length.

Well No. 4 was drilled in 1928 and located 25 ft. west of Well No. 3. When cleaned out in 1935, it was found to be 90 ft. deep and cased with 8-in. pipe from 6 ft. below to 82 ft. below ground level and with 8 ft. of screen, having 1/16-in. slot openings.

Well No. 5 was drilled in 1935 and located 15 1/2 ft. east of Well No. 1. When cleaned out in 1935, it was found to be 92 ft. deep and cased with 8-in. pipe from 5 ft. below to 76 ft. below ground level and with 16 ft. of screen having 1/32-in. slot openings.

Well No. 6 was drilled in 1940 by city employees under the direction of James Alkire, Mayor, and is located about 70 ft. south of Well No. 5. This well is 79 ft. 9 in. deep and is cased with 12 3/4-in. pipe to the bottom. The casing has 3/16-in. slot openings between the depths of 15 and 23 ft., and between 59 and 79 3/4 ft.

When the well was completed, it was reported that the non-pumping water level averaged 6 1/2 ft. below the ground surface, and that, when pumping at a rate of 300 gpm. from Well No. 6 only, the drawdown was 4 1/2 ft.

Water is pumped from the wells by means of common suction pipes, by either of 2 Fairbanks-Morse centrifugal pumps set in the basement of the pumping station, about 5 ft. below normal ground level. One of the pumps replaced an 8-in. by 10-in. triplex suction pump in 1939. It is rated at 300 gpm. against 45 ft. of head and driven by a 5-hp. Fairbanks-Morse electric motor. The other pump, having the same rated capacity, was installed in 1947. A 5-hp. Fairbanks-Morse electric motor was installed at the same time.

The combined pumpage rate from all wells is estimated to average 240 gpm.

Analysis of a sample (Lab. No. 114,962) collected June 5, 1948 after 6-hr. pumping showed the water to have a hardness of 18.9 gr.per gal., a residue of 560 ppm. and an iron content of 7.0 ppm.

The water is aerated, softened and chlorinated.

Analysis of a sample (Lab. No. 115,179) collected June 5, 1948 showed the treated water to have a hardness of 5.2 gr. per gal., a mineral content of 345 ppm. and an iron content of 0.28 ppm.

From Aug. 7, 1946 to Sept. 20. 1947 metered pumpage averaged 187,700 gpd.

LABORATORY NO. 114,962

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	7.0		Silica	SiO_2	19.3	
Manganese	Mn	0.0		Fluoride	F	0.4	
Calcium	Ca	76.2	3.81	Chloride	Cl	97.0	2.74
Magnesium	Mg	32.2	2.65	Nitrate	NO_3	Tr.	Tr.
Ammonium	NH_4	6.0	0.34	Sulfate	SO_4	3.1	0.06
Sodium	Na	88.3	3.84	Alkalinity	(as $CaCO_3$)	392.	7.84
Turbidity		10		Hardness	(as $CaCO_3$)	323.	6.46
Color		0		Residue		560.	
Odor		0		Free CO_2	(calc.)	20.	
Temperature 54.7° F.				pH = 7.7			

LABORATORY NO. 115,179

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.28		Fluoride	F	0.4	
				Chloride	Cl	100.0	2.82
Turbidity		10-		Alkalinity	(as $CaCO_3$)	148.	2.96
Color		0		Hardness	(as $CaCO_3$)	89.	1.78
Odor		M		Total Mineral Content		345.	
Temperature 58.5° F.							

A public water supply was installed in 1935, by the village of Catlin (845).

Well No. 1 was drilled in 1934 to a depth of 90 ft. by O. A. Musson, Hoopeston, and located 50 ft. south and 200 ft. west of the intersection of Commercial and Sandusky St. (or approximately 1830 ft. N. and 2140 ft. W. of the S. E. corner of Section 34, T. 19 N., R. 12 W.). The ground elevation at the well site is 655± ft.

The well was cased with 8-in. pipe to a depth of 33 ft. below which the hole was 8 in. in diameter.

A production test was made by the State Water Survey on Sept. 5, 1934. Before the test the static water level was 11 ft. below ground level. After 4 1/2-hr. pumping at 14 gpm. the drawdown was 70 ft. When pumping at a higher rate, the water would be drawn down below the suction pipe at 86 ft. The rate of recovery was rapid until the water level was 22 ft. and quite slow above 22 ft. It has been reported that the well was not placed in service until about Mar. 1935 and then the yield rate was only 5 gpm. In 1936, the supply became exhausted after a 20-min. pumping period. On examination the well had not filled and it was believed that the cracks in the shale had become plugged. The pump was installed in Well No. 5 and Well No. 1 has not been used since.

Analysis of a sample (Lab. No. 75694) collected Feb. 19, 1935 showed this water to have a hardness of 14.1 gr. per gal., a residue of 495 ppm., and an iron content of 0.2 ppm.

Well No. 2 was completed in Oct. 1934 by O. A. Musson and located 600 ft. northeast of Well No. 1 about 55 ft. east of Sandusky St., 150 ft. south of Vermilion St. (or approximately 2490 ft. N. and 1940 ft. W. of the S. E. corner of Section 34). The well was drilled to a depth of 106 ft. and cased with 8-in. pipe to a depth of 37 1/2 ft., below which the hole was 8 in. in diameter.

A production test was made by the State Water Survey on Oct. 3, 1934. Before the test, the static water level was 10.0 ft. below ground level. When pumping at 9.1 gpm. the drawdown was negligible but when pumping at 10 gpm. or more, equilibrium could not be maintained.

The pumping equipment includes a plunger pump, Fairbanks-Morse No. 9, D. W. head, with a 2 3/4-in. cylinder attached to 3-in. drop pipe; the pump stroke is 9 in. and is operated at 30 gpm.; at a metered discharge rate of 7 gpm. to the distribution system; 3-hp. Fairbanks-Morse electric motor.

Well No. 2 is still in service but may be discontinued because of the low yield.

Analysis of a sample (Lab. No. 75695) collected Feb. 8, 1935 showed this water to have a hardness of 5.1 gr. per gal., a residue of 658 ppm., and an iron content of 0.8 ppm.

Well No. 3 was completed at a depth of 100 ft. in Oct. 1934 by O. A. Musson and located on the west side of Webster St., about 1800 ft. northwest of Well No. 2 (or approximately 1200 ft. S. and 2580 ft. E. of the N. W. corner of Section 34). The ground surface elevation at the well is 655± ft.

Well No. 3 was cased with 8-in. pipe to 30 ft. 9 in., below which the hole was 8 in. in diameter. A production test was made by the State Water Survey on Oct. 19, 1934. Before the test, the static water level was 15 ft. 3 in. below ground level. When pumping at 7 gpm. for one hour the water was lowered below the bottom of the suction pipe, set at 95 ft. 8. in.

The well is equipped with a plunger pump Fairbanks-Morse No. 9, D. W. head, with a 2 1/4-in. cylinder attached to 90 ft. of 2 1/2-in. drop pipe; the pump stroke is 9 in., rated at a capacity of 8 gpm. when operated at 54 spm. Well No. 2 was in operation in Oct. 1948 after being out of service for five years. The yield rate is about 2 gpm. for a three-hour pumping period after

Sample-study log of Well No. 3 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Silt and till	25	25
Pennsylvanian system		
Siltstone, shaly and shale at bottom	75	100

LABORATORY NO. 101,410

	ppm.	epm.		ppm.	epm.
Iron (total) Fe	0.5		Chloride Cl	58.0	1.63
Turbidity	0		Alkalinity (as $CaCO_3$)	368.	7.36
Color	0		Hardness (as $CaCO_3$)	260.	5.20
Odor	Tr.		Total Mineral Content	518.	
Temperature 53.9° F.					

which a three-hour recovery period is necessary. It is not planned to operate the pump during the winter.

Analysis of a sample (Lab. No. 75170) collected Oct. 19, 1934 showed this water to have a hardness of 4.7 gr. per. gal., a residue of 664 ppm., and an iron content of 1.0 ppm.

Well No. 4 was completed to a depth of 91 ft. in Nov. 1936 by W. C. Le Roy, Danville, and located on the east side of Jackson St. south of Vermilion St., about 1600 ft. west of Well No. 2, (or approximately 2300 ft. N. and 1670 ft. E. of the S. W. corner of Section 34.).

The well was cased with 8-in. pipe to a depth of 41 ft. below which the hole was 6 in. in diameter. A production test was made by the State Water Survey on Nov. 13-14, 1936. Before the test the static water level was 16 ft. below the top of the casing and after 24-hr. pumping at 12 gpm. the drawdown was 22 ft. When pumping at any higher rate, equilibrium could not be maintained.

Well No. 4 was drilled to replace Well No. 1 which had failed. The pumping equipment consists of: 84 ft. of 2 1/2-in. drop pipe; plunger pump, Fairbanks-Morse type C head, with a 2 1/4-in. cylinder and 9-in. stroke; 1 1/2-hp., 1750 gpm. Fairbanks-Morse electric motor No. HP 2P960.

Well No. 4 is in service averaging 12 hours daily and yields about 5 gpm. Interference is caused by the operation of the high school well.

Analysis of a sample (Lab. No. 101,410) collected Sept. 29, 1944 after 30-hr. pumping at 8 gpm. showed this water to have a hardness of 16.7 gr. per gal., a residue of 518 ppm., and an iron content of 0.5 ppm.

An electrical earth resistivity survey was made by the State Geological Survey in Nov. 1942. Recommendations were made for drilling test holes in the northeast portion of Section 3, just south of town and on the south line of Sections 3 and 4, from 1 to 1 1/2 mile south of town.

Well No. 5 was drilled to a depth of 92 ft. in May 1943, by W.C. Le Roy, and located about 110 ft. east of Paris St., just south of Vermilion St., (or approximately 2600 ft. N. and 1240 ft. W. of the S. E. corner of Section 34.). The well was cased with 8-in. id. pipe from 18 in. above ground level to 34 ft. 10 in.

A production test was made by the State Water Survey on May 26, 1943. For test purposes a cylinder pump was installed with 24-in. working barrel and 60 ft. of drop pipe and 8 ft. of suction

LABORATORY NO. 118,847

	ppm.	epm.		ppm.	epm.
Iron (total) Fe	.5		Silica SiO_2	26.1	
Manganese Mn	0.0		Fluoride F	Tr.	
Calcium Ca	115.1	5.76	Chloride Cl	74.0	2.09
Magnesium Mg	48.6	4.03	Nitrate NO_3	3.2	.05
Ammonium NH_4	.8	.04	Sulfate SO_4	263.7	5.49
Sodium Na	120.5		Alkalinity (as $CaCO_3$)	372.	7.44
Turbidity	5		Hardness (as $CaCO_3$)	490.	9.79
Color	0		Residue	892.	
Odor	0				

pipe. The pump was operated from the drill rig. Before the test the static water level was 7 1/2 ft. below the top of the casing and after 4-hr. pumping at 20 gpm. the drawdown was 14 1/2 ft.

Well No. 5 was placed in service in the fall of 1944. The pumping equipment consists of a plunger pump with Fairbanks-Morse No. 9 D. W. head, with a 3 1/4-in. cylinder attached to 60 ft. of 3 1/2-in. drop pipe and having a 9-in. stroke. The pump is operated at 54 spm. and discharges about 16 gpm. for an average of 12 hours daily, 3-hp. electric motor.

Analysis of a sample (Lab. No. 118,847) collected July 15, 1949 after 24.-hr. pumping at about 16 gpm., showed this water to have a hardness of 28.6 gr. per gal., a residue of 892 ppm., and an iron content of 0.5 ppm.

All water for the village supply is chlorinated at the wells.

Pumpage is estimated to average 23,700 gpd.

The village wells have been unable to furnish an adequate supply of water at times. Water from Catlin Township High School well has been used as an auxiliary supply. The well is located north of Vermilion St., west of town, (or approximately 2100 ft. S. and 1100 ft. E. of the N. W. corner of Section 34).

The well is 86 ft. deep below a surface elevation of 652t ft. and is equipped with a Western centrifugal pump with the 4-in. casing used as a discharge pipe. The average rate of discharge is 20 gpm.

Use of this well for public supply is limited generally to summer months or at night during periods of emergency.

Analysis of a sample (Lab. No. 90069) collected Mar. 12, 1941 showed this water to have a hardness of 16.3 gr. per gal., a mineral content of 517 ppm., and an iron content of 0.5 ppm.

CEDAR POINT
La Salle County
June 17, 1947

Water for the village of Cedar Point (279) is obtained from a well drilled in 1912 for the La Salle Carbon Coal Co., which owned the village water works. The well and pumping station are located on the mine property about 1/4 mi. northeast of the village (or approximately 1100 ft. N. and 900 ft. E. of the S. E. corner of Section 4, T. 32 N., R. 1 E.).

The well, now owned by the Cedar Point Light and Water Co., was drilled to a depth of 1750 ft. below a ground surface elevation of 655 ft. When the drilling reached 1500 ft., the water was analysed and found to have a mineral content of 1015 ppm. The drilling was continued into sandstone at 1750 ft. and cased to the top of the sandstone. The quality of the water from the sandstone was found to be very similar to that from the limestone at 1500 ft. depth, so the casing was withdrawn from the limestone in order to increase the yield.

The top of the casing is 3 ft. above the ground surface, and the well is cased as follows:

16-in. casing from top to 124 ft.
12-in. casing from top to 275 ft.
10-in. casing from 222 to 405 ft.
8-in. casing from 222 to 667 ft.

A 10-in. casing also extends from the top to a depth of about 200 ft. at which depth it is reduced to a 6-in. diameter and extends to a depth of 1104 ft.

The well is equipped with a Sullivan air lift with 416 ft. of 2-in. eduction pipe. A 1-in. air pipe is connected to the bottom of the discharge pipe.

During construction when the drilling was at 1500 ft. depth, the water level was 102 ft. beiow the surface; and when the well was completed, the water level was 101 ft. Water was pumped for 2 hr. at a rate of 183 gpm. In 1922 before starting a production test, the water level was 122 ft. 8 in.; and after pumping 3.6 hr. at 57 gpm., the water level was lowered 6 ft. 8 in.

Analysis of a sample (Lab. No. 110,703) collected June 17, 1947 from a tap, at the service pump, showed the water from this well to have a hardness of 13.1 gr. per gal., a residue of 1023 ppm., and an iron content of 3.6 ppm. Samples collected in 1913 and in 1922 showed an iron content of 0.3 ppm. and 0.2 ppm. respectively.

Pumpage is estimated at 16,000 gpd.

Correlated driller's log of well drilled in 1912 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene and Pennsylvanian systems		
No record	565	565
Pennsylvanian system		
Shale	125	690
Sandstone, fine	40	730
Shale and sand	95	825
Silurian system		
Niagaran and Alexandrian dolomites	245	1070
Ordovician system		
Maquoketa shale	145	1215
Galena-Platteville dolomites	395	1610
St. Peter sandstone	139	1749
Shakopee formation		
Limestone	at	1749

LABORATORY NO. 110,703

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	3.6		Silica	SiO_2	15.3	
Manganese	Mn	0.0		Fluoride	F	1.1	
Calcium	Ca	53.7	2.69	Chloride	Cl	308.0	8.69
Magnesium	Mg	22.1	1.81	Nitrate	NO_3	1.7	0.03
Ammonium	NH_4	1.1	0.06	Sulfate	SO_4	182.9	3.80
Sodium	Na	297.2	12.92	Alkalinity	(as $CaCO_3$)	248.	4.96
Color		0		Hardness	(as $CaCO_3$)	225.	4.50
Odor		0		Residue		1023.	
Turbidity		30					

CEDARVILLE
Stephenson County
April 26, 1949

A public water supply was installed by the village of Cedarville (420) in 1949.

Well No. 1 was completed in Apr. 1949 to a depth of 401.5 ft. by E. L. Niffenegger, Monroe, Wisconsin, and located in the north central part of town (or approximately 850 ft. N. and 475 ft. W. of the S. E. corner of Section 36, T. 28 N., R. 7 E.). The ground elevation at the well is 860± ft. The driller reported the following formations penetrated:

Formation	Thickness	Depth
	ft.	ft.
Unconsolidated	68	68
Limestone	127	195
Sandy lime	15	210
Sandstone	191.5	401.5

The drill-hole record was:

16-in. from 0 to 110 ft.
12-in. from 110 to 200 ft.
8-in. from 200 to 401.5 ft.

An 8-in. id. casing was set from 2 ft. above to 138 ft. below ground level. The lower part of the annular space outside the casing was filled with 98 bags of cement and the upper space outside the casing was filled with 2.5 cu. yd. of concrete.

A production test was made by the State Water Survey on Apr. 26, 1949. For test purposes, the well was equipped with a belt-driven turbine pump. Before the test was started, the water level was 74 ft. below the pump-head base which was 2.5 ft. above ground level. The pumping rate was 68 gpm. at the start and gradually accelerated to 310 gpm. at the end of 6 hr. The drawdown was 51.5 ft. Pumping was then gradually decelerated to 205 gpm. and after 6 hr. the drawdown was 39.5 ft. Pumping was then stopped and after 11 min. the water level was 84 ft. or 10 ft. below the starting level.

Analysis of a sample (Lab. No. 117,974) collected on Apr. 26, 1949 after 8 3/4 hr. pumping at 213 gpm. showed this water to have a hardness of 33.6 gr.per gal., a residue of 628 ppm. and an iron content of 2.9 ppm.

LABORATORY NO. 117,974

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.9		Silica	SiO_2	23.4	
Manganese	Mn	0.2		Fluoride	F	0.1	
Calcium	Ca	137.3	6.87	Chloride	Cl	14.0	0.39
Magnesium	Mg	56.6	4.65	Nitrate	NO_3	0.3	0.01
Ammonium	NH_4	0.2	0.01	Sulfate	SO_4	63.8	1.33
Sodium	Na	12.0	0.52	Alkalinity	(as $CaCO_3$)	516.	10.32
Turbidity		22 *		Hardness	(as $CaCO_3$)	576.	11.52
Color		0		Residue	(calc.)	628.	
Odor		0		Free CO_2		139.	
Temperature 50.6° F.				pH = 7.0			

CERRO GORDO
Piatt County
May 7, 1949

A public water supply was established for the village of Cerro Gordo (1016) in 1898, for fire protection. Well No. 1, known then as the West Well, was drilled on a village-owned lot, 150 ft. west of Monroe St. between South and Walt St. (or approximately 1500 ft. S.and 820 ft. W. of the N. E. corner of Section 34, T. 17 N., R. 4 E.).

The well was 6 in. in diameter and 150 ft. deep and was used very little until 1909 when the water works system was completed. In 1914, the yield was limited. Several years later the well was abandoned.

Well No. 2, East Well, was drilled in 1909 to a depth of 150 ft. and located 8 ft. from Well No. 1. The well was 8 in. in diameter but had a 6-in. inner casing. The drilling of Well No. 2 was extended considerably below the 150-ft. depth of Well No. 1, but on finding no additional water supply, the well was finished with a Cook screen set at 150 ft. In 1914 the yield of the well was estimated to be 71 gpm.

In 1923, the discharge was irregular after 2-hr. pumping.

Both wells No. 1 and 2 penetrated gas pockets at depths from 125 to 150 ft.

Analysis of a sample (Lab. No. 50804) collected Jan. 4, 1924, showed the water from Well No. 2 to have a hardness of 22.6 gr. per gal., a mineral content of 567 ppm., and an iron content of 2.2 ppm.

Well No. 3 was drilled in 1918 by Omer Kersey, Sullivan, and located 32 ft. north of Well No. 1. The well was drilled to limestone at 228 ft. The 8-in. casing was pulled back and a screen set at 151 ft. In 1922, Geo. M. Patton, driller for A.D. Cook Co., deepened the well to 171 ft. Two screens were placed in the well, one 8 ft. in length at the bottom and the other screen in sand and gravel at 150 ft. The upper screen was wedged in the 8-in. casing but later slipped down about 2 ft.

In May, 1924, Grub Bros. repaired the well. The lower screen was removed and a Cook screen 14 1/2 ft. long was placed with the bottom at 151 ft. 10 in.

In 1921, the water level was 38 ft. below the top of the well and on May 12, 1924 the water level was 115 ft. On May 14, considerable gas was being pumped.

Well No. 4 was drilled to a depth of 205 1/2 ft. in 1922 by G. M. Patton and located 1/4 mile south of the pumping station and the old wells. The elevation of the ground surface is 730± ft., about 18 ft. lower than at the pumping station.

An 8-in. casing was set with the bottom at 193 ft. and then pulled back to 176 ft., the top of a Cook screen with No. 40 slot openings. Before a production test made by the driller in Oct. 1923, the water level was 85 ft. below the top of the well. The yield was 30 gpm. and in **Jan.** 1924 the yield was estimated to be 20 gpm.

When the well was completed, an explosion occurred from ignited gas after pulling an electric switch.

Correlated driller's log of Well No. 4 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay mixed with gravel	85	85
Trace of water	1	86
Loam or soil	3	89
Clay	9	98
Sand, hardpan	11	109
Clay and gravel, strong flow of gas	3	112
Sand and gravel, water-bearing	20	132
Sand, clay and gravel	68	200
Pennsylvanian system		
Clay, shale, thin limestone bed at base	5 1/2	205 1/2

LABORATORY NO. 115,791

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.7		Silica	SiO_2	14.4	
Manganese	Mn	0.1		Fluoride	F	0.1	
Calcium	Ca	85.5	4.28	Chloride	Cl	25.0	0.71
Magnesium	Mg	35.7	2.94	Nitrate	NO_3	0.2	Tr.
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	108.4	2.25
Sodium	Na	16.1	0.70	Alkalinity	(as $CaCO_3$)	248.	4.96
Turbidity		Tr.		Hardness	(as $CaCO_3$)	361.	7.22
Color		0		Residue		462.	
Odor		0		Free CO_2	(calc.)	62.	
Temperature 55° F.				pH = 7.1			

Well No. 4 was abandoned in 1925.

Analysis of a sample (Lab. No. 50805) collected Jan. 8, 1924 showed this water to have a hardness of 25.7 gr. per gal., a mineral content of 738 ppm., and an iron content of 4.0 ppm.

All of the old wells have been abandoned.

In 1925-1926 a number of test wells were drilledby Ned Ross, Bloomington. Four test wells were drilled in various locations in the village. A fifth well was drilled one mile east of the village. Five more test wells were drilled 1 1/2 miles west of the village, or one mile west of the Piatt County line in Macon County. Two-wells were drilled at that location.

Well No. 1, East Well, was drilled in 1925 to a depth of 27 ft. and was located 16.5 ft. from Well No. 2. This is the location of Test Well No. 5.

Six ft. of coarse sand was encountered at the bottom and the well was cased with 8-in. pipe to 13 ft., below which was placed a Cook screen, 12 ft. in length.

TABLE 1

Date and Time	Pumping Rate Well No. 3 gpm.	Feet to Water Below Ground Level				Remarks
		No. 3	No. 4	No. 2	No. 1	
May 11						
7:23 AM			4.3			No pumping
7:48		4.3				
8:22		4.3	4.3	4.5	4.5	Started pumping No. 3
8:27	50	9.2				
8:55	50	10.0		5.8	5.6	Start pumping No. 2
11:30	50	12.4	7.8	13.8	9.0	
11:33 AM	75					
1:00 PM	75	15.6	8.9	14.8	9.9	
1:15	100					
2:00	100	19.1	9.8	15.6	10.7	
2:05	124	22.4		16.1		
2:13			10.4	16.3	11.1	Stopped No. 2
2:45	130	21.9	9.5	9.0	8.9	
2:50	90	16.7				
3:15	90	16.0	8.2	7.5	7.8	Stopped No. 3
3:50 PM		5.1	5.3	5.8	5.5	

The pumping equipment, installed in 1939, consisted of: 6-in. American Well Works turbine pump No. 63962, rated at 90 gpm. at 200 ft. of head at 3450 rpm.; 1/8-in. copper air line of unknown length; 7 1/2-hp., electric motor. The pump was installed in Well No. 4 for a production test on May 7, 1949 and in Well No. 3 for a test on May *11,* 1949.

On June 15, 1945, both wells were given an acid treatment and the result was not an expected increase in production, but seemed to indicate that both pumps had declined in efficiency. Much hydrogen sulfide gas was released. The acid had little effect. Before and after the treatment the West Well was producing about 102 gpm. and when pumping simultaneously in the East Well at 65 gpm. the drawdown was 8 ft.

In Sept. 1948 the East Well had become so badly sand clogged that the pump could be operated only for 3-minute periods before running dry. On Sept. 9, 1948 the air line altitude gauge reading was 12 ft. while the West Well was in operation.

The West Well, now called Well No. 2, is 25 ft. deep and located approximately 40 ft. S. and 257 ft. E.of the N. W. corner of Section 33. The elevation of the ground surface is 690± ft.

The well is equipped with a 6-in., American Well Works turbine pump, No. 71561, rated at 90 gpm. against 200 ft. of head at 3450 rpm. Power is from a 7 1/2-hp. U. S. electric motor.'The capacity of the well has decreased to 55 gpm., and considerable sand is discharged.

When the test well was drilled at this site the water level was 3 ft. below the surface. On Sept. 9, 1948, after 7-hr. pumping at 55 gpm. the altitude gauge read zero. This well is the present source of public supply.

Analysis of a sample (Lab. No. 115,791) collected Sept. 9, 1948 after 7-hr. pumping showed this water to have a hardness of 21.0 gr. per gal., a residue of 462 ppm., and an iron content of 0.7 ppm. The methane gas content was less than 0.5 cu. ft. per 1000 gal.

A softening unit was installed about 1940 but has been out of service since July 3, 1947.

In the spring of 1949, three test holes were drilled by Woolen Bros., Wapella. The first test hole was drilled 90 ft. east of the pumping station but very little sand and gravel was encountered. Test holes No. 2 and 3 were then drilled at 100 and 200 ft., respectively, west of the pump house.

Well No. 3 was completed to a depth of 29 ft. below the ground surface in May 1949 by Otis Woolen, and located at the site of Test Hole No. 2. The well was cased with 8-in. pipe from 2.0

TABLE 2

Date and Time	Pumping Rate Well No. 4 gpm.	Feet to Water Below Ground Level				Remarks
		No. 4	No. 3	No. 2	No. 1	
May 7						
8:25 AM				4.3		No pumping
8:55		5.0				Start pumping No. 4
9:00	30	9.0	4.8	11.3	7.0	& No. 2
10:25	30	10.3	5.4	12.6	7.8	
10:33 AM	45	12.3	5.7			
12:00	45	12.6	6.1	12.8	8.2	
12:10 PM	60	14.3	6.3	12.9	8.6	
2:33	69	16.1		13.1	9.2	Stopped No. 2
3:15	70	15.0	5.7			Stopped No. 4
3:21		7.0	5.6	6.8	6.7	
3:40		5.8	3.9	6.3	5.7	Start No. 4
3:42	70	13.3	4.1			
4:00	117	21.5	6.2			Stopped No. 4
4:07		6.4	5.1		6.1	

ft. above ground level and 1/2 in. above the top of the pump foundation and with 10 ft. 10 in. of Johnson Everdur screen, having No. 50 slot openings. A one-foot plug was placed in the bottom of the screen and the bottom of the screen was set at 29 ft. below ground level.

A production test was made on May 11, 1949 using State Water Survey calibrated measuring equipment. During the test, water levels were observed in Wells No. 1, 2 and 4, the latter well having been finished just before Well No. 3 was drilled. For test purposes the pump from Well No. 1 was used. The results of the test are shown in Table 1.

Well No. 4 was completed just before **Well** No. 3 in May 1949 and located at the site of Test Hole No. 3, or 200 ft. west of the pump house. The well is 25 ft. deep from ground level to the bottom of an 8 1/2 ft. length of Johnson Everdur screen. The screen has No. 60 slot openings. A production test was made on May 7, 1949, using State Water Survey calibrated measuring equipment. For test purposes the pump from Well No. 1 was used. During the test, water levels were observed in Wells No. 1, 2 and 3. The results of the test are shown in Table 2.

Pumpage is estimated to average 68,000 gpd.

A water supply was installed by the village of Chadwick (581) in 1895. At that time a 5 5/8-in. well was drilled to a depth of 215 ft. and located in the village-owned park on Main St. south of Third St. The well produced about 335 gpm. In Oct. 1920 the well was reported to be dry and was later abandoned.

In 1913, due to an inadequate supply, a new well was drilled, located about 10 ft. east from the old well. The well was 8 in. in diameter and drilled to a depth of 615 ft. below a surface elevation of 800± ft., and was cased to a depth of 200 ft. Original pumping equipment was replaced in Nov. 1935 by 240 ft. of 4-in. column pipe; 6-in., 6-stage Sterling turbine pump, No. S-1741, designed to deliver 125 gpm. against a total head of 260 ft.; 30 ft. of 4-in. suction pipe with strainer; 15-hp. U. S. electric motor.

In Oct. 1913 the non-pumping water level was reported to be 100 ft. below the ground surface.

In 1945 the well was found to be filled 90 ft. and was producing 12 to 14 gpm. Analysis of a sample (Lab. No. 83699), collected June 7, 1938, showed the water to have a hardness of 20.6 gr. per gal., a residue of 385 ppm., and an iron content of 2.44 ppm.

Well No. 2 was completed in Nov. 1945, to a depth of 1215 ft., by C. W. Varner, Dubuque, Iowa. It is located in the village square 50 ft. east and 110 ft. south of the intersection of Main and Third St. (or approximately 2520 ft. N. and 2130 ft. E. of the S. W. corner of Section 2, T. 23 N., R. 5 E.).

When the drilling had penetrated the St. Peter sandstone, the well was tested and reported to produce 143 gpm. with a drawdown of 190 ft. from a non-pumping level of 60 ft. The well was then completed to the final depth of 1215 ft., and the hole and casing diameter record was reported as given in Table 1.

The well is equipped with 250 ft. of 5-in. column pipe; 8-in., 15-stage American Well Works turbine pump, No. 707552, rated at 200 gpm. against a total head of 338 ft.; 250 ft. of air line; 30 ft. of 5-in. suction pipe with strainer; 25-hp.

Sample-study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay and till	40	40
Ordovician system		
Maquoketa shale and dolomite	37	77
Galena-Platteville dolomites	343	420
Glenwood shale, dolomite and sandstone	20	440
St. Peter formation		
Sandstone, silty, thin shale bed 495-500'	100	540
Conglomerate of sandstone, chert and shale	25	565
Shakopee dolomite	40	605
New Richmond dolomite and sandstone	25	630
Oneota dolomite and compact sandstone	198	828
Cambrian system		
Trempealeau dolomite	150	978
Franconia sandstone, shale and dolomite	92	1070
Galesville sandstone		
Sandstone, incoherent	25	1095
Sandstone, partly dolomitic	40	1135
Sandstone, incoherent	65	1200
Eau Claire shale, sandstone and dolomite	15	1215

Westinghouse electric motor.

It is reported that, in a test when completed, this well produced 240 gpm. at free discharge.

Analysis of a sample (Lab. No. 108,716), collected Dec. 17, 1946, from a tap in the five stations, showed the water in Well No. 2 to have a hardness of 22.5 gr. per gal., a residue of 377 ppm., and an iron content of 0.4 ppm.

The water is not treated.

Pumpage is estimated to be 25,000 gpd. for winter demands; 35,000 gpd. during summer.

TABLE 1

Hole Record	Casing Record
16-in. from surface to 115 ft.	16-in. od. casing from surface to rock at 77 ft.
10-in. from 610 to 1215 ft.	12-in. id. pipe from surface to 115 ft.
	10-in. liner from 450 to 610 ft.

LABORATORY NO. 108,716

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.4		Silica	SiO_2	17.4	
Manganese	Mn	0.0		Fluoride	F	0.2	
Calcium	Ca	89.2	4.46	Chloride	Cl	2.0	0.06
Magnesium	Mg	39.5	3.25	Nitrate	NO_3	0.8	0.01
Ammonium	NH_4	0.7	0.04	Sulfate	SO_4	2.3	0.05
Sodium	Na	1.2	0.05	Alkalinity	(as $CaCO_3$)	384.	7.68
Color		0		Hardness	(as $CaCO_3$)	386.	7.72
Odor		Tr.		Residue		377.	
Turbidity		10		Free CO_2	(calc.)	92.	
				pH = 7.05			

A public water supply was installed for the cities of Champaign (23,302) and Urbana (14,064) in 1885 by a private company, the Union Water Supply Corporation. In prospecting for coal, a shaft was dug and an apparently abundant supply of water was encountered. In 1899 the Champaign and Urbana Water Company acquired the water works and system, and operated until 1926 when the Illinois Water Service Company, the present owner and operator, purchased the property.

The original well in the coal shaft was located under the engine room of the present pumping plant. That well was abandoned and well No. 1 was drilled just west of the pumping plant.

Prior to 1908, nine wells were drilled and located at the pumping station site in northwest Urbana between Goodwin and Lincoln Ave. and south of Church St. extended, (or approximately 1500 ft. S. and 500. ft. W. of the N. E. corner of Section 7, T. 19 N., R. 9 E.). By 1913, Wells No. 10 to 18, inclusive, were drilled at the same location. All 18 wells were cased with 8-in. pipe except Well No. 10 which had 10-in. casing. All wells ranged in depths from 154 to 161 ft. below a ground surface elevation of 730 ft. In 1903, the non-pumping water level was 70 ft. In June 1914the non-pumping water level was 118 ft. below the ground surface and in May 1925 the depth to water in an abandoned well at the filter plant was 143 ft. The production rate, from any one well, was reported to average about 105 gpm.

Prior to 1921, Wells No. 19 to 33, inclusive, were drilled and located as follows: Wells No. 19 to 25, inclusive, and No. 28 were located in a new field on the east side of Goodwin Ave. and about 1600 ft. northwest of the pumping station. Wells No. 26, 27 and 29 to 33, inclusive, were located east of Goodwin Ave. at the pumping station. Of the first 33 wells drilled, Wells No. 1, 4, 6, 17, 24, and 27, have been abandoned. All other wells of the first 33 drilled, are available for service or can be made so by the installation of pumping equipment.

Since Oct. 26, 1942, the State Water Survey has maintained an automatic water level recorder in Well No. 20. This is one of the oldest of continuous water level recordings which the Survey has installed. Well No. 20 is located in the 8-well group on the east side of Goodwin Ave. and more particularly 80 ft. east of Goodwin Ave. and 15 ft. south of the south line of Dublin St. extended.

Wells No. 34 to 37, inclusive, were drilled during the years 1921 to 1925.

Well No. 34 was located in the extreme northwest corner of Urbana atthe intersection of Bradley Ave. with Wright St. extended. The original well was abandoned because of over-pumping during a production test in Sept. 1921, resulting in the loss of the plug at the bottom of the well and damaging the equipment. The same mishap occurred about Mar. 25, 1922. Another No. 34 well was drilled about 60 ft. south of the original hole (or approximately 100 ft. S. and 2640 ft. W. of the N. E. corner of Section 7). The depth of the well was reported to be 216 ft. below a ground elevation of 741 ft. In 1921 the non-pumping water level was reported to be 106 ft. and on Dec. 12, 1922 after 20-hr. pumping at 388 gpm. the water level was 134 1/2 ft. The non-pumping water level on that date, before starting the pump, was not observed but was estimated to be about 110 ft. Previous to the test the pump had not been operated for several weeks. Well No. 34 was located about one-half mile northwest of the older wells, where the non-pumping water level, at the same time, was approximately 130 to 135 ft. below a ground elevation of 740 ft. Because of pumping too much sand, damaging the pumping equipment, Well No. 34 was abandoned and the pump removed in the spring of 1925.

Well No. 35 was completed to a depth of 204 ft. in 1922 and located in the southeast corner of the intersection of Goodwin and Bradley Ave., one-quarter mile east of Well No. 34 and about 2000 ft. due north of the well-field which includes Wells No. 19-25 and Well No. 28, (or approximately 50 ft. S. and 50 ft. E. of the northwest corner of Section 8). Well No. 35 is cased with 181 ft. 10 in. of 18-in. pipe and 22 ft. of Cook screen, having No. 60 slot openings. When drilled, the water level was 106 ft. below a ground level of 748 ft. In Mar. 1928 the production rate of this well was 400 gpm. and in Apr. 1946the production rate was estimated to be about 275 gpm. This was under conditions of normal discharge pressure, with the water level 6 ft. above the bottom of the suction, which was about 2 ft. above the bottom of the well.

Well No. 35 is used occasionally.

Well No. 36 was drilled in 1923 to a depth of 201 ft. and located 125 ft. east of Well No. 35. The well was cased with 12-in. pipe. In 1925, with the pumps in Wells No. 35 and 3 7 in operation, the water level in No. 36 was 119 ft. Well No. 36 is available for service.

Well No. 37 was drilled in 1923 to a depth of 209 ft. and located 112 ft. east of Well No. 36. The well was cased with 14-in. pipe and, when first drilled, was capable of producing at a rate of 3 75 gpm. The well had been abandoned.

Well No. 38 was drilled in 1925 to a depth of 165 1/2 ft. by Layne and Bowler, Chicago, and located 73 ft. west of Well No. 34. An outer casing of 30-in. pipe was set to a depth of 110 ft. and an inner casing of 18-in. pipe was set to a depth of 110 ft. with an 18-in. screen from 110 to 140 ft.; an 18-in. blank pipe from 140 to 150 ft. and 18-in. screen from 150 to 165 1/2 ft. The space between the 18-in. and 30-in. casings and outside the screens was packed with gravel.

A production test was made on Dec. 31, 1925. Before pumping, the water level in Well No. 38 was 111.6 ft. and in Well No. 34, inactive and 73 ft. distant, was 115.4 ft. After 6-hr. pumping in Well No. 38 at a rate of 423 gpm. the drawdowns were 45.5 ft. in No. 38 and 1.9 ft. in No. 34. During the test, the pumps in Wells No. 35, 36 and 37, one-quarter mile farther east than Well No. 34, were operating. Well No. 38 has been abandoned.

Well No. 39 was drilled in July 1926 to a depth of 216 ft. by Layne and Bowler, and located 50 ft. east of Well No. 36 and 60 ft. west of No. 37. The well was cased with 140 ft. of 30-in. outer pipe and 167 ft. of 21-in. inner casing with 48 ft. 10 in. of 21-in. Layne shutter screen. The space between the casings and outside the screen was packed with gravel.

When the well was finished, a production test was made. When pumping at a rate of 743 gpm. the drawdown was 18 ft. from a non-pumping water level of 126 ft. below a ground surface elevation of 750 ft. Subsequent non-pumping water levels have been reported in ft. below the top of casing (elev. 750.0):

Date	Non-Pumping Water Level ft.
9-20-1926	126.0
3-28-1930	129.5
1-26-1932	139.3
5-23-1935	136.1
8-15-1936	136.0
6-17-1937	138.4

Variations in the water level curve are doubtless caused by interference from pumping in other wells in the field.

In Mar. 1928 this well was reported to be producing at a rate of 700 gpm.

Well No. 39 has been retired for several years.

Well No. 40 was completed to a depth of 212 ft. in Sept. 1927 by Ohio Well Drilling Co., Massillon, Ohio, and located 325 ft. east of Well No. 37. The well was cased with 164 ft. of 20-in. outer casing and 192 ft. of 12-in. inner casing. The bottom of a 12-in. Ohio Bar screen was set at 20 6 ft. Gravel was packed between the two casings and outside the screen. The top of the 12-in. casing is about 2.0 ft. above a ground surface elevation of 750.0 ft.

In Mar. 1928, after several month's continuous operation, a production test was made. When pumping at 610 gpm. the drawdown was 36.8 ft. from a non-pumping water level of 137.7 ft. Some non-pumping water level elevations have been reported in ft. below the pump base as follows:

Date	Non-pumping Water Level ft.
9-01-1927	130.5
4-03-1929	134.2
6-16-1930	143.6
5-04-1935	139.9
10-12-1935	135.3
6-17-1937	146.9

Variations in the water level curve are doubtless caused by interference from pumping in other wells in the field.

Well No. 40 is in service.

Well No. 41 was completed in 1928 to a depth of 224 ft. by the Ohio Well Drilling Co. and located about 200 ft. south of Well No. 36. The 24-in. outer casing extends from the surface to 139 ft. and the 16-in. inner casing from the sur face to 172 1/2 ft. with 52 ft. of 16-in. Ohio Angle screen. Upon completion of the well, a production test was made. When pumping at a rate of 800 gpm. the drawdown was 22.4 ft. from a water level of 143.2 ft. below a ground elevation of 748 ft. The well was reconditioned by Layne-Western Co., about 1933. After completing the work a production test was made. When pumping at a rate of 700 gpm., the drawdown was 9.75 ft. from a water level of 149.7 ft. below the surface. Analysis of a sample (Lab. No. 80001) collected Dec. 28, 1933, showed this water to have a hardness of 16.2 gr. per gal., a residue of 336 ppm., and an

LABORATORY NO. 80,001

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.4		Chloride	Cl	3.0	0.08
Calcium	Ca	59.9	2.99	Nitrate	NO_3	.8	4.0
Manganese	Mn	0.		Silica	SiO_2	11.	
Magnesium	Mg	31.6	2.50	Sulfate	SO_4	Tr.	Tr.
Sodium	Na	38.9	1.69	Alkalinity	(as $CaCO_3$)	352.	7.04
Ammonium	NH_4	3.9	.22				
Turbidity		6.		Hardness	(as $CaCO_3$)	279.5	5.59
				Residue		336.	

iron content of 1.4 ppm.

Well No. 42 was completed in June 1937 to a depth of 217 1/2 ft. and located 300 ft. south of Well No. 35 (or approximately 360 ft. S. and 1270 ft. W.of the N. E. corner of Section 7). The well was cased with 36-in. outer casing from the ground surface to 155 ft. and with 26-in. inner casing from 2 ft. above to 167 1/2 ft. below ground surface with 50 ft. of 26-in. Layne No. 5 shutter-type screen. The space between the casings and outside the screen was packed with gravel.

When the well was completed a production test was made. When pumping at a rate of 1000 gpm. the drawdown was 10 ft. from a water level of 139 1/2 ft. below the top of the casing (elev. 750.0). In Mar. 1942, when pumping at 610 gpm., the drawdown was 13 ft. After an acid treatment the pumping rate was 750 gpm. with a drawdown of 13 ft. In Oct. 1944 the pumping rate was 470 gpm. with a drawdown of 46.5 ft. After an acid treatment the production rate was 630 gpm. with a drawdown of 25.0 ft.

After the acid treatment in Oct. 1944, the following pumping equipment was reinstalled in the well: 201 ft. of 8-in. column pipe; 12-in., 4-stage Peerless turbine pump, having an overall length of 5.0 ft.; 8 ft. 8 in. of 8-in. suction pipe; 214 1/2 ft. of 1/4-in. gi. air line. The pump base was 2.0 ft. above ground level.

Well No. 42 is available for service.

Well No. 43 was completed in Dec. 1938 by Layne-Western Co. and located on the north side of Bradley Ave. about 200 ft. west of Goodwin Ave. (or approximately 50 ft. N. and 1520 ft. W. of the S. E. corner of Section 6). On Oct. 31, 1944, the well was measured 226.0 ft. deep below the top of

Sample-study and driller's log of Well No. 43 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Soil and clay"	95	95
"Sand"	5	100
"Clay"	25	125
"Gravel and sand"	10	135
"Sand, dirty"	5	140
"Clay and gravel"	15	155
Till	5	160
Sand, clean	10	170
Sand, silty	10	180
Granule gravel, clean	15	195
Sand, clean	5	200
Sand, silty	5	205
Sand, clean	10	215
"Clay"	2	217
"Sand ended on clay"	6	223

the casing, which was 18 in. above a ground surface elevation of 745.0± ft.

The well was cased, with 36-in. id. pipe from 18 in. above to 166 ft. 2 in. below ground level and with 26-in. id. pipe from 18 in. above to 175 ft. below ground level. Below the 26-in. casing was 48 ft. 8 in. of 26-in. Layne screen. The annular space between the casings and outside the screen was packed with gravel.

When the well was completed a production test was made. When pumping at a rate of 810 gpm. the drawdown was 16 ft. 10 in. from a water level of 146 ft. 5 in. below the top of casing (elev. 747.0).

On Oct. 31, 1944, while the pump was out of the well, the water level was measured to be 166.0 ft. The pumping equipment at that time consisted of 200 ft. of 8-in. column pipe; 12-in., 4-stage Peerless turbine pump, No. 11157, having an overall length of 5.0 ft.; 219.0 ft. of 1/4-in. gi. air line; 14 ft. of 8-in. suction pipe; 50-hp., 1770 rpm. General Electric motor, No. 5422316.

Electrical earth resistivity surveys were made by the State Geological Survey in Nov. 1938 and Dec. 1939 covering the area on both sides of Bradley Ave. northeasterly from Wright St., extended, to Coler Ave.

Well No. 44 was completed to a depth of 270 ft. in June 1940 by Layne-Western Co. and located 700 ft. N. and 50 ft. W. of the intersection of Bradley and Lincoln Ave., which is the S. E. corner of Section 6). The ground elevation at the well-site is 745t ft.

The well was cased with 36-in. pipe, welded inside and outside, from 2.0 ft. above to 156 ft. below ground level and with 26-in. pipe, welded on outside only, from 2.0 ft. above to 172 ft. below ground level. Below the 26-in. casing was 50 ft. of 26-in. Layne No. 5 screen having 0.115-in. slot openings. Inside the 26-in. screen was set 50 ft. of 12-in. Layne No. 5 screen. The annular space between the casings and between the screens was packed with gravel. The bottom 7.0 ft. of the 26-in. casing was slotted with 1/16-in. openings and spaced 4 1/2 in. center to center.

The pumping equipment consists of 194 ft. 7 in. of 8-in. column pipe; Byron-Jackson pump, No. 66-256, with Byrpn-Jackson pump head, No. 116879, set above a 10-in., 9-stage Peerless, all-bronze turbine having an overall lengthof 6 ft. 6 in.; air line 216 ft. 7 in. long; 15 ft. of 6-in. suction pipe; 25-hp., 1200 rpm. General Electric motor. The total length of the assembly from top of pump base, which is 2.0 ft. above ground level, to the bottom of the suction pipe is 216 ft. 1 in.

Well No. 44 is in service.

Well No. 45 was completed in Sept. 1941 to a depth of 199 ft. by Hayes and Sims, Champaign, and located at the site of Test-hole No. 2, which was 526 ft. east of Goodwin and 57.7 ft. south of Bradley Ave.

The well was cased with 16-in. pipe from 2.0 ft. above to 177 ft. 11 in. below ground level and 32 ft. 3 in. of 16-in. screen. In 1945, the screen was removed and a 10-in. casing was set from 2.0 ft. above to 176 ft. 1 in. below ground level with 26 ft. 7 in. of 10-in. Johnson Armco-iron screen. The screen extends up in the casing a length of 5 ft. 6 in.

The pump installed in this well in Sept. 1941 had been purchased in 1938 for use in another well. It was designed to produce 800 gpm. against 180 ft. of head. It was throttled to 500 gpm. when installed in Well No. 45 but by May 1943 the capacity had declined to 80 gpm. due to corrosion in one of the bowls. After repair the production rate increased to 400 gpm. By Jan. 1944 the capacity declined to 340 gpm. due to corrosion in the edges of the veins in the bowls. The pump equipment installed in Apr. 1946 now consists of 17-1 ft. of 6-in. column pipe; 8-in., 9-stage Peerless Moturbo pump No. 4509, having an overall length of 5 ft. 7 in.; air line 196 ft. 4 in. long; 9 ft. 11 in. of 6-in. suction pipe; 60-hp., 1800 rpm. U. S. electric motor, 89477.

On Nov. 1, 1949, the non-pumping water level was 166 ft. 2 in. below the pump base. Well No. 45 is not in service but is available for use.

Hayes and Sims drilled a number of test-holes in the area of Bradley Ave. between Goodwin and Lincoln Ave.

Well No. 46 was drilled in June 1946 to a depth of 207 ft. by Hayes and Sims and located at the site of Test-hole No. 17, on the west side of Lincoln Ave. and 300 ft. south of Bradley Ave. The well was cased with 16-in. pipe from 2.0 ft. above to 208 ft. 11 in. below ground level and 32 ft. 1 in. of Johnson Everdur screen. The top 10 ft. of screen had No. 14 slot openings, the next 7 ft. had No. 20 slot, and the bottom 13 ft. had No. 60 slot openings.

When completed the well produced 400 gpm. with a drawdown of 7.0 ft. from a water level of 163.2 ft.

The pumping equipment consists of 181 ft. 3 in. of 8-in. column pipe; 10-in., 6-stage Peerless turbine pump, No. 6023, having an overall length of 5 ft. 3 1/2 in.; air line 214 ft. 7 in. long; 30 ft. 1 in. of 7-in. suction pipe; 30-hp., 1800 rpm. U. S. motor, No. 117768.

Oh Dec. 1, 1949 the pump was producing 360 gpm. with a pumping water level at 28.9 ft. above the bottom of the suction.

Well No. 46 is not in use but is available for service.

Well No. 47 was drilled to a depth of 217 ft. 2 in. in June 1946 by Hayes and Sims, and located on the east side of Goodwin Ave. between Wells No. 35 and 42. The well was cased with 16-in. blank pipe from 2.0 ft. above to 191 ft. 3 in. below ground level and with 32 ft. 2 1/2 in. of silicon, red brass screen. The screen extends up in the casing for 6 ft. 3 in. The top 5 ft. of the screen had No. 60 slot openings; the next 7 ft. had No. 40 slots, the next 8 ft. had No. 18 slots, and the bottom 5 ft. had No. 12 slot openings.

The pumping assembly consists of 200 ft. of 6-in. column pipe; 10-in., 5-stage Layne turbine pump, 4 ft. 7 in.; air line 211 ft. 1 in. long; 6 ft. of 6-in. suction pipe; 30-hp., 1800 rpm. U. S. electric motor, No. 55119.

On Dec. 1, 1949, while pumping at 280 gpm. the water level was 24.2 ft. above the bottom of the suction, or a drawdown of 21 1/2 ft.

Well No. 47 is not in service but is available for use.

A critical water shortage began to develop in 1944 and 1945, forecast largely through the decreasing yields from the wells and the demand from an increasing population. New wells added to the field did not increase the overall production from the field. Table 1 shows the production rates from some of the wells at the time of construction and as of Mar. 26, 1946.

TABLE 1

Well No.	Date Constructed	Initial Yield gpm.	Current Yield gpm.
42	6-01-1937	780	550
43	12-01-1938	800	200
44	11-20-1940	140	30
45	11-17-1941	430	50

About the same time the yield rates from Wells No. 2, 3, and 10 were checked and found to be 68, 78 and 64 gpm.

A search was started for a new well supply at some distance from the city wells. Electrical earth resistivity surveys were made by the State Geological Survey in the area west of Champaign. In the fall of 1945 and early in 1946 five test-holes were drilled by Hayes and Sims from northwest of Champaign to Mahomet at points recommended from the resistivity surveys. In June 1946, restrictions were placed on non-essential water usage.

Well No. 48 was completed in May 1947 at a depth of 231 ft. by Kelly Well Co., Inc., Grand Island, Neb., and located near the site of Test-hole D-1 about one-half mile west of Five Points, northwest of Champaign (or approximately 40 ft. N. and 2400 ft. W. of the S. E. corner of Section 34, T. 20 N., R. 8 E.). The ground surface ele-

Correlated driller's log of Well No. 48 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay	41	41
Gravel and boulders	9	50
Clay and boulders	116	166
Sand	17	183
Gravel	21	204
Sand	6	210
Gravel	22	232
Pennsylvanian system		
Shale	at	232

vation at the well-site is 764t ft.

A 38-in. hole was drilled and Kelly 17-in. id. by 22-in. od. concrete casing and screen were installed from 2.0 ft. above ground level as follows:

47	plain	sections from	0 to 188 ft.
5	screen	sections from	188 to 208 ft.
2	plain	sections from	208 to 216 ft.
4	screen	sections from	216 to 232 ft.
1	base	section from	232 to 233 ft.

Each screen section contained 184 openings with dimensions of 6.75 in. by 3/16 in. Sand and gravel were packed between the screen and casing and the wall of the bore-hole to 152 ft. below the surface. The remainder of the annular space to the surface was filled with material from the mud-pit.

A production test was made by the State Water Survey on May 12-13, 1947. Before the test was started, the pump had been in operation about 4 hr. No pumping occurred for 1 hr. while installing the measuring equipment for the test, and also a sand-trap. After the 1-hr. shut-down the water level was 113.5 ft. below the top of the casing. After 12-hr. pumping at 885 gpm. the drawdown was 15.5 ft. The pump was then operated at 1030 gpm. for 1 hr. and the drawdown was 18.5 ft. Seventeen minutes after the shut-down of the test the water level was 115.1 ft. Six hr. after the test the water level was 112.5 and27hr. after the test the water level was 111.3 ft.

The amount of sand trapped from 5.2 million pounds of water pumped was 14.35 rounds, or a sand content of 2.8 ppm.

The pumping equipment consists of 150 ft. of 8-in. column pipe; 12-in., 5-stage Peerless all-bronze turbine pump, No. 34150, having an overall length of 5.0 ft. and rated at 700 gpm. against 225 ft. of head; 10 ft. of 8-in. suction pipe; 60-hp., 1765 rpm. General Electric motor. Actually the pump is operating against 180 to 190 ft. of head.

Analysis of a sample (Lab. No. 117,517) collected Mar. 15, 1949 showed this water to have a hardness of 14.5 gr. per gal., a residue of 403 ppm., and an iron content of 3.2 ppm. This quality is typical for waters from wells in this field.

Well No. 48 is in daily service.

Well No. 49 was completed in Apr. 1947 to a depth of 297 ft. by Layne-Western Co., and located 1 1/2 mile west of Well No. 48 (or approximately 935 ft.S. and 40 ft. W. of the N. E. corner of Section 5,T. 19 N., R. 8 E.). The ground surface elevation at the well-site is 735i ft.

A 30-in. hole was drilled to a depth of about 250 ft. and a 24-in. od. welded casing was set from 2.0 ft. above to 244.5 ft. below ground level. The annular space between the casing and the wall of the bore-hole was filled with pit-run gravel after the bottom 15 or 20 ft. had been filled with tamped drill cuttings. Fifty ft. of 14-in. od. No. 5 Layne silicon bronze shutter screen was set on the bottom of a 14-in. od. inner casing. The top of the inner casing was cut off even with the top of the 24-in. outer casing and the total length of inner casing and screen is 299.5 ft. The bottom 5.0 ft. of screen was a 14-in. by 20-in. cone section with 21-in. od. cutting shoe. A 1.0 ft. thick concrete plug was poured in the bottom of the screen and the screen was packed with washed gravel with the top of the gravel, after development of the well, left at 235.0 ft. below the top of

LABORATORY NO. 117,517

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	3.2		Silica	SiO_2	24.4	
Manganese	Mn	0.0		Fluoride	F	0.5	
Calcium	Ca	61.2	3.06	Chloride	Cl	3.0	0.09
Magnesium	Mg	23.2	1.90	Nitrate	NO_3	0.4	0.01
Ammonium	NH_4	3.2	0.18	Sulfate	SO_4	1.0	0.02
Sodium	Na	63.0	2.74	Alkalinity	(as $CaCO_3$)	388.	7.76
Turbidity		22		Hardness	(as $CaCO_3$)	248.	4.96
Color		0		Residue		403.	
Odor		0					

the casings.

A production test was made by the State Water Survey on Apr. 10-11, 1947, using a temporary pumping installation. Before pumping the water level was 78.0 ft. below the top of the 24-in. casing and after 10-hr. pumping at 1015 gpm. the drawdown was 27.5 ft. Recovery of the water level, after shutdown of pumping, was almost instantaneous. During the test, observations of water levels were made in a 2-in. hole located 37 ft. northeast of Well No. 49. The drawdown in the observation well, after 10-hr., was 4.0 ft. from a non-pumping water level of 78.6 ft. On Sept. 12, 1947 when pumping at 1230 gpm. the water level in Well No. 49 was 107.5 ft. and, in the observation well, was 85.2 ft.

The permanent pumping equipment in Well No. 49 consists of 200 ft. of 8-in. column pipe; 12-in., 5-stage Peerless, all-bronze turbine pump, No. 34150, having an overall length of 5.0 ft., and a rated capacity of 1000 gpm. against 225 ft. of head; 205.0 ft. of air line; 55-hp., 1765 rpm. U. S. electric motor.

Analysis of a sample (Lab. No. 117,518) collected Mar. 15, 1949, showed this water to have a hardness of 14.7 gr. per gal., a residue of 310 ppm., and an iron content of 0.7 ppm.

Well No. 49 is in daily service.

Well No. 50 was completed in Nov. 1947 to a depth of 299 ft. by Kelly Well Co. and located about 1500 ft. north of Well No. 49 (or approximately 562 ft. N. and 50 ft. E. of the S. W. corner of Section 33, T. 20 N., R. 8 E.). The ground surface elevation at the well-site is 733t ft.

A 38-in. hole was drilled and Kelly 17-in. id. by 22-in. od. concrete casing and screen were installed from 1.0 ft. above ground level as follows:

56 plain sections from 0 to 223 ft.
18 screen sections from 223 to 295 ft.
1 plain section from 295. to 299 ft.
1 9-in. concrete base plug from 29ft to 299.75 ft.

A 38-in. id. steel surface pipe was left in the hole from 0 to 31 ft. Each screen section contained 184 openings of 6.75 in. by 3/16 in. The annular space between the casing and screen and the wall of the bore-hole was back-filled with selected sand and gravel to 180 ft. below the top. From 30 to 180 ft. the annular space was filled with material from the mud-pit and from the surface to 30 ft. was filled with clay.

The well was developed with a temporary pumping installation and on Nov. 21-22, 1947 a production test was made by the State Water Survey. Before the test the water level was 79.9 ft. and after 24-hr. pumping at an average rate of 1050 gpm. the drawdown was 12.3 ft. One hr. after shutdown the water level was 80.9 ft. Observations were made, during the test, in the small well, 1465 ft. south and 37 ft. from Well No. 49. Before starting the test the water level in the observation well was 87.8 ft. (pumping in Well No. 49) and at the end of the test the drawdown was 1.4 ft.

Analysis of a sample (Lab. No. 117,042) collected Jan. 19, 1949 showed this water to have a hardness of 13.8 gr. per gal., a residue of 288 ppm., and an iron content of 0.8 ppm.

Well No. 50 is in daily service.

All water for the Champaign-Urbana supply is aerated and filtered. Pumpage averages 5.0 mgd. including 1/4 mgd. to the University of Illinois and 1/4 mgd. to the New York Central R. R.

After Wells No. 48 and 49 were put in produc-

LABORATORY NO. 117,042

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.8		Silica	SiO_2	19.2	
Manganese	Mn	Tr.		Fluoride	F	0.1	
Calcium	Ca	50.3	2.52	Chloride	Cl	2.0	0.06
Magnesium	Mg	26.9	2.21	Nitrate	NO_3	0.2	Tr.
Ammonium	NH_4	0.8	0.04	Sulfate	SO_4	0.0	0.00
Sodium	Na	26.0	1.13	Alkalinity (as $CaCO_3$)		292.	5.84
Turbidity		Tr.		Hardness (as $CaCO_3$)		237.	4.73
Color		0		Residue		288.	
Odor		0					

tion in July 1947, all wells in the old field, except No. 35 and No. 40, were shutdown. From July 1947 to July 1948, from 1/2 to 3/4 mgd. were withdrawn from the old wells and 4 1/4 mgd. from the new wells No. 48 and 49 and later on No. 50 when it was completed. During the period, observations of water levels were made in Well No. 36. A recovery of 24.1 ft. is shown in Table 2.

TABLE 2

Date	Ft. to Water
7-25-47	173.1
9-02-47	172.7
10-31-47	167.4
2-10-48	156.0
7-19-48	149.0

CHANDLERVILLE
Cass County
May 5, 1948

The village of Chandlerville (874) installed a public water supply in 1936.

Several test wells were drilled. Test Well No. 3 was located near the end of River St., near the northwestern limits of the village (or approximately 1000 ft. N. and 900 ft. E. of the S. W. corner of Section 31, T. 19 N., R. 9 W.). The ground surface elevation is 460± ft. The well was 34 ft. deep, and was cased with 8-in. pipe to a depth of 24 ft. A 10-ft. length of No. 100 slot Cook screen, wrapped with ordinary screen wire, was installed below the casing.

A production test was made by the State Water Survey on Apr. 16, 1936. After 3-hr. pumping at a rate of 50-52 gpm., the drawdown was 4 ft. 7 in. from a non-pumping water level of 9 ft. 9 in.

The permanent well was constructed to a depth of 32 ft. by Thorpe Concrete Well Co., Alton, and located about 20 ft. north and 10 ft. east of Test Well No. 3. A 26-in. id. by 36-in. od. solid concrete casing extends to a depth of 16 ft., and a porous concrete screen of the same size is installed between the depths of 16 and 32 ft. The annular space outside the porous concrete screen was packed with selected gravel to a thickness of 6 1/2 in.

A production test was made by the State Water Survey on July 9-10, 1936. After 24-hr. pumping at a rate of about 154 gpm., the drawdown was 7.9 ft. from a non-pumping water level of 11.5 ft.

In 1940, it was reported that the non-pumping water level was 14 ft., and that the pump produced 40 gpm. with no noticeable drawdown. Recent water levels have not been reported. In dry seasons water levels are said to be low.

Water is pumped from the well by either of 2 Westco Centrifugal pumps (Serial No. SR6H5-1-89315 BF, and SR6H5-1-89316 BF) each set in a pit 10 ft. deep, and each driven by a 2-hp. Wagner electric motor.

Analysis of a sample (Lab. No. 114,560) collected May 5, 1948 after 40-min. pumping showed the water to have a hardness of 27.4 gr. per gal., a residue of 592 ppm. and a trace of iron.

The water is softened. Analysis of a sample (Lab. No. 114,559) collected May 5, 1948 showed the treated water to have a hardness of 10.1 gr. per gal., a mineral content of 355 ppm. and an iron content of 0.14 ppm.

Pumpage is estimated to average 13,000 gpd.

LABORATORY NO. 114,560

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	Tr.		Silica	SiO_2	18.1	
Manganese	Mn	0.2		Fluoride	F	0.1	
Calcium	Ca	115.8	5.79	Chloride	Cl	23.0	0.65
Magnesium	Mg	44.1	3.63	Nitrate	NO_3	57.8	0.93
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	175.5	3.65
Sodium	Na	17.7	0.77	Alkalinity	(as $CaCO_3$)	248.	4.96
Turbidity		Tr.		Hardness	(as $CaCO_3$)	471.	9.42
Color		0		Residue		592.	
Odor		0					

LABORATORY NO. 114,559

		ppm.			ppm.	epm.
Iron (total)	Fe	0.14	Fluoride	F	0.1	
			Chloride	Cl	23.0	0.65
Turbidity		0	Alkalinity	(as $CaCO_3$)	36.	0.72
Color		0	Hardness	(as $CaCO_3$)	173.	3.46
Odor		Tr.	Total Mineral Content		355.	

CHATSWORTH
Livingston County
May 31, 1947

The public water supply for the town of Chatsworth (1036) was installed in 1909.

Water is obtained from a well located 48 ft. west of Fourth St. and 42 ft. south of Maple St. (or approximately 2600 ft. S. and 1230 ft. E. of the N. W. corner of Section 3, T. 26 N., R. 8 E.).

The well was drilled to a reported depth of 1285 ft. below a ground surface elevation of 733t ft.

The top of the well is at floor level. No specific record of the casing is available, but a proposal by the Harris Pump Co. about 1922 for the installation of an air lift, stipulated a No. 8 Harris standard air lift pump for a well 12 in. in diameter at the top and 8 in. below a depth of 500 ft.

The well is now equipped with an air lift pump with 1 1/2-in. air pipe and 3-in. discharge pipe.

In 1920 the water level was reported to be 65 ft. below the ground surface. In Feb. 1941 a production test was made by the State Water Survey. Before the test was started, the water level was 75 ft.; and after pumping 3 hr. at 96 gpm., the drawdown was 138 ft.

Analysis of a sample (Lab. No. 110,261) collected from the reservoir May 12, 1947, showed the raw water to have a hardness of 24.3 gr. per gal., a residue of 699 ppm., and an iron content of 0.3 ppm. The general character is tpyical for water from sand and gravel in this vicinity.

The water is aerated, filtered, and softened.

Sample-study log of well drilled in 1909 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Glacial drift	118	118
Gravel and sand	20	138
Glacial drift	82	220
Pennsylvanian system (?)		
Siltstone, sandstone and coal measures (?)	40	260
Silurian system		
Niagaran - Alexandrian limestones	355	615
Ordovician system		
Maquoketa shale, some limestone	150	765
Galena - Platteville limestones	445	1210
St. Peter sandstone	75	1285

LABORATORY NO. 110,261

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.3		Silica	SiO_2	12.6	
Manganese	Mn	0.0		Fluoride	F	0.6	
Calcium	Ca	93.9	4.70	Chloride	Cl	2.0	0.06
Magnesium	Mg	44.1	3.63	Nitrate	NO_3	8.8	0.14
Ammonium	NH_4	2.8	0.16	Sulfate	SO_4	183.5	3.82
Sodium	Na	84.9	3.69	Alkalinity	(as $CaCO_3$)	408.	8.16
Color		0		Hardness	(as $CaCO_3$)	417.	8.34
Odor		0		Residue		699.	
Turbidity		10					

Analysis of a sample (Lab. No. 110,477) of treated water collected May 31, 1947 showed it to have a hardness of 5.3 gr. per gal., a mineral content of 710 ppm., and an iron content of 0.44 ppm.

An electrical earth resistivity survey was made by the State Geological Survey in May 1946. The survey completely surrounded the town of Chatsworth and, as a result, recommendations were made to drill test holes, northeast of town from 1/2 to 2 1/2 mi. distant. In May 1947 no test wells had been drilled.

Metered pumpage for the period of Mar. 27 to May 31, inclusive, averaged 39,400 gpd.

LABORATORY NO. 110,477

	ppm.		ppm.	epm.
Iron (total) Fe	0.44	Fluoride F	0.5	
		Chloride Cl	16.0	0.45
Turbidity	0	Alkalinity (as $CaCO_3$)	416.	8.32
Color	25	Hardness (as $CaCO_3$)	90.	1.80
Odor	D	Total Mineral Content	710.	

CHEBANSE
Iroquois County
Feb. 23, 1949

A public water supply was installed for the village of Chebanse (603) about 1874.

Water was obtained from a 6-in. well drilled to a depth of about 100 ft. The water works plant was installed by a private company and when the well supply became inadequate to meet the demands of the entire village, the pumping equipment was not replaced when it became worn out about 1905.

In 1948, the village approved a bond, issue, the proceeds of which were to be made available for a proposed municipal water and sewerage system.

A well was drilled to a depth of 152 ft. by Geo. Berns, Chebanse, and located in the southeast corner of Walnut and First North St. (or approximately 400 ft. S. and 2000 ft. W. of the N. E. corner of Section 14, T. 29 N., R. 14 W.). The ground elevation is 660± ft. The driller reported rock at 70 ft. depth.

The well was cased with 8-in. galvanized steel pipe from 2 1/2 ft. above to 83 1/2 ft. below ground level, penetrating 13 1/2 ft. of bed rock. A production test was made on Feb. 23, 1949, using State Water Survey calibrated measuring equipment. The pumping equipment included a Peerless turbine test pump, powered by an Allis-Chalmers tractor. Before the test the static water level was 39.0 ft. below the top of the casing. After 53-minute pumping at 371 gpm. the drawdown was 20.3 ft. Then after 2-hr. intermittent pumping at a final rate of 455 gpm. the drawdown was 30.5 ft. Thirty minutes after stopping the pump the water level was 45.5 ft.

Analysis of a sample (Lab. No. 117,374) collected Feb. 23, 1949 after 1-hr. pumping at 461 gpm. showed this water to have a hardness of 15.2 gr. per gal., a residue of 469 ppm. and an iron content of 1.7 ppm.

LABORATORY NO. 117,374

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.7		Silica	SiO_2	11.9	
Manganese	Mn	0.1		Fluoride	F	0.7	
Calcium	Ca	64.6	3.23	Chloride	Cl	4.0	0.11
Magnesium	Mg	24.1	1.99	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	0.9	0.05	Sulfate	SO_4	163.9	3.41
Sodium	Na	68.3	2.97	Alkalinity	(as $CaCO_3$)	236.	4.72
Turbidity		33		Hardness	(as $CaCO_3$)	261.	5.22
Color		0		Residue		469.	
Odor		0					

A public water supply was installed by the city of Chenoa (1401) in 1895.

At that time water was obtained from a 183-ft. well, but due to its insufficient yield, an abandoned coal mine was developed as a supply. This was used until 1897 when the mine caved in. A well was drilled 22 in. in diameter, but about 3 years later, it caved in due to weakness of the boiler-iron pipe casing. From 1900 to 1911, water was furnished to the public supply from one of the local canning company wells located in the extreme northern part of town.

In 1911, a well, now called Well No. 1, was drilled by the J. P. Miller Artesian Well Co., Brookfield, and located at the newly constructed water works pumping station 90 ft. east of Lutcher St. and 275 ft. north of the Toledo, Peoria, & Western R. R. (or approximately 1575 ft. N. and 725 ft. W. of the S. E. corner of Section 2, T. 26 N., R. 4 E.).

The well was 2035 ft. deep below a ground surface elevation of 722± ft.

The hole and casing diameter record is given in Table 1.

The well was cleaned by J. P. Miller Co. in 1923.

Water was pumped originally by air lift with the pump placed at 165 ft. In 1938 the pumping equipment consisted of a Cook 2-stroke plunger pump with a 5 3/4-in. by 74-in. cylinder set with the bottom at 264 1/2 ft. Power was furnished by a 15-hp. General Electric motor. Non-pumping water levels have been reported in feet below ground surface, as follows:

Year	Water Level ft.
1914	40
1918	147 1/3
1923	155
1938	176
Sept. 11, 1945	186

The pumping equipment, installed in the summeroff 1946, consists of 250 ft. of 5-in. column pipe; 6-in., 17-stage Peerless turbine pump, No. 33525, having a rated capacity of 150 gpm.; 10 ft. of 5-in. suction pipe; air line of unknown length; 15-hp. U. S. electric motor. The pump discharge is throttled to 55 to 60 gpm. to the storage reservoir.

The pump is operated generally at night and furnishes about 37 1/2% of the public supply.

Analysis of a sample (Lab. No. 105,205) collected Jan. 9, 1946 after 3-hr. pumping, showed the water from Well No. 1 to have a hardness of 13.4 gr. per gal., a residue of 1314 ppm., and an iron content of 1.4 ppm.

In Dec. 1939 the city purchased a well formerly owned by the Bloomington Canning Co. and located 75 ft. east of the center line of the Gulf, Mobile and Ohio R. R., 225 ft. east of Division St. and 600 ft. north of Lincoln St., (or approximately 1940 ft. S. and 300 ft. E. of the N. W. corner of Section 1).

The well, now called Well No. 2, was drilled in 1926 by Mike Ebert, Washington, to a depth of 194 ft. It was cased with 174 ft. of 8-in. black pipe and 20 ft. of 8-in. Cook screen. Water-bearing sand was encountered at 157 ft.

In 1940, during a production test, after 1-hr. pumping at 215 gpm., the drawdown was reported to be 82 ft. from a non-pumping water level of 18 ft. below the pump base.

The pumping assembly includes 160 ft. of column pipe; Cook turbine pump, No. 4552, approximately 160 ft. of air line; 20 ft. of suction pipe; 25-hp. U. S. electric motor.

In Jan. 1946 and on Dec. 8, 1947, the non-pumping altitude gauge reading was 30 ft. above the bottom of the air line and on the same dates, when pumping at 75 gpm., the gauge reading was 12 ft. On Oct. 4, 1948, after 40-minutes pumping at 75 gpm. the gauge reading was 12 ft.

Analysis of a sample (Lab. No. 116,019) collected Oct. 4, 1948 after 40-minutes pumping, showed the water to have a hardness of 7.3 gr. per gal., a residue of 670 ppm., and an iron content of 1.7 ppm. The water is colored. Methane gas was found to be present in a concentration of 7.7 cu. ft. per 1000 gal.

This water is blended with water from the deep well and is aerated, filtered and chlorinated.

Analysis of a sample (Lab. No. 116,033) collected Oct. 4, 1948 showed the treated water, to have a hardness of 8.3 gr. per gal., a mineral content of 770 ppm. and an iron content of 0.62 ppm.

Total pumpage is estimated to average 37,000 gpd. which includes 9000 gpd. metered commercial consumption.

Correlated driller's log of Well No. 1 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay, sand, and gravel	197	197
Pennsylvanian system		
Shale and thin coal beds	281	478
Silurian and Ordovician systems		
Niagaran-Alexandrian series and Maquoketa formation		
Limestone	62	540
Limestone, sandy	65	605
Limestone	205	810
Shale	5	815
Caving limestone	15	830
Limestone	145	975
Ordovician system		
Maquoketa formation		
Blue shale	81	1056
Galena-Platteville formation		
Limestone	374	1430
St. Peter formation		
Sandstone	270	1700
Shakopee formation		
Limestone	226	1926
New Richmond formation		
Sandstone	70	1996
Oneota formation		
Limestone	39	2035

LABORATORY NO. 105,205

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.4		Silica	SiO_2	13.0	
Manganese	Mn	0.0		Fluoride	F	2.	
Calcium	Ca	53.7	2.68	Chloride	Cl	540.0	2.68
Magnesium	Mg	22.9	0.53	Nitrate	NO_3	1.0	.5
Ammonium	NH_4	1.2	.06	Sulfate	SO_4	63.6	1.32
Sodium	Na	419.5	18.06	Alkalinity	(as $CaCO_3$)	316.	6.32
Turbidity		10		Hardness	(as $CaCO_3$)	229.	4.58
Color		5-		Residue		1314.	
Odor (at well)		H_2S		pH = 7.62			

TABLE 1

Hole Record	Casing Record
4-in. from 2003 to 2035 ft.	12-in. from surface to 203 ft. 8-in. from surface to 478 ft. 5-in. liner from 796 to 844 ft. 5-in. liner from 1680 to 1780 ft. 4 1/4-in. liner from 1849 to 1925 ft. 4-in. liner from 1925 to 2003 ft.

LABORATORY NO. 116,019

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.7		Silica	SiO_2	27.4	
Manganese	Mn	0.1		Fluoride	F	0.1	
Calcium	Ca	32.0	1.60	Chloride	Cl	63.0	1.78
Magnesium	Mg	10.9	0.90	Nitrate	NO_3	0.4	0.01
Ammonium	NH_4	9.0	0.50	Sulfate	SO_4	2.3	0.05
Sodium	Na	214.4	9.32	Alkalinity (as $CaCO_3$)		524.	10.48
Turbidity		30		Hardness (as $CaCO_3$)		125.	2.50
Color		70		Residue		670.	
Odor		0		Free CO_2 (calc.)		74.	
Temperature 55° F.				pH = 7.25			

LABORATORY NO. 116,033

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.62		Fluoride	F	0.5	
				Chloride	Cl	149.0	4.20
Turbidity		Tr.		Alkalinity (as $CaCO_3$)		484.	9.68
Color		70		Hardness (as $CaCO_3$)		142.	2.84
Odor		M		Total Mineral Content		770.	
Temperature 60° F.				Free CO_2 (calc.)		41.	
				pH = 7.45			

The public water supply was installed about 1911 by the village of Cherry (583).

Water was obtained from a well located north and west of the intersection of Campbell Ave. and Railroad St. (or approximately 2030 ft. N. and 1350 ft. E. of the S. W. corner of Section 27, T. 17 N., R. 11 E.). The well was approximately 98 ft. deep and cased with 6-in. pipe. The ground surface elevation is 680± ft. The bottom of the well was reported to be in a water-bearing stratum of sand and gravel.

The well was equipped with a single-acting cylinder pump rated at 100 gpm. with the 5-in., working barrel set at about 80 ft. Power was furnished by a 15-hp. Century electric motor. In 1920, the non-pumping water level was reported to be 40 ft. below the ground surface.

Due to frequent and costly breakdowns in the pumping equipment and because of decreased revenue, the public supply was shut off in 1920. Water was pumped into the elevated storage tank for fire protection only. About 1930, the water was lost from the well through the workings of a coal mine. In 1938, it was reported that the well contained 80 ft. of water, but it could be pumped dry in a short time.

The well was abandoned due to subsidence around the top of the well.

Analysis of a sample (Lab. No. 31776), collected Oct. 4, 1915, showed the water from this well to have a hardness of 23.0 gr. per gal., a mineral content of 699 ppm., and an iron content of 2.0 ppm.

In 1937, public interest was revived for a rehabilitation of the water supply. An electrical earth resistivity survey was made by the State Geological Survey. A test hole was drilled by P. E. Millis Co., Byron, to a depth of 470 ft., in 1939, and located 2600 ft. N. and 1320 ft. E. of S. W. corner of Section 27). The elevation of the ground surface is 690t ft.

In 1940, a test hole was drilled by C. W. Varner, Dubuque, Iowa, in the valley of Brush Creek about two miles northwest of the village. The hole was 32 1/2 ft. deep; and after a short production test, it was reported that water could be obtained at a rate of 50 gpm. or more.

The water supply for the village of Cherry is now obtained from a well constructed at 400 ft. S. and 2500 ft. W. of the N. E. corner of Section 21). The well is 33 ft. deep below a ground surface elevation of 695± ft. and is cased with 23 ft. of 10-in.pipe below which is 10 ft. of 10-in. Johnson Everdur welded screen with No. 24 slot openings.

The pumping equipment consists of 25 ft. of 4-in. column pipe; 6-in., 5-stage Fairbanks-Morse turbine pump, No. 11156, rated at 69 gpm. against 60 ft. of head; 29 ft. of air line; 3 ft. of 4-in. suction pipe; 3-hp., 1750 rpm. Fairbanks-Morse electric motor.

A short production test of the new well was conducted by the State Water Survey on Nov. 22, 1940. After pumping 2 hours at 121 gpm., the drawdown was 2 3/4 ft. below a non-pumping water level of 11.3 ft.

Sample-study log of the Cherry test hole furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Till	20	20
Gravel, silty	15	35
Till	40	75
Gravel and sand, silty	10	85
Gravel, sandy, fairly clean, "water, 87-90"	5	90
Pennsylvanian system		
Shale, thin limestone, sandstone and coal beds	320	410
Sandstone, compact	35	445
Shale	25	470

Analysis of a sample (Lab. No. 111,311), collected July 30, 1947 after 2-hr. pumping at 121 gpm., showed the water from this well to have a hardness of 17.5 gr. per gal., a residue of 324 ppm., and an iron content of 1.8 ppm.

The water is aerated and a softening unit is in place but was not in operation on July 30, 1947. No sample of treated water was collected.

Pumpage in July 1947 averaged 24,000 gpd.

LABORATORY NO. 111,311

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.8		Silica	SiO_2	15.7	
Manganese	Mn	0.1		Fluoride	F	0.2	
Calcium	Ca	72.6	3.63	Chloride	Cl	5.0	.14
Magnesium	Mg	28.5	2.34	Nitrate	NO_3	0.9	.01
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	69.1	1.44
Sodium	Na	0.5	.02	Alkalinity	(as $CaCO_3$)	220.	4.40
Color		0		Hardness	(as $CaCO_3$)	299.	5.98
Odor		0		Residue		324.	
Turbidity		10					
Temperature 53° F.							

A public water supply was installed by the city of Chicago Heights (22,461) in 1894.

Water was first obtained from 10 wells drilled in the bottoms of 2 pits located at the northeast corner of East End Ave. and Fourteenth St. The center of the south pit was approximately 66 ft. S. and 850 ft. E. of the N. W. corner of Section 21, T. 35 N., R. 14 E., and the center of the north pit was about 97 ft. north of Fourteenth St. and 25 ft. east of East End Ave. (or approximately 2500 ft. S. and 860 ft. E. of the N. W. corner of Section 21).

The elevation of the ground surface at these pits is 657± ft., and the pits were about 34 ft. deep. It is reported that there were four 4-in. holes in the south pit and six 8-in. holes in the north pit.

In 1910, water was pumped directly from the wells into the distribution system by high-pressure pumps at an average of 3 mgd. With increasing demands and a recession of 50 ft. in the water level below the station floor between 1894 and 1912, the original wells were abandoned as a source of supply. All wells were sealed in these pits by 1917 except one well in the northeast part of the north pit which is still used as an observation well for water levels.

In 1910, 4 wells, No. 11, 12, 13, and 14, were drilled in an area, 11 by 22 ft., in the north end of the Fourteenth St. pumping station at a distance of 30 to 45 ft. from the center of the north pit. These wells were reported drilled to a depth of 300 ft., entirely in the Niagaran limestone with the exception of a few ft. at the surface. They were 15 in. in diameter from the surface to a depth of 150 ft., and then reduced to 12 in. in diameter. In the summer of 1914, the total production was 3.5 mgd. The non-pumping water level was 60 ft. below the surface.

On Nov. 18, 1921, it was reported that Well No. 11 was equipped with a pump of 1300 gpm. capacity which was operated continuously. The well was in service until 1943, and the pumping equipment has been removed. The State Water Survey has a water level recorder installed in the well.

Well No. 12 is still equipped with a Layne turbine pump but has not been operated since 1944. When the water level receded to a depth of 149 ft. in 1944, it was impossible to lower the turbine due to a dog-leg in the well at this depth.

Analysis of a sample (Lab. No. 88722), collected Aug. 14, 1940, showed the water from Well No. 12 to have a hardness of 37.0 gr. per gal., a mineral content of 816 ppm., and an iron content of 0.7 ppm.

Well No. 13 is still equipped with a Layne turbine pump and a 75-hp. Westinghouse electric motor but has not been operated since 1941.

Well No. 14 was reamed out to a depth of 174 ft. by S. B. Geiger & Co., Chicago, and was replaced in operation Nov. 7, 1940 when the water demand was very high.

The following pump installation, made at that time and overhauled in 1945, is still in service: 160 ft. of 7-in. column pipe; 12-in., 4-stage American Well Works turbine pump, No. 61046, rated at 1200 gpm. against 206 ft. of head; 20 ft. of 7-in. suction pipe; 100-hp. U. S. electric motor.

The pump in No. 14 is now operated about 2 hr. daily against 45 to 50 psi. pressure as an auxiliary supply unit to maintain pressure in the mains.

Well No. 15, drilled in 1917, is located about 70 ft. southwest of the center of the 4-well group in the north end of the Fourteenth St. pumping station and 28 ft. northwest of the center of the south pit. It is 24 in. in diameter and 200 ft. deep. The elevation of the ground surface is 657t ft.

This well was reported to have encountered a cavity between depths of 147 and 171 ft. producing about 1400 gpm. On Nov. 18, 1921, water was pumped at a rate of 1400 gpm. for daily periods of 19 to 20 hr. and was the principal source of the public water supply.

The following pump installation is in service: 180 ft. of 8-in. column pipe; 14-in., 3-stage American Well Works turbine pump, No. 63677, rated at 1500 gpm. against 199 ft. of head; 100-hp. U. S. electric motor.

In July 1946 the pump was operated from 8 to 10 hr. daily and discharged about 1200 to 1300 gpm. to the reservoir.

From Mar. 1946 to Aug. 1947 the hardness of weekly composite samples from Well No. 15 and later No. 14 varied from 41 to 63 gr. per gal.

Well No. 16, drilled in 1921, is located about

TABLE 1

Hole Record	Casing Record
26-in. from surface to 205 ft.	22-in. od. from surface to 205 ft.
20-in. from 205 to 695 ft.	18-in. od. liner from 440.5 to 695 ft.
17 1/2-in. from 695 to 1518 ft.	16-in. od. liner from 1518 to 1538 ft.
15-in. from 1518 to 1832 ft.	

40 ft. north of the Fourteenth St. pumping station and 55 ft. north of Well No. 14 of the 4-well group in the north end of the station.

The well is 24 in. in diameter and has a depth of 235 ft. At a depth of 90 ft., the driller encountered a cavity large enough to permit the entrance of a man from the well to make repairs during drilling. At this time, the water level was 97 ft. below an elevation of 657 ft. on the floor of the pumping station. When the pumps were operated in the station wells, the water level was lowered about 18 in.

The following pump installation was in service in July 1946: 210 ft. of 10-in. column pipe; 14-in., 3-stage American Well Works turbine pump, No. 63676, rated at 1500 gpm. against 226 ft. of head; 125-hp. U. S. electric motor.

During 1946, the pump was operated about 2 hr. daily and delivered from 1300 to 1400 gpm.

Well No. 17 is located at the northeast corner of East End Ave. and Main St. (or approximately 600 ft. S. and 450 ft. E. of the N. W. corner of Section 28). It was drilled by S. B. Geiger & Co. and completed to a depth of 1832 ft. on June 28, 1924. The elevation of the pump base is 676.7 ft.

When the drilling of the well had reached a depth of about 1500 ft., a pump was installed and operated at a rate of 1 mgd. from Feb. 12 to Feb. 27, 1923. A production of 890 gpm. against 45 psi. pressure was reported at that time.

After the well was completed, the pump was operated as an auxiliary to the shallow well supply until 1940. Since then it has been operated continuously.

The available data of hole and casing diameters are conflicting between original and later reports, but those given in Table 1 are believed to be the nearest correct.

On Mar. 17, 1944, the water level, after an idle period of 16 hr., was 162 ft. below the pump base. After 30-min. pumping at 1350 gpm. against 45 pounds of discharge pressure, the drawdown was 35 ft., and the temperature of the water was 53° F.

After 3 1/2 hr. of identical operation, the same conditions were observed. The rate of pumpage was then increased to 1500 gpm. against the same discharge pressure; and after 30 min., the drawdown was 39 ft. and the temperature was 53° F. After 4 hr. of similar operation, no changes of drawdown or temperature were observed.

The temperature and analyses indicated the water to be completely from the limestone and none from the sandstone, and no change was observed when the pumping rate was increased from 1350 to 1500 gpm.

After the pump was pulled on July 12, **1946,** the water level was 108 ft. below the pump base. The well had been idle for 3 weeks.

After repairs, the following pumping equip-

LABORATORY NO. 107,306

	ppm.		ppm.
Iron (total) Fe	7.6		
		Chloride	11.0
Turbidity	20+	Alkalinity (as $CaCO_3$)	428.
Color	0	Hardness (as $CaCO_3$)	875.
Odor	M	Total Mineral Content	1160.
Temperature 53.5° F.			

LABORATORY NO. 96,468

	ppm.		ppm.
Iron (total) Fe	1.1	Chloride	3.0
		Alkalinity (as $CaCO_3$)	400.
Turbidity	10	Hardness (as $CaCO_3$)	495.
Color	0	Total Mineral Content	584.
Odor	0		
Temperature 52.5° F.			

ment was re-installed: 260 ft. of 8-in. column pipe; 12-in., 6-stage (all bronze) American Well « Works turbine pump, No. 63166, rated at 1000 gpm. against 324 ft. of head; 260 ft. of airline; 20 ft. of 8-in. suction pipe; 125-hp. U. S. electric motor.

On July 31, 1946 after 5-hr. pumping at 1260 gpm. against a discharge pressure of 54 psi., the drawdown was 14 ft. from a non-pumping water level of 110 ft.

Analysis of a sample (Lab. No. 107,306), collected July 31, 1946 after 7-hr. pumping at 1000 gpm., showed the water from this well to have a hardness of 51 gr. per gal., a mineral content of 1160 ppm., and an iron content of 7.6 ppm.

Well No. 18, located about 100 ft. north of the center line of Tenth St. and 330 ft. east of the center line of Campbell Ave. (or approximately 100 ft. N. and 1600 ft. E. of the S. W. corner of Section 17), and was drilled by S. B. Geiger &

Sample-study log of Chicago Heights Well No. 20 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Glacial drift"	42	42
Silurian system		
Niagaran-Alexandrian dolomites, siltstone at base	383	425
Ordovician system		
Maquoketa shale, some dolomite	240	665
Galena-Platteville dolomites	328	993
Glenwood dolomitic sandstone	7	1000
St. Peter formation		
Sandstone, incoherent	158	1158
Shale	2	1160
Oneota dolomite, thin sandstone and shale beds at base	210	1370
Cambrian system		
Trempealeau dolomite	105	1475
Franconia sandstone and dolomite	135	1610
Galesville formation		
Sandstone and dolomitic sandstone	100	1710
Sandstone, incoherent	45	1755
Eau Claire dolomite, sandstone and thin shale beds at base	34	1789

1789 ft. = **1794** ft. by steel tape measurement

Co. in 1941. The elevation of the pump base is 653 ft. It is 251 ft. deep and cased with 26-in. pipe from 2 ft. above to 55 ft. below the ground surface.

On July 16, 1941, a free flow was reported from the well in excess of 200 gpm. through a 4-in. pipe connected to the side of the casing about 1 ft. above ground surface.

In 1941 it was reported that the well produced 1650 gpm. with a drawdown of 39 ft. In July 1946 a pumping rate of 750 to 850 gpm. was maintained. The following installation was in service: 120 ft. of 8-in. column pipe; 12-in., 4-stage American Well Works turbine pump, No. 64700, rated at 1000 gpm. for 6 stages against 220 ft. of head; 20 ft. of 8-in. suction pipe; 60-hp. Westinghouse electric motor.

Well No. 19 is located north of the Elgin, Joliet, & Eastern R. R. tracks about 100 ft. east of Thorn Creek (or approximately 1300 ft. S. and 1200 ft. E. of the N. W. corner of Section 29). The elevation of the pump base is 675.3 ft. This well was formerly owned and operated by the Elgin, Joliet, & Eastern R. R. but was leased by the city in 1940. It is reported to have a depth of 330 ft. and a diameter of 10 in.

In July 1946 the pump was operating at a rate of about 350 gpm.

The following installation was in service: 100 ft. of 5-in. column pipe; 10-in., 4-stage American Well Works turbine pump, No. 59049, rated at 400 gpm. against 140 ft. of head; 10 ft. of 6-in. suction pipe; 20-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 96,468), collected June 15, 1943, showed this water to have a hardness of 28.8 gr. per gal., a mineral content of 584 ppm., and an iron content of 1.1 ppm.

Well No. 20 is located at the main pumping station about 223 ft. north and 10 ft. east of the intersection of 14th St. and Lowe Ave. (or approximately 2420 ft. S. and 1025 ft. E. of the N. W. corner of Section 21). The elevation of the top of the pump base is 660 ft.

The drilling, casing, "shooting," and cleaning of this well was completed by S. B. Geiger & Co., on Mar. 20, 1942.

The well was 1794 ft. deep from a point 2 ft. above the ground level.

Table 2 shows the hole and casing diameters as reported by the driller.

After drilling was completed, the well was "shot" with 1300 lb. of 100% blasting gelatin, as follows: first shot of 400 lb. between depths of 1740 and 1750 ft.; second shot, 400 lb. between depths of 1631 and 1638 1/2 ft.; third shot, 500 lb. between depths of 1711 and 1719 ft.

The well was cleaned after each shot but only a relatively small amount of sand was removed. After 15-min. pumping on Mar. 27, 1942, the well was found to have 50 ft. of material at the bottom.

On Apr. 8 and 9, 1942, a production test was terminated by pump failure. At the end of a 17-hr. pumping period, the well was producing 634 gpm. with a drawdown of 78 ft. from a non-pumping water level of 216 ft. below the pump base.

After 72-hr. pumping from Apr. 17 to 20, 1942 at a rate of 650 gpm., the drawdown was 91 ft. from a water level of 216 ft. Equilibrium conditions were established near the end of the first 24 hr., and 24 to 72 hr., very little change in conditions was noted except in the temperature of the water which increased from 55° to 57° F.

TABLE 2

Hole Record	Casing Record
30-in. from sur face to 58 1/2 ft.	30-in. spiral casing from surface to 49 ft.
25-in. from 58 1/2 to 259 ft.	26-in. from 6 to 50 ft.
21-in. from 259 to 760 ft.	22-in. from 1 to 258 ft.
17-in. from 760 to 1210 ft.	18-in. liner from 404 ft. 3 in. to 756 ft. 10 in.
14-in. from 1210 to 1794 ft.	15-in. liner from 1127 to 1210 ft.
	The annular space between the 26-in. and 30-in. casings was filled with concrete.

This well was in operation as an auxiliary-reservoir supply unit until Mar. 1943 at which time it was producing about 300 to 350 gpm. It was equipped with 300 ft. of 8-in. column pipe; 12-in., 6-stage American Well Works turbine pump rated at 1400 gpm.; 20 ft. of 6-in. suction pipe; 150-hp. U. S. electric motor.

A production test was attempted on Apr. 3, 1945, but the pump "broke suction" at the end of 1 1/2 min. operating time while producing approximately 300 gpm. The pump could not be throttled down to a discharge low enough to prevent breaking suction or to accurately determine the pumping rate.

A water level recorder was placed in this well on Oct. 22, 1945. The water level was 273 ft. below the top of the pump base. Limestone water was reported entering the well above this level. The well was sounded for depth on Nov. 21, 1945 and found to be 1720 ft. 4 in. below the pump base.

A precast concrete plug, 19 in. in diameter by 24 in. long with 14 in. of tapered point, was set in the top of the 18-in. liner at a depth of 404 ft. 3 in. by the J. P. Miller Artesian Well Co., Brookfield, on Feb. 19, 1946. This was followed by pouring Bentonite and gravel in the well until it was filled to a depth of 12 ft. above the plug. Another precast concrete plug, 20 1/2 in. in diameter and 14 in. long, was lowered into the well and stopped at 326 ft. 4 in. About 2 cubic yards of gravel was poured on top of the plug. On Feb. 26, 1946, the water level was 111.2 ft., and the depth to the top of gravel was 339 ft.

The well has been abandoned as a source of supply and is used for observation of water levels only.

Well No. 21 is located about 100 ft. north of Tenth St. and 245 ft. east of Campbell Ave. (or approximately 100 ft. N. and 1515 ft. E. of the S. W. corner of Section 17), or about 70 ft. west of Well No. 18. The elevation of the pump base is 652± ft.

This well was drilled by the J. P. Miller Artesian Well Co. and was completed in Oct. 1945. It has a depth of 203 ft., and the driller's record of hole and casing diameters is as follows:

An outer casing of 30 in. od. was placed from the surface to a depth of 50 ft., and an inner casing of 24 in. od. from the surface to 58 ft. Both casings were equipped with drive shoes, and the annular space between the casings was sealed with 85 bags of cement pumped in from the top. Below the casing, the hole was 23 in. in diameter to the bottom.

The driller reported a water-bearing crevice at a depth of 70 ft., and the best water-bearing formation was found between depths of 130 and 150 ft. A 23-hr. production test was made, starting at 8:00 a.m. on Oct. 26, 1945. Well No. 18 was operated during the period at an approximate rate of 900 gpm. except for a 2-hr. period between 8:00 p.m. and 10:00 p.m. on Oct. 26, 1945. The elevation of the pump bases were practically identical. A non-pumping water level of 22 ft. below the pump base was reported by the driller for Well No. 21 with No. 18 idle.

The same non-pumping water level may be assumed for No. 18. After 12-hr. operation of both pumps, No. 21, at an average rate of 870 gpm. and No. 18 at an approximate rate of 900 gpm., the drawdown was 24 ft. in No. 21 and 28 ft. in No. 18.

LABORATORY NO. 104,680

	ppm.	epm.			ppm.	epm.
Iron (total) Fe	0.4		Silica	SiO_2	19.0	
Manganese Mn	Tr.		Chloride	Cl	4.0	.11
Calcium Ca	111.6	5.58	Nitrate	NO_3	4.1	.07
Magnesium Mg	45.4	3.74	Sulfate	SO_4	159.2	3.31
Ammonium NH_4	Tr.	Tr.	Alkalinity (as $CaCO_3$)		364.	7.28
Sodium Na	33.4	1.45				
Color	0		Hardness (as $CaCO_3$)		466.	9.32
Odor	0		Residue		618.	
Turbidity	10-		Free CO_2 (calc.)		96.	
Temperature 51.6° F.			pH = 7.0			

TABLE 3

Date	Depth to Water ft.	Date	Depth to Water ft.
1894	4	Jan. 1939	94
June 1908	39	July 1939	85
June 1916	65	Jan. 1940	115
Sept. 1918	102	July 1940	110
May 1919	64	Oct. 1940	144
Oct. 1920	129	Nov. 1940	127
July 1921	60	Mar. 1941	147
Aug. 1922	91	June 1941	119
Jan. 1923	137	Oct. 1941	138
July 1923	126	Apr. 1942	112
Oct. 1924	62	Oct. 1942	133
Aug. 1925	86	June 1943	92
May 1927	55	Mar. 1944	123
Jan. 1933	52	June 1944	100
June 1936	58	Jan. 1945	140
Jan. 1938	93	July 1945	120
June 1938	87	Dec. 1945	146

No. 18 was then shut down for a period of 2 hr., and the pumping rate in No. 21 was increased to 1680 gpm. and held at this rate for 2 hr. after which the drawdown in No. 21 was 45 1/2 ft. and 29 ft. in No. 18. The operation of No. 18 was then resumed at the approximate rate of 900 gpm., but that of No. 21 was reduced to an average of 855 gpm., and both pumps were then operated at these rates for 9 hr. At the end of this period, the drawdown was 24 ft. in No. 21 and 28 ft. in No. 18, indicating no changes in drawdown from the 12-hr. observations.

The following pump installation, made in Nov. 1925, is in service: 120 ft. of 8-in. column pipe; 12-in., 4-stage American Well Works turbine pump rated at 1150 gpm. against 160 ft. of head; 10 ft. of 8-in. suction pipe; 125-hp. U.S. electric motor. In July 1946 this unit was operated continuously and, pumping against 65 lb. of pressure, delivered about 850 gpm.

Analysis of a sample (Lab. No. 104,680), collected Oct. 20, 1945 after pumping 22 hr. at 800 gpm., showed the water from Well No. 21 to have a hardness of 27.2 gr. per gal., a residue of 618 ppm., and an iron content of 0.4 ppm.

Water levels in the wells at the main pumping station have been reported as given in Table 3.

Depths to water are in feet below the station floor (Elev. 657.5 ft.).

Well No. 22 was completed to a depth of 270 ft. in Oct. 1946 by J. P. Miller Artesian Well Co. and located in the northeast corner of Division St. and Sixteenth St. extended (or approximately 1400 ft. N. and 2600 ft. W. of the S. E. corner of Section 19). The ground elevation at the well-site is 675t ft. The well was cased with 33-in. od. pipe from 2.0 ft. above to 71.0 ft. below the ground surface and with 24-in. od. pipe from 2.0 ft. above to 80.0 ft. below ground level. Below the 24-in. casing the hole was finished 23 in. in diameter to the bottom. The annular space outside the 24-in. casing was filled with cement grout. The top of the limestone was reported at 70 ft. and many soft sections but no large crevices were encountered in the limestone.

A production test was made by the State Water Survey on Oct. 24-25, 1946. Before the test was started the water level was 26 ft. below the top of the casing (2.0 ft. above ground level). After 22-hr. pumping at 960 gpm. the drawdown was 21 ft. When pumping for 1 hr. at 1500 gpm. the drawdown was 46 ft. Twelve minutes after stopping the pump, the water level was 28 ft.

Well No. 23 was completed to a depth of 260 ft. in Dec. 1946 by J. P. Miller Artesian Well Co. and located in the southwest corner of the intersection of Wilson Ave. and Thirteenth St. (or approximately 2160 ft. S. and 1234 ft. W. of the N. E. corner of Section 19). The ground elevation at the well-site is 671± ft. The well was cased

with 30-in. od. pipe from the ground surface to 67 ft., penetrating 9 ft. of limestone, and with 24-in. od. pipe from the surface to 78 ft. Below the 24-in. casing the hole was finished 23 in. in diameter to the bottom. The annular space outside the 24-in. casing was filled with cement grout.

A production test was made by the State Water Survey on Dec. 5-6, 1946. Before the test was started the water level was 33.5 ft. below the top of the casing (ground level). After 23-hr. pumping at a rate of 1270 gpm. the drawdown was 28 ft. The rate was gradually accelerated and after 1 1/2-hr. pumping at a final rate of 1810 gpm. the drawdown was 55 ft. Fifteen minutes after stopping the pump the water level was 39 ft.

Analysis of a sample (Lab. No. 108,579) collected Dec. 6, 1946 after 22-hr. pumping at 1200 gpm. showed this water to have a hardness of 28.2 gr. per gal., a residue of 587 ppm. and an iron content of 2.2 ppm.

Total pumpage in 1948 for the city averaged 3.883 mgd.

CHILLICOTHE
Peoria County
Jan. 16, 1947

A public water supply was installed by the city of Chillicothe (2303) in 1891.

Water was obtained from 10 wells driven to a depth of 42 ft. with 8 ft. of strainer on the bottom of each well. The wells passed through 3 or 4 ft. of soil below which was 12 ft. of gravel underlaid by water-bearing sand and fine gravel. In 1915, water was being obtained from 10 wells driven to a depth of 60 ft.

The wells are located in one group in an area about 10 ft. wide and 45 ft. long, and located in the northeast part of town, about 100 ft. from the river (or approximately 1500 ft. N. and 1500 ft. E. of the S. W. corner of Section 21, T. 11 N., R. 9 E.). Six of the wells are 6 in. in diameter, and the remaining four are 4 in. in diameter. Strainers, about 10 ft. long, are at the bottom of each well. Water was pumped by direct suction. The non-pumping water level varied with the river stage. These wells were abandoned in 1944.

In 1944, a new well was drilled by C. W. Varner Well Drilling Co., Dubuque, Iowa. The well is located northwest of Second and Chestnut St. (or approximately 1280 ft. N. and 100 ft. E. of the S. W. corner of Section 21). The well was drilled to a depth of 80 ft. through 3 ft. of top soil, 77 ft. of sand and gravel, and terminating at the top of a limestone formation. The casing and screen record is as follows:

66 ft. 4 in. of 12-in. wi. casing.
18 ft. 4 in. of 12-in. Cook red brass screen having 17 ft. exposed.
The top 8 ft. of screen has No. 30 slot opening.
The next 4 ft. of screen has No. 20 slot opening.
The bottom 5 ft. of screen has No. 30 slot opening.

The elevation of the pump base is 490.5 ft., which is about 2 ft. above the ground surface elevation.

The well is equipped with 60 ft. of 6-in. column pipe; 9 1/2-in., 5-stage Aurora deep-well turbine pump, No. E 2514, rated at 300 gpm. against a head of 205 ft.; the overall length of the pump is 5 ft.; 80 ft. of 1/4-in. galvanized steel air line; 15 ft. of 6-in. suction pipe; 25-hp. General Electric motor.

The bottom of the air line is at elevation 411 ft.

When the well was finished, the non-pumping water level was 48 ft. below the pump base. On Nov. 9, 1944, a short production test was run, and a drawdown of 17 ft. was reported after pumping at a rate of 300 gpm; At present, the non-pumping water level is 58 ft. below the pump base with a drawdown of 10 ft. when pumping at a rate of 300 gpm.

Analysis of a sample (Lab. No. 108,929), collected Jan. 16, 1947, showed the water to have a hardness of 21.8 gr. per gal., a residue of 456 ppm., and an iron content of 0.1 ppm.

The amount of water pumped is measured by a Worthington-Gamon turbine meter, and at present is about 150,000 gpd. The mains are connected to the mains of North Chillicothe so that in case of emergency, water can be pumped to, or received from, the water works at North Chillicothe.

LABORATORY NO. 108,929

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	19.2	
Manganese	Mn	0.0		Fluoride	F	0.2	
Calcium	Ca	89.2	4.46	Chloride	Cl	16.0	0.45
Magnesium	Mg	37.0	3.04	Nitrate	NO_3	32.9	0.53
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	113.8	2.37
Sodium	Na	9.4	0.41	Alkalinity	(as $CaCO_3$)	228.	4.56
Color		0		Hardness	(as $CaCO_3$)	375.	7.50
Odor		0		Residue		456.	
Turbidity		0					
Temperature 55° F.							

CHRISMAN
Edgar County
June 14, 1948

The city of Chrisman (1112) installed a public water supply in 1905.

Water was originally obtained from a well called the South Well, or Well No. 1, drilled in 1905 by A. M. Dillow, Decatur, and located on the north side of the Baltimore and Ohio R. R. at its intersection with Ohio St. (or approximately 2500 ft. S., and 900 ft. W. of the N. E. corner of Section 35, T. 16 N., R. 12 W.). The ground surface elevation is 640± ft.

The well was apparently drilled to a depth of 150 ft. but completed at 132 ft. as the bottom of the 10-in. casing was set at 132 ft.

Water was originally pumped from the well by a 6-in. by 24-in. Gould deep well pump rated at 120 gpm., driven by a gasoline engine. In 1910 or 1911, this was replaced with air lift equipment. The well was reported to yield about 60 gpm. The non-pumping water level in 1912 was reported to be 49 ft. below the ground surface.

In 1913, the well was found to have filled in to a depth of 128 ft., and a 14-ft. length of perforated iron pipe, wrapped with No. 16 mesh, was placed in the bottom, after which the yield was 24 gpm.

In 1921 and 1922, it was reported that the well yielded an average of 66 gpm., and in a short production te st made July 30, 1924 by the State Water Survey the production rate was 63 gpm. The non-pumping water level was reported to be 43.2 ft.

In 1945, the air lift pipes were replaced. The new equipment consisted of 122 ft. 3 in. of 3-in. eductor pipe and 1/4-in. air pipe. The non-pumping water level, with the air lift in the North Well operating, was 56 ft. The production was increased by the installation of the new pipes.

Analysis of a sample (Lab. No. 114,992) collected June 12, 1948 after 4 1/2-hr. pumping showed the water to have a hardness of 19.8 gr. per gal., a residue of 823 ppm., and an iron content of 5.0 ppm.

A second well was drilled in 1905, about 15 ft. west of Well No. 1. This well was 10 in. in diameter, and 109 ft. deep.

The well produced little water and was never used.

Well No. 2, North Well, was drilled in 1926 by Meister Bros. Tuscola, and is located about 100

Correlated driller's log of Well No. 1 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Dirt and clay	18	18
Sand, water	2	20
Clay	66	86
Sand, water	6	92
Clay	28	120
Sand, water	12	132
Pennsylvanian system		
Limestone, some shale at base	18	150

LABORATORY NO. 114,992

	ppm.	epm.			ppm.	epm.
Iron (total)	Fe	5.0	Fluoride	F	0.2	
Turbidity		50	Chloride	Cl	105.0	2.96
Color		35	Alkalinity	(as $CaCO_3$)	628.	12.56
Odor		Tr.	Hardness	(as $CaCO_3$)	340.	6.80
Temperature 55.5° F.			Total Mineral Content		823.	
pH = 7.9			Free CO_2 (calc.)		20.	

ft. north of Well No. 1.

This well is 165 ft.-deep and was drilled 10 in. in diameter to the top of the rock, and 8 in. in diameter to the bottom of the well. A Cook screen, originally installed in the well, clogged rapidly and was immediately replaced by a 16-ft. length of casing, perforated with 1/2-in. holes, between the depths of 116 and 132 ft.

The well is equipped with an air lift. About 160 ft. of 1-in. air pipe and 3-in. eductor pipe were installed originally. In 1945, it was reported that 160 ft. 7 in. of 1 in. air pipe and 3-in. eductor pipe were cleaned and replaced.

The non-pumping water level in 1945, when the air lift in the South Well was operating, was 56 ft.

When the air lifts in this well and the South Well were repaired in 1945, the combined production of the two wells was increased from 65 to 120 gpm.

In 1947, the well was reported to produce 36 gpm. The well was treated with chlorinated lime and muriatic acid by the village on Jan. 28, 1947. Following the treatment, the production was reported to have been increased about 10%.

In Feb., 1947, the non-pumping water level was reported to be 51 ft. below the top of the well.

Analysis of a sample (Lab. No. 114,991) collected June 12, 1948 after 4 1/2-hr. pumping showed the water from Well No. 2 to have a hardness of 15.8 gr. per gal., a residue of 549 ppm., and an iron content of 2.5 ppm. Methane gas has been reported to be present at these wells.

Well No. 3 was completed at a depth of 165 ft. on June 1, 1948 by Harry Cramer, Westville, and located 125 ft. northeast of Well No. 1 and 90 ft. east of Well No. 2. The well was reported to be cased with 10-in. pipe to 107 ft. below which an 8-in. pipe was installed. The pipe was perforated opposite a water-bearing sand and gravel vein from 107 to 124 1/2 ft.

The pumping equipment includes an air lift with 160 ft. of 1 1/4-in. air pipe and 3-in. eductor pipe. The well was placed in service June 3, 1948 and is estimated to yield at a rate of 80 gpm.

The combined yield rate of all three wells is estimated at 150 gpm.

Analysis of a sample (Lab. No. 114,993) collected June 12, 1948 after 4 1/2-hr. pumping showed this water to have a hardness of 16.3 gr. per gal., a residue of 532 ppm., and an iron content of 6.0 ppm.

From June 5, 1947 to June 5, 1948 metered pumpage averaged 50,480 gpd.

LABORATORY NO. 114,991

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.5		Silica	SiO_2	25.9	
Manganese	Mn	0.0		Fluoride	F	0.3	
Calcium	Ca	67.0	3.35	Chloride	Cl	51.0	1.44
Magnesium	Mg	25.2	2.07	Nitrate	NO_3	Tr.	Tr.
Ammonium	NH_4	15.5	0.87	Sulfate	SO_4	0.0	0.00
Sodium	Na	109.3	4.75	Alkalinity (as $CaCO_3$)		480.	9.60
Turbidity		15		Hardness (as $CaCO_3$)		271.	5.42
Color		35		Residue		549.	
Odor		0		Free CO_2 (calc.)		19.	
Temperature 55° F.				pH = 7.8			

CISSNA PARK
Iroquois County
Nov. 17, 1948

A public water supply was installed in 1894 by the village of Cissna Park (582).

Water was first obtained from a flowing well developed at the water works near the center of town. The well was 5 in. in diameter and 150 ft. deep. The top of the well was in the bottom of a brick collecting reservoir 15 ft. in diameter and 11 ft. deep below a ground surface elevation of 682± ft.

This well is maintained as an auxiliary supply unit. On Nov. 13, 1948 the free flow to the collecting reservoirs was measured 15 gpm.

In 1906, a second flowing well 5 in. in diameter was drilled to a depth of 237 ft. and located 20 ft. west of the first well. In 1922 the flow was less than 1 gpm. This well has been capped with concrete.

In 1920, a 3-in. flowing well was drilled to a depth of 171 ft., to supply a privately-owned swimming pool. The flow rate was 25 gpm. The free flow ceased about 1938. The well is capped about 3 ft. below the surface and the pool has been filled in.

In 1921, a well was drilled to a depth of 239 ft. and located 1 1/2 ft. west of 237-ft. well. The well was cased with 4-in. pipe to the bottom. The lower length of casing was perforated and the bottom left open. Water-bearing formations were encountered at 40 and 145 ft. and a sand and gravel formation was encountered at the bottom, from which water was obtained. This well flowed to the large reservoir, but the flow has decreased to a trickel. The well is to be abandoned.

In May 1922, water for the public supply was obtained from the 150 and 239-ft. wells, drilled in 1894 and 1921, respectively. The total yield for both wells, at that time, was estimated to be from 50 to 63 gpm. In Jan. 1944, the entire supply was obtained from the well drilled in 1894, the other well, 239 ft. deep, having become clogged with sand.

In Sept. 1944, a well was drilled to a depth of 163 ft. by L. F. Swanson, Gibson, and located in the southwest part of town, along Pigeon Creek, (or approximately 1000 ft. N. and 700 ft. E. of the S. W. corner of Section 1, T. 34 N., R. 14 W.). The ground elevation is 674± ft.

The well was cased with 150 ft. of 6-in. pipe and 13 ft. of copper screen. The top of the casing was 40 in. above ground level.

When completed, a production test was made by the driller who reported a yield of 200 gpm. with a drawdown of 26 ft. from a static level of 3 in. below the top of the casing. When the pump has been idle for an hour, water still flows from a small pipe outlet, installed in the casing about 1 ft. below the pump base.

The pumping assembly, installed in 1944,

Sample-study log of well drilled in 1944 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Till	45	45
Sand, slightly silty	15	60
Sand and granule gravel	10	70
Till	10	80
Sand	5	85
Sand, gravelly, silty	5	90
No record	5	95
Till	25	120
Sand, slightly silty	5	125
Till	15	140
Sand	5	145
No record	18	163

consists of 30 ft. of 4-in. column pipe; 6-in., 11-stage Fairbanks-Morse turbine pump, No. SW 37187, rated at 150 gpm.; the overall length of the pump is 10 ft.; 10 ft. of 4-in. suction pipe; 5-hp. 1450 rpm. Fairbanks-Morse electric motor.

This well is the principal source of supply.

Analysis of a sample (Lab. No. 116,411) collected Nov. 13, 1948 after 20-minutes pumping, showed this water to have a hardness of 21.7 gr. per gal., a residue of 430 ppm., and an iron content of 0.7 ppm.

Pumpage is estimated to average 65,000 gpd.

LABORATORY NO. 116,411

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.7		Silica	SiO_2	20.7	
Manganese	Mn	Tr.		Fluoride	F	0.1	
Calcium	Ca	86.9	4.35	Chloride	Cl	2.0	0.06
Magnesium	Mg	37.5	3.08	Nitrate	NO_3	0.2	Tr.
Ammonium	NH_4	2.7	0.15	Sulfate	SO_4	30.2	0.63
Sodium	Na	14.5	0.63	Alkalinity (as $CaCO_3$)		376.	7.52
Turbidity		7		Hardness (as $CaCO_3$)		372.	7.43
Color		0		Residue		430.	
Odor		0		Free CO_2 (calc.)		31.	
Temperature 54° F.				pH = 7.5			

CLARENDON HILLS
Du Page County
June 17, 1947

A public water supply was installed under private ownership of the A. T. Mcintosh Co. in 1923. It was operated by the Clarendon Hills Water Co. until June 25, 1936when it was acquired by the village of Clarendon Hills (1281).

The initial supply was obtained from a well drilled to a depth of 875 ft. by F. M. Gray, Jr., Milwaukee, and located about 25 ft. south of Burlington Ave. and 185 ft. east of Gilbert Ave. (approximately 2570 ft. N. and 800 ft. W. of the S. E. corner of Section 10, T. 38 N., R. 11 E.). The elevation of the ground surface is 730+ ft.

The well was reported to be cased with 8-in. pipe from the surface to rock at a depth of 140 ft. and with 202 ft. of 6-in. liner through the shale. A 24-hr. production test made upon the completion of the well indicated a yield of 70 gpm.

In 1932 when pumping at 75 gpm. the drawdown was 270 ft. from a non-pumping water level of 95 ft. below the pump base. The normal rate of production was reported to be 60 gpm. when operating the pump 10 hr. a day. The well was abandoned as a source of supply sometime after 1932, and was capped and sealed at the time the municipal building was constructed at the well-site.

Well No. 2 was drilled to a depth of 250 ft. by Henry Boysen, Jr., Libertyville, in 1932 and located about 100 ft. west of the older well. It is cased with 12-in. id. casing from the surface to a depth of 145 ft., penetrating 5 ft. of rock, followed by a 12-in. hole in limestone to the bottom.

A test made upon the completion of the well by pumping with a plunger pump indicated a production of 150 gpm. with a drawdown of 11 1/2 ft. from a non-pumping water level of 95 ft. below the pump base.

Water levels observed periodically during 1938 show a non-pumping level of 97 ft. and a pumping level of 106 ft.

On May 19, 1947 after 2-hr. pumping at 300 gpm., the water level was 117 ft. and the non-pumping level, following 30 min. of idle period, was 113 ft.

The existing pump installation made on Oct. 25, 1945 is: 146 ft. 7 in. of 6-in. column pipe; 8-in., 4-stage Layne turbine pump, No. 6379 which delivers at a rate of 300 gpm. against 130 ft. of head; the overall length of the pump is 3 ft. 4 in.; 12 ft. 11 in. of 6-in. suction pipe, 160 ft. of 1/4-in. gi. air line; 20-hp. Fairbanks-Morse electric motor.

Analysis of a sample (Lab. No. 110,351) collected May 19., 1947 after 2-hr. pumping at 300 gpm. shows this water to have a hardness of 32.3 gr. per gal., a residue of 687 ppm., and an iron content of 1.5 ppm.

A third well was drilled to a depth of 354 ft. by Layne-Western Co., Chicago, in April-May 1945 and located about 30 ft. north of Sheridan Ave. and 65 ft. east of Ann St. (approximately 650 ft. N. and 2225 ft. E. of the S. W. corner of Section 11). The elevation of the ground surface

Driller's log of Well No. 1 correlated by State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Drift	140	140
Silurian system		
Niagaran - Alexandrian series		
Limestone	192	332
Ordovician system		
Maquoketa formation		
Shale	174	506
Galena - Platteville formation		
Limestone	312	818
St. Peter formation		
Sandstone	57	875

LABORATORY NO. 110,351

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.5		Silica	SiO_2	23.4	
Manganese	Mn	0.0		Fluoride	F	0.3	
Calcium	Ca	145.2	7.26	Chloride	Cl	5.0	0.14
Magnesium	Mg	46.3	3.81	Nitrate	NO_3	0.7	0.01
Ammonium	NH_4	0.8	0.04	Sulfate	SO_4	215.4	4.48
Sodium	Na	25.8	1.12	Alkalinity	(as $CaCO_3$)	380.	7.60
Turbidity		30		Hardness	(as $CaCO_3$)	554.	11.07
Color		0		Residue		687.	
Odor		0		Free CO_2 (calc.)		100.	
Temperature		51.5° F.		pH = 7.0			

is 730± ft.

The well was cased from the surface to a depth of 127 ft. with 12-in. pipe below which the hole was 12-in. diameter to the bottom. Water bearing creviced formations were encountered between depths of 170 and 210 ft., 255 and 280 ft., and 300 and 345 ft. A production test was made on May 19, 1945. After pumping for 9 3/4 hr. at 385 gpm. the drawdown was 12.2 ft. from a non-pumping water level of 91.3 ft. below the top of the casing.

The existing pump installation, made July 8, 1945, is: 150 ft. of 6-in. column pipe; 8-in., 8-stage Layne turbine pump, No. 15022, having an overall length of 5 ft. 4 in. and a rated capacity of 300 gpm. against 230 ft. of head; 50 ft. of 6-in. suction pipe; 160 ft. of 1/4-in. galvanized iron air line; 30-hp. General Electric motor.

This well serves only as an auxiliary supply unit. It is seldom used because the water is untreated.

In 1933 much trouble was caused by the growth of crenothrix in the mains which had been stimulated by the high iron content of the water. A treating plant was constructed and the water treated for iron removal and zeolite softened.

Analysis of a sample (Lab. No. 110,888) collected May 19, 1947, shows the treated water to have a hardness of 2.1 gr. per gal., a mineral content of 673 ppm., and an iron content of 0.1 ppm.

A 3-year record of metered pumpage for the period of Aug. 1, 1942 to Aug. 1, 1945 indicates an average of 97,400 gpd. which varies from a winter minimum average of 87,700 gpd. to a summer maximum average of 120,000 gpd.

LABORATORY NO. 110,888

	ppm.			ppm.	epm.
Iron (total) Fe	0.1	Chloride	Cl	5.	.14
Turbidity	0	Fluoride	F	0.3	
Color	0	Alkalinity	(as $CaCO_3$)	352.	7.04
Odor	Tr.	Hardness	(as $CaCO_3$)	36.	.72
Temperature	53° F.	Total Mineral Content		673.	
pH = 7.65		Free CO_2 (calc.)		20.	

CLIFTON
Iroquois County
Nov. 17, 1948

A public water supply was installed by the village of Clifton (580) before 1897. Water was obtained from a well, 117 ft. deep. About 1897 the water works plant was partly destroyed by fire and the remainder was torn down later.

The public water supply was put back in operation in 1943. A well was drilled to a depth of 137 ft. in 1941 by Hayes and Sims, Champaign, and located at the northwest corner of First St. and Third Ave. (or approximately 2200 ft. N. and 2440 ft. W. of the S.E. corner of Section 3, T. 28 N., R. 14 W.). The ground elevation is 660± ft.

The well was cased with 6-in. pipe from the surface to 96 ft.

A production test was made by the State Water Survey on Aug. 28, 1941. For test pumping, the driller furnished a lift-type pump with 4-in. drop pipe and plunger. The pump was operated from the drill rig motor. Before the test, the static water level was 24 1/2 ft. After 2-hr. pumping at 25 gpm. the drawdown was 2 1/4 ft., and, after an additional 3-hr. pumping at 46 gpm., the drawdown was 3 3/4 ft. Recovery to a 24 1/2-ft. water level was instantaneous. On Nov. 28, 1945, the non-pumping water level was 26 ft. On Nov. 4, 1948, the non-pumping water level was 26 1/2 ft. below the pump base and after 25-minutes pumping at an estimated rate of 50 gpm., the drawdown was 1 1/2 ft.

The pumping assembly, installed in 1943, consists of 40 ft. of 4-in. id. column pipe; 6-in. American Well Works oil-lubricated turbine pump, No. 65373 rated at 50 gpm. at 1740 rpm.; 40 ft. of air line; 1 1/2-hp. 1800 rpm. U. S. electric motor.

Analysis of a sample (Lab. No. 116,365) collected Nov. 14, 1948 after 20-minutes pumping showed this water to have a hardness of 26.0 gr. per gal., a mineral content of 664 ppm.; and an iron content of 0.8 ppm.

The water is aerated and filtered for iron removal. Analysis of a sample (Lab. No. 116,351) collected Nov. 4, 1948 showed the treated water to have a hardness of 26.0 gr.per gal., a mineral content of 567 ppm., and an iron content of 0.1 ppm.

Pumpage is estimated to average 20,000 gpd.

Sample-study log of Well No. 1 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Till	60	60
Gravel	5	65
Till	25	90
Gravel	6	96
Silurian system		
Dolomite	41	137

LABORATORY NO. 116,365

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.8		Silica	SiO_2	12.2	
Manganese	Mn	Tr.		Fluoride	F	0.5	
Calcium	Ca	105.2	5.26	Chloride	Cl	4.0	0.11
Magnesium	Mg	44.2	3.64	Nitrate	NO_3	0.4	0.01
Ammonium	NH_4	2.5	0.14	Sulfate	SO_4	242.9	5.05
Sodium	Na	52.7	2.29	Alkalinity	(as $CaCO_3$)	308.	6.16
Turbidity		7		Hardness	(as $CaCO_3$)	445.	8.90
Color		0		Residue		664.	
Odor		0		Free CO_2 (calc.)		71.	
Temperature 53° F.				pH = 7.05			

CLINTON
DeWitt County
Oct. 14, 1948

A public water supply was installed by the city of Clinton (6331) in 1888.

Water was obtained originally from wells, about 100 ft. in depth and located near Salt Creek, 3 miles south of town. In 1906, due to the inadequacy of that supply, a new source was developed in the south part of town near the pumping station. There were 4 wells in this group, 2 of which were 65 ft. deep and were 4 and 6 in. in diameter. The other 2 wells were 285 ft. deep, with diameters of 6 and 8 in. At times it was necessary to draw water from Salt Creek to supplement the well supply. This method of supplying Clinton with water continued until about 1911 when work on enlarging the pumping station was started. Constant increase in demand for water made it necessary to drill additional wells.

Well No. 1, East Well, was drilled in 1913 by Ira De Ment, Hallsville, and located in the southeast corner of the pumping station building (or approximately 2240 ft. N. and 1460 ft. W. of the S. E. corner of Section 34, T. 20 N., R. 2.E.). Well No. 1 is 12 in. in diameter and 327 ft. deep from a ground surface elevation of 730t ft. The well was equipped with an 8-in. brass screen.

The pumping equipment consists of 180 ft. of 5-in. column pipe; 9 5/16-in. 4-stage Peerless oil lubricated turbine pump, No. 8031, rated at 250 gpm. against 150 ft. of head; the overall length of the pump is 3 ft. 2 1/4 in.; 180 ft. of air line; 15-hp., 1765 rpm. westinghouse electric motor.

In May 1923, the non-pumping water level was 121 ft. below the surface and when pumping with air lift equipment at 386 gpm. the drawdown was 17 ft. In July 1938, when pumping with the turbine unit at 250 gpm., the drawdown was 20 ft. from a water level of 150 ft. In Oct. 1941, after the well had been treated with 40 to 50 lb. of chlorine, the pumping rate was increased to 247 gpm. from a rate of 130 gpm. prior to the treatment. On Apr, 3, 1948 while pumping at an estimated rate of 160 gpm. the water level was reported to be 129 ft.

Analysis of a sample (Lab. No. 108,365) collected Nov. 26, 1946 while pumping at 200 gpm. showed this water to have a hardness of 17.5 gr. per gal., a total mineral content of 526 ppm., and an iron content of 1.8 ppm.

Well No. 2 was drilled in 1914 to a depth of 358 ft. by Omer Kersey, Bedford, Ind., and located 70 ft. west and 20 ft. south of Well No. 1. The well was cased with 12-in. pipe and with8-in. brass screen.

Well No. 2 is equipped with 170 ft. of 5-in. column pipe; 9 5/16-in., 4-stage Peerless oil lubricated turbine pump, No. 8032, rated at 250 gpm. against 150 ft. of head and having an overall length of 3 ft. 2 1/4 in.; 192 ft. of 1/4-ihV air line; 20 ft. of 5-in. suction pipe; 15-hp., 1765 rpm. Westinghouse electric motor.

In Oct. 1941, after the well had been treated with 40 to 50 lb. of chlorine, the pumping rate was increased to 267 gpm. from a rate of 160 gpm. prior to the treatment.

Well No. 3 was drilled in 1923 to a depth of 360 ft. by M. Ebert and Son, Washington, and located 155 ft. west and 40 ft. north of Well No. 1. The well was cased with 12-in. pipe to 340 ft. and with 20 ft. of iron pipe screen, perforated with 1/4-in. hoies.

The pump assembly consists of 150 ft. of 7-in. column pipe; 9 1/2-in., 5-stage Peerless turbine pump, No. 8033, rated at 500 gpm. against

LABORATORY NO. 115,703

	ppm.	epm.			ppm.	epm.
Iron (total) Fe	0.5		Silica	SiO_2	13.9	
Manganese Mn	0.0		Fluoride	F	0.7	
Calcium Ca	72.2	3.61	Chloride	Cl	51.0	1.43
Magnesium Mg	32.1	2.64	Nitrate	NO_3	0.4	0.01
Ammonium NH_4	4.2	0.24	Sulfate	SO_4	0.2	Tr.
Sodium Na	67.9	2.95	Alkalinity (as $CaCO_3$)		400.	8.00
Turbidity	30		Hardness (as $CaCO_3$)		313.	6.25
Color	0		Residue		510.	
Odor	Tr.		Temperature 55.3° F.			

150 ft. of head; overall length of pump is 4 ft. 4 3/16 in.; 174 ft. 10 in. of 1/4-in. gi. air line; 21.75 ft. of 6-in. suction pipe; 30-hp. Westinghouse electric motor.

In Oct. 1941, after the well had been treated with 40 to 50 lb. of chlorine, the pumping rate was increased to 460 gpm. from a rate of 350 gpm. prior to the treatment. On Feb. 19, 1946, the non-pumping water level in Wells 1, 2 and 3 was reported to be about 118 ft. below the ground surface. In Apr. 1948, the pumps in Wells 1, 2, and 3 were operated continuously, except for short periods at night. On Aug. 26, 1948 when pumping at an estimated rate of 250 gpm. the water level in Well No. 3 was 148 ft. below the pump base. The pumps in Wells No. 1, 2, and 5 were operating at the time.

Well No. 3 is in service about 22 hr. daily. Analysis of a sample (Lab. No. 115,703) collected Aug. 26, 1948 after 5-hr. pumping, showed this water to have a hardness of 18.3 gr. per gal., a residue of 510 ppm., and an iron content of 0.5 ppm. Methane gas is present in the water from these wells in a concentration of 7.5 cu. ft. per 1000 gal.

All water is aerated.

Well No. 4, formerly one of the old 8-in. wells drilled in 1906, was rehabilitated in 1940 by installing a 6-in. screen and casing inside the old 8-in. casing. The well was equipped with a 4-in. pump, rated at 230 gpm. and set at 140 ft.

In Oct. 1941, after the well had been treated with 40 to 50 lb. of chlorine, the pumping rate was increased to 220 gpm. from a rate of 180 gpm. prior to the treatment. An attempt was made in 1946 to salvage the screen but it became lodged in the well and nothing more was done to the well.

Old Well No. 4 has been abandoned.

Well No. 5 was completed in Jan. 1946, at a depth of 361 ft. by Layne-Western Co., Chicago, and located 250 ft. west of Quincy St. extended, and 50 ft. north of the Illinois Central R. R. switch line (or approximately 2320 ft. N. and 1940 ft. W. of the S. E. corner of Section 34.). The ground surface elevation is 725± ft.

The well was cased as follows: 26-in. od. outer casing from the ground surface to 312 ft.; 14-in. od. inner casing from the ground surface to 211 1/2 ft.; 12-in. id. pipe from 211 1/2 ft. to 321 ft. 1 in.; 12-in. Layne shutter Armco-iron screen, with No. 80 slot openings, from 321 to 361 ft. About 30 cu. yd. of gravel was placed in the annular space outside of the screen and between the inner and outer casings.

When the well was finished in Jan. 1946 the drillers reported the water level to be 119 ft. and after 7-hr. pumping at 410 gpm. the drawdown was 19 ft. Due to critical need for the well to be in service, a temporary pump of unrecorded capacity was installed with 170-ft. setting. After 6 months the production had declined and after removing the pump, the well was surged and a quantity of sand was removed.

The permanent pump was installed July 26, 1946, with a setting of 150 ft. The pump was in service until Oct. 1947, at which time the pump was breaking suction. The well was surged and the pump reset at 195 ft. During the surging,

Sample-study log of Well No. 5 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Silt and till	60	60
Sand, silty	35	95
Granule gravel and sand, silty	20	115
Sand and granule gravel, clean	5	120
Sand, gravelly, silty	40	160
Sand, clean	5	165
Sand and granule gravel, silty	80	245
Silt, sand and gravel	15	260
Sand, some granule gravel, slightly silty	40	300
Sand, some gravel	50	350
Sand, and granule gravel, silty	10	360

about 2 cu. ft. of sand was bailed out and the gravel pack dropped about 25 ft., equivalent to a volume of 60 cu. ft. After this work, the pump was restored in the well and, when pumping at 500 gpm. the drawdown was 46 ft. from a water level of 124 ft. When pumping at 575 gpm. the drawdown was 53 ft. On Nov. 10, 1947 the pumping level was reported to be 190 ft. or 13 ft. lower than on the previous Oct. date.

On Apr. 3, 1948, arrangements were made to pour 2500 gal. of 15% hydrochloric acid into the well. Before the acid treatment, a production test was made by the State Water Survey. Water was pumped for 40 minutes at a rate of 136 gpm. with a drawdown of 66 ft. from a non-pumping water level of 121 ft. Soon after the introduction of the acid into the well, two violent reactions occurred. Water, acid, and foam squirted through openings in the pump base. The pump was not operating at the time. A sample of water collected shortly after the acid treatment was completed showed some very fine sand almost resembling mud.

Before acidizing, the top of the gravel pack was 31 ft. 3 in. below the pump base, and after acidizing was 36 ft. 8 in. below the base. The pumps in Wells 1, 2, and 3 were operated continuously during the production tests, except that the pump in Well No. 3 was shut down while the acid was in Well No. 5.

After cleaning out the well, a production test was made by the State Water Survey. At the start of the test, while pumping at 260 gpm. the drawdown was 26 ft. from a water level of 121 ft. After 4-hr. pumping at rates gradually accelerated from 260 to 508 gpm. the final drawdown was 58 ft.

After the acid treatment, the pumping level, during regular operation, was maintained at 15 lb. pressure above the bottom of the air line. Within 2 months the pumping level dropped off to about 9 lb. On a Sunday, the well was treated with chlorine and Calgon, with periodic surging, after which the pumping level was 121b. The following Sunday a 50% greater dose of the same treatment was applied and the pumping level raised to 14 1/2 lb. pressure above the bottom of the air line.

On Aug. 26, 1948, after 5-hr. pumping at an estimated rate of 500 gpm., the water level was 170 ft. below the pump base.

The pumping equipment consists of 190 ft. of 8-in. column pipe; 10-in., 4-stage Layne turbine pump, No. 15772, rated at 650 gpm.; the overall length of the pump is 4 ft. 3 in.; 195 1/2 ft. of air line; 10 ft. of 8-in. suction pipe; 40-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 114,041) collected Apr. 4, 1948 after 4-hr. pumping at 508 gpm. showed this water to have a hardness of 19.7 gr. per gal., a mineral content of 555 ppm., and an iron content of 1.9 ppm.

Well No. 5 is in service for periods of 22 hr. daily.

In an effort to supplement the city's water supply, 2 test wells have been drilled.

Test Well No. 1 was completed to a depth of 336 ft. in May 1948 by Layne-Western Co. and located 1500 ft. northwest of Well No. 1, (or approximately 2570 ft. N. and 2500 ft. E. of the S. W. corner of Section 34). The well was finished in 60 ft. of sand and gravel, and was cased with 6-in. pipe from the surface to 316 ft. and with 22 ft. 7 in. of 5-in. Johnson Everdur screen, having 20 ft. of exposed length and having No. 20 slot openings.

A production test was attempted by the State Water Survey on May 28, 1948. Because the test-well had not been completely developed, no significant amount of water could be pumped. It is estimated that 150,000 gal. of water were pumped into the well at a rate of 200 gpm. under pressure of 60 to 70 psi. The formation did not take it.

A second test well, now called Well No. 4, was drilled in July 1948 to a depth of 345 ft. by Layne-Western Co. at a location 80 ft. north of the old abandoned well No. 4 and 25 ft. northeast of Well No. 6, (or approximately 2200 ft. N. and 1150 ft. W. of the S.E. corner of Section 34). The ground surface elevation is 702t ft. or 23 ft. lower than at Well No. 5.

The test well was cased with 6-in. pipe from the surface to 308 ft. and with 22 ft. 10 in. of 5-in. Johnson Everdur screen, with 20 ft. exposed length. The No. 20 slot openings in the screen were enlarged to 3/32 in. Below the screen, the hole was back filled with gravel.

A production test was made by the State Water Survey on July 15, 1948. For test purposes, a 5-in. American Well Works turbine pump, rated at 250 gpm., at 150 ft. head was attached to 180 ft. of 4-in. column pipe; a 15-hp., 3600 rpm. U. S. electric motor furnished the power. Before the

test the water level was 100 1/2 ft. below the pump base and after 4-hr. pumping at rates increasing from 107 to 204 gpm., the drawdown was 25 ft. Ten minutes after stopping the pump, the water level had returned to the starting level.

This well is being maintained for service as permanent Well No. 4. The pumping equipment, installed July 15, 1948, is still in place.

Well No. 6 was completed to a depth of 345 ft. in Oct. 1948, by Layne-Western Co. and is located 22 1/2 ft. west of permanent Well No. 4. A 32-in. diameter hole was drilled to a depth of 305 ft. and a 26-in. outer casing was set from the surface to 305 ft. with the annular space outside the casing filled with drill cuttings, soil and clay. The inner casing consists of 197 ft. of 14-in. casing and 108 ft. of 12-in. casing swedged together at a depth of 197 ft. Forty feet of 12-in. Layne shutter screen was attached to the bottom of the 12-in. casing, with the bottom of the screen at 345 ft. below ground level. The lower 5 ft. of screen was cone-shaped with the bottom 24 in. in diameter. The annular space between the casings and outside the screen was filled with selected gravel.

A production test was made onOct. 14 and 1,6, 1948, using State Water Survey calibrated measuring equipment. On Oct. 14th, before the test was started, the, water level in Well No. 6 was 104 ft. below the top of the casing. The pump in Well No. 4 was being operated at the time and the water level in Well No. 4 was 125 ft. below the top of the casing. After 4 1/2-hr. pumping in Well No. 6 (with pumping from Well No. 4 at 200 gpm.) the drawdown in Well No. 6 was 29.0 ft. (the added drawdown in Well No. 4 was 1.0 ft.) and after a total of 8-hr. pumping in Well No. 6 at a final pumping rate of 585 gpm. the drawdown in Well No. 6 was 24.4 ft. (the added drawdown in Well No. 4 was 3.0 ft.)

The temporary test-pump equipment used on Oct. 14th, included a 5-stage turbine with the top set at 170 ft. For the test on Oct. 16th the pump was reduced from 5 stages to 2 stages and the top of the pump set at 150 ft. in an attempt to get higher engine speed and greater pump capacity.

Before starting the test on Oct. 16th the water level in Well No. 6 was 102 ft. (Pump in Well No. 4 running continuously). The pumping rate in Well No. 6 was started at 590 gpm. and gradually increased. After 3 1/2-hr. pumping at a final rate of 805 gpm. the drawdown was 23.6 ft. (the added drawdown in Well No. 4 was 5.5 ft.) Pumping was then gradually reduced in Well No. 6 and after 1 1/2-hr. at a final rate of 610 gpm. the drawdown in Well No. 6 was 22.2 ft. (the drawdown in Well No. 4 was 5+ ft.). Pumping was stopped in Well No. 6 and 12 minutes later the water level was 106 ft.

Analysis of a sample (Lab. No. 116,186) collected Oct. 14, 1948 after 8-hr. pumping at 585 gpm. showed the water in Well No. 6 to have a hardness of 20.0 gr. per gal., a residue of 543 ppm. and an iron content of 8.5 ppm. The turbidity at this time was 100 ppm.

From July 17, 1947 to July 19, 1948 metered pumpage for the city of Clinton averaged 859,000 gpd. of which 128,000 gpd. was used by Goodyear Footwear Plant, Illinois Central R. R. and Beatrice Foods Co.

A public water supply was installed by the village of Coal City (1852) about 1892. The plant was operated by the Public Service Co. of Northern Illinois from 1910 - 1921 but has since been municipally operated.

Water was first obtained from a well drilled about 1892 by Gray Brothers, Chicago, and was located near present Well No. 1 near the city hall and adjacent to the railroad tracks. The well was 350 ft. deep below a surface elevation of 565± ft. The hole and casing record is given in Table 1.

The 4-in. casing was directly connected to the well section.

When the well was completed, the free flow was sufficient to make pumping unnecessary. About 1894, a Knowles 14-in. by 7-in. by 12-in. duplex steam pump was installed. In 1910 the well was equipped with an 8 1/4-in. by 10-in. Gould triplex pump rated at 500,000 gpd. and gear-connected to a 30-hp. Westinghouse electric motor.

In 1914 the non-pumping water level was 32 ft. and in 1919, 33 ft. below the ground surface.

Analysis of a sample (Lab. No. 53080) collected Jan. 15, 1925 after the pump had operated for several hr., showed the water to have a hardness of 28.7 gr. per gal., a residue of 1191 ppm., and an iron content of 2.8 ppm.

About 1926 this well was abandoned and was plugged.

In 1925, C. S. Cumming, Gardner, drilled a well about 8 ft. from the old well, (approximately 2275 ft. S. and 75 ft. E. of the N. W. corner of Section 2, T. 32 N., R. 8 E.). The new well, known as Well No. 1 was drilled to a depth of 265 ft. and reported to be cased with 12-in. pipe from the surface to 40 ft. and 10-in. pipe from the surface to 190 ft. A 6-in. liner was set at 256 ft., the length of the liner was about 6 ft.

In 1927 it was reported that when pumping at 300 gpm. the drawdown was 2 ft. from a non-pumping level of 50 ft. In 1937 the W. L. Thorne Co., Des Plaines, reamed the well, after which the hole and casing records were as given in Table 2.

The annular space between the 2 casings was filled with cement.

In 1945 it was reported that the pumping water level was 142 ft.

The well is temporarily out of service. The 10-in., 4-stage American Well Works turbine pump, No. 61710, having a rated capacity of 425 gpm. against 197 1/2 ft. of head, and the 30-hp. U. S. electric motor were removed about June 1, 1947, and are to be replaced by a new turbine pump and some new column sections now on order. The installation when completed will consist of 160 ft. of 7-in. column pipe (2 new 5-ft. sections of heavy brass pipe to be placed immediately above the bowls, and 5 new 10-ft. sections of 6-in. gwi, column pipe); 11 1/2-in. 4-stage (all bronze bowls and stainless steel shaft) American Well Works turbine pump having a rated capacity of 500 gpm. against 240 ft. of head at 1750 rpm.; the length of the pump is 4 ft. 5 11/16 in.; 160 ft. of 1/4-in. brass pipe air line; 30 ft. of 8-in. suction pipe; 30-hp. United States electric motor.

The pump change was necessitated by the

TABLE 1

Hole Record	Casing Record
Pit from surface to 30 ft.	7-in. from surface to about 285 ft.
8-in. from 30 to 350 ft.	4-in. from surface

TABLE 2

Hole Record	Casing Record
30-in. from surface to 30 ft.	20-in. from surface to 214 ft.
20-in. from 30 to 214 ft.	10-in. from surface to 214 ft.
10-in. from 214 to 260 ft.	

LABORATORY NO. 112,574

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.6		Silica	SiO_2	23.2	
Manganese	Mn	0.0		Fluoride	F	0.5	
Calcium	Ca	38.5	1.93	Chloride	Cl	2.0	0.06
Magnesium	Mg	16.7	1.37	Nitrate	NO_3	0.4	0.01
Ammonium	NH_4	0.6	0.03	Sulfate	SO_4	31.3	0.65
Sodium	Na	52.2	2.27	Alkalinity (as $CaCO_3$)		244.	4.88
Turbidity		15.		Hardness (as $CaCO_3$)		165.	3.30
Color		0		Residue		317.	
Odor		Tr.					

erection of a new 100,000 gal. capacity elevated steel storage tank on the site which requires a pump pressure of 53 psi. to fill the tank.

About Oct. 1, 1947 the distance to water was 117 ft. below the pump base after the well had been idle 4 months and Well No. 3 located about 30 ft. east was not in operation.

Well No. 2 (South side) was drilled in 1929 to a depth of 129 ft. by C. S. Cumming and located about 40 ft. north of the south corporate limits and 90 ft. east of the center line of the Chicago & Alton R. R. (or approximately 40 ft. N. and 1250 ft. E. of the S. W. corner of Section 2). The elevation of the top of the casing is 571± ft.

Casing Record

16-in. wi. from the surface to 12 ft.
12-in. wi. from the surface to 33 ft.
12-in. hole from 33 to 129 ft.

The following pump installation, made in Apr. 1930, is in service: 100 ft. of 6-in. drop pipe; single-acting Deming plunger pump, Fig. 1062, Serial No. 33408, having a 5 1/2-in. cylinder and 18-in. stroke with bottom of suction at 120 ft.; 7 1/2-hp. Westinghouse electric motor rated at 1160 rpm. The theoretical displacement of the pump, when operated at a speed of 27 spm., is about 50 gpm., which is greater than the present productive capacity of the well estimated to be 25 gpm.

The pump is operated about 10 hr. daily and furnishes water principally to the Atlas Wall Paper Mills. Water from Well No. 2 is not metered.

Analysis of a sample (Lab. No. 112,574) collected Nov. 15, 1947 after 7-hr. pumping at an estimated rate of 25 gpm., showed this water to have a hardness of 9.6 gr. per gal., a residue of 317 ppm., and an iron content of 0.6 ppm.

Well No. 3 located 30 ft. east of Well No. 1, was drilled to a depth of 360 ft. by W. L. Thorne Co., in 1937. The surface elevation is 565± ft.

The hole and casing record is given in Table 3.

The annular space between the 20-in. casing and the 12-in. casing was filled with cement.

This well is equipped with: 160 ft. of 7-in. Toncan-iron column pipe; 4-stage, 12-in. Ameri-

Sample-study log of Well No. 3 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
No record	40	40
Pennsylvanian system		
Shale, some sandstone, limestone and coal	115	155
Ordovician system		
Maquoketa shale	60	215
Galena limestone	150	365

TABLE 3

Hole Record	Casing Record
24-in. from surface to 200 ft.	24-in. drive pipe from surface to 30 ft.
19-in. from 200 to 300 ft.	20-in. from surface to 200 ft.
12-in. from 300 to 360 ft.	12-in. from surface to 213 ft.

can Well Works turbine pump, No. 61079, rated at 500 gpm. against 240 ft. of head at 1750 rpm.; the overall length of the pump is 4ft. 5 11/16 in.; 160 ft. of 1/4-in. od. copper tubing air line; 30 ft. of 8-in. Toncan-iron suction pipe; 50-hp. U. S. electric motor, No. 166,773.

In 1938 it was reported that the non-pumping water level was 69 ft. and when pumping at 700 gpm. the drawdown was 42 ft. In 1945 it was reported that the pumping water level was 136 ft. OnNov. 15, 1947 the water level was 143 ft. after 45-minute pumping at 700 gpm. and after a 1-hr. idle period the water level was 111 ft.

Analysis of a sample (Lab. No. 112,573) collected Nov. 15, 1947 after 3/4-hr. pumping at 700 gpm., showed the water to have a hardness of 28.6 gr. per gal., a residue of 1470 ppm., and an iron content of 1.2 ppm. The quality is similar to that obtained in 1938 and appears to be typical for water from the St. Peter sandstone and the Galena-Platteville formations in this vicinity.

Water from Well No. 1 and 3 is metered and, from Nov. 14, 1946 to Nov. 14, 1947, averaged 258,000 gpd. Water from Well No. 2 is not metered and is estimated to average 15,000 gpd. The total pumpage from all wells is estimated at 273,000 gpd.

Water is furnished to the village of Eileen.

LABORATORY NO. 112,573

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.2		Silica	SiO_2	11.2	
Manganese	Mn	0.0		Fluoride	F	0.6	
Calcium	Ca	112.2	5.61	Chloride	Cl	225.0	6.35
Magnesium	Mg	51.2	4.21	Nitrate	NO_3	0.5	0.01
Ammonium	NH_4	1.4	0.08	Sulfate	SO_4	516.7	10.75
Sodium	Na	327.8	14.25	Alkalinity	(as $CaCO_3$)	352.	7.04
Turbidity		5		Hardness	(as $CaCO_3$)	491.	9.82
Color		0		Residue		1470.	
Odor		Tr.		pH = 7.25			
Temperature		52.7° F.		Free CO_2 (calc.)		52.	

COAL VALLEY
Rock Island County
Oct. 15, 1947

The source of the village of Coal Valley (243) water supply is a well located on Lot 1 of Block 5 about 10 ft. south of State Highway No. 150 (or approximately 100 ft. N. and 2550 ft. E. of the S. W. corner of Section 26, T. 17 N., R. 1 W.).

The well was drilled in 1902 by Mr. Bailey, Moline, to a depth of 375 ft. below a ground surface elevation of 630± ft. An 8-in. casing extended from the surface to 150 ft., below which the hole was 6 in. in diameter.

A plunger pump is installed with a 3 1/4-in. by 24-in. cylinder reported to be set at 100 ft. below the top of the casing. The pump was originally operated by a one-cylinder semi-diesel engine which was replaced by a 5-hp. 1750 rpm. Westinghouse electric motor, No. 2444246. The motor is shaft-connected to the old engine, and the pump is belt-driven from the engine pulley.

In April 1938 the non-pumping water level was reported to be 50 ft. below the top of the casing and daily pumpage averaged 1500 gal.

Analysis of a sample (Lab. No. 112,248), collected Oct. 16, 1947 after 1-hr. pumping showed this water to have a hardness of 11.4 gr. per gal., a residue of 428 ppm., and an iron content of 0.6 ppm.

The water is chlorinated periodically.

LABORATORY NO. 112,248

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.6		Silica	SiO_2	14.9	
Manganese	Mn	0.0		Fluoride	F	0.3	
Calcium	Ca	45.4	2.27	Chloride	Cl	6.0	0.17
Magnesium	Mg	19.7	1.62	Nitrate	NO_3	11.8	0.19
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	20.6	0.43
Sodium	Na	95.0	4.18	Alkalinity	(as $CaCO_3$)	364.	7.28
Turbidity		Tr.		Hardness	(as $CaCO_3$)	195.	3.89
Color		0		Residue		428.	
Odor (at well)		H_2S					
Temperature 53° F.							

Correlated driller's log of Rock Island County Home well furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay, soil at top and bottom	104	104
Pennsylvanian system		
Shale, thin limestone bed	96	200
Devonian and Silurian systems		
Limestone, thin shale bed	57	257
Limestone, water	38	295
Limestone, thin shale bed at base	46	341
Limestone, water	19	360
Shale strip	1	361
Limestone	54	415
Sandrock (probably dolomite), water	19	434

In 1947 pumpage averaged 7500 gpd.

ROCK ISLAND COUNTY HOME

A well was drilled at the Rock Island County Home, in 1940, by D. E. Edwards, West Branch, Iowa, and located about 1 1/2 miles southwesterly of Coal Valley, (or approximately 2600 ft. S. and 800 ft. W. of the N. E. corner of Section 3, T. 16 N., R. 1 W.). The well was drilled to a depth of 434 ft. below a ground surface elevation of 725± ft.

The well was cased with 300 ft. of 6-in. cast-iron pipe, and the casing cemented at top andbottom. The hole was 10 in. in diameter from 0 to 295 ft.; 8 in. from 295 to 300 ft.; and 6 in. from 300 to 434 ft.

During the drilling, water was reported between depths of 275 and 295 ft., between 341 and 360 ft. and from 415 to 434 ft. After completion of the well, the water level was reported to be 168 ft. 10 in. below the top of the casing, and the drawdown was 21 ft. when pumping at a rate of 50 gpm.

The village of Cobden(1098) installed a public water supply in 1934.

Water is obtained from a well drilled in 1934 by Charles Haverstick, DeSoto, Mo., and located about 1200 ft. south of Ash St. and 200 ft. east of East St. (or approximately 1020 ft. N. and 570 ft. W. of the S. E. corner of Section 30, T. 11 S., R. 1 W.). This well was drilled to a depth of 226 ft. below a surface elevation of 610± ft.

The well was cased with 8-in. pipe to a depth of 146 ft. 3 in. with the top of the casing 1 ft. 9 in. above the ground surface.

The well is equipped as follows: 175 ft. of column pipe; 8-in., 6-stage, Cook deep-well turbine, No. 1254, estimated discharge of 175 gpm; 20 ft. of 6-in. suction pipe; 10-hp. U. S. electric Co. motor No. 10, operating at 1760 rpm.

The State Water Survey made a 3 1/2-hr. production test on June 25, 1934. The well produced an average of 190 gpm. with a drawdown of 14 1/2 ft. from a non-pumping water level of 83.25 ft. below the ground surface. When the pump was pulled for repairs on Feb. 7, 1943 the distance to water measured 83 1/4 ft. below the pump house floor after 12 hr. of idle period.

Analysis of a sample (Lab. No. 113,372) collected Feb. 2, 1948 after 1/2-hr. pumping at 175 gpm., showed the water to have a hardness of 11.8 gr. per gal., a residue of 295 ppm., and an iron content of 0.1 ppm.

All water is aerated, filtered and softened.

The treating plant was temporarily out of service.

The estimated average pumpage is 58,000 gpd.

Sample-study log of well drilled in 1934 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Silt	5	5
Mississippian system		
Chester series		
Glen Dean limestone and shale	55	60
Hardinsburg sandstone, calcareous	5	65
Golconda limestone	25	90
Cypress sandstone, silty, compact, thin shale bed from 205-208	128	218
Paint Creek shale	8	226

LABORATORY NO. 113,372

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	16.6	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	69.4	3.47	Chloride	Cl	9.0	0.25
Magnesium	Mg	6.8	0.56	Nitrate	NO_3	2.4	0.04
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	44.2	0.92
Sodium	Na	17.9	0.78	Alkalinity (as $CaCO_3$)		180.	3.60
Turbidity		0		Hardness (as $CaCO_3$)		202.	4.03
Color		0		Residue		295.	
Odor		Tr.		Free CO_2 (calc.)		111.	
Temperature 58° F.				pH = 6.6			

The city of Colchester (1426) installed a public water supply in 1935.

Water was originally obtained from a well dug about 1932, and located near the northwest corner of the intersection of Lee and Fulton St. (or approximately 2000 ft. S. and 300 ft. E. of the N. W. corner of Section 18, T. 5 N., R. 3 W.). The ground surface elevation is 690t ft.

The well was reported to be about 76 ft. deep and 6 ft. in diameter and connected with abandoned mine workings.

The walls were lined with a thickness of 6-in. brick.

During the construction, it was reported that a centrifugal pump rated at 600 gpm. was operated in the well, and that after 24-hr. pumping the drawdown was 50 ft. from the non-pumping water level of 14 ft.

The State Water Survey made a production test on Oct. 10, 1935. The well was equipped with a 5-stage Sterling Unitype turbine, operating at 1800 rpm. Pumping was started at 150 gpm. and in 8 hr. the rate declined to 133 gpm. where it remained constant with a drawdown of 16 ft. from a non-pumping water level of 27 ft. below the pump base. In July, 1941, the water level was declining at the rate of 1 ft. per month, and it was estimated that about 2 months supply remained in the working. In 1945, the well had not been used for two years, but the mine workings had not refilled with water.

The well is used only when demand exceeds the supply obtained from a well drilled in 1942.

Analysis of a sample (Lab. No. 76801), collected Oct. 10, 1935, showed the water to have a hardness of 23.3 gr. per gal., a residue of 542 ppm., and an iron content of 0.3 ppm.

A well was drilled in 1941 by W. H. Mourning, Colchester and located in the southwest corner of the city, near the end of Lee St., (or approximately 2640 ft. S. and 850 ft. W. of the N. E. corner of Section 13, T. 5 N., R. 4 W.). This well was reported to have penetrated an old mine entry at a total depth of 62 ft.

The well was cased with 10-in. pipe to a depth of 31 ft.

The non-pumping water level was 20 ft. in Nov., 1940, and about 50 ft. on July 2, 1941.

Very little water was obtained from this well.

Amine shaft located about 800 ft. south of the well was then equipped with a pump but this source was soon abandoned.

In 1942, a well was drilled by W. H. Mourning, at the "Terra Cotta" or "Curnow" mine, located about 1/2 mile northwest of the city (or approximately 2300 ft. N., and 2100 ft. E. of the S. W. corner of Section 7, T. 5 N., R.3 W.). The ground surface elevation is 660± ft. The well was drilled near the air shaft after the air shaft was sealed, and is 8 in. in diameter and approximately 91 ft. deep. The mine area is estimated to be 15 acres.

Pumping equipment is installed as follows: 80 ft. of 4 1/2-in. od. column pipe; 6-in., 20-stage Pomona MC turbine pump No. 77319, rated at 100 gpm. against 240 ft. of head when operating at 1760 rpm; 91 ft. of air-line; 18-in. length of strainer with bottom of strainer 87 1/2 ft. below top of well; 10-hp., 1760 rpm. U. S. electric motor.

Correlated driller's log of well drilled in 1941 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil	3	3
Clay, yellow	15	18
Clay, sandy	9	27
Pennsylvanian system		
Soapstone	23	50
Coal	2	52
Fire Clay	10	62
Lump rock	at	62

When the well was completed, the water level was 70 ft. In 1945, it was reported that the pump operated 10-12 hr. per day with an actual discharge of about 170 gpm., and that there had been no lowering of the water level. In Mar., 1948, the non-pumping water level was 79 ft. This well has furnished the village supply since 1942.

Analysis of a sample (Lab. No. 113,831), collected Mar. 15, 1948, showed the water to have a hardness of 43.2 gr. per gal., a residue of 1132 ppm., and an iron content of 2.3 ppm.

The water is aerated, filtered, softened and chlorinated.

Analysis of a sample (Lab. No. 113,830), showed the treated water to have a hardness of 10.1 gr. per gal., a mineral content of 1172 ppm., and a trace of iron.

Pumpage is estimated at 70,000 gpd.

LABORATORY NO. 113,831

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.3		Silica	SiO_2	16.7	
Manganese	Mn	0.4		Fluoride	F	0.1	
Calcium	Ca	190.1	9.51	Chloride	Cl	10.0	0.28
Magnesium	Mg	64.2	5.28	Nitrate	NO_3	Tr.	Tr.
Ammonium	NH_4	1.1	0.06	Sulfate	SO_4	479.5	9.98
Sodium	Na	104.2	4.53	Alkalinity	(as $CaCO_3$)	456.	9.12
Turbidity		30.		Hardness	(as $CaCO_3$)	740.	14.79
Color		0		Residue		1132.	
Odor		0					
Temperature		48 1/2° F.					

LABORATORY NO. 113,830

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	Tr.		Fluoride	F	0.2	
				Chloride	Cl	13.0	0.37
Turbidity		0		Alkalinity	(as $CaCO_3$)	468.	9.36
Color		0		Hardness	(as $CaCO_3$)	173.	3.46
Odor		0		Total Mineral Content		1172.	

COLFAX
McLean County
Oct. 7, 1948

The village of Colfax (821) installed a public water supply in 1910.

Water was obtained originally from a well located in the center of the village. This well was dug to a depth of 28 ft. and drilled to a total depth of 54 ft. below the ground surface. The well was abandoned in 1912.

In 1912, two wells were drilled and were located 5 ft. apart, 150 ft. north of Cooper St. and 40 ft. west of Harrison St. (or approximately 1200 ft. S. and 40 ft. W. of the N. E. corner of Section 3, T. 24 N., R. 5 E.). The surface elevation is 750± ft.

The North Well was 6 in. in diameter and 105 ft. deep. The well was drilled to a total depth of 340 ft., but the casing was pulled back to 105 ft. where a vein of water of stronger flow was encountered.

The well was cased with 6-in. pipe to a depth of 90 ft., and a 15-ft. length of screen was placed at the bottom.

In 1918, the non-pumping water level was reported to be 15 ft., and the pumping level 22 ft.

The well was equipped with a Goulds pump, rated at 75 gpm., but was used only for emergency service, and was not used after 1924. The well is filled with yellow clay.

The South Well, now called Well No. 1, is 105 ft. deep. The 10-in. casing extends to a depth of 90 ft., and a 15-ft. length of screen extends from 90 to 105 ft.

In 1924 it was reported that the non-pumping water level was 20 ft. below the ground surface, and that the water level was not lowered by pumping. The pump was operated about 5 hr. per day.

In 1933 a broken shaft was replaced, and in 1936, the bowl section was badly worn and replaced.

The pumping equipment installed in 1940, consists of 60 ft. of 6-in. column pipe; 8-in. 5-stage Fairbanks-Morse turbine pump, having a rated capacity of 100 gpm. against 88 ft. of head; 10 ft. of 6-in. suction pipe; 60 ft. of 1/4-in. gi. air line; 7 1/2-hp. U. S. electric motor.

Well No. 1 is maintained for emergency supply.

Analysis of a sample (Lab. No. 39699) collected on July 6, 1918, showed the water to have a hardness of 18.8 gr. per gal., a residue of 739 ppm., and an iron content of 2.7 ppm. The water had a pH of 6.7. Methane gas was found to be present in a concentration of 9.0 cu. ft. per 1000 gal.

Well No. 2 was drilled to a depth of 102 ft. in 1945 by Hayes & Sims, Champaign, and was located 150 ft. north of Well No. 1 (or approximately 1050 ft. S. and 50 ft. W. of the N. E. corner of Section 3).

The 12-in. casing extends from 8 in. above the ground surface to 88 ft. 4 in. below which is 16 ft. 4 1/2 in. of Johnson Everdur screen, having No. 25 slot openings. The screen has an exposed length of 13 ft.

A production test was made July 25, 1945 by the. State Water Survey. For test purposes, the pumping equipment consisted of a 7 1/2-ft. cylinder pump, attached to 65 ft. 3 in. of 6-in. column pipe and 61 ft. of air line. Power was furnished from the drill rig. After 6-hr. pumping at

Correlated driller's log of the North Well furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Black soil	20	20
White soil	10	30
Hard clay	50	80
Fine sand	7	87
Sand, water-bearing	16	103
Gravel	57	160
Mississippian system		
Lime rock	180	340

95 gpm. the drawdown was 7.5 ft. from a non-pumping water level of 33.5 ft. below the top of the casing.

On Sept. 27, 1948, after a 2-hr. non-pumping period the water level was 28 ft. below the pump base (1 ft. below top of casing) and after 2 1/2-hr. pumping the water level was 43 1/2 ft.

The pump assembly, installed May 20, 1948, consists of 60 ft. of 6-in. column pipe; 8-in., 4 or 5-stage Aurora Pump Co. turbine pump, No. 32342, having a rated capacity of 150 gpm. against 88 ft. of head; 60 ft. of 1/4 -in. gi. air line.

Analysis of a sample (Lab. No. 115,949) collected after 2 1/2-hr. pumping on Sept. 27, 1948, showed the water to have a hardness of 22.0 gr. per gal., a residue of 664 ppm., and an iron content of 1.8 ppm. Methane gas was found to be present in a concentration of 4.5 cu. ft. per 1000 gal.

All water is aerated, softened and chlorinated.

Analysis of a sample (Lab. No. 116,037) collected Sept. 27, 1948 showed the treated water to have a hardness of 4.4 gr. per gal., a mineral content of 374 ppm. and an iron content of 0.15 ppm.

Pumpage is estimated to average 43,910 gpd.

LABORATORY NO. 115,949

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.8		Silica	SiO_2	30.9	
Manganese	Mn	0.0		Fluoride	F	0.3	
Calcium	Ca	91.1	4.56	Chloride	Cl	59.0	1.66
Magnesium	Mg	36.3	2.98	Nitrate	NO_3	0.4	0.01
Ammonium	NH_4	13.3	0.74	Sulfate	SO_4	0.2	Tr.
Sodium	Na	103.7	4.51	Alkalinity (as $CaCO_3$)		556.	11.12
Turbidity		15		Hardness (as $CaCO_3$)		377.	7.54
Color		30		Residue		664.	
Odor		Tr.		Free CO_2 (calc.)		127.	
Temperature		53.7° F.		pH = 7.05			

LABORATORY NO. 116,037

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.15		Fluoride	F	0.3	
				Chloride	Cl	66.0	1.86
Turbidity		0		Alkalinity (as $CaCO_3$)		208.	4.16
Color		20		Hardness (as $CaCO_3$)		76.	1.52
Odor		M		Total Mineral Content		374.	
Temperature		58° F.		Free CO_2 (calc.)		.02	
				pH = 10.15			

A public water supply was installed in 1892 by the city of Collinsville (9767).

Water was obtained from 2 wells, 60 ft. apart and 600 ft. deep, located on the north side of Church St. between Morrison and Center St. Water levels were reported to be within 120 and 165 ft. of the ground surface in 1892 and 1898, respectively. The ground elevation is 565± ft.

Analysis of a sample (Lab. No. 4271) collected Oct. 26, 1898 showed this water to have a hardness of 9.9 gr. per gal., a mineral content of 2489 ppm., and an iron content of 2.5 ppm.

The wells were abandoned about 1902 and the supply has since been obtained from wells located in the American Bottoms about 1 1/4 mile west of Collinsville.

Four wells were drilled in 1902 to depths of 70 to 90 ft. and located at the waterworks, onthe south side of U. S. Highway No. 40, about 1/4 mile west of the foot of the bluff (or approximately 500 ft. N. and 3570 ft. E. of the S. W. corner of Section 31, T. 3 N., R. 8 W.). Later, wells were drilled to a depth of 100 ft. and as the sand was coarser at that depth, the older wells were deepened. All of the wells were 10 in. in diameter. In 1919, one of the 10-in. wells was reconstructed by the Well Casing and Strainer Manufacturing Co., Alton, and was cased with 26-in. id. concrete pipe. The lower 45 ft. of the casing was porous concrete to act as a strainer.

In 1923 the non-pumping water level was reported at one time to be 14 ft. below the ground level elevation of 428t ft. and at another time in the same year, it was 17 1/2 ft. When pumping at 1000 gpm. the water was reported to be lowered to 35 ft.

In 1923 it was reported that the strainers in the seven 10-in. wells in use were badly clogged and practically all water was obtained from the 26-in. well, which was first designated as Well No. 1. Later it was changed to Well No. 4 and finally abandoned prior to 1938.

In 1923, another of the old 10-in. wells was reconstructed by Parker, St. Louis, Mo. This well was designated as Well No. 2 and was cased with 26-in. id. concrete pipe to a depth of 97 ft. The lower 30 ft. of the casing was porous concrete. Prior to reconstruction of Well No. 2, the yield in Well No. 4 (old No. 1) had been 1000 gpm. In 1928 the yields from Well No. 4 and No. 2 was 750 and. 800 gpm. respectively.

Between 1923 and 1928, two more of the old 10-in. wells were reconditioned by Chas. E. Wise, St. Louis, and were later designated as No. 1 and No. 3, after the abandonment of the original Well No. 1 which had been designated as Well No. 4 after 1923. Wells 1,2, and 3 were about 20 to 25 ft. apart and arranged in a southeast-northwest line, south of the pumping station. Well No. 4 was located about 40 ft. east of the pumping station.

Wells No. 1 and No. 3 were cased with 24-in. id. concrete pipe to 100-ft. depth and cater screens, 30 ft. long were set in both wells. Wells No. 2, 3 and 4 must have been abandoned, because they cannot be identified in the present system of well-numbering or location.

The present water supply is obtained from three wells, No. 1, No. 2 and No. 4 located south of the pumping station and roughly in a southeast-northwest line, with Well No. 1 at the southerly end of the line.

Well No. 1 is believed to be the 6ame Well No. 1 thatwas reconditioned by Chas. Wise about 1928. The pumping equipment consists of 85 ft. of 10-in. column pipe; Aurora turbine pump head fitted with No. 14 Johnson Pump Co.;4-stage pump, rated at 1375 gpm. against 70 ft. of head at 1160 rpm.; 6 ft. of 10-in. suction pipe; 50-hp. Wagner electrical motor, No. 361787.

Correlated driller's log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and clay	22	22
Sand	48	70
Water sand	18	88
Gravel	9	97

The pump discharges at the rate of 100 gpm. When a new well under construction is completed, it is planned to clean and apply an acid treatment to Well No. 1.

Well No. 2 was reported to be drilled in 1936 to a depth of 100 ft. by Chas. Wise and is located a little north and 95 ft. west of Well No. 1. This could be the Well No. 2, reconstructed by Parker in 1923. If so, it was reconditioned, not drilled, by Wise in 1936. It is cased with 26-in. concrete pipe.

The pumping equipment consists of 85 ft. of 10-in. column pipe; 3-stage Byron Jackson turbine pump No. 2 LC 4, rated at 800 gpm. against 70 ft. of head at 1150 rpm.; 6 ft. of 10-in. suction pipe; 25-hp. General Electric motor, No. 4809989.

The pump discharges at a rate of 500 gpm.

Well No. 3 was drilled in 1945 to a depth of 100 ft. by Harold Watson, East St. Louis, and located between Wells No. 1 and No. 2. The well was in service about 1 year and then abandoned. Some of the records refer to this well as No. 5, probably to avoid confusion with the old Well No. 3.

Well No. 4 is reported to have been drilled in 1940 to a depth of 100 ft. by Chas. Wise and located 60 ft. northwest of Well No. 2. It is cased with 26-in. id. concrete pipe. The pumping equipment consists of 85 ft. of 10-in. column pipe; Johnson turbine pump, No. 202933, Serial No. 7875, 6 ft. of 10-in. suction pipe; air line of unknown length; 40-hp., 1160 rpm. Louis Allis electric motor, No. 338893.

Well No. 6 was drilled in 1948 to a depth of 93 ft. by Harold Watson and is located east of the pumping station and about 75 ft. north of Well No. 1. The construction of the well had been completed but the well is not yet in service.

A 44-in. casing was set with the bottom at 93 ft. A 24-in. inner casing with 31 ft. 5 in. of 24-in. screen was set with the bottom of the screen at 93 ft. The space between the casings was packed with gravel and the outer casing then pulled back. The final length of 44-in. casing was 33 ft. 8 in. from the surface. The screen has No. 100 slot openings.

The pump in Well No. 6 was removed from Well No. 3, abandoned about 2 years ago, and consists of 72 ft. of 10-in. column pipe; 3-stage Byron Jackson pump head fitted with a No. 14 Johnson Pump Co. turbine pump, rated at 1200 gpm. against 70 ft. of head at 1150 rpm.; 8 ft. of 10-in. suction pipe; 40-hp. Wagner electric motor, No. 351624.

When the well was completed, the static water level was 24 ft. 10 in. below ground level. The water was chlorinated and pumped for a few hours on Dec. 13, 1948

Analysis of a composite sample (Lab. No. 116,736) collected Dec. 13, 1948 from the reservoir, showed the water from the three wells to have a hardness of 24.6 gr. per gal., a residue of 521 ppm., and an iron content of 0.3 ppm.

The water is not treated.

Pumpage is estimated to average 1.7 mgd.

LABORATORY NO. 116,736

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.3		Silica	SiO_2	29.8	
Manganese	Mn	0.3		Fluoride	F	0.4	
Calcium	Ca	103.5	5.18	Chloride	Cl	11.0	0.31
Magnesium	Mg	39.3	3.23	Nitrate	NO_3	6.1	0.10
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	123.6	2.57
Sodium	Na	7.6	0.33	Alkalinity	(as $CaCO_3$)	288.	5.76
Turbidity		2		Hardness	(as $CaCO_3$)	421.	8.41
Color		0		Residue		521.	
Odor		0					

COMPTON
Lee County
Jan. 19, 1948

The village of Compton (300) installed a public water supply in 1895.

Water has been obtained from 2 wells located in the village hall on the east side of 4th St. between Main and Cherry St. (approximately 2395. ft. S. and 1265 ft. E. of the N. W. corner of Section 11, T. 37 N., R. 1 E.). At the top of the wells is a pit 4 ft. deep. The ground surface elevation is 982± ft.

The East Well was reported to be 335 ft. deep and 3 in. in diameter and was equipped with a 2-stroke American Well Works pump with the pump cylinder wedged into the casing at a depth of 272 ft. In 1937 the pump failed in the well, and the well has been out of service. The pump has been removed.

The West Well is located 8 ft. west of the East Well and was reported originally to be 335 ft. deep. In 1938, the depth was reported to be 315 ft. and cased with 8-in. id. pipe from the surface to 300 ft. and 6-in. id. pipe from 300 to 307 ft. A 4 1/2-in. casing was set from 307 ft. to the bottom of the hole.

In 1927, the non-pumping water level was reported to be 155 ft. below the floor, and in 1938, during a production test by the American Well Works Co., the drawdown was 29 ft. from a non-pumping water level of 235 ft. At that time, the following pump was installed: American Well Works oil lubricated turbine pump No. 61826, rated at 70 gpm. against 412 ft. of head at 1750 rpm.; 15-hp. U. S. electric motor, No. 162290. A new assembly was made in Jan. 1948 and now includes 290 ft. of 5-in. column pipe; 290 ft. of air line terminating at top of stages; 5-in. suction strainer with close nipple (no suction pipe); 7 5/8-in. od., 14-stage American Well Works pump.

Analysis of a sample (Lab. No. 113,200) collected Jan. 9, 1948, after 1 1/2-hr. pumping, showed this water to have a hardness of 11.8 gr. per gal., a residue of 284 ppm., and an iron content of 1.2 ppm.

The water is not treated. Pumpage is estimated at 23,000 gpd.

LABORATORY NO. 113,200

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.2		Silica	SiO_2	19.9	
Manganese	Mn	0.0		Fluoride	F	0.5	
Calcium	Ca	46.5	2.33	Chloride	Cl	1.0	0.03
Magnesium	Mg	20.6	1.70	Nitrate	NO_3	0.2	Tr.
Ammonium	NH_4	0.4	0.02	Sulfate	SO_4	0.0	0.00
Sodium	Na	30.8	1.34	Alkalinity (as $CaCO_3$)		268.	5.36
Turbidity		10		Hardness (as $CaCO_3$)		202.	4.03
Color		0		Residue		284.	
Odor		Tr.		Temperature 52° F.			

COWDEN
Shelby County
July 22, 1948

The village of Cowden (709) installed a public water supply in 1941.

Well No. 1, or High School Well, was drilled for the high school, about 1935 by E.O.Baker and Sons, Sigel, and was later acquired by the village. The well is located in the Kaskaskia River bottom, about one mile southeast of the village (or approximately 750 ft. S. and 400 ft. W. of the N.E. corner of Section 10, T. 9 N., R. 3 E.). The ground surface elevation at the well-site is 520± ft.

The well is 51 ft. deep, and is reported to be 10 in. in diameter, with a 4-ft. length of 10-in. screen exposed between the depths of 48 and 51 ft.

The well was equipped in 1941 as follows: 40 ft. of 5-in. column pipe; 17-stage, 6-in. Fairbanks-Morse turbine pump, No. 11012, having an overall length of 8 ft. 2 5/8-in., and rated at 75 gpm. against 212 ft. of head; no suction pipe; no air line; 7 1/2-hp. Fairbanks-Morse electric motor operating at 1750 rpm.

Correlated driller's log of Well No. 1 furnished by the State Geological Survey:

Formation	Thickness ft.	Thickness in.	Depth ft.	Depth in.
Pleistocene system				
Sand, dirty	35		35	
Sand and gravel	8	6	43	6
Clay	3		46	6
Gravel and sand	4	6	51	

The driller reported that, when the well was completed in 1935, it produced 180 gpm. to free discharge. The well was given an acid treatment in 1943, which temporarily increased its capacity from 20 to 100 gpm. However, by June 1944, the supply was inadequate and a new well was drilled. The pump has been overhauled and reinstalled and the unit is now maintained for emergency supply.

Analysis of a sample (Lab. No. 91357) collected Sept. 5, 1941, showed the water to have a hardness of 14.1 gr. per gal., a residue of 437 ppm., and an iron content of 0.2 ppm.

Well No. 2 was drilled in June, 1944 to a depth of 56 ft. by E. C. Baker and Sons, and is located 100 ft. southeast of Well No. 1. The well is cased with 10-in'. pipe from 2 ft. above to 44 ft. below ground level and with a 10-in. Johnson Everdur screen from 44 to 54 ft. The bottom 3. ft. of the drilling was in shale.

On June 15, 1944, the static water level was 18 ft. 2 in. below the top of the casing and after 9-hr. pumping at 225 gpm. the drawdown was reported to be 20 ft. 4 in. On June 16, 1944 and 15 hr. later, the water level was 18 ft. 2 in. Then after 9-hr. pumping at 225 gpm. the drawdown was 18 ft. 8 in.

The pumping equipment consists of a Fairbanks-Morse turbine pump, No. 29881, rated at 100 gpm., driven by a 10-hp. Fairbanks-Morse electric motor.

Analysis of a sample (Lab. No. 115,229) collected from the storage tank July 8, 1948 showed the water to have a hardness of 21.0 gr.per gal., a residue of 420 ppm., and an iron content of 0.1 ppm.

Pumpage is estimated to average 20,000 gpd.

LABORATORY NO. 115,229

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	20.4	
Manganese	Mn	Tr.		Fluoride	F	0.1	
Calcium	Ca	87.3	4.37	Chloride	Cl	7.0	0.20
Magnesium	Mg	34.5	2.84	Nitrate	NO_3	9.5	0.15
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	62.3	1.30
Sodium	Na	2.8	0.12	Alkalinity	(as $CaCO_3$)	284.	5.68
Turbidity		0		Hardness	(as $CaCO_3$)	361.	7.21
Color		0		Residue		420.	
Odor		10		Free CO_2 (calc.)		61.	
				pH = 7.0			

CRESCENT
Iroquois County
Nov. 18, 1948

A public water supply was installed about 1892, by the village of Crescent (332).

Water was obtained from two 1 1/4-in. flowing wells with pumps operated by a windmill. In 1903, because the small wells were not yielding much water, a 4-in. well was drilled. In 1908 a second 4-in. well was drilled and located with the older well on the village hall lot at the northeast corner of Main and Grant St. (or approximately 40 ft. S. and 1496 ft. E. of the N. W. corner of Section 5, T. 26 N., R. 13 W.). The ground surface elevation is 645± ft.

The well was cased the entire depth of 120 ft. and water flowed from the well into a wooden collecting reservoir.

In 1921, some sand was pumped from the well, in an effort to increase the yield, but without success.

A new 4-in. Kewanee triplex pump No. 10355 and 7 1/2-hp. Imperial electric motor were installed in 1922 to pump water from the reservoir, and was operated 1 1/2 to 2 hr. periods twice weekly. At the same time, the reservoir did not over flow until about 36 hr. after stopping the pump.

About 1934 the well was abandoned and plugged.

A flowing well was drilled in 1934 to a depth of 122 ft. by F. P. Campbell, Crescent, and located 4 ft. east of the old well.

Correlated driller's log of well drilled in 1934 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay	8	8
Sand	2	10
Clay	60	70
Sand grading into gravel	52	122

The well was cased with 4-in. pipe the entire depth of 122 ft. and with no screen.

In 1939, when the reservoir was empty, about 10 hr. time was required to fill it. The reservoir capacity was estimated to be 20,000 gal.

The artesian flow has ceased and the well is now directly connected to the Kewanee suction pump and motor installed in 1922. This well is the sole source of public supply.

Analysis of a sample (Lab. No. 116,413) collected Nov. 13, 1948 showed this water to have a hardness of 21.0 gr. per gal., a residue of 490 ppm., and an iron content of 0.9 ppm.

Pumpage is estimated to average 9000 gpd.

LABORATORY NO. 116,413

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.9		Silica	SiO_2	22.0	
Manganese	Mn	Tr.		Fluoride	F	0.2	
Calcium	Ca	88.1	4.40	Chloride	Cl	5.0	0.14
Magnesium	Mg	34.0	2.79	Nitrate	NO_3	0.4	0.01
Ammonium	NH_4	2.3	0.13	Sulfate	SO_4	95.9	1.99
Sodium	Na	33.6	1.46	Alkalinity (as $CaCO_3$)		332.	6.64
Turbidity		9		Hardness (as $CaCO_3$)		360.	7.19
Color		0		Residue		490.	
Odor		0		Temperature 54° F.			

CRESTON
Ogle County
Dec. 3, 1947

The public water supply for the village of Creston (284) was installed in 1906.

Water is obtained from a well drilled to a depth of 585 ft. in 1907 by C. H. Feldott, Batavia, and R. L. Ferguson, Creston, and located 75 ft. south of North St. between Main and Prairie St. (approximately 1575 ft. S. and 800 ft. W. of the N. E. corner of Section 23, T. 40 N., R. 2 E.). The elevation of the ground surface is 903± ft.

The well was cased as follows: 8-in. from surface to 180 ft.; 6-in. from 150 to 403 ft.; 4 1/2-in. from 339 to 417 ft.

Sixty-six ft. of 4 1/2-in. casing was pulled when Jacuzzi pump was installed.

In 1944, the original Deming pump and assembly was removed and replaced by a Jacuzzi jet pump with 158 ft. of 2 1/2 and 3-in. air and eductor pipes; 40 ft. of suction pipe; 10-hp., 3470 rpm. General Electric motor, No. 5620662. At that time the non-pumping water level was 140 ft. below the ground surface.

Analysis of a sample (Lab. No. 112,799) collected Dec. 3, 1947 after 1/2-hr. pumping, showed the water to have a hardness of 13.1 gr.per gal., a residue of 306 ppm., and an iron content of 1.8 ppm.

Estimated pumpage is 10,000 gpd.

Correlated driller's log of well drilled in 1907 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay, sand and gravel	250	250
Clay and shale	75	325
Ordovician system		
Galena-Platteville formations		
Limestone	160	485
St. Peter formation		
Sandstone	100	585

LABORATORY NO. 112,799

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.8		Silica	SiO_2	16.2	
Manganese	Mn	0.0		Fluoride	F	0.5	
Calcium	Ca	43.9	2.20	Chloride	Cl	2.0	0.06
Magnesium	Mg	28.0	2.30	Nitrate	NO_3	0.2	Tr.
Ammonium	NH_4	0.7	0.04	Sulfate	SO_4	0.0	0.00
Sodium	Na	23.9	1.04	Alkalinity	(as $CaCO_3$)	276.	5.52
Turbidity		15		Hardness	(as $CaCO_3$)	225.	4.50
Color		0		Residue		300.	
Odor		0		Temperature	53.8° F.		

CRETE
Will County
Oct. 23, 1946

The water works at Crete (1772) is owned and operated by the village and was installed in 1903. Water for the public supply has been obtained from 2 limestone wells.

The original well was drilled to a depth of 192 ft. and is located about 20 ft. south of Exchange St. and 100 ft. west of Benton St. (or approximately 730 ft. N. and 180 ft. W. of the S. E. corner of Section 8, T. 34 N., R. 14 E.). The elevation of the ground surface is 719± ft.

The. well is reported to have a 10-in. diameter terminating in a water-bearing limestone and to be cased to a depth of about 150 ft. below the surface. Rock was encountered at a depth of about 100 ft. On June 29, 1915, non-pumping water level was reported to be 30 ft. below the pump base.

Water was pumped from this well extensively during a period of concrete road construction in 1921 when a minimum of 60,000 gal. was pumped 7 hr. daily. At this rate, the plunger pump, having a cylinder setting of 80 ft., would occasionally run dry. The well furnished the entire public water supply until 1924 when a second well was drilled.

During the period between 1924 and 1938, the original well served only as a standby unit. In May 1938, when it was equipped with a 30-stage turbine pump rated at a capacity of 175 gpm. against a total pumping head of 190 ft. with a setting of 90 ft., this well again became the producing unit.

Changes in the above pump installation have been made, and the pumping equipment in service on Oct. 7, 1946 consists of 90 ft. of 5-in. column pipe; 6-in., 20-stage Pomona turbine pump, Serial J-1694, rated at a capacity of 175 gpm. against 195 ft. of head; 10 ft. of 4 1/2-in. suction pipe and strainer; 15-hp. Westinghouse electric motor.

A production test of 3-hr. duration was run with this equipment on Dec. 5, 1945; and the following results were obtained; a production rate of 123 gpm. with a drawdown of 4 1/2 ft. against a discharge pressure of 52 psi.; 139 gpm. with a drawdown of 5 1/2 ft. against a discharge pressure of 43 psi.; 147 gpm. with a drawdown of 6 1/2 ft. against a discharge pressure of 30 psi.; and 169 gpm. with a drawdown of 8 1/2 ft. against a discharge pressure of 17 psi. Before the test the water level was 48 1/2 ft. below the pump base.

Analysisof a sample (Lab. No. 107892), collected Oct. 7, 1946 after 1-hr. pumping at 125 gpm., showed this water to have a hardness of 25 gr. per gal., a residue of 452 ppm., and an iron content of 0.3 ppm.

Well No. 2, the second well in the public water supply system, was drilled to a depth of 264 ft. by W.L. Thorne Co., Des Plaines, in 1924 and is located 70 ft. south of the original well.

The hole and casing record were reported as shown in Table 1.

TABLE 1

Hole Record

12-in. from surface to 215 ft.
10-in. from 215 to 264 ft.

Casing Record

12-in. id. from surface to 99 ft.
10-in. id. liner from 166 to 215 ft.

LABORATORY NO. 107,892

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.3		Silica	SiO_2	18.5	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	99.0	4.95	Chloride	Cl	3.0	0.08
Magnesium	Mg	44.0	3.62	Nitrate	NO_3	Tr.	Tr.
Ammonium	NH_4	0.3	0.02	Sulfate	SO_4	41.1	0.86
Sodium	Na	2.5	0.11	Alkalinity (as $CaCO_3$)		388.	7.76
Turbidity		10		Hardness (as $CaCO_3$)		429.	8.58
Color		0		Residue		452.	
Odor		Tr.		Free CO_2 (calc.)		81.	
Temperature 51.7° F.				pH = 7.1			

Sample-study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay	12	12
Sand, silty	8	20
Sand, clean	15	35
Sand, dirty	45	80
Silurian system		
Niagaran series		
Dolomite	70	150
Dolomite, silty, siltstone, thin shale bed at top	65	215
Dolomite	30	245
Dolomite, partly silty	19	264

When first completed, the water level in Well No. 2 was 40 to 45 ft. below the pump base. During the acceptance test, a production of 300 gpm. with a drawdown of 32 ft. was reported.

The following pump installation, made in 1924, is still in place; a Keystone Driller Co. double-acting plunger pump having a 7 1/2-in. diameter cylinder, with 18-in. plunger, set at 90 ft. It was operated at a speed of 25 rpm. and furnished all the water for the public supply from 1924 to 1938. It is now seldom used and serves only as an emergency supply unit.

Well No. 1 has been the source of the entire public water supply since July 21, 1945 during which time the estimated average pumpage has been 100,000 gpd.

All water for the public supply has been chlorinated since Oct. 1944. The chlorine residual at the pumping station was 0.3 ppm.

CREVE COEUR
Tazewell County
Feb. 10, 1949

A description of the physical and chemical data of the Creve Coeur (3535) Well No. 1 may be found in Bulletin No. 33, published in 1940. The well is located 2500 ft. N. and 2675 ft. W. of the S. E. corner of Section 12, T. 25 N., R. 5 W.

In 1941 when Well No. 2 was constructed, the old pump was removed from Well No. 1, and the new pump assembly, as installed in Well No. 1, now consists of: 40 ft. of 8-in. column pipe; 10-in., 12-stage Fairbanks-Morse turbine pump, rated at 500 gpm. against 430 ft. of head at 1750 rpm.; 10 ft. of 8-in. suction pipe with an 8-in. strainer 1 ft. 10 in. long; 75-hp. General Electric motor.

Well No. 2 was drilled in 1941 by M. Ebert Co., Washington, to a depth of 80 ft. and located 25 ft. west of Well No. 1 (or approximately 2500 ft. N. and 2700 ft. W. of the S. E. corner of Section 12).

The top of the 10-in. casing was set 5 ft. above the ground surface elevation of 452± ft., and the well was cased with 75 ft. of 10-in. black steel pipe and with 10-ft. exposed of 10-in. Johnson Everdur brass screen, the bottom of the screen being 80 ft. below the surface.

The old pumping assembly from Well No. 1 was installed in Well No. 2 in 1941, and Well No. 2 is now maintained as a standby unit.

The quality varies somewhat, but the general character of the water is represented by an analysis of a sample (Lab. No. 117,267) collected Feb. 10, 1949. The water from the No. 1 well is shown to have a hardness of 28.6 gr. per gal., a residue of 678 ppm. and an iron content of 0.1 ppm.

Total pumpage for the Village of Creve Coeur is estimated at 200,000 gpd.

Sample-study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Sand and silt	25	25
Gravel, clean, water at 34', silt at base	25	50
Sand, pebbly, clean	30	80
Silt	5	85
Sand	4	89
Pennsylvanian system		
"Shale"	at	89

LABORATORY NO. 117,267

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	22.6	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	117.1	5.86	Chloride	Cl	11.0	0.31
Magnesium	Mg	47.9	3.94	Nitrate	NO_3	8.4	0.14
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	245.6	5.11
Sodium	Na	42.3	1.84	Alkalinity	(as $CaCO_3$)	304.	6.08
Turbidity		1		Hardness	(as $CaCO_3$)	490.	9.80
Color		0		Residue		678.	
Odor		0					
Temperature 53° F.							

CROSSVILLE
White County
Feb. 25, 1948

The village of Crossville (875) installed a public water supply in 1941.

A test well was drilled in 1940 to a depth of 40 ft. by E. L. Potts, St. Francisville, and located about 35 ft. north of Main St. and 150 ft. west of State Highway No. 1. There is no visible evidence of the existence of the test well. It is presumed to have been located about 10 ft. north of Well No. 1, in the treatment plant, and that the test-well casing was pulled when the plant was built in 1941. The surface elevation is 395± ft.

The well was cased with 6-in. pipe and was originally driven into clay, below sand and gravel. The hole remained dry, so the casing was jacked up 7 in. exposing 4 in. of gravel.

A production test was made on Sept. 16, 1940 by the State Water Survey. For test purposes, the well was equipped with a turbine pump with the bottom of the bowl section at a depth of 32 ft. below the top of the casing. The well produced at a rate of 20 gpm. for 4 hr. with a drawdown of 18 1/2 ft. from the non-pumping water level of 11 1/2 ft. below ground level. When tested by the driller on Sept. 12-13, 1940 the drawdown was 17 ft. after pumping for 30 hr. at a rate of 18 gpm.

Analysis of a sample (Lab. 88873) collected Sept. 16, 1940, showed the water to have a hardness of 39.0 gr. per gal., a residue of 770 ppm., and an iron content of 3.5 ppm.

Well No. 1 was drilled in 1940 to a depth of 40 ft. 4 in. by E. L. Potts and is located in the treatment plant about 10.2 ft. south of where the test well was located.

This well was cased with 12-in. pipe from 1 ft. 8 in. above to 36 ft. below the ground surface." A 4 ft. length of Johnson screen was installed with slot openings as follows: top 1 ft. No. 20 slots; second 1 ft., No. 50; third 1 ft., No. 100; and the lower 1 ft., No. 150 slots.

A production test was made by the State Water Survey on Nov. 6, 1940. For test purposes, the well was equipped with a turbine pump, with the bottom of the suction pipe at a depth of 38 ft. When pumping at 27 gpm., the drawdown was 19 1/2 ft. from a non-pumping water level of 15 1/2 ft. below the top of the casing.

Another production test was made by the State Water Survey on Dec. 10, 1940. Results were similar to the previous test except that the non-pumping water level was only 11 1/2 ft. below the ground surface.

Permanent pumping equipment was installed as follows: 3 1/2-in. column pipe; 5-in., 6-stage Fairbanks-Morse turbine pump No. 9270, rated at 25 gpm. when operating at 1750 rpm.; the overall length of the pump is 2 ft. 4 in.; 5 ft. of 3 1/2-in. suction pipe; unknown length of 1/4-in. air line; 1-hp. electric motor.

In 1944, the well was reported to be producing 20 gpm. with a drawdown of 8 ft. In Feb. 1948, the well was in daily service and when pumping at 20 gpm., the drawdown was 21 1/2 ft.

Analysis of a sample (Lab. No. 89221) collected Nov. 6, 1940," showed the water to have a hardness of 36.9 gr. per gal., a residue of 731 ppm., and an iron content of 2.4 ppm.

Well No. 2 was drilled in 1940 to a depth of 47 1/2 ft. by Albert Lancaster, Harrisburg, and located 10 ft. north of Main St. about 265 ft. west of Well No. 1.

LABORATORY NO. 89571

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.8		Silica	SiO_2	23.0	
Manganese	Mn	0.0					
Calcium	Ca	88.7	4.44	Chloride	Cl	14.0	0.39
Magnesium	Mg	33.5	2.75	Nitrate	NO_3	0.2	1.0
Ammonium	NH_4	0.6	0.03	Sulfate	SO_4	0.0	0.0
Sodium	NA	26.9	1.17	Alkalinity (as $CaCO_3$)		398.0	7.96
Turbidity		95		Hardness (as $CaCO_3$)		359.0	7.18
Color		0		Residue		455.0	
Odor		0		Free CO_2 (calc.)		65.0	
				pH = 7.0			

Correlated driller's log of Well No. 4 furnished by the State Geological Survey:

Formation	Thickness ft.	Thickness in.	Depth ft.	Depth in.
Pleistocene and Pennsylvanian (?) systems				
Clay	18		18	
Sand, water	7		25	
Clay, sandy	12	6	37	6
Sand and gravel, water-bearing	4	6	42	
Clay, sandy	8		50	
Sand, water	7		57	
Shale	18		75	
Sandstone, and sand and gravel	7		82	
Gravel, muddy	6		88	
Sandstone and water sand	19		107	
Sandstone, sand and gravel breaks, water-bearing	58		165	

The well was cased with 6-in. pipe and is equipped with a 4 ft. length of 6-in. Johnson screen placed at the bottom of the well. Slot openings of the screen are as follows: top 1 ft., No. 20 slot; second 1 ft., No. 40 slot; and bottom 2 ft., No. 80 slot. During drilling operations water was encountered in a sand and gravel formation between 41 and 47 1/2 ft.

A production test was made by the State Water Survey on Dec. 23, 1940. For test purposes, the well was equipped with the Fairbanks-Morse turbine pump, No. 9270, which was later installed in Well No. 1. The well produced 20 gpm. for 4 hr. with a drawdown of 31.25 ft. from a non-pumping water level of 12 ft. During the test the water level in Well No. 1, 265 ft. east, was lowered 6 in.

In 1942, the pump was oper ated about 9 1/2 hr. per day at a rate of about 20 gpm. and in Dec. 1944, it was reported that the well produced about 10 gpm. The well was acidized in an attempt to increase the yield, but with no beneficial results. The yield was 3 gpm. when the well was retired from service, late in 1947. The pump has been removed.

Analysis of a sample (Lab. No. 89571) collected Dec. 23, 1940, after 4-hr. pumping at a rate of 20 gpm., showed the water to have a hardness of 20.9 gr. per gal., a residue of 455 ppm., and an iron content of 2.8 ppm.

An electrical earth resistivity survey was made by the State Geological Survey in May, 1943. The survey included the area about 2 miles in all directions from Crossville.

Well No. 3 was drilled in the winter of 1943-

LABORATORY NO. 118,845

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.5		Silica	SiO_2	18.1	
Manganese	Mn	0.0		Fluoride	F	0.0	
Calcium	Ca	46.3	2.32	Chloride	Cl	76.0	2.14
Magnesium	Mg	22.7	1.87	Nitrate	NO_3	.2	Tr.
Ammonium	NH_4	.8	.04	Sulfate	SO_4	0.0	0.0
Sodium	Na	130.4		Alkalinity	(as $CaCO_3$)	388.	7.76
Turbidity		9		Hardness	(as $CaCO_3$)	209.	4.19
Color		0		Residue		528.	
Odor		0					

44 to a depth of 37 ft., by R. R. Collaghan and located 90 ft. north and 10 ft. west of Well No. 1.

The well was cased with 6-ft. id. concrete pipe from 2 ft. above the ground surface to the bottom where a water-bearing sand and gravel formation was encountered. The static water level was 15 ft. below the surface and when pumping at 20 gpm. the drawdown was 14 ft.

The pump installation, mounted on the concrete cap of the well, consists of 3 1/2-in. column pipe; 5-in., 6-stage Fairbanks-Morse turbine pump, rated at 25 gpm.; the overall length of the pump is 2 ft. 4 in.; 5 ft. of 3 1/2-in. od. suction pipe; 1 1/2-hp. electric motor.

The bottom of the suction pipe is reported to be 5 ft. above the bottom of the well.

The well is in daily service.

Well No. 4 was drilled in 1946 by Lockwood and Sutton and located 27 ft. north and 18 ft. west of Well No. 1 (or approximately 2550 ft. S. and 1450 ft. W. of the N. E. corner of Section 23, T. 4 S., R. 10 E.).

This well was drilled to a total depth of 165 ft., but the permanent well was finished at a depth of 107 ft. below a ground surface elevation of 395± ft.

The well was cased with 7-in. pipe to a depth of 107 ft.

The well is equipped with a Myers ejecto pump catalog No. F 300A2 having a 2 1/2-in. eductor pipe extending to a depth of 67 ft., a 2-in. pressure pipe extending to 68 ft., and a 2-in. tail pipe from 68 to 98 ft.

The well was reported to produce about 10 gpm. with a drawdown of 5 1/2 ft. but in Feb. 1948 the yield was 5 gpm., limited because of the length of the tail pipe or because of a possible dislocated sand point. On July 8, 1949, Mr. R. L. Endicott, Water Superintendent, reported that "the pump was pulled and reset three months ago, and is now producing about 25 gpm."

Analysis of a sample (Lab. No. 118,845) collected July 15, 1949, showed this water to have a hardness of 12.2 gr. per gal., a residue of 528 ppm., and an iron content of 0.5 ppm.

All water for the public supply is aerated, filtered and softened, and occasionally chlorinated.

Analysis of a sample (Lab. No. 114,110) collected Feb. 23, 1948 showed the treated water to have a hardness of 7.7 gr. per gal., a mineral content of 614 ppm., and an iron content of 0.1 ppm.

From Nov. 1, 1947 to Feb. 1, 1948, metered pumpage averaged 42,300 gpd. In July 1949, Mr. Endicott reported "present average 48,000 gpd."

LABORATORY NO. 114,110

	ppm.	epm.			ppm.	epm.
Iron (total) Fe	0.1		Fluoride	F	0.1	
Turbidity	0		Chloride	Cl	83.0	2.34
Color	0		Alkalinity	(as $CaCO_3$)	352.	7.04
Odor	0		Hardness	(as $CaCO_3$)	132.	2.64
Temperature 55° F.			Total Mineral Content		614.	
pH = 7.55			Free CO_2 (calc.)		25.	

A public water supply was installed by the village of Crotty (1235) (Seneca post office) in 1927.

Water is obtained from 2 wells located a block east of the center of the business district. Well No. 1 was drilled in 1927 by Otis Heflin, Joliet, to a depth of 700 ft. below a ground surface elevation of 510± ft., and located 1795 ft. N. and 200 ft. E. of the S. W. corner of Section 24, T. 33 N., R. 5 E.

The well was cased with 132 ft. of 10-in. wrought iron pipe and from 132 to 700 ft. the hole was finished 10 in. in diameter. During drilling operations no water was encountered until 128 ft. depth was reached and when the well was completed the free flow at the surface was reported to be 30 gpm. At that time the driller reported that water was pumped for 8 hr. at 159 gpm. and when pumping at 190 gpm. the water level was 47 ft. Two minutes after pumping was stopped, the free flow started.

In Sept., 1943 the water level was 43 ft. below the pump base after a 45-min. quiet period. On Sept. 29, 1944 the water level was 55 ft., at 10 min. after stopping the pump and when pumping the water level was 149 ft. On Feb. 18, 1946, nearly 9 months after the closing of the Seneca Shipyards plant, the pumping water level was 138 ft. and 30 min. after the pump was stopped, the water level was 25 ft. This indicated a measurable recovery in ground water levels following the cessation of the pumping which had been taking place in this area during the previous 3 years.

Originally, the well was equipped with a Keystone Driller Co. 2-stroke cylinder pump 7 3/4 by 18 in. and rated at 200 gpm., with 72 ft. of 8-in. column pipe. The present pump assembly, installed in 1935, consists of 200 ft. of 6-in. column pipe; 10-in., 6-stage Peerless turbine pump having an overall length of 6 ft.; 20 ft. of 6-in. suction pipe; 25-hp., 1800 rpm. U. S. Electric motor, No. 165620.

In the spring of 1943, due to the erection of the nearby Seneca Shipyards plant, the population of the town increased quickly from 1200 to approximately 12,000. A fire in the business district necessitated 17 hr. pumping from the lone well and a resultant lowering of water in storage. The combination of circumstances required the construction of an additional source of water supply.

Well No. 2 was completed in Sept. 1943 to a depth of 704 ft. by J. P. Miller Artesian Well Co., Brookfield, and located 25 ft. south and 54 ft. west of Well No. 1.

Correlated driller's log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay	10	10
Pennsylvanian system		
Sandstone, firm	8	18
Shale, thin bed of coal	82	100
Sandstone, firm	18	118
Ordovician system		
Platteville formation		
Limestone	98	216
Glenwood and St. Peter formations		
Sandstone, soft	189	405
Shale and sandstone	20	425
Shakopee formation		
Limestone	100	525
New Richmond formation		
Sandstone	15	540
Sandstone and lime shells	76	616
Onecta formation		
Limestone	28	644
Limestone and sand	60	704

TABLE 1

Pumping Conditions	Water Level Well No. 1 ft.	Water Level Well No. 2 ft.	Pumping Rate Well No. 2 gpm.
No pumping after 45 min.	43	40	
No. 1 pump operating		62	
Simultaneous pumping after 4 hr.	155	193 1/2	407
No. 2 pumping	74	184	438

The well was cased with 135 ft. of 10-in. pipe below which the hole was finished 10 in. in diameter from 135 to 704 ft.

The pumping equipment consists of 230 ft. of 6-in. column pipe; 9 1/2-in., 6-stage Peerless turbine pump, No. 21870, rated at 500 gpm. at 1760 rpm.; the overall length of the pump is 5 ft.; 250 ft. of 1/4-in. air line; 30 ft. of 6-in. suction pipe; 30-hp., 1760 rpm. U. S. Electric motor.

On Sept. 24, 1943 a production test was run under the supervision of the State Water Survey, using a pump assembly of total length of 226 ft., with 6-in. diameter column and suction pipes. Before the test, the water level was observed in Well No. 2 while the pump in Well No. 1 was operating, then pumping was discontinued in Well No. 1 for a 45-min. period and water levels observed in both wells. During the test of Well No. 2 water levels were observed in both wells under conditions of simultaneous pumping in both wells and pumping in Well No. 2 only. A summary of water levels in ft. below the pump bases under various pumping conditions is given in Table 1.

Fifty min. after the test was stopped the water level in No. 2 well returned to 50 ft. The pump in No. 1 well was not running.

Analysis of a sample (Lab. No. 118246) collected May 18, 1949, showed the water to have a hardness of 21.2 gr. per gal., a residue of 628 ppm., and an iron content of 2.1 ppm. The quality is very similar to that obtained from Well No. 1 and represents a blend of waters from the St. Peter and the New Richmond sandstones.

The water is treated for hydrogen sulfide removal.

Prior to the sudden influx of population which started in 1942, the pumpage had averaged 65,000 gpd. In June, July, and Aug. of 1943 pumpage averaged 315,000 gpd. From Jan. 1944 to Feb. 1945, inclusive, pumpage averaged 460,000. gpd. From Mar. 1945 to Nov. 1945, inclusive, pumpage declined from 620,000 to 120,000 gpd. and averaged 255,000 gpd. In Jan. 1946, pumpage averaged 128,000 gpd.

LABORATORY NO. 118246

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.1		Silica	SiO_2	12.6	
Manganese	Mn	Tr.		Fluoride	F	.4	
Calcium	Ca	73.2	3.66	Chloride	Cl	100.0	2.82
Magnesium	Mg	35.8	2.95	Nitrate	NO_3	.1	Tr.
Ammonium	NH_4	.7	.04	Sulfate	SO_4	123.6	2.51
Sodium	Na	98.0	4.26	Alkalinity	(as $CaCO_3$)	276.	5.52
Turbidity		11.		Hardness	(as $CaCO_3$)	330.	6.61
Color		0		Residue		628.	
Odor		0					

The villages of North Crystal Lake and Crystal Lake were consolidated in 1914 and incorporated as the city of Crystal Lake (3917).

The village of North Crystal Lake installed a public water supply in 1898 and the village of Crystal Lake installed a supply in 1913.

The installation in North Crystal Lake consisted of a dug well 64 ft. deep and a drilled well 280 ft. deep. These wells were located on the south side of Beardsley St. on the west side of the alley one half block east of Main St. (approximately 1200 ft. N. and 150 ft. E. of the S. W. corner of Section 33, T. 44 N., R. 8 E.). The ground surface elevation is 925t ft.

The dug well, located 12 ft. north of the drilled well, was 3 ft. in diameter, curbed with brick, and a pit, about 5 ft. deep, surrounded the top. Water was obtained from a gravel formation and the well was the source of the initial public supply until about 1913 when it was abandoned. On Nov. 19, 1923 the depth of the water in the well was 7 ft. The well was filled and is covered by the concrete floor of the garage.

The 280 ft. drilled well, now calledthe Beardsley St. well is reported cased with 10-in. pipe to limestone at a depth of 260 ft. A non-pumping water level of 80 ft. below the ground surface was reported on Oct. 23, 1913. Following the consolidation of the 2 villages in 1914 this well was used only as an auxiliary supply unit and in recent years has supplied the Chicago and Northwestern Railway. A production test of this well was made on June 12, 1940 by the State Water Survey. The water level before the test was 98 1/2 ft. below the pump base. The following results were obtained during the test: after pumping at 300 gpm. for 3 1/2 hr. the drawdown was 30 ft.; on increasing the rate of pumping to 400 gpm. and continuing for 4 additional hr. the total drawdown was 55 ft.; and increasing the rate to 445 gpm. and continuing for 1 hr. the total drawdown was 66 1/2 ft.

Non-pumping water levels, below the pump base: 105 ft. on Mar. 17, 1947 and May 24, 1947, and 107 ft. on July 3, 1947 after a 1-hr. idle period. On July 3, 1947, the water level was 153 ft. after 1-hr. pumping at 415 gpm.

The metered consumption by the Chicago and Northwestern Railway from May 1,1943 to May 1, 1947 averaged 112,230 gpd. The metered pumpage from Dec. 2, 1946 to July 2, 1947 averaged 158,860 gpd.

The existing pump installation made in July, 1940 is: 180 ft. of 6-in. column pipe; 10-in., 7-stage American Well Works turbine pump, Shop No. 63609, rated at a capacity of 350 gpm. against 290 ft. of head; 180 ft. of 1/4-in. gi. air line; 40-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 110,906) collected July 3, 1947 after 1-hr. pumping at 415 gpm. showed this water to have a hardness of 21.5 gr. per gal., a residue of 449 ppm., and an iron content of 0.6 ppm.

The initial water supply installed by the village of Crystal Lake in 1913 consisted of a dug well 8 ft. in diameter and 32 ft. in depth below a ground surface elevation of 901± ft. and located in the city park about 115 ft. southwest of Virginia St. and 85 ft. northeast of King St. (approximately 2500 ft. S. and 500 ft. W. of the N. E. corner of Section 6, T. 43 N., R. 8 E.). The top of the well was in a pit about 15 1/2 ft. below the ground surface and the bottom was in water-bearing sand

LABORATORY NO. 110,906

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.6		Silica	SiO_2	24.2	
Manganese	Mn	0.0		Fluoride	F	0.3	
Calcium	Ca	77.4	3.87	Chloride	Cl	17.0	0.48
Magnesium	Mg	42.7	3.51	Nitrate	NO_3	0.9	0.01
Ammonium	NH_4	0.4	0.02	Sulfate	SO_4	78.8	1.64
Sodium	Na	15.0	0.65	Alkalinity	(as $CaCO_3$)	296.	5.92
Turbidity		Tr.		Hardness	(as $CaCO_3$)	369.	7.38
Color		0		Residue		449.	
Odor (at well)		H_2S		Free CO_2 (calc.)		17.	
Temperature 52.5° F.				pH = 7.65			

and gravel. The well was curbed with concrete blocks laid with open joints.

When the well was completed water rose to about 17 ft. below the ground surface. On Nov. 13, 1922 the water level was 22.6 ft. below the ground surface after an idle period of 2 1/2 hr. and when pumping at 225 gpm. for 2 hr. the drawdown was 7 ft. A production test was made by the State Water Survey on Oct. 23, 1925. Before the test the distance to water was 23.4 ft. below the ground surface after an idle period of almost 19 hr. Pumping was started at a rate of 466 gpm. and gradually decreased to 300 gpm. during a period of 1 1/4 hr. The drawdown during this period was 7 ft. Pumping was continued at a rate of 300 gpm. for 1 1/2 hr., at the end of which the total drawdown was 7.85 ft. and a state of equilibrium was not attained.

The distance to water was 19 1/2 ft. below the normal ground level on July 3, 1947.

The well was continued as the principal source of the public water supply until 1930 when a new well was placed in service.

The dug well has not been in use since July 20, 1943. A centrifugal pump and 25-hp. Westinghouse electric motor are still in place, but the motor was disconnected.

The well now in service as the principal source of the public supply was drilled in 1930 to a depth of 2000 ft. by W. L. Thorne Co., Des Plaines, and located 76 ft. south of Franklin Ave. and 61 ft. 4 in. west of College St. (approximately 1080 ft. S. and 2450 ft. W. of the N. E. corner of Section 5.). The elevation at the ground surface is 917± ft. The hole and casing record is given in Table 1.

TABLE 1

Hole Record

20-in. from 0 to 234 ft.
16-in. from 234 to 248 ft.
12-in. from 248 to 569 ft.
10-in. from 569 to 964 ft.
8-in. from 964 to 2000 ft.

Casing and Liner Record

20-in. from 0 to 234 ft.
16-in. from 205 to 242 ft. 6 in.
10-in. from 235 to 569 ft.
8-in. liner from 748 to 964 ft.

After completion of the well when pumping at 318 gpm. the drawdown was 69 ft. below a non-pumping water level of 200 ft. below the ground surface.

The existing pump installation, made in 1942, is: 380 ft. of 6-in. column pipe; 10-in., 12-stage American Well Works turbine pump, Shop No. 66265, rated at a capacity of 400 gpm. against a head of 500 ft.; 380 ft. of 1/4-in. gi. air line; 20 ft. of 6-in. suction pipe; 100-hp. Westinghouse electric motor.

Water levels below the pump base are given in Table 2.

TABLE 2

Date	Non-Pumping ft.	Pumping ft.
July 20, 1943	263	337
July 11, 1944		346
Nov. 8, 1944	266	343
July 5, 1945	279	342
July 3, 1947		350

Metered pumpage from May 1, 1943 to July 1, 1945 averaged 278,168 gpd.

Analysis of a sample (Lab. No. 110,907) collected July 3, 1947 after 7-hr. pumping at an estimated rate of 400 gpm. showed this water to have a hardness of 14.0 gr. per gal., a residue of 292 ppm., and an iron content of 0.3 ppm.

CRYSTAL HEIGHTS

Crystal Heights subdivision is located on East Crystal Lake Ave., just at the city limits and north of the Chicago and Northwestern Railway.

Water is supplied from a well which is located approximately 750 ft. S. and 2900 ft. E. of the N. W. corner of Section 4, T. 43 N., R. 8 E. and owned and operated by the Crystal Heights Association which was formed on Sept. 20, 1943 by 16 property owners. The top of the well, which has an 8-in. casing, is located in a pit about 6 ft. below a ground surface of 940± ft. The well has been deepened from 178 to 238 ft. and is equipped with a Deming turbine pump, Serial No. MT 2355 powered by a 3-hp. General Electric motor. During a test the well was reported to produce 60 gpm. for 5 hr. without lowering the water level.

Analysis of a sample (Lab. No. 111,018) collected July 10, 1947 from the pressure tank after 5-hr. pumping at 60 gpm. showed this water to

have a hardness of 17.8 gr.per gal., a residue of 365 ppm., and an iron content of 1.0 ppm.

Sample-study and driller's log of well drilled in 1930 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Glacial drift"	225	225
"Sand and gravel, silty, water bearing"	6	231
Silurian system		
Niagaran-Alexandrian series		
"Limestone, very little water"	66	297
Ordovician system		
Maquoketa shale and dolomite	145	442
Galena-Platteville dolomites	333	775
Glenwood shale, dolomite, and sandstone	45	820
St. Peter formation		
Sandstone	100	920
Siltstone	10	930
Oneota formation		
Dolomite, thin sandstone beds	40	970
Sandstone	20	990
Cambrian system		
Trempealeau dolomite	90	1080
Franconia dolomite, thin sandstone bed at top	55	1135
Galesville formation		
Sandstone, dolomitic	40	1175
Sandstone, incoherent	115	1290
Eau Claire dolomitic sandstone, some shale and dolomite	485	1775
Cambrian and Pre-Cambrian systems		
Mt. Simon and Fond du Lac sandstones	225	2000

LABORATORY NO. 110.907

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.3		Silica	SiO_2	13.5	
Manganese	Mn	0.0		Fluoride	F	0.3	
Calcium	Ca	53.2	2.66	Chloride	Cl	5.0	0.14
Magnesium	Mg	26.3	2.16	Nitrate	NO_3	1.0	0.02
Ammonium	NH_4	0.3	0.02	Sulfate	SO_4	21.0	0.44
Sodium	Na	11.0	0.48	Alkalinity	(as $CaCO_3$)	236.	4.72
Turbidity		Tr.		Hardness	(as $CaCO_3$)	241.	4.82
Color		0		Residue		292.	
Odor		0		Free CO_2 (calc.)		23.	
Temperature 61.2° F.				pH = 7.4			

LABORATORY NO. 111,018

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.0		Silica	SiO_2	25.1	
Manganese	Mn	0.0		Fluoride	F	0.4	
Calcium	Ca	66.8	3.34	Chloride	Cl	21.0	0.59
Magnesium	Mg	33.9	2.78	Nitrate	NO_3	1.3	0.02
Ammonium	NH_4	1.7	0.10	Sulfate	SO_4	22.2	0.46
Sodium	Na	17.7	0.77	Alkalinity (as $CaCO_3$)		296.	5.92
Turbidity		10-		Hardness (as $CaCO_3$)		306.	6.12
Color		0		Residue		365.	
Odor		0		Free CO_2 (calc.)		21.	
Temperature 53.5° F.				pH = 7.55			

CUBA
Fulton County
July 15, 1947

A public water supply was installed in 1915 by the city of Cuba (1620).

Water was obtained originally from a well, drilled in 1914 to a depth of 1768 ft. by W.H.Gray and Bros., Chicago, and located on the south side of the Toledo, Peoria and Western R. R. and on the east side of Ave. A (or approximately 250 ft. N. and 1150 ft. E. of the S. W. corner of Section 17, T. 6 N., R. 3 E.). The ground surface elevation at the well-site is 677t ft.

The well known as Well No. 1, was cased with 16-in. pipe from the surface to 34 ft. and with 12-in. pipe from the surface to 317 ft. The hole was finished 12 in. in diameter from 317 to 1000 ft. and 10-in. in diameter from 1000 ft. to the bottom. When the well was completed, a production test was made by the driller, who reported a static water level of 103 ft. below ground level and after 34-hr. pumping at a final rate of 164 gpm., the drawdown was 39 ft. After stopping the pump, the water level recovered to 103 ft. within a few minutes. In 1936 the non-pumping water level was 125 ft.

Due to the high mineral quality of the water, it was necessary to repair the pumping equipment every few years. In 1929 about one-half of the meters were out of service because of clogged condition. In Jan. 1943, while removing the cylinder and column pipe, a cable broke and the equipment dropped in the well. A new turbine, rated at 75 gpm. and set at 109 ft. was installed and the well has been used as an emergency unit since that time.

Analysis of a sample (Lab. No. 119,405) collected Sept. 21, 1949 showed this water to have a hardness of 36.8 gr. per gal., a residue of 2380 ppm., and a trace of iron.

In an effort to obtain water of more desirable mineral quality and at the same time a more abundant supply, an electrical earth resistivity survey was made by the State Geological Survey in 1941. The area surveyed, extended west one mile and north two miles from the city. By Sept. 1944, thirty-eight test wells had been drilled to bedrock, which is about 40 ft. below the /surface in that area. The resistivity survey was extended in Oct. 1944 to cover areas adjacent to Put Creek, 2 1/2 miles northwest and north of the city, and in an area of suspected buried valley of the Spoon River, about 5 to 6 miles southwest of the city.

At this time consideration was given to the possibility of installing a surface water supply in two nearby creek valleys, Put Creek and Big Creek. The former was abandoned because Put Creek receives waste waters from coal mine operations. The latter was abandoned because there are coal outcroppings present.

The construction of a concrete well was attempted by Frank Foote in 1945. The well was designated as Well No. 2, and was located in the Strip mine area on the east side of State Highway

Correlated driller's log of well drilled in 1914 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Glacial drift	34	34
Pennsylvanian system		
Shale, with a few thin limestones and sandstones	276	310
Mississippian system		
St. Louis limestone	25	335
Warsaw shale	95	430
Keokuk-Burlington limestones	197	627
Kinderhook shale	243	870
Devonian-Silurian system		
Dolomites	120	990
Ordovician system		
Maquoketa shale	180	1170
Galena-Platteville ("Trenton") dolomite	300	1470
St. Peter sandstone	298	1768

LABORATORY NO. 119,405

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	Tr.		Silica	SiO_2	14.0	
Manganese	Mn	0.0		Fluoride	F	3.5	
Calcium	Ca	153.1	7.66	Chloride	Cl	390.	11.0
Magnesium	Mg	60.6	4.98	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	3.4	.19	Sulfate	SO_4	990.4	20.61
Sodium	Na	552.0	23.98	Alkalinity (as $CaCO_3$)		260.	5.20
Turbidity		3		Hardness (as $CaCO_3$)		632.	12.64
Color		0		Residue		2380.	
Odor (at well)		H_2S					
Temperature 72.5° F.							

No. 97, about 1 1/4 mile south of town (or approximately 2000 ft. N. and 2400 ft.W. of the S. E. corner of Section 29, T. 6 N., R. 3 E.).

A 40-in. od. concrete pipe casing was sunk to a depth of 22 ft. below a ground elevation of 650± ft. Fine sand was encountered at this depth and the 40-in. casing could not be lowered further. A 16-ft. section of 16-in. id. or 26-in. od. porous concrete screen was then sunk to bedrock at a depth of 39 ft. Solid concrete pipe sections, 16-in. id. were placed from the top of the screen to ground level. The bottom of the screen was not sealed.

It was reported that, when pumping at 60 gpm. the water level was at 22 ft. and the water could be seen to be boiling up in the well. On cessation of pumping, 5 ft. of sand was found in the well. A 12-in. concrete plug was then poured in the bottom of the well. After an additional 10-hr. pumping, the water did not clear any, the suspended material being a fine clay. Static water level was said to be 8 ft. and the specific capacity to be 9.0 gpm. per foot of drawdown. Neither the pump level nor the pumping rate were reported. The aquifer was a cemented, dirty fine sand and normal static water level was about 4 in. higher than in the strip mine pit, about 30 ft. to the east.

In the summer of 1946, while constructing Well No. 3, Hayes and Sims, Champaign, reconstructed Well No. 2. A 6-ft. section of 12-in. screen was placed below 12-in. steel casing and the annular space outside the 12-in. casing and screen was filled with gravel of unreported gradation. The finished depth of the well was 35.8 ft. The driller reported that the well yielded 40 gpm. with the pumping level just above the screen. The water was clear.

The well was equipped with an American Well Works turbine pump rated at 100 gpm., with the bottom of a 3-ft. length of suction pipe, set at 18 in. above the bottom of the well.

On Jan. 8, 1947, after one-hour non-pumping period the water level in Well No. 2 was reported to be 17.9 ft. At the same time, it was found that the gravel pack had dropped to 23.3 ft. below the surface. The drop in the gravel pack was attributed to some one having operated the pump at full capacity instead of at the throttled rate of 60 gpm. or less which had been prescribed for this well.

On Feb. 21, 1947 after a 45-day period of pumping simultaneously in Wells No. 2 and 3, the 2 meters showed a total production of 800,000 gal. for the period or an average production rate from each well of 12.3 gpm. Both pumps were breaking suction, and both pumps were discharging sand. The meter at each well had considerable sand in it.

Twenty minutes after stopping the pumps the water level in Well No. 2 was 21 ft. and at 40 minutes, the water level was 20.3 ft.

Analysis of a sample (Lab. No. 109,544) collected Feb. 21, 1947 after 45-days pumping showed the water to have a hardness of 30.2 gr. per gal., a mineral content of 718 ppm., and an iron content of 0.2 ppm.

In July 1947, Well No. 2 was reported to be abandoned.

Well No. 3 was completed in 1946 to a depth of 35.9 ft. by Hayes and Sims, and located about 50 ft. northwest of Well No. 2, or about 150 ft. east of

State Highway No. 97. The well was cased with 12-in. id. solid concrete pipe, with a 6-ft. section of 12-in. id. porous concrete pipe screen. The driller reported that, when completed, the well produced 35 gpm. with the water level just above the screen. The water was clear.

The pumping equipment includes an American Well Works turbine pump, rated at 100 gpm. with a 3-ft. length of suction pipe set with the bottom at 18-in. above the bottom of the well. The top of the pump base is 2.0± ft. above ground level.

On Jan. 9, 1947, after a one-hour non-pumping period, the water level was 17.3 ft. below the top of the pump base. It was reported that the top of the gravel pack in Well No. 3 was at the ground surface and had not lowered as in Well No. 2. On Feb. 21, 1947 after a 45-day pumping period from both wells No. 2 and No. 3 the meters indicated an average production from each well of 12.3 gpm. The pump in Well No. 3 was shut down and after 15 minutes the water level in Well No. 3 was 22.8 ft. and after one hour the water level was 19.1 ft.

In Apr. 1948, it was reported that Well No. 3 had been rehabilitated and was the principal source of supply for the city. The production rate was estimated to be 30 gpm. Well No. 3 has not been used since July 1949, at which time it was reportedly yielding less than 7 gpm. On Sept. 26, 1949 the water level was 17.08 ft. below the pump base.

Analysis of a sample (Lab. No. 109,545) collected Feb. 21, 1947 after 45-days pumping showed the water to have a hardness of 19.3 gr. per gal., a mineral content of 3 74 ppm., and an iron content of 0.1 ppm.

In July 1947 pumpage was estimated to average 36,000 gpd.

LABORATORY NO. 109,545

	ppm.	epm.			ppm.	epm.
Iron (total) Fe	0.1		Chloride	Cl	3.0	.08
Turbidity	0		Sulfate	SO_4	43.2	.90
Color	0		Alkalinity	(as $CaCO_3$)	308.	6.16
Odor	0		Hardness	(as $CaCO_3$)	331.	6.62
Temperature 54 1/2 - 55° F.			Total Mineral Content		374.	

CULLOM
Livingston County
Sept. 2, 1947

The public water supply for the village of Cullom (509) was installed in 1907.

The first well was reported to be drilled to a depth of 280 ft., but the water was obtained from a 12-ft. deposit of sand and gravel and quicksand at a depth of 140 ft. and at a rate of 25 gpm. The well was located near the center of the village.

Analysis of a sample (Lab. No. 18273) collected Oct. 5, 1908, showed this water to have a hardness of 61 gr. per gal., a mineral content of 2056 ppm., and a high iron content.

In 1914 a well was drilled to a depth of 1670 ft. near the old well (or approximately 650 ft. N. and 2200 ft. W. of the S. E. corner of Section 23, T. 28 N., R. 8 E.). The elevation of the ground surface at the well-site is 656 ft.

Sample-study and driller's log of well drilled in 1914 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Drift"	165	165
Pennsylvanian system		
"Blue shale and coal"	145	310
Silurian system		
Niagaran - Alexandrian limestones	390	700
Ordovician system		
Maquoketa shale and limestone	165	865
Galena-Platteville limestones	415	1280
St. Peter sandstone	190	1470

A definite casing record is not available, but it is reported that the casing is 10 in. in diameter at the top and extends to 400 or 500 ft. depth. A small flow of salt water was encountered somewhere above 700 ft.

The well is equipped with an American Well Works single-acting deep-well pump, having a 5 3/4-in. cylinder and 21-in. stroke. The working barrel is 60 in. long and is attached to 180 ft. of 6-in. discharge pipe. A 15-ft. length of 5-in. suction pipe is attached to the bottom of the working barrel. Power is furnished by a 15-hp. General Electric motor, rated at 845 rpm. The pump is operated 7 to 11 hr. daily.

In 1916 the water level was 70 ft. below the top of the well.

Analysis of a sample (Lab. No. 35953) collected Nov. 16, 1916 showed the water to have a hardness of 4.5 gr.per gal., a mineral content of 1072 ppm., and an iron content of 0.5 ppm. A sample collected July 29, 1930 was found to have a mineral content of 2267 ppm.

On May 31, 1947 samples (Lab. No. 110,478-110,487) collected for a quality-source test showed the following composition. The pump had been idle for a period of 13 hr.

The higher sulfate content of the samples collected at the beginning of the test shows the presence of some drift water entering through a leaking casing. The exceptional chloride content at 4:41 PM represents a high proportion of water from the upper Silurian or lower Pennsylvanian formation. The samples from 4:14 to 5:11 were also noted to have a very strong odor of H_2S.

LABORATORY NOS. 110,478-110,487

Time & Date	Temp. °F.	Fe ppm.	F ppm.	Cl ppm.	SO_4 ppm.	Alk. ppm.	Hd. ppm.	Res. ppm.
5-31-47								
4:11 PM	Pump started							
4:12	61.5	17.1	3	355	182.3	224	134	1157
4:14	61.5	6.0	3	340	111.3	276	127	1072
4:16	63.5	3.7	3	330	74.9	300	119	1024
4:21	62.5	1.5	3	325	66.6	300	127	1002
4:26	62.5	1.1	3	515	55.7	360	127	1348
4:41	63.0	0.5	3	900	60.7	356	134	1996
5:11	64.0	0.6	3.5	430	54.3	316	142	1150
7:11	65.5	0.5	3	330	58.6	312	119	1016
9:11	65.5	2.0	3	330	81.7	292	127	1044
11:11	65.5	0.5	3	330	72.0	300	122	975

The last 3 samples were largely representative of water from the bottom of the well although some hydrogen sulfide water was still evident.

In July 1945 an electrical earth resistivity survey was made by the State Geological Survey. The survey completely surrounded the village of Cullom for a distance of at least 2 1/2 miles in any direction.

In Feb. 1947, Hayes & Sims, Champaign, drilled a test well for the village. It was located east of the east end of Jeffrey St.

The well was drilled to a depth of 152 1/2 ft. and penetrated sand and gravel from 131 to 152 1/2 ft. A 2-in. casing was installed with a sand point, 7 ft. 10 1/2 in. long, placed at the bottom. The water level was reported at 32 ft. below the ground surface, and water was pumped by air lift for 1 1/4 hr. at a rate of 16 gpm.

Analysis of a sample (Lab. No. 109,328) collected Feb. 24, 1947 after 1 1/4-hr. pumping at 16 gpm., showed the water from this test well to have a hardness of 45.0 gr. per gal., a mineral content of 1218 ppm., and an iron content of 3.5 ppm.

Village Well No. 2 was completed in Aug. 1947 at a location 10 ft. east of the test well drilled in Feb. 1947 (or approximately 725 ft. N. and 550 ft. W. of the S. E. corner of Section 23.). The well was drilled by Hayes & Sims to a depth of 152 1/2 ft. below ground level and cased with 145 ft. of 8-in. pipe and 10 ft. of Johnson Everdur screen. The top of the casing is three feet above ground level, and the upper five feet of the screen has No. 40 slot openings, and the lower five feet has No. 60 slot openings. The lower 21 1/2 ft. of the well was reported to penetrate sand and gravel.

A production test was made on Aug. 29, 1947 by the State Water Survey after the well had been developed with a surge block. A rig-operated cylinder pump was installed for test purposes.

Before starting the test, the water level was 35 ft. below the proposed pump base (2 ft. above ground level). After pumping five hours at 118 gpm. the drawdown was 18 1/2 ft. Nine minutes after stopping the pump, the water level had returned to within 1.7 ft. of the starting level.

Analysis of a sample (Lab. No. 111,683) collected Aug. 29, 1947 after five-hours pumping at 118 gpm., showed the water from Well No. 2 to have a hardness of 44.0 gr. per gal., a residue of 1438 ppm., and an iron content of 3.6 ppm.

The water is not treated.

Pumpage is estimated at 25,000 gpd.

LABORATORY NO. 111,683

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	3.6		Silica	SiO_2	18.5	
Manganese	Mn	0.1		Fluoride	F	0.8	
Calcium	Ca	187.9	9.40	Chloride	Cl	14.0	.39
Magnesium	Mg	69.3	5.70	Nitrate	NO_3	8.1	.13
Ammonium	NH_4	0.1	.01	Sulfate	SO_4	888.0	18.48
Sodium	Na	141.0	6.13	Alkalinity (as $CaCO_3$)		112.	2.24
Color		0		Hardness (as $CaCO_3$)		755.	15.10
Odor (at well)		H_2S		Residue		1438.	
Turbidity		40		Free CO_2 (calc.)		11.	
Temperature 53.3° F.				pH = 7.4			

CUTLER
Perry County
Mar. 11, 1948

The village of Cutler (590) installed a public water supply in 1941.

Water is obtained from a well drilled in 1940 to a depth of 550 ft. by Glen Clark, Fredericktown, Mo., and located about 100 ft. south of the Missouri-Pacific Railroad and 100 ft. west of Market St. (or approximately 2080 ft. N. and 2300 ft. W. of the S. E. corner of Section 5, T. 6 S., R. 4 W.). The elevation of the ground surface at the well site is 500± ft.

Correlated driller's log of well drilled in 1940 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay	30	30
Pennsylvanian system		
Shale, limestone, and thin coal beds	390	420
Sandstone	130	550

The hole and casing record is given in Table 1.

The pump assembly consists of: 170 ft. of column pipe; 6-in., 20-stage, Pomona turbine pump No. SW76; 8.2 ft. overall length, rated at 50 gpm. against 240 ft. of head; 5 ft. of suction pipe; 5-hp. Westinghouse electric motor.

A production test was made by the State Water Survey on Feb. 12, 1940. When pumping at a rate of 33 gpm., the drawdown was below the bottom of the air line, or more than 77 ft. below the non-pumping water level of 93 ft. from the top of the 6-in. casing (1 1/2 ft. above ground level).

TABLE 1

Hole Record

Caving shale formations necessitated extensive use of casing and reduction of hole sizes. Bottom of hole drilled with bit working through 4 7/8-in. casing.

Casing Record

8-in. pipe from surface to 36 ft.
6-in. pipe from surface to 212 ft.
4 7/8-in. pipe from 175 to 495 ft.

Analysis of a sample (Lab. No. 87254) collected Feb. 12, 1940, showed the water to have a hardness of 32.3 gr. per gal., a residue of 1084 ppm., and an iron content of 1.7 ppm. and a free CO_2 content of 50 ppm.

The quality of the water changed considerably as shown by analysis of a sample (Lab. No. 113,695) collected Mar. 4, 1948 after 15-min. pumping at 30 gpm. showed the water to have a hardness of 10.8 gr. per gal., a residue of 313 ppm. and an iron content of 0.7 ppm.

Pumpage is estimated to average 12,600 gpd.

LABORATORY NO. 113,695

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.7		Silica	SiO_2	13.5	
Manganese	Mn	Tr.		Fluoride	F	0.1	
Calcium	Ca	49.0	2.45	Chloride	Cl	25.0	0.71
Magnesium	Mg	15.4	1.27	Nitrate	NO_3	0.5	0.01
Ammonium	MH_4	0.6	0.03	Sulfate	SO_4	14.4	0.30
Sodium	Na	53.1	2.31	Alkalinity	(as $CaCO_3$)	252.	5.04
Turbidity		Tr.		Hardness	(as $CaCO_3$)	186.	3.72
Color		0		Residue		313.	
Odor		0		Free CO_2	(calc.)	19.	
Temperature		63.2° F.		pH = 7.5			

DALZELL
Bureau County
July 31, 1947

A public water supply, was installed by the village of Dalzell (496) in 1941.

An electrical earth resistivity survey was made by the State Geological Survey in Nov., 1940. Recommendations were made for location of test hole drilling. In March 1941, a well was drilled by Daniel Schmidt, Mendota, and located 2100 ft. N. and 600 ft. W. of the S. E. corner of Section 24, T. 16 N., R. 11 E.

The well was reported to be 41 ft. deep, 8 in. in diameter, and equipped with 8 ft. of 7 1/2-in. Cook screen having No. 18 slot openings. The top one foot of the screen was not exposed to the water-bearing sand. A short production test was made by the State Water Survey on March 10, 1941. The non-pumping water level was 24 1/2 ft.belowthe ground surface; andafter 2-hr. pumping at 20 gpm.,the water level was below the 30-ft. length of air line; and after 3 1/2-hr. pumping at 16 gpm., the water level was lowered to the bottom of the suction pipe at a depth of 40 2/3 ft. The well produced 16 to 20 gpm., and was abandoned because of undesirable quality of the water.

Water is now obtained from a well drilled in June, 1941 by Daniel Schmidt, and located on the west side of Spring Creek west of the village (or approximately 2240 ft. S. and 10 ft. E. of the N.W. corner of Section 24). It was drilled to a depth of 14 1/2 ft. below a ground surface elevation of 575± ft., and was cased with 10 ft. of 8-in. pipe below which is 8 ft. of 8-in. Johnson Everdur screen having No. 16 slot openings. The top of the casing is 3 1/2 ft. above ground level.

The pump assembly consists of 6-in. American Well Works turbine pump, No. 64909, rated at 50 gpm. against a head of 125 ft. at 1720 rpm.; 5-hp. U. S. motor, Serial No. 259375. A plate was installed in the discharge of the pump to control the production to 40 gpm. or less.

A production test was made June 25, 1941 by the State Water Survey. A Rex direct-suction pump was hooked up to a 2 1/2-hp. gasoline motor. The non-pumping water level was 5 3/4 ft. below the ground surface; and after 5 1/2-hr. pumping at 37 1/2 gpm., the drawdown was 4 ft.

Analysis of a sample (Lab. No. 111,333), collected July 31, 1947 from a tap at the plant about 3/4 miles from the well showed the water to have a hardness of 26.0 gr. per gal., a residue of 535 ppm. and an iron content of 0.3 ppm.

A softening unit is installed but was not in operation on July 31, 1947.

Pumpage is estimated at 25,000 gpd.

LABORATORY NO. 111,333

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.3		Silica	SiO_2	20.9	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	102.8	5.14	Chloride	Cl	11.0	0.31
Magnesium	Mg	45.8	3.76	Nitrate	NO_3	4.5	0.07
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	116.6	2.43
Sodium	Na	10.8	0.47	Alkalinity	(as $CaCO_3$)	328.	6.56
Color		0		Hardness	(as $CaCO_3$)	445.	8.90
Odor		0		Residue		535.	
Turbidity		0					

A public water supply was installed in 1891 by the village of Danforth (362).

Water was obtained from a 108-ft. drilled well located across the street from the pumping station near the center of the village. The well is cased with 3-in. pipe and is used by the public for drinking. A hand pump is used with a cylinder set at 40 ft.

In 1896, Well No. 1 was drilled to a depth of 1250 ft. and located at the pumping station on the north side of Jefferson St. and east of Front St. The well was cased with 6-in. pipe to rock, and it was said to have a liner at a depth of about 500 ft. The ground surface elevation at the well-site is 645± ft.

In 1922, the pumping equipment consisted of a cylinder pump set at 350 ft. The non-pumping water level was 80 ft. and when pumping at 13 gpm. for 20 minutes, the yield was limited and it was thought the water was drawn down to the cylinder. In 1937, when pumping, the water level was lowered to the bottom of the pump. Air escaped with the water.

Well No. 1 has not been in service since 1939. The plunger pump is in place, but the discharge line has been disconnected.

Analysis of a sample (Lab. No. 82392) collected Nov. 16, 1937 showed this water to have a hardness of 9.9 gr. per gal., a residue of 1248 ppm., and no iron.

About 1918, a 4-ft. diameter well was dug to a depth of 108 ft. and located at the side of the pumping station. The bottom of the well was in a 3-ft. stratum of sand from which many of the private wells were obtaining water. During a yield test of the well, the water level was lowered in the other wells. The well caved in at a depth of 80 ft. and was abandoned, and filled in with earth.

In 1935, two wells were drilled by Lars Jensen, Clifton.

Well No. 2 was drilled to a depth of 164 ft. and located on Adams St. one block north of the old well (or approximately 1350 ft. S. and 50 ft. W. of the N. E. corner of Section 18, T. 27 N., R. 14 W.). The ground elevation is 647± ft.

The well was cased to rock with 4-in. pipe. The pumping equipment consisted of a Deming plunger pump, operated by a 3-hp., 1160 rpm. Westinghouse electric motor.

Correlated driller's log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Drift	131	131
Silurian system		
Lime rock	33	164

Well No. 2 was abandoned in 1939. The pump was removed and installed in the main pumping station, to pump water from the reservoir to the distribution system.

Analysis of a sample (Lab. No. 82389) collected Nov. 16, 1937 showed this water to have a hardness of 24.4 gr. per gal., a residue of 1125 ppm., and no iron.

Well No. 3 was drilled to a depth of 100 ft. and located one block west of Well No. 2, (or approximately 1150 ft. S. and 375 ft. W. of the N.E. corner of Section 18.). The well was cased with 100 ft. of 4-in. pipe and with no screen. The bottom of the well is in gravel.

The pumping equipment consisted of a Deming plunger pump, No. 48294, operated by a 2-hp. Century electric motor. Well No. 3 was abandoned in 1939. The pump was removed and installed in a well leased by the village.

Analysis of a sample (Lab. No. 82388) collected Nov. 16, 1937 showed this water to have a hardness of 9.5 gr. per gal., a residue of 607 ppm., and an iron content of 0.6 ppm.

In 1939 the village leased a private well located about 0.2 mile north and 1.3 miles west of Well No. 1. The well was drilled in 1934 to a reported depth of 208 ft. and is cased with 4-in. pipe. The ground elevation at the well-site is 660± ft.

This well has furnished the entire public supply since Nov. 18, 1939 and is equipped with a Deming plunger pump, having a 2 3/4-in. by 4-ft. cylinder attached to 60 ft. of 3-in. drop pipe. The pump is operated as a single-acting plunger pump with an 18-in. stroke, at a rate of 25 spm. The 2-hp. Century electric motor was removed from Well No. 3.

Analysis of a sample (Lab. No. 116,360) collected Nov. 5, 1948 showed this water to have a

hardness of 2.3 gr. per gal., a residue of 859 ppm., and an iron content of 0.2 ppm.

All water is chlorinated.

Pumpage is estimated to average 10,000 gpd.

LABORATORY NO. 116,360

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	11.7	
Manganese	Mn	0.0		Fluoride	F	3.0	
Calcium	Ca	9.1	0.46	Chloride	Cl	235.	6.63
Magnesium	Mg	4.0	0.33	Nitrate	NO_3	0.7	0.01
Ammonium	NH_4	0.6	0.03	Sulfate	SO_4	3.7	0.08
Sodium	Na	328.9	14.30	Alkalinity (as $CaCO_3$)		420.	8.40
Turbidity		0		Hardness (as $CaCO_3$)		40.	0.79
Color		0		Residue		859.	
Odor		0		Free CO_2 (calc.)		12.	
Temperature 54° F.				pH = 7.95			

A public water supply was installed by the village of Danvers (705) about 1892.

Water was obtained originally from a deep drift well, drilled about 1892. This well furnished the entire village supply until 1906. The well was abandoned about 1915.

A second well was drilled in 1900 for an emergency supply. This well was crooked and was abandoned.

A well drilled in 1905 for an emergency supply failed when no water had been encountered at a depth of 218 ft. This well was 25 ft. east of the original well.

In 1906, a well, called the South Well, and now referred to as Well No. 1, was drilled, 6 ft. south of the first well, on Main St. between Broadway and Chatham St. (or approximately 900 ft. S. and 500 ft. W.of the N. E. corner of Section 23, T. 24 N., R. 1 W.). The surface elevation is 825± ft. This well was reported to be 208 ft. deep and cased with 6-in. pipe to a depth of 195 ft., below which was a 10-ft. length of Cook screen. Water was withdrawn from a stratum of fine sand which contained quantities of natural gas.

The original pumping equipment consisted of a 6-in. by 24-in. Cook single-acting deep well pump with steam head, rated at 130,000 gpd. when operating at 30 gpm. The working barrel of the pump was set at a depth of 205 ft. This pump was replaced in 1920 by a Fairbanks-Morse deep well cylinder pump with a 4 1/2-in. working barrel. The non-pumping water level in 1922 was reported to be 173 ft. below the surface, and in 1936 the, non-pumping water level was reported to be 206 ft. below the ground surface.

A new screen was installed in this well in 1932.

In 1939 it was reported that the production of the well dropped from 16 to 8 gpm. after a few hours pumping. The water level was reported to be within 8 ft. of the bottom of the well. The well is abandoned and the casing plugged with cement to a depth of about 15 ft. below the pump base.

The North Well, now called Well No. 2, was drilled in 1916 and located 20 ft. north of Well No. 1. This well is reported to be 8 in. in diameter, 218 ft. deep, and to be cased with 10-in. pipe to a depth of 208 ft. with a 10-ft. length of Cook screen placed in the bottom of the well. Water comes from a stratum of fine sand containing quantities of natural gas.

The original pumping equipment consisted of an 8-in. by 36-in. Cook single-acting deep-well pump with a steam head, rated at 225,000 gpd. when operating at 30 gpm.

In 1920 the well was equipped with a Fairbanks-Morse deep-well cylinder pump, No. 4038, belt-connected to shaft driven by 20-hp. Fairbanks-Morse kerosene engine.

The non-pumping water level in 1922 was reported to be 173 ft. below the surface.

The screen in this well was cleaned and replaced in 19.26.

In 1936 it was reported that the production of the well dropped from 16 to 8 gpm. after a few hours pumping, and that the non-pumping water level was within 8 ft. of the bottom of the well.

Well No. 2 is maintained as a standby unit.

Analysis of a sample (Lab. No. 85190) collected Feb. 24, 1939 showed the water to have a hardness of 19.7 gr. per gal., a residue of 522 ppm., and an iron content of 2.7 ppm. Methane gas was found to be present in a concentration of 5.0 cu. ft. per 1000 gal.

An electrical earth resistivity survey within the incorporated limits of Danvers was made by the State Geological Survey in Mar. 1939. High resistivity values were reported in the eastern part of the village.

Well No. 3 was drilled in 1939 to a depth of 428 ft. by John Bolliger & Sons, Fairbury, and was located near the water works, or 5 ft. north and 10 ft. west of Well No. 2. This well was 6 in. in diameter, and equipped with 20 ft. of 6-in. Johnson Silicon Red Brass Welded screen, having No. 15 slot openings. Eighteen feet of the screen is exposed.

A production test was made by the State Water Survey on Oct. 16, 1939. For test purposes, a turbine pump, belt-driven by a gasoline engine, was installed. The well produced 104 gpm. with a drawdown of 12 ft. from a non-pumping water level of 284 1/2 ft. below the ground surface. When the pumping rate was raised to 190 gpm. for 4 minutes the drawdown increased to 21 *i/Z it.* After pumping stopped, the water level rose to within 1/4 ft. of the non-pumping level in 3 minutes. A considerable quantity of inflammable

methane gas was noted to be present during the test.

Sample-study log of Well No. 3 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil, silt and till	115	115
Gravel, sandy, silty	5	120
Till, thin layers of sand	170	290
Soil	5	295
Till, thin layers of sand	70	365
Sand	5	370
Clay	5	375
Sand	12	387
Clay	8	395
Sand, and some gravel	33	428

Due to a crooked bore, the hole was reamed and straightened by John Bolliger & Sons in 1939 and was finished at a depth of 416 1/2 ft. and cased with 8-in. pipe to a depth of 400 ft. A 20-ft. length of 6-in. screen extended from 3 ft. inside the casing to the bottom of the well.

The non-pumping water level, when the well was completed, was reported to be 134 ft. On May 24, 1946, the water level, after the pump had been operating for 5 hr., was reported to be 236 ft. On Sept. 30, 1948, after 30-minutes pumping the water level was 236 1/2 ft.

The pumping equipment consists of 320 ft. of column pipe; 6-in. Aurora Pump Co. turbine pump, No. 11010, rated at 100 gpm. against 320 ft. of head; 15-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 115,974) collected Sept. 30, 1948 after 30-minutes pumping showed the water to have a hardness of 18.8 gr. per gal., a residue of 656 ppm., and an iron content of 1.8 ppm.

All water is aerated, filtered and softened.

From Sept. 30, 1947 to Sept. 30, 1948, pumpage averaged 24,100 gpd.

LABORATORY NO. 115,974

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.8		Silica	SiO_2	22.4	
Manganese	Mn	Tr.		Fluoride	F	0.1	
Calcium	Ca	65.5	3.28	Chloride	Cl	54.0	1.52
Magnesium	Mg	30.8	2.53	Nitrate	NO_3	0.4	0.01
Ammonium	NH_4	11.2	0.63	Sulfate	SO_4	1.2	0.03
Sodium	Na	139.8	6.08	Alkalinity	(as $CaCO_3$)	548.	10.96
Turbidity		10		Hardness	(as $CaCO_3$)	322.	6.44
Color		30		Residue		656.	
Odor		0		Free CO_2	(calc.)	81.	
Temperature		55.5° F.		pH = 7.25			

DEER CREEK
Tazewell County
Oct. 10, 1947

The public water supply was installed by the village of Deer Creek (469) in 1913.

Water is obtained from 2 wells. Well No. 1, East Well, was drilled in 1907 and located on Main St., 100 ft. south of First St. (or approximately 1060 ft. S. and 1340 ft. W. of the N. E. corner of Section 16, T. 25 N., R. 2 W.). The well is 267 ft. deep below a ground surface elevation of 755± ft.

The well is equipped with an American Well Works deep-well pump with a 3 1/2-in. by 24-in. cylinder attached to 260 ft. of 4-in. drop pipe and operating at 17 strokes per min. The pump is belt-operated from an overhead shaft which is belt-driven by a 10-hp. electric motor. A 10-hp. Fairbanks-Morse oil engine is kept for emergency power. At present this well furnishes water for the village.

Well No. 2, West Well, was drilled in 1925 by Chris Ebert, Washington. It is 265 ft. deep and is located 25 ft. west of the old well.

The well is cased with 255 ft. of 6-in. black steel pipe with 10 ft. of 6-in. brass screen. The well has been equipped recently with a 75 gpm. turbine pump.

Correlated driller's log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay	225	225
Sand and gravel	40	265

When the well was completed in 1925, the non-pumping water level was at a depth of 225 to 230 ft.

Analysis of a sample (Lab. No. 109,235), collected from a tap near the pump house Feb. 13, 1947, showed the water from the West Well to have a hardness of 17.5 gr. per gal., a mineral content of 325 ppm., and an iron content of 0.6 ppm.

Pumpage is estimated to be 7500 gpd.

LABORATORY NO. 109,235

		ppm.	epm.			ppm	epm.
Iron (total)	Fe	0.6		Silica	SiO_2	20.4	
Manganese	Mn	Tr.		Fluoride	F	0.1	
Calcium	Ca	73.2	3.66	Chloride	Cl	1.0	0.03
Magnesium	Mg	28.2	2.32	Nitrate	NO_3	1.2	0.02
Ammonium	NH_4	0.2	0.01	Sulfate	SO_4	3.7	0.08
Sodium	Na	8.7	0.83	Alkalinity	(as $CaCO_3$)	312.	6.24
Turbidity		10-		Hardness	(as $CaCO_3$)	299.	5.98
Color		0		Residue		323.	
Odor		0					

DE KALB
De Kalb County
Oct. 18, 1947

Waterworks were first installed by the city of De Kalb (9146) about 1875.

The initial supply was obtained from 2 wells each about 2400 ft. deep. These wells were abandoned about 1895 when a well, now called No. 3, was drilled at the main pumping station on the southwest corner of Pearl and Anne St.

In the spring of 1898 a well, now called No. 1, was drilled. Two other wells were drilled at the main pumping station; a 107 ft. drift well abandoned in 1908 because of poor production, and Well No. 2 drilled in 1912. Another well, now known as No. 4, was drilled in 1925-26. Well No. 5 was acquired from the American Steel & Wire Co. in 1941.

Well No. 1 is located about 135 ft. north of Gurler St. and 15 ft. east of Pearl St. (approximately 2525 ft. N. and 1275 ft. W. of the S. E. corner of Section 22, T. 40 N., R. 4 E.). The elevation of the ground surface is 870± ft. It was originally drilled to a depth of 841 ft. in 1898 and deepened to 1331 ft. by the J. P. Miller Artesian Well Co., Brookfield, in 1912 or 1913.

The well was rehabilitated by W. L. Thorne Co., Des Plaines, in 1936 when it was reamed, "shot" at depths of 1300, 1250, and 725 ft., and cleaned to its original extended depth of 1331 ft.

The hole, casing and liner record is shown in Table 1.

The existing pump installation was made in May, 1943; 210 ft. of 8-in. Toncan-iron column pipe; 12-in., 5-stage American Well Works turbine pump, No. 68054, rated at a capacity of 1000 gpm. against 235 ft. of head; 230 ft. of 1/4-in. galvanized air line; 30 ft. of 8-in. Toncan-iron suction pipe; 75-hp. General Electric motor; Sparling flow meter. The pump discharges to the surface storate reservoir at Pearl and Anne St.

TABLE 1

Hole Record

15-in. from 0 to 618 ft.
12-in. from 618 to 911 ft.
10-in. from 911 to 1331 ft.

Casing and Liner Record

15-in. od. from 0 to 161 ft.
14-in. od. from 348 to 368 ft.
12-in. id. from 479 to 620 ft.
10-in. id. from 811 to 911 ft.

This well is in daily service and now furnishes about 800,000 gpd. to the public supply.

Partial analysis of a sample (Lab. No. 111,965) collected Sept. 20, 1947 after 5-hr. pumping at 930 gpm., showed this water to have a hardness of 15.6 gr. per gal., a mineral content of 316 ppm., and an iron content of 0.9 ppm.

Well No. 2 is the north well in the main pumping station at the southwest corner of Pearl and Anne St. (approximately 2350 ft. S. and 1400 ft. W. of the N. E. corner of Section 22). The elevation at the ground surface is 860± ft. This well was drilled to a depth of 1306 ft. by the J. P. Miller Artesian Well Co. in 1912.

The well is reported to be cased with 16-in. od. pipe from the surface to a depth of 160 ft. A 10-in. liner was installed between depths of 511 and 625 ft. and an 8-in. liner between depths of 795 and 896 ft.

Upon completion of the well in 1912 a non-pumping water level of 104 ft. below the casing was reported and the production was 306 gpm. when pumping with a double-stroke plunger pump having a cylinder setting at 175 ft.

LABORATORY NO. 111,965

	ppm.	epm.			ppm.	epm.
Iron (total)	Fe 0.9		Fluoride	F	0.4	
Turbidity	Tr.		Chloride,	Cl	1.0	0.03
Color	0.		Sulfate	SO_4	7.6	0.16
Odor	0.		Alkalinity	(as $CaCO_3$)	292.	5.84
Temperature 54.5° F.			Hardness	(as $CaCO_3$)	268.	5.36
Free CO_2 (calc.)	29.		Total Mineral Content		316.	

pH = 7.4

LABORATORY NO. 111,966

	ppm.	epm.			ppm.	epm.
Iron (total)	Fe 1.7		Fluoride	F	0.4	
Turbidity	Tr.		Chloride	Cl	1.0	0.03
Color	0.		Sulfate	SO_4	6.0	0.12
Odor	0.		Alkalinity (as $CaCO_3$)		312.	6.24
Temperature 51.5° F.			Hardness (as $CaCO_3$)		282.	5.64
Free CO_2 (calc.)	43.		Total Mineral Content		334.	

pH = 7.3

Sample-study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Till	90	90
Sand and gravel	60	150
Ordovician system		
Maquoketa, Galena-Platteville dolomites	374	524
St. Peter formation		
Sandstone	311	835
Conglomerate of chert, sandstone, and shale	55	890
Cambrian system		
Trempealeau dolomite	180	1070
Franconia sandstone, some dolomite and shale	110	1180
Galesville sandstone	105	1285
Eau Claire sandstone, some shale	21	1306

In 1921 the non-pumping water levelwas 125 ft. below the pump base after an idle period of several days.

On July 20, 1930, after 40 min. of pumping with a plunger pump having a 216 ft. cylinder setting, the average production was 320 gpm., as calculated by reservoir measurements. On Oct. 3, 1931, the non-pumping water level was reported to be 130 1/2 ft. below the pump base after an idle period of 1 month.

In 1933, after the installation of a 500 gpm. capacity turbine pump at a depth of 268 ft. below the ground surface the production was. reported to be 510 gpm. In March 1934 the non-pumping water level was 137 ft.

The existing pump installation was made in June 1939; 240 ft. of 7-in. gwi. column pipe; 10-in., 7-stage American Well Works turbine pump, No. 62691, rated at a capacity of 400 gpm. against 280 ft. of head; 260 ft. of 1/4-in. gwi. air line (now defective); 30 ft. of 6-in. gwi. suction pipe; 60-hp. Westinghouse electric motor.

On May 18, 1944 a non-pumping water level of 140 1/2 ft. below the pump base was found by direct measurement and a pumping level of 248 1/2 ft., after pumping at a rate of 385 gpm. for a period of 1 1/2 hr,. during which Well No. 1 was in operation. The pump discharges to the surface storage reservoir and was being operated about 10 hr. daily in Sept. 1947 at a discharge rate of about 320 gpm.

Partial analysis of a sample (Lab. No. 111,966) collected Sept. 20, 1947 after pumping 6 hr. at 320 gpm. showed this water to have a hardness of 16.4 gr. per gal., a mineral content of 334 ppm., and an iron content of 1.7 ppm.

Well No. 3 is the south well at the main pumping station and is located about 22 ft. south of Well No. 2.

This well was drilled to a depth of 890 ft. about 1895 and cased with 15-in. od. pipe to rock at a depth of 161 ft. No other construction data is available.

In a test made in July 1930, when pumping by existing air lift, the production was 180 gpm. with a drawdown of 18 ft. from a non-pumping water level of 113 ft. below the surface.

The existing pump installation was made in 1936: 230 ft. of 6-in. od. column pipe; 8-in., 17-stage American Well Works turbine pump, No. 57539, rated at a capacity of 250 gpm. against a head of 350 ft.; 20 ft. of 5-in. suction pipe; 30-hp. U. S. electric motor. The pump when last operated discharged to the reservoir.

This well has been in service as an auxiliary supply unit but has not been used in 1947. Close

proximity to Well No. 2 prohibits operation when Well No. 2 is in service.

Well No. 4 was drilled to a depth of 1325 ft. by W. L. Thorne Co. in 1925-1926. It is located about 15 ft. north of E. locust St. and 60 ft. east of Eighth St. (approximately 2500 ft. N. and 2600 ft. E. of the S. W. corner of Section 23). The elevation of the ground surface is 885± ft.

The hole, casing and liner record is shown in Table 2.

TABLE 2

Hole Record

20 ± in.	from	0 to	223 ft.
16 ± in.	from	223 to	623 ft.
13 ± in.	from	623 to	1155 ft.
12-in.	from	1155 to	1325 ft.

Casing and Liner Record

20-in. od.	from	0 to	223 ft.
16-in. od.	from	563 to	623 ft.
12-in. id.	from	1049 to	1155 ft.

After the well was completed it was tested on May 7, 1926. Water was pumped with a 10-in. single-acting plunger pump set at a depth of 190 ft. After 8-hr. pumping at 270 gpm. apparent equilibrium was attained with a drawdown of 32 ft. from a non-pumping water level of 131 ft. below the ground surface.

In a test made on June 24, 1930 after pumping for 1 hr. at 725 gpm. the drawdown was 97 ft. from a non-pumping water level of 149 ft. below the pump base.

The well was repaired in 1938 by W. L. Thorne Co. It was "shot" at depths of 1275, 1200, 840, 780, and 720 ft. After the work was completed a production test was made on Aug. 23, 1938. When pumping at 700 gpm. during the first 6 hr. against a pressure of 35 to 36 psi. the drawdown was 58 1/2 ft. from a non-pumping water level of 152 ft. below the pump house floor. Pumping was then continued at 810 gpm. with a total drawdown of 68 1/2 ft. at the end of 10 hr. 40 min.

On July 20, 1945, the non-pumping water level was reported to be 172 ft. below the pump base and the drawdown was 64 ft. after 1 1/2-hr. pumping at 630 gpm.

The existing pump installation was made in 1943: 270 ft. of 8-in. od. column pipe; a 12-in., 8-stage Pomona turbine pump, Serial No. K853, rated at a capacity of 700 gpm. against 350 ft. of head; 20 ft. of 7-in. od. suction pipe (No record of last installation of air line -assumed to be 270 ft.); 100-hp. General Electric motor.

The well is operated as an auxiliary supply unit and the water is discharged directly into the distribution mains at a rate of 630 gpm. It is in daily service during the summer months.

Well No. 5, formerly owned by the American Steel & Wire Co. was acquired by the city in 1941. It is located about 50 ft. south of the center of Oak St. and 320 ft. east of Eleventh St. (approximately 2450 ft. S. and 1250 ft. W. of the N.E. corner of Section 23). The elevation of the ground surface is 890± ft.

The well was drilled to a depth of 1330 ft. in 1915.

The hole and casing record is shown in Table 3.

TABLE 3

Hole Record

16 ± in.	from	0 to	183 ft.
14 ± in.	from	183 to	615 ft.
11 ± in.	from	615 to	920 ft.
10-in.	from	920 to	1330 ft.

Casing Record

16-in.	od. from	0 to	183 ft.
12 1/2 in.	id. from	507 to	615 ft.
10-in.	from	809 1/2 to	920 ft.

The well was tested on Apr. 12, 1915, pumping with an 8 1/2-in., single-acting plunger pump placed at a depth of 197 ft. After 3-hr. pumping at 300 gpm. the drawdown was 55 1/2 ft. from a non-pumping water level of 131 1/2 ft. below the ground surface.

A production test of 20 1/2-hr. duration was made on Mar. 3-4, 1941. Water was pumped at a rate of 460 gpm. during the first 3 hr. of the test and then reduced to 432 gpm. Apparent equilibrium was attained after 5 1/2-hr. pumping and maintained throughout the balance of the test. The drawdown was 144 ft. from a non-pumping water level of 133 ft. below the ground surface. On Mar. 28, 1947 the non-pumping water level was reported to be 162 ft., and the pumping level 250 ft.

below the pump base.

The existing pump installation was made in Sept. 1941: 310 ft. of 6-in. column pipe; 10-in., 10-stage American Well Works turbine pump, No. 64627, rated at a capacity of 400 gpm. against 420 ft. of head; 310 ft. of 1/4 -in. bronze air line; 10 ft. of 6-in. suction pipe; 75-hp. General Electric motor.

The pump discharges directly into the distribution system and is generally operated for periods of 2 to 6 hr. during the night. The pump discharges at a rate of 445 gpm.

Analysis of a sample (Lab. No. 111,969) collected Sept. 20, 1947 after 2 1/2-hr. pumping at 445 gpm., showed this water to have a hardness of 17.1 gr. per gal., a residue of 328 ppm., and an iron content of 0.4 ppm.

The metered pumpage for the public supply from Sept. 1, 1946 to Sept. 1947 averaged 1.1 mgd. A maximum record was 1.65 mgd. on Aug. 22, 1947. Some of the larger consumers of the public supply are: Northern Illinois State Teachers College, General Electric Co., Englander Co., Wurlitzer Co., Creamery Package Co., and F. E. Schundler and Co.

Water levels for the city wells are given in Table 4.

LABORATORY NO. 111,969

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.4		Silica	SiO_2	12.8	
Manganese	Mn	0.0		Fluoride	F	0.3	
Calcium	Ca	63.3	3.17	Chloride	Cl	4.0	0.11
Magnesium	Mg	32.9	2.70	Nitrate	NO_3	1.5	0.02
Ammonium	NH_4	0.2	0.01	Sulfate	SO_4	6.6	0.14
Sodium	Na	12.7	0.55	Alkalinity	(as $CaCO_3$)	308.	6.16
Turbidity		Tr.		Hardness	(as $CaCO_3$)	294.	5.87
Color		0.		Residue		328.	
Odor		0.		Free CO_2 (calc.)		25.	
Temperature 55.5° F.				pH = 7.5			

TABLE 4

WATER LEVELS (FT. BELOW PUMP BASE) CITY OF DE KALB

Date	Well No. 1			Well No. 2			Well No. 4			Well No. 5		
	Non-Pumping ft.	Pumping ft.	Pumping Rate gpm.	Non-Pumping ft.	Pumping ft.	Pumping Rate gpm.	Non-Pumping ft.	Pumping ft.	Pumping Rate gpm.	Non-Pumping ft.	Pumping ft.	Pumping Rate gpm.
1898	75											
1912				104								
Apr. 12, 1915										131	187	300
1921				125								
Apr. 19, 1922		140	370									
May 7, 1926							131	163	270			
1929	134											
June-July, 1930			300			320	149	246	725			
Oct. 3, 1931				130								
Mar. 1933				137		500						
(1) July 13-14, 1936	143	163	390									
(1) Aug. 23, 1938							152	210	700			
May 29, 1940	141	176		142	245		152	213	800 (3)			
Feb. 5, 1941	145	176	915	145	241	390	155	212	730			
(2) Mar. 3-4, 1941										133	277	432
Nov. 18, 1942	140	177	946	156	221	384	159	221	570	167	280	447
Feb. 5, 1943	146	183	1040	168	214	372	158	221		167	282	
May 10, 1944	136	177	1040	140	248	372	161	220	630	164	263	440
July 20, 1945							172	236	630	175	255	444
Aug. 22, 1947	155	198	1000							167	255	445

(1) Denotes production tests made after completion of well repairs and where apparent equilibrium was attained.
(2) Production test made after well had been idle since about 1938.
(3) Pumping some sand.

DELAND
Piatt County
Feb. 4, 1949

The village of Deland (487) made attempts to establish a public water supply in 1914 and 1915. Three wells were drilled near the village hall, each well about 80 ft. deep, into a sand stratum. The maximum yield of any well was 15 gpm. Another well drilled to a depth of 225 ft. was in blue clay and shale below a sand stratum at 80 ft. In 1915 a well was drilled to a depth of 1085 ft. and salt water was encountered at 510 and 725 ft. The well was abandoned.

In 1933, seven test wells were drilled in and near the village and together with an electrical earth resistivity survey, made by the State Geological Survey, there were evidences of the presence of a thin but fairly widespread deposit of sand and gravel at a depth of about 85 ft.

On Oct. 1, 1935 a production test of 6-in. Test Well No. 7 was made by the State Water Survey. Before the test, the water level was 20 ft. below a ground surface elevation of 705± ft. After 8-hr. pumping at 50 gpm. the drawdown was 48 1/2 ft.

In Dec. 1935 a permanent well, No. 1, was finished by Chas. Cummings, Gardner, at a depth of 83 ft. and located 15 ft. northwest of Test Well No. 7, (or approximately 1195 ft. N. and 300 ft. E. of the S. W. corner of Section 9, T. 19 N., R. 5 E.). This is in the southwestern part of the village, near the high school.

Well No. 1 is gravel-walled with a 26-in. outer casing from the surface to 75 ft. and a 12-in. inner casing extending from the surface to 73 1/2 ft. below which is a 12-in. Cook screen, 9 1/2 ft. long, and having No. 60 slot openings.

A production test was made by the State Water Survey on Dec. 13, 1935. On the 4 days preceding the test the pump had operated for 6 hr. daily. Before the test the water level was 18 ft. below the ground level. After 7 1/2-hr. pumping at 65 gpm. the drawdown was 45 1/2 ft.

The pumping equipment was replaced in Mar. 1948 by new equipment identical to that previously in service and now consists of: 74.6 ft. of 4-in. column pipe; 6-in., 6-stage Aurora turbine pump, No. 9563, rated at 30 gpm. against 100 ft. of head at 1750 rpm.; the overall length of the pump is 6.15 ft.; 5-hp. electric motor,

On Feb. 16, 1948 after 8-hr. pumping in Well No. 1 the water level was 61 ft. and in Test Well No. 7 was 34.2 ft. In Aug. 1948 the pump discharge rate was estimated to be 23 gpm. On Sept. 1, 1948 after 3 1/2-hr. pumping in Well No. 1 at 23 gpm. the depth to water in Test Well No. 7, 15 ft. southeast, was 33.6 ft. below the top of the casing. The top of the casing is 1.6 ft. above ground level and about the same elevation as the pump base of Well No. 1.

Analysis of a sample (Lab. No. 115,723) collected Sept. 1, 1948 after 3 1/2-hr. pumping showed this water to have a hardness of 31.7 gr. per gal., a residue of 689 ppm., and an iron content of 4.1 ppm. Methane gas was found to be present in the water in a concentration of 9.3 cu. ft. per 1000 gal.

The water is aerated, filtered and softened. Analysis of a sample (Lab. No. 115,781) collected Sept. 1, 1948 showed the treated water to have a hardness of 3.8 gr. per gal., a mineral content of 738 ppm., and an iron content of 0.34 ppm.

Pumpage is estimated to average 20,780 gpd.

LABORATORY NO. 115,723

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	4.1		Silica	SiO_2	38.8	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	120.8	6.04	Chloride	Cl	14.0	0.39
Magnesium	Mg	58.6	4.82	Nitrate	NO_3	0.2	Tr.
Ammonium	NH_4	19.9	1.11	Sulfate	SO_4	4.3	0.09
Sodium	Na	59.6	2.59	Alkalinity (as $CaCO_3$)		704.	14.08
Turbidity		40		Hardness (as $CaCO_3$)		543.	10.86
Color		30		Residue		689.	
Odor		0		Temperature 54.5° F.			

LABORATORY NO. 115,781

	ppm.	epm.			ppm.	epm.
Iron (total) Fe	0.34		Fluoride	F	0.2	
			Chloride	Cl	16.0	0.45
Turbidity	0		Alkalinity	(as $CaCO_3$)	688.	13.76
Color	60		Hardness	(as $CaCO_3$)	66.	1.32
Odor	M		Total Mineral Content		738.	
Temperature 57° F.						

DELAVAN
Tazewell County
Feb. 17, 1949

The public water supply was installed by the city of Delavan (1181) about 1887.

Water was obtained from 2 wells, each drilled to a depth of 160 ft. The wells were located 30 ft. apart within the pump station near the center of town. One well was cased with 6-in. pipe to a depth of 140 ft. and the other well (now known as East Well) with 8-in. pipe to the same depth. Both wells had Cook strainers at the bottom, 20 ft. in length. In 1914 the water level was at a depth of 90 ft.

In 1917 the 6-in. well was abandoned after a new well, now known as the West Well, was drilled 20 ft. distant from the 8-in. well and located at the pumping station (or approximately 2640 ft. N. and 1320 ft. E. of the S. W. corner of Section 10, T. 22 N., R. 4 W.). The well was drilled by Mount and Dunseth, Delavan, to a depth of 158 ft. The driller reported that a water-bearing stratum of sand and gravel was encountered at a depth of 121 ft., and that drilling continued through sand and gravel to a depth of 242 ft. where some tools were lost. It is cased with 10-in. pipe to a depth of 140 ft., below which is a Cook strainer, 14 ft. in length. The well is equipped with: 120 ft. of 6-in. column pipe; a 12-stage Worthington turbine pump, No. 920531, rated at 200 gpm. against a head of 225 ft.; overall length of the pump is 8 ft. 4 3/4 in.; 10 ft. of 6-in. suction pipe; 20-hp. General Electric motor.

The East Well is equipped with: 120 ft. of 6-in. column pipe; 11-stage Worthington turbine pump, No. 292521, rated at 300 gpm. against a head of 225 ft.; overall length of pump is 7 ft. 7 3/4 in.; 10 ft. of 6-in. suction pipe; 30-hp. General electric motor.

In 1926 the non-pumping water level was reported to be 93 ft. below the ground surface elevation of 605t ft.

Analysis of a sample (Lab. No. 109,277), collected Feb. 17, 1947 after the pump had been operating about 3 1/2 hr., showed the water to have a hardness of 18.3 gr. per gal., a residue of 328 ppm., and an iron content of 2.0 ppm.

Pumpage is estimated to average 130,000 gpd.

LABORATORY NO. 109,277

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.0		Silica	SiO_2	25.9	
Manganese	Mn	Tr.		Fluoride	F	0.2	
Calcium	Ca	77.0	3.85	Chloride	Cl	2.0	0.06
Magnesium	Mg	29.6	2.43	Nitrate	NO_3	0.8	.01
Ammonium	NH_4	1.5	.08	Sulfate	SO_4	0.0	0.00
Sodium	Na	2.5	0.11	Alkalinity	(as $CaCO_3$)	320.	6.40
Color		0		Hardness	(as $CaCO_3$)	314.	6.28
Odor		0		Residue		328.	
Turbidity		30					
Temperature		54.5° F.					

A public water supply was installed by the village of De Pue (2296) about 1899.

Water was obtained from a well owned by a railroad company.

About 1909 a well was drilled for the village by W. F. Townsell, Streator, and located in the south part of town on the bank of Lake De Pue (or approximately 400 ft. N. and 2600 ft. W. of the S. E. corner of Section 35, T. 16 N., R. 10 E.). It was reported to be 1278 ft. deep and was cased with 6-in. pipe to 900 ft. below which the hole was 6-in. diameter. The elevation of the ground surface at this location is 464± ft.

At first, water flowed from the well directly into the distribution system. Two 3-in. centrifugal pumps were in use in 1915 to supply pressure for fire protection. In 1915, the pressure at the top of the well was 31 psi., and in 1920 the pressure was 29 psi.

Analysis of a sample (Lab, No. 31419) collected Sept. 1, 1915 showed the water to have a hardness of 13.8 gr. per gal., a residue of 545 ppm., and an iron content of 2.0 ppm.

In Oct. 1919 a 1 1/2-in. American Well Works single-stage centrifugal pump was installed for booster service during daytime. At night no pumping was necessary. The pump was rated at 75 gpm. against 56 ft. of head.

In 1923 two Deming 6 by 8-in. single-acting triplex pumps, rated at 150 gpm. each, replaced the two 3-in. centrifugal pumps. Each pump was belt-driven by a 15-hp. electric motor. When not operating, the pressure on the triplex pump was 30 psi. and there was a 10-in. vacuum after 30-min. operation.

Analysis of a sample (Lab. No. 52934) collected Dec. 2, 1924, showed the water to have a hardness of 12.4 gr. per gal., a residue of 1236 ppm., and an iron content of 1.2 ppm. The chloride content was 490 ppm.

In 1928, the well was recased with 4 1/2-in. pipe, and the artesian flow was reported to be about 100 gpm.

This well, and Well No. 2, furnish water for the public water supply. There is no pump in the well, as the water flows by artesian pressure to the treating plant.

In 1916, about 85 consumers on high ground in the eastern part of town were supplied water from a well 10 ft. in diameter and 32 ft. deep. When tested in 1920, the drawdown was 1 ft. 3 in. and, by measurement of the amount of water pumped into the reservoir, the inflow to the well was calculated at 40 gpm. This well was discontinued several years prior to 1938.

Analysis of a sample (Lab. No. 52935) collected Dec. 2, 1924, showed the water from this well to have a hardness of 23.4 gr. per gal., a mineral content of 489 ppm., and an iron content of 4.8 ppm.

Well No. 2 was completed to a depth of 1487 ft. by Sewell Well Co., St. Louis, Mo., in 1938 and located 150 ft. west of Well No. 1 on the bank of Lake De Pue about 250 ft. southwest of the pumping station (or approximately 400 ft. N. and 2450 ft. E. of the S. W. corner of Section 35).

The elevation of the ground surface at this site is 464.12 ft.

Sample-study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Till	65	65
Pennsylvanian system		
Shale, sandstone, thin siltstone, limestone and coal beds	280	345
Silurian system		
Niagaran-Alexandrian dolomites, siltstone at base	505	850
Ordovician system		
Maquoketa shale, some dolomite	155	1005
Galena-Platteville dolomites	380	1385
St. Peter sandstone	102	1487

The hole and casing record is given in Table 1.

All of the casing joints were welded, and the outside of the 8-in. casing was primed and coated (hot) with Bitumastic enamel for salt water protection.

During drilling operations, the free flow estimations by the driller and some mineral analyses by the Mineral Point Zinc Co. were reported as given in Table 2.

TABLE 1

Hole Record

15-in. from surface to 93 ft.
12 1/4-in. from 93 to 496 1/2 ft.
10-in. from 496 1/2 to 1034 ft.
7 1/2-in. from 1035 to 1487 ft.

Casing Record

12-in. from surface to 93 ft.
10-in. from surface to 496 1/2 ft.
8-in. from surface to 1034 ft.
Lead packer from 1034 to 1035 ft.

Analysis of a sample (Lab. No. 83491) collected May 11, 1938, while cased to 490 ft. and drilling at 825 ft., showed the chloride content to be 2850 ppm., and residue of 5501 ppm.

On June 28, 1938, the well was capped and the shut-in pressure was reported to be 38 psi. On Aug. 27, 1945, the free flow was estimated at 120 gpm., and the shut-in. pressure at 25 psi.

Analysis of a sample (Lab. No. 111,363) collected Aug. 4, 1947, from a tap at the pump station about 250 ft. from Well No. 2 showed the water to have a hardness of 13.2 gr. per gal., a residue of 546 ppm. and an iron content of 0.7 ppm.

The water is treated for iron removal.

Water from Wells No. 1 and No. 2 flows by artesian pressure to an aerator at the treating plant which is located on Second St. about 250 ft. northeast of Well No. 2.

Analysis of a sample (Lab. No. 111,362) collected Aug. 4, 1947 from a tap at the pumping station, showed the treated water to have a hardness of 13.2 gr. per gal., a mineral content of 805 ppm., and an iron content of 0.12 ppm. The chloride content indicates the presence of an appreciable proportion of water from the No. 1 well.

Consumption for July 1947 averaged 135,300 gpd.,and for June 1947 averaged 132,000 gpd. In the winter months the consumption drops to an average of 75,000 gpd.

TABLE 2

Date	Depth ft.	Free Flow gpm.	Partial Analyses
	460	flow	
May 6, 1938	705	20	Chloride, 2835 ppm.
" 9,	735	50	Salt water
" 10,	825	120	Salt water, fluoride 3 ppm.
" 20,	1035	120	Chloride, 2644 ppm.
" 21,	Installed 8-in. casing		
June 1	1210	50	
" 3	1284	85	Chloride 184 ppm. Temp. 63° F.
" 10	1370	85	Fluoride 0.8 ppm.
" 13	1415	150	Fluoride 0.7 ppm.
" 17	1487	150	Fluoride 0.6 ppm., Chloride 120 ppm.

LABORATORY NO. 111,363

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.7		Silica	SiO_2	14.0	
Manganese	Mn	0.0		Fluoride	F	0.7	
Calcium	Ca	53.2	2.66	Chloride	Cl	88.0	2.48
Magnesium	Mg	22.5	1.85	Nitrate	NO_3	0.9	0.01
Ammonium	NH_4	1.1	0.06	Sulfate	SO_4	63.6	1.32
Sodium	Na	118.7	5.16	Alkalinity	(as $CaCO_3$)	296.	5.92
Color		0.		Hardness	(as $CaCO_3$)	226.	4.51
Odor		0.		Residue		546.	
Turbidity		0.		Temperature 65° F.			

DES PLAINES
Cook County
May 11, 1946

A public water supply for the city of Des Plaines (9518) was started in 1893, on ground back of the old village hall at the southeast corner of Lee and Ellinwood St. (approximately 800 ft. N. and 1000 ft. W. of the S. E. corner of Section 17, T. 41 N., R. 12 E.). F. M. Gray, Milwaukee, drilled a hole to a depth of 1800 ft. without obtaining water. No log of the material penetrated is available but it was reported that, below a depth of 120 ft., the hole was in shale.

In 1895 three sand and gravel wells were developed on an acre plot of ground located on the east bank of the Des Plaines River. The center of the plot was on the north line of Ashland Ave., extended east across the river, (approximately 800 ft. S. and 800 ft. E. of the N. W. corner of Section 21). The wells in this group were 8 in. in diameter and about 130 ft. in depth. Originally they were pumped simultaneously by air lift and had a combined yield of 300 gpm. The non-pumping water level was 15 ft. below the ground surface.

Analysis of a sample (Lab. No. 20941) submitted in 1910 showed this water to have a hardness of 27.0 gr.per gal. and a mineral content of 884 ppm.

In 1915 the combined discharge from the 3 wells was 220 gpm., and a new well was added to the group. It was located 60 ft. from the well on the river bank, and about 200 ft. from the other 2 wells. This well was dug to a diameter of 4 ft. and was in clay to a depth of 102 ft. A small hole was then bored below the dug part of the well, penetrating 5 ft. of additional clay and 2 ft. of very fine sand. Water rose to within 15 ft. of the ground surface and flooded the well. Several 8-in. pipes were driven to a depth of 7 ft. below the bottom of the dug portion. This well furnished part of the supply for a time, but the yield was small and was influenced by the pumping in the other wells in the group.

In 1919 and 1920 tw6 of the 8-in. holes in the dug well were deepened, 1 to a depth of 175 ft. During pumping operations the water level lowered rapidly, and fine sand was drawn into the well. Only 2 of the 3 original 8-in. wells were operated in 1922 because their combined yield equalled the yield of all 3 wells. By May 1927 these wells were furnishing a total of only 5000 gpd. They were operated for about one-half hr. per day in Aug. 1928 and were abandoned sometime during 1928 or 1929.

A water shortage was alleviated in 1922 by purchasing water from the Benjamin Electric Manufacturing Co; located at the intersection of Northwest Highway and Seegers Road.

A sandstone well was completed for the city by W. L. Thorne, Des Plaines, in 1924. It is located on the west bank of the Des Plaines River at the foot of Ashland Ave. (approximately 800 ft. S. and 600 ft. E. of the N. W. corner of Section 21). The ground surface elevation at this point is 633.0 ft. The well is 1670 ft. deep and its diameter is 16 in. at the top and 8 in. at the bottom. No log or casing records are available. However, it was reported to have penetrated a soft formation all the way and to be cased to the bottom. Water was pumped by air lift and furnished part of the supply in 1924, but the yield was limited. The air line extended to a depth of 300 ft. The starting pressure was 103 psi., and the operating pressure was 60 psi. The well was abandoned as. a source of supply before 1927. The State Water Survey installed a water level recorder in this well on June 29, 1942. Since that time an average annual water level recession of 6.4 ft. has been recorded. The water level on Jan. 15, 1946 was 166 ft. below the ground surface.

LABORATORY NO. 20941

		ppm.	epm.			ppm.	epm.
				Silica	SiO_2	14.4	
Calcium	Ca	107.2	5.36	Chloride	Cl	215.0	6.06
Magnesium	Mg	47.2	3.87	Nitrate	NO_3	4.4	0.07
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	247.4	5.15
Sodium	Na	117.4	5.10	Alkalinity	(as $CaCO_3$)	173.	3.46
Color		5		Hardness	(as $CaCO_3$)	463.	9.26
Odor		E		Residue		884.	
Turbidity		0					

LABORATORY NO. 52577

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.7		Silica	SiO_2	32.8	
Manganese	Mn	0.0		Chloride	Cl	670.	18.89
Calcium	Ca	112.3	5.60	Nitrate	NO_3	0.0	.00
Magnesium	Mg	64.3	5.27	Sulfate	SO_4	189.7	3.94
Ammonium	NH_4	2.3	0.13	Alkalinity (as $CaCO_3$)		250.	5.00
Sodium	Na	355.8	15.47	Residue		1660.	
				Hardness (as $CaCO_3$)		542.	10.84

Color	40
Odor	0
Turbidity	40

Analysis of a sample (Lab. No. 52577) collected Oct. 2, 1924 from this well showed the water to have a hardness of 31.7 gr. per gal., and a mineral content of 1660 ppm.

In 1924 Layne & Bowler Co. attempted to develop a supply of 300 gpm. from sand and gravel wells. One 10-in. well was drilled to a depth of 150 ft. on the village plot on the east bank of the Des Plaines River. It was located about 200 ft. east of the north 8-in. well which had been drilled in 1895. This well was equipped with a pump and was used for approximately 1 year. No record of its capacity is available. Two other test wells were drilled but were not developed.

A well was completed by W. H. Cater, Chicago, in June 1927 as a private venture. It is located on Thacker St. west of the Chicago & Northwestern R.R.Co. Norma yards (approximately 100 ft. N. and 1450 ft. E.of the S. W. corner of Section 18). This well was purchased by the city in 1935 and has been the principal source of the public water supply since 1927. The Cater Well, or City Well No. 1, was drilled to a depth of 1735 ft. The elevation of the top of the pump base is 652.0 ft.

The hole and casing records are given in Table 1.

The lower 160 ft. of the 10-in. liner was constructed as a screen. Vulcanite was placed outside of the 16-in. casing and the 12 1/2-in. liner. On Aug. 29, 1928 water was pumped for a period of 1 hr. and 10 min. at an average rate of 1050 gpm. In 1936 the non-pumping water level was reported to be 155 ft. below the pump base. A 24-hr. production test was conducted on Dec. 21 and 22, 1943. The production was 750 gpm., with a drawdown of 185 ft. from a non-pumping water level of 210 ft.

TABLE 1

Hole Record

24-in. from 0 to 300 ft.
15-in. from 300 to 800 ft.
12 1/2-in. from 800 to 1600 ft.
10-in. from 1600 to 1735 ft.

Casing Record

19-in. from surface to 170 ft.
16-in. from surface to 300 ft.
12 1/2-in. liner from 699 to 800 ft.
10-in. liner from 1010 to 1600 ft.

The depth of the well on Oct. 18, 1944, found to be 1604 ft., indicated a filling of 131 ft. since construction in 1927. This filling was not removed. The depth to water on Oct. 23, 1944, after a non-pumping period of 5 days, was 200 ft.

Due to increasing water demands new pumping equipment was installed and put into service Nov. 8, 1944, and at present consists of 501.5 ft. of 10-in. column pipe; 14-in., 22-stage Pomona turbine pump; 10 ft. of 8-in. suction pipe; 501.5 ft. of 1/4-in. air line; 200-hp. Westinghouse electric motor.

The pump discharge to the treating plant is measured by a Venturi meter. On Dec. 7, 1944 after pumping at a rate of 1050 gpm. for 4 hr., the water level was 468 ft. below the pump base. Water-level readings, taken in July 1945, varied from 454 ft. after 4-hr. pumping to 466 ft. after 18-hr. pumping at a rate of about 1000 gpm. Observations, made in Mar., Apr., and May, 1946, when pumping at a rate of about 815 gpm., showed water levels varying from 420 ft; after 2 1/2 hr. to 434 ft. after 22 hr.

LABORATORY NO. 98770

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	10.5	
Manganese	Mn	0.1		Chloride	Cl	30.0	0.85
Calcium	Ca	68.1	3.41	Nitrate	NO_3	2.4	0.04
Magnesium	Mg	18.0	1.48	Sulfate	SO_4	158.4	3.30
Ammonium	NH_4	0.5	0.03	Alkalinity	(as $CaCO_3$)	212.	4.24
Sodium	Na	80.7	3.51	Hardness	(as $CaCO_3$)	244.	4.88
Color		0		Residue		501.	
Odor		0		Temperature	62.5° F.		
Turbidity		0					

Sample-study log of Des Plaines Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and clay	20	20
Sand, silty	18	38
Clay and some sand and gravel near top	47	85
Sand and granule gravel, silty	5	90
Silurian system		
Alexandrian dolomite	12	102
Ordovician system		
Maquoketa shale and dolomite	232	334
Galena-Platteville dolomite, some limestone	326	660
Glenwood sandstone, dolomitic at top, thin shale bed at base	60	720
St. Peter formation		
Sandstone, incoherent	75	795
Conglomerate of sandstone, chert, and clay	9	804
Oneota dolomite, some sandstone, thin shale bed at base	86	890
Cambrian system		
Trempealeau dolomite, thin sandstone bed	120	1010
Franconia sandstone and dolomite, thin shale beds	90	1100
Galesville sandstone		
Sandstone, partly dolomitic	125	1225
Sandstone, incoherent	20	1245
Sandstone, partly dolomitic	55	1300
Eau Claire formation		
Sandstone, shale and dolomite	370	1670
Sandstone, incoherent	50	1720
Mt. Simon sandstone	45	1765
Pre-Cambrian system		
Fond du Lac sandstone	48	1813

A sample (Lab. No. 98770) of water collected Jan. 13, 1944, after 4 1/2-hr. pumping at a rate of 700 gpm., was shown by analysis to have a hardness of 14.2 gr. per gal.; a mineral content of 501 ppm.; and character indicating a mixture of waters from the Galesville and Mt. Simon sandstones in this vicinity. Water of similar character was obtained in a sample collected July 3, 1942 after pumping 15 hr. at 800 gpm. and in sample collected May 3, 1946 after 24-hr. pumping at 815 gpm.

In Dec. 1946, Des Plaines Well No. 2 was completed by S. B. Geiger & Co. The well is located 100 ft. north and 200 ft. east of the intersection of Thacker St. with Mt. Prospect Road (or approximately 100 ft. N. and 200 ft. E. of the S. W. corner of Section 18). It is about 1000 ft. west of the Cater Well and the city water works.

The well was drilled to a depth of 1813 ft. below a ground surface elevation of 655± ft.

The hole and casing record, as reported by the driller, is given in Table 2.

TABLE 2

Hold Record

23-in.	from	0 to	345 ft.
19-in.	from	345 to	550 ft.
15-in.	from	550 to	870 ft.
12-in.	from	870 to	1572 ft.
10-in.	from	1572 to	1813 ft.

Casing Record

24-in. od. surface pipe from 0 to 96 ft.
20-in. od. from 0 to 345 ft.
12-in. id. liner from 787 to 870 ft.
10-in. id. liner from 1304 to 1572 ft.

A production test was made on Dec. 28-31, 1946 by representatives of the driller, city and State Water Survey. For test purposes, a deep-well turbine-pump assembly was used, consisting of 500 ft. of column pipe; 8.5 ft. of bowl section; 20.0 ft. of suction pipe.

After 1-hr. pumping at a rate of 1050 gpm. the drawdown was 28 ft. below a non-pumping water level of 230 ft.

The air line became plugged, and all efforts to break the plug were unsuccessful. The pump was then operated at 1010 gpm. for a period of 17 hr. During this period the pumping level in Well No. 1 receded 7 ft. to 444 ft. below the pump base.

Analysis of a sample (Lab. No. 108,774) collected on Dec. 31, 1946, after 18 hr. of pumping at 1055 gpm., showed the water from this well to have a hardness of 16.0 gr. per gal. and a mineral content of 443 ppm. The well had not been thoroughly pumped and cleaned at this time, and this sample is possibly not representative.

The Norma Well, owned by the Chicago & Northwestern R. R. and located at the Norma Yards, has been an important factor in the public water supply. It has served at various times as the principal, auxiliary and emergency water source for the city in addition to furnishing from 2 to 3 mg, monthly for locomotive use.

It is located approximately 600 ft. south of Thacker St. (or approximately 600 ft. S. and 2500 ft. W. of the N.E. corner of Section 19, T. 41 N., R. 12 E.). The well was drilled in 1913 to a depth of 1890 ft. by J., F. McCarthy of Minneapolis, Minnesota. The elevation of the top of the pump base is 653.3 ft.

A sample of water (Lab. No. 98769) collected

LABORATORY NO. 108,774

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.6		Silica	SiO_2	11.9	
Manganese	Mn	0.1		Fluoride	F	1.0	
Calcium	Ca	75.6	3.78	Chloride	Cl	17.0	.48
Magnesium	Mg	20.9	1.72	Nitrate	NO_3	1.1	.02
Ammonium	MH_4	0.5	.03	Sulfate	SO_4	116.0	2.41
Sodium	Na	48.3	2.10	Alkalinity (as $CaCO_3$)		236.	4.72
Color		0		Hardness (as $CaCO_3$)		275.	5.50
Odor		0		Residue		443.	
Turbidity		30		Free CO_2 (calc.)		18.3	
Temperature 59.5° F.				pH = 7.5			

LABORATORY NO. 98769

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.7		Silica	SiO_2	13.0	
Manganese	Mn	0.1					
Calcium	Ca	77.6	3.88	Chloride	Cl	10.0	0.28
Magnesium	Mg	41.0	3.37	Nitrate	NO_3	2.9	0.05
Ammonium	NH_4	0.1	Tr.	Sulfate	SO_4	348.9	7.26
Sodium	Na	71.3	3.10	Alkalinity	(as $CaCO_3$)	138.	2.76
Color		0		Hardness	(as $CaCO_3$)	362.	7.24
Odor		M		Residue		674.	
Turbidity		Tr.					
Temperature 52° F.							

Jan. 14, 1944 after 1-hr. pumping at 500 gpm.,was shown by analysis to have a hardness of 21.1 gr. per gal., a mineral content of 674 ppm., and character not unusual for waters from the upper limestone in the vicinity west of the city.

Water of similar character was obtained in a sample collected Oct. 24, 1944 after continuous pumping for 6 days.

A water softening plant rated it 1 1/2 mgd. was constructed by the city in 1936. It is located about 200 ft. west of the Cater well and is operated at a rate of 1 mgd. It is a lime-soda type with rapid sand filters. All water is aerated, softened, filtered, and chlorinated before being pumped to the distribution system.

Analysis of a sample (Lab. No. 106,432) collected from a tap of t'reated water in the treating plant on May 3, 1946, showed this water to have ahardness of 6.1 gr.per gal., and a mineral content of 328 ppm. A chlorine residual of 0.25 ppm. was recorded at the time of collection of the sample.

The metered pumpage for the year 1945 averaged 90.7,000 gpd. which varied from a winter minimum average of 790,000 gpd. to a summer maximum average of 1.018 mgd.

LABORATORY NO. 106;432

	ppm.	epm.		ppm.	epm.
Iron (total) Fe	Tr.				
			Chloride	36.0	
Turbidity	0		Alkalinity (as $CaCO_3$)	50.	
Color	0		Hardness (as $CaCO_3$)	104.	
Odor	M		Total Mineral Content	328.	
Temperature 66° F.					

DIXON
Lee County
Jan. 8, 1948

A public water supply for the city of Dixon (10,671) was installed in 1883 by the Dixon Water Co.

Water was first obtained from the Rock River. In 1888, two deep wells were drilled by the J. P. Miller Artesian Well Co., Brookfield.

Well No. 1 (East Well) is located near the south bank of Rock River and 400 ft. east of Artesian Ave. (or approximately 300 ft. N. and 900 ft. E. of the S. W. corner of Section 33, T. 22 N., R. 9 E.). The surface elevation is 662± ft. The well was 1630 ft. deep and was cased with 8-in. pipe to a depth of 160 ft.

In 1915 the free flow was inadequate and the production was increased by installation of an air lift having 107 ft. of 1 1/2-in. air pipe.

The present pump equipment is as follows: American Well Works centrifugal pump, No. 42950; 30 ft. of 4-in. suction pipe; 15-hp. General Electric motor, No. 4023021.

In 1938 this well was seldom used, but could supply 500 to 600 gpm. when needed. In Jan., 1948, the pump had been removed and the well capped.

Well No. 2 was drilled to a depth of 1700 ft. and was cased to 160 ft. with 8-in. pipe and located 100 ft. west of Well No. 1. The surface elevation is 661± ft.

Water was originally pumped by air lift, but in 1916, a centrifugal pump, similar to that in Well No. 1, was installed. In 1938, the well was equipped as follows: 40 ft. of 5-in. column pipe; 3-stage, 5-in. Johnson turbine pump, No. 6518, rated at 600 to 700 gpm.; 10 ft. 5 in. of 5-in. suction pipe and strainer; 40 ft. of 1/4-in. air line; 20-hp. U. S. electric motor, No. 153579, operating at 3600 rpm. The top of the well and the pump were originally in a pit about 14 ft. deep. On Feb. 15, 1938, the non-pumping water level was reported to be 17.2 ft. below the pump base plate. In Jan. 1948 the pump was at ground level and the well used only for emergency. The air line is defective.

Well No. 3 was drilled to a depth of 1865 ft. in 1914 by H. W. Hambrecht, Sterling, and located 400 ft. west of Well No. 1. It was cased with 8-in. pipe to a depth of 645 ft. The surface elevation is 656± ft.

The top of the well and the pump were in a pit about 10 ft. deep. On July 22, 1937, the non-pumping water level was reported to be 42 ft. below the ground surface. About 1938 the well was reported to have filled in to a depth of 1793 ft. and in 1943-1944, the well was rehabilitated by C. W. Varner, Dubuque, after which the hole and casing record was reported as shown in Table 1.

TABLE 1

Hole Record

24-in. from surface to 162 ft.
18-in. from 162 to 546 ft.
12-in. from 546 to 990 ft.
8-in. from 990 to 1700 ft.

Casing and Liner Record

18-in. casing from surface to 161 ft.
16-in. liner from 327 to 546 ft.

The 18-in. casing was grouted in place with cement. On Mar. 29, 1944 the well was "shot" at 3 levels: 1427, 950, and 900 ft. An estimated

LABORATORY NO. 113,127

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.6		Silica	SiO_2	14.4	
Manganese	Mn	Tr.		Fluoride	F	0.3	
Calcium	Ca	66.9	3.35	Chloride	Cl	2.0	0.06
Magnesium	Mg	34.0	2.79	Nitrate	NO_3	Tr.	Tr.
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	13.2	0.27
Sodium	Na	4.1	0.18	Alkalinity (as $CaCO_3$)		300.	6.00
Turbidity		Tr.		Hardness (as $CaCO_3$)		307.	6.14
Color		0		Residue		308.	
Odor		0		Temperature 57.4° F.			

75 cu. yards of sand were bailed out of the well after the shooting and when repair work was completed, the well was flowing at a rate of 40 gpm.

The existing pump installation, made on June 19, 1944, consists of 100 ft. of 10-in. column pipe; 12-in., 3-stage Peerless turbine pump, No. 22294, rated at 800 gpm.; 100 ft. of 1/8-in. air line; 30-hp. U. S. motor, No. 328666.

When tested by the driller on June 19, 1944, the well produced 1145 gpm. with a drawdown of 83 ft. The water flowed when not pumping. On Jan. 8, 1948 the non-pumping water level was 15 ft. and after 4-hr. pumping at 800 gpm., the drawdown was 67 ft.

Analysis of a sample (Lab. No. 113,127) collected Jan. 8, 1947 after pumping 20 hr. at 800 gpm., showed this water to have a hardness of 17.9 gr. per gal., a residue of 308 ppm., and an iron content of 0.6 ppm.

Well No. 4 was drilled in 1894 to a depth of 1700 ft. by J. P. Miller Artesian Well Co. and located 900 ft. west of Well No. 1 (or approximately 250 ft. N. of the S. W. corner of Section 33). The well was cased with 7-in. pipe to a depth of 160 ft. below a surface elevation of 653t ft.

This well was put back into service in 1936 after having been out of service for about 12 years.

Water has been pumped from Well No. 4 by a Dayton Dowd centrifugal pump, No. 35497, rated at 700 gpm. against 45 ft. of head and operating at 1750 rpm. The pump is driven by a 15-hp. Westinghouse electric motor, No. 21A798758, operating at 1750 rpm. The pump was located in the pump house at Well No. 3 and in a pit about 12 ft. deep. A 6-in. pipe extended from the pump section to the well. The pump is now removed and is expected to be replaced by a deep-well pump.

On July 22, 1937, the non-pumping water level was 17.1 ft. below the ground surface and in

Sample-study log of Well No. 5 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Glacial drift"	8	8
Ordovician system		
Galena-Platteville dolomite	112	120
Glenwood sandstone, some shale	45	165
St. Peter formation		
Sandstone	165	330
Conglomerate of sandstone, shale and chert	47	377
Shakopee dolomite, thin shale bed at top	38	415
Oneota dolomite, some sandstone and thin shale bed at base	131	546
Cambrian system		
Trempealeau dolomite	184	730
Franconia dolomite, shale and sandstone	100	830
Galesville formation		
Sandstone, thin dolomite beds	80	910
Sandstone, incoherent	65	975
Eau Claire formation		
Shale, sandstone, dolomite, and siltstone	275	1250
Sandstone, incoherent	175	1425
Cambrian and Pre-Cambrian systems		
Mt. Simon and Fond du Lac sandstones		
Sandstone, incoherent	275	1700

1938 water was being pumped from this well almost 24 hr. per day with Wells No. 2 and 3 being used to supply peak demands.

Analysis of a sample (Lab. No. 83968) collected on July 26, 1938, showed water from this well to have a hardness of 17.6 gr. per gal., a residue of 3 73 ppm., and an iron content of 0.44 ppm.

Well No. 5 was completed in Nov. 1947 by C. W. Varner and located 25 ft. south of East River St. and 350 ft. west of Well No. 4. The ground elevation is 660t ft. The well was drilled to 1700 ft. but was "shot" and cleaned out to 1472 ft.

The hole and casing record is as shown in Table 2.

The pump assembly consists of 120 ft. of 10-in. column pipe; 3-stage Peerless turbine pump, No. 33403, having an over all length of 52 1/2 in.; 120 ft. of 1/8-in. air line; 10 ft. of 10-in. suction pipe; 60-hp. General Electric motor, No. 6056537.

Upon completion, the non-pumping water level was 12 ft. 4 in. below the top of the casing, and during a production test by the driller, after pumping 24 hr. at 1200 gpm. the drawdown was 70 ft.

TABLE 2

Hole Record

23-in. from 0 to 160 ft.
19-in. from 160 to 420 ft.
15-in. below 420 ft.

Casing Record

18-in. from 0 to 160 ft.
16-in. liner from 330 to 420 ft.
The 18-in. casing was grouted in place.

Analysis of a sample (Lab. No. 113,128) collected Jan. 8, 1948 after 25-min. pumping at 1200 gpm., showed this water to have a hardness of 17.8 gr. per gal., a residue of 320 ppm., and an iron content of 1.1 ppm.

In Dec. 1947, Wells 1 and 4 were not in service. Well 2 and 5 were being maintained for emergency usage. Well No. 3 furnished all of the demand, except for occasional pumping from No. 2 and No. 5.

From Jan. to Sept. 1947, pumpage averaged 1.03 mgd.

LABORATORY NO. 113,128

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.1		Silica	SiO_2	14.1	
Manganese	Mn	Tr.		Fluoride	F	0.3	
Calcium	Ca	68.5	3.43	Chloride	Cl	1.0	0.03
Magnesium	Mg	36.5	3.00	Nitrate	NO_3	Tr.	Tr.
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	10.5	0.22
Sodium	Na	3.0	0.13	Alkalinity	(as $CaCO_3$)	316.	6.32
Turbidity		10±		Hardness	(as $CaCO_3$)	322.	6.43
Color		0		Residue		320.	
Odor		0		Temperature 56 1/2° F.			

DIXON STATE HOSPITAL,
Lee County
Dec. 11, 1947

The Dixon State Hospital obtains water from 2 deep wells.

Well No. 1 was drilled in 1915 to a depth of 1922 ft. by H. W. Hambrecht, Sterling, and located approximately 200 ft. N. and 2300 ft. W. of the S.E. corner of Section 21, T. 22 N., R. 9 E. The surface elevation is 680± ft.

The hole and casing record is as shown in Table 1.

TABLE 1

Hole Record

12 1/4-in. from surface to 466 ft.
10-in. from 466 to 515 ft.
8-in. from 515 to 1922 ft.

Casing Record

14-in. od. drive pipe from surface to 28 ft. 4 in.
10-in. casing from surface to 466 ft.
8-in. casing from 466 to 515 ft.

The well is equipped as follows: 65 ft. of 8-in. column pipe; 8-stage Pomona turbine pump, SR 1494; the overall length of the pump is 6 1/2 ft.; 20 ft. of 8-in. suction pipe; 50-hp. General Electric motor.

When the well was completed, the non-pumping water level was 3 ft. On Aug. 15, 1938, the non-pumping water level was 18 ft. 8 in. below the pump house floor. The State Water Survey made a production test on that date, and the well produced 990 gpm. for 5 hr. The water level when pumping could not be measured. In Dec, 1947, the non-pumping water level was estimated to be 35 ft. below the ground surface.

Analysis of a sample (Lab. No. 112,902) collected Dec. 12, 1947 after 1-hr. pumping at 650 gpm., showed the water to have a hardness of 20.6 gr. per gal., a residue of 383 ppm., and an iron content of 2.0 ppm.

Well No. 2 was drilled in 1915 to a depth of 1780 ft. by H. W. Hambrecht, and located 150 ft. north of Well No. 1.

The hole and casing record is given in Table 2.

TABLE 2

Hole Record

12 1/2-in. from surface to 468 ft.
10-in. from 468 to 518 ft. 10 1/2 in.
8-in. from 518 ft. 10 1/2 in. to 1780 ft.

Casing Record

14-in. od. drive pipe from surface to 34 ft. 8 1/2 in.
10-in. wi. pipe from surface to 469 ft. 9 1/2 in.
8-in. wi. pipe from 469 ft. 9 1/2 in. to 526 ft. 9 1/2 in.

When the well was completed, the non-pumping water level was 5 ft. 5 in.

The well is equipped as follows: 70 ft. of 7-in. column pipe; 7-stage Pomona turbine pump, SR 1495, having an overall length of 8 ft.; 20 ft. of 7 in. suction pipe; 70 ft. of air line; 50-hp. General Electric motor.

On Sept. 14, 1938 the State Water Survey made a production test. Due to a pump failure,

LABORATORY NO. 112,902,

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.0		Silica	SiO_2	13.7	
Manganese	Mn	Tr.		Fluoride	F	0.5	
Calcium	Ca	77.9	3.90	Chloride	Cl	14.0	0.39
Magnesium	Mg	38.5	3.17	Nitrate	NO_3	6.3	0.10
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	47.1	0.98
Sodium	Na	3.7	0.16	Alkalinity (as $CaCO_3$)		288.	5.76
Turbidity		10		Hardness (as $CaCO_3$)		354.	7.07
Color		0		Residue		383.	
Odor		0		Temperature 57.3° F.			

the test period was only 2 1/2 hr. When pumping at a rate of 960 gpm., the drawdown was 2i. ft. from a non-pumping water level of 21 ft. below the pump house floor. In Dec, 1947, the non-pumping water level was estimated to be 35 ft. below the ground surface.

Analysis of a sample (Lab. No. 112,903) collected Dec. 12, 1947, showed this water to have a hardness of 20.0 gr. per gal., a residue of 354 ppm. and an iron content of 0.7 ppm. The temperature was 56.6° F.

The water is softened each day for a few hr. The softening unit was not in operation at the time of collecting the sample.

Pumpage during 1947 averaged 684,400 gpd.

Sample-study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Glacial drift	19	19
Ordovician system		
Platteville dolomite	30	49
Glenwood shale, sandstone, some dolomite	36	85
St. Peter sandstone	100	185
Shakopee dolomite, thin shale bed	114	299
Oneota dolomite, some sandstone and shale in lower part	179	478
Cambrian system		
Trempealeau dolomite	156	634
Franconia sandstone, some dolomite at top	102	736
Galesville formation		
Sandstone, dolomite at base	62	798
Sandstone, incoherent	71	869
Eau Claire formation		
Shale, sandstone, and dolomite	264	1133
Sandstone	146	1279
Mt. Simon sandstone	83	1362
Pre-Cambrian system		
Fond du Lac sandstone	418	1780

DONGOLA
Union County
Feb. 6, 1948

The village of Dongola (638) installed a public water supply in 1936.

A test hole was first drilled in 1935 and was located near the east corner of the intersection of Charles and Oak St. (or approximately 400 ft. S. and 1900 ft. W. of the N. E. corner of Section 25, T. 13 S., R. 1 W.). The ground surface elevation is 390± ft.

The test hole was 300 ft. deep and cased with 6-in. pipe to a depth of 104 ft. The hole was reported to terminate in limestone.

The State Water Survey made a production test on June 14, 1935. For test purposes, the pumping equipment consisted of: 195 ft. of 4-in. column pipe; 13-stage turbine pump; 20 ft. of 4-in. tail pipe; gasoline engine. The well produced 47 gpm. with a drawdown of 53 ft., and 70 gpm. with a drawdown of 70 ft. from a non-pumping water level of 26 ft. below the ground surface.

The city well, located at the site of the test well, was drilled in 1936 by C. W. Haverstick, De Soto, Mo., and was cased to a depth of 101 ft. with 18-in. od. pipe, below which the hole was 14 in. in diameter.

The well is equipped as follows: 200 ft. of 6-in. column pipe; 8-in., 18-stage Pomona, water-lubricated, turbine pump, No. N 1118, the pump discharged 65 gpm. against 75 psi. pressure; defective air line; 25-hp. electric motor operating at 1760 rpm.

The pump base is about 18 in. above ground level.

The State Water Survey made a production test on Sept. 4, 1935. After 2-hr. 47-min. pumping at the rate of 100 gpm., the drawdown was 134 ft. from a non-pumping water level of 7 ft. below ground level. Another production test was made on Oct. 4, 1935. After 8-hr. pumping at a rate of 110 gpm., the drawdown was 109 1/2 ft. from a non-pumping water level of 26 ft.

It was reported that the well was not fully developed during these tests. During a period in the summer of 1943 the pump was in continuous operation for 7 consecutive days pumping at a rate of 60 gpm. At the end of the period the water was turbid.

Water is obtained from creviced zones in the limestone at depths of 165 ft. and from the bottom of the well according to report of a council member at the time the well was drilled.

Analysis of a sample (Lab. No. 113,371) collected Feb. 3, 1948, after 1-hr. pumping at 65 gpm. showed the water to have a hardness of 14.1 gr. per gal., a residue of 331 ppm., and an iron content of 0.4 ppm.

The estimated pumpage during 1947 averaged 27,600 gpd.

LABORATORY NO. 113,371

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.4		Silica	SiO_2	16.9	
Manganese	Mn	0.1		Fluoride	F	0.1	
Calcium	Ca	87.9	4.40	Chloride	Cl	13.0	0.37
Magnesium	Mg	5.2	0.43	Nitrate	NO_3	10.7	0.17
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	10.5	0.22
Sodium	Na	27.8	1.21	Alkalinity (as $CaCO_3$)		264.	5.28
Turbidity		15.		Hardness (as $CaCO_3$)		242.	4.83
Color		0		Residue		331.	
Odor		Tr.		Free CO_2 (calc.)		41.	
Temperature		58.7° F.		pH = 7.2			

DONOVAN
Iroquois County
Nov. 18, 1948

A public water supply was installed about 1906, by the village of Donovan (381).

An oil-well driller by name of Rodiger drilled a well to a depth of 130 ft. and located north of Third St. and east of Railroad Ave. (or approximately 1800 ft. N. and 100 ft. E. of the S. W. corner of Section 28, T. 28 N., R. 11 W.).

In 1937 the well was reconditioned by Ira French, Fairbury, at which time the well was reported to be cased with 6-in. pipe, terminating in gravel and sand.

In Apr. 1938, the non-pumping water level was 40 ft. below the ground level elevation of 658± ft.

The pumping equipment consists of 84 1/2 ft. of4-in. drop pipe; 4 1/4 by 48-in. Deming single-acting brass cylinder pump, No. 3226, with a 4-leather plunger and having a 12-in. stroke, and operated at 15 spm.; belt-drawn by a 5-hp., 570 rpm. General Electric motor, No. 3742273.

Analysis of a sample (Lab. No. 83362) collected Apr. 21, 1938 showed this water to have a hardness of 9.4 gr. per gal., a residue of 307 ppm.,'and an iron content of 0.8 ppm.

A well was finished in Apr. 1945 at a depth of 170 ft. by Ira French, and located one block east of the old well. The drilling was originally 235 ft. deep, encountering a compact hard rock formation, but the yield was insufficient for the public supply. The casing was pulled back and installed with the bottom in a 17-ft. stratum of water-bearing gravel. The well is cased with 155 ft. of 6-in. pipe and 15 ft. of 5-in. screen.

When finished, the static water level was 53 ft. below the ground surface and when pumping at 65 gpm. the drawdown was 9 ft. On Nov. 10, 1948, the 'non-pumping water level was 47 ft. and after intermittent pumping the water level was 63 ft.

The pumping equipment includes a 6-in. Deming turbine pump, No. T 6743, rated at 50 gpm. against 203 ft. of head; 90 ft. of air line; 5-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 116,417) collected Nov. 10, 1948 after 2-minutes pumping showed the water to have a hardness of 8.0 gr. per gal., a residue of 315 ppm., and an iron content of 2.3 ppm.

Pumpage is estimated to average 15,000 gpd.

LABORATORY NO. 116,417

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.3		Silica	SiO_2	16.6	
Manganese	Mn	0.0		Fluoride	F	0.7	
Calcium	Ca	40.0	2.00	Chloride	Cl	30.0	0.85
Magnesium	Mg	9.0	0.74	Nitrate	NO_3	0.2	Tr.
Ammonium	NH_4	0.7	0.04	Sulfate	SO_4	0.0	0.00
Sodium	Na	64.2	2.79	Alkalinity (as $CaCO_3$)		236.	4.72
Turbidity		11		Hardness (as $CaCO_3$)		137.	2.74
Color		0		Residue		315.	
Odor		Tr.		Free CO_2 (calc.)		12.	
Temperature 54° F.				pH = 7.7			

A public water supply was installed by the village of Downers Grove (9526) in 1894.

A group of 3 wells constituted the public supply until 1925. These wells were located at the southeast corner of Middaugh and Warren Ave. (approximately 2000 ft. S. and 600 ft. W. of the N.E. corner of Section 7, T. 38 N., R. HE.). The elevation of the ground surface at this location is 715± ft. The original well in the group was drilled to a depth of 240 ft. in 1894. It was cased with 10-in. pipe to rock at an approximate depth of 83 ft. In 1918 a production of 125 gpm. was reported when the pump installation consisted of a plunger pump with a cylinder setting at a depth of 140 ft. The non-pumping water level at this time was reported to be 80 ft. below the surface.

The second well in this group was drilled in 1906-1907 to a depth of 2021 ft. by the J. P. Miller Artesian Well Co., Brookfield. It was reported cased with 12-in. pipe to a depth of 90 ft. below which the hole was 5-in. diameter to the bottom. In 1921 when water was pumped by a plunger pump having a cylinder setting of 140 ft. a production of about 185 gpm. was reported. At that time the non-pumping water level was reported to be 80 ft. below the surface.

A third well in the group was reported to have a depth of about 850 ft. In 1921 the rate of production was very small when pumping with a plunger pump having a 90 ft. cylinder setting.

All wells in the original group were abandoned by 1927. It is reported that they were filled with concrete.

Afourth well, called the Kelly well, was completed on Feb. 17, 1925 and located on the west side of Park Ave. between Randall St. and Summit Ave. (approximately 1200 ft. N. and 2600 ft. W. of the S. E. corner of Section 8). The well was drilled to a depth of 105 ft. below a ground surface elevation of 740± ft. by the Kelly Well Co., Grand Island, Nebr. It was reported to be cased with 24-in. concrete pipe having 21 ft. 8 in. of concrete screen in the bottom. During a test made upon its completion the production was 450 gpm. with a drawdown of 5 1/2 ft. from a non-pumping water level of 76 ft. below the surface. This well was the source of the public water supply until the summer of 1928 when it was abandoned, because of a high hydrogen sulphide content which could not be entirely eliminated by aeration.

In 1926 the American Water Corporation drilled a well on Park Ave. about 150 ft. east of the Kelly well. This well was drilled to the top of limestone at a depth of 100.6 ft. It was cased with 26-in. pipe and an 18-in. wi. strainer was placed at the bottom. When tested for capacity, the well discharged 450 gpm. but the water contained considerable sand and dirt. A 16-in. Johnson screen was then installed which held out the sand and dirt but reduced the discharge to 150 gpm. The well was not used as a source of supply and was capped and sealed.

Another well, now called Lee Ave. Well, was drilled to a depth of 250 ft. by Palmer & Son, Aurora, in 1928 and located about 60 ft. west of the center of Lee Ave. and about 750 ft. south of the Chicago, Burlington and Quincy Railroad (approximately 2340 ft. N. and 1350 ft. E. of the S. W. corner of Section 7). The elevation of the top of the pump base is 695.7 ft., and is 3 ft. below ground level.

Sample-study log of Lee Ave. Well by State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Drift, soil, gravelly hardpan, blue clay, cemented gravel?"	67	67
Silurian system		
Niagaran - Alexandrian dolomites	178	245
Ordovician system		
Maquoketa shale	5	250

The well was reported to be cased with 30-in. pipe from 1 ft. 8 in. above ground surface to rock, below which the hole is 24-in. diameter. Upon the completion of the well the non-pumping water level was 39 ft. 8 in. below the top of casing and after 10-hr. pumping at 570 gpm. the drawdown was 25 ft. 8 in. After stopping the pump, all but 5 ft. 8 in. of the drawdown was eliminated in 1 min.

This well has been the source of a large part of the public water supply since it was placed in service in the fall of 1928.

Water levels below the pump base during 1943, 1944, and 1945 were: non-pumping 41 to 44 ft. and pumping 54.7 ft. to 56.2 ft. On Mar. 7, 1947, the non-pumping water level was 46 ft. 3 in. and on May 27, 1947 the pumping level was 58 ft. 3 in.

LABORATORY NO. 110,516

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.5		Silica	SiO_2	17.9	
Manganese	Mn	0.0		Fluoride	F	0.0	
Calcium	Ca	105.1	5.26	Chloride	Cl	17.0	0.48
Magnesium	Mg	48.4	3.98	Nitrate	NO_3	3.5	0.06
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	154.5	3.21
Sodium	Na	2.5	0.11	Alkalinity (as $CaCO_3$)		280.	5.60
Turbidity		0		Hardness (as $CaCO_3$)		462.	9.24
Color		0		Residue		536.	
Odor		0		Free CO_2 (calc.)		67.	
Temperature 49.2° F.				pH = 7.05			

The existing pump installation, made in April, 1945, is: 88 ft. of 10-in. column pipe; 14-in., 7-stage Aurora Pump Co. turbine pump, No. 25284, having a rated capacity of 840 gpm. against 250 ft. of head at 1150 rpm., 10 ft. of 10-in. suction pipe; 100-hp. General Electric motor.

Analysis of a sample (Lab. No. 110,516) collected June 3, 1947 after 1-hr. pumping at 860 gpm. showed this water to have a hardness of 26.9 gr. per gal., a residue of 536 ppm., and an iron content of 0.5 ppm.

In 1930 the Layne North Central Co., Chicago, drilled a well now known as the Park Ave. well to a depth of 291 ft. and located about 50 ft. north of Summit St. and 75 ft. west of Park Ave. (approximately 900 ft. N. and 2400 ft. W. of the S. E. corner of Section 8). The elevation of the top of the pump base is 741.9 ft.

The following information was furnished by the Wells Engineering Co.: the well was cased through the unconsolidated formation with a 30-in. id. genuine wi. casing of 3/8-in. thickness extending from the pump house floor to the top of the limestone at a depth of 118 ft. Below the casing the hole was 24-in. diameter through the Niagaran limestone to a depth of 291 ft. below floor level and terminated in shale formation.

The final acceptance test was conducted on Dec. 3, 1930. While pumping at an average rate of 1068 gpm. to free discharge at ground level for a period of 6 hr. 24 min. the drawdown was 27 ft. from a non-pumping water level of 93 ft. below the pump base.

The well has been a large contributor to the public water supply since it was placed in service in Dec. 1930.

Water levels during 1943, 1944, and 1945 were: non-pumping 96 1/2 to 98 1/2 ft. and pumping 111 to 111 1/2 ft. On Mar. 7, 1947, after a year of inactive service, the non-pumping water level was 94 ft. 3 in. below the pump base.

The existing pump installation is: 139 ft. of 10-in. column pipe; 15-in., 4-stage Layne turbine pump, No. 5644, having a discharge of 1040 gpm. against 170 ft. of head; the overall length of the

LABORATORY NO. 110,517

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	Tr.		Silica	SiO_2	18.5	
Calcium	Ca	122.2	6.11	Chloride	Cl	9.0	0.25
Magnesium	Mg	54.2	4.45	Nitrate	NO_3	0.6	0.01
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	189.1	3.95
Sodium	Na	10.0	0.45	Alkalinity (as $CaCO_3$)		340.	6.80
Turbidity		10		Hardness (as $CaCO_3$)		528.	10.56
Color				Residue		621.	
Odor		0		pH = 7.05			
Temperature 51.1° F.							

pump is 4 1/2 ft.; 20 ft. of 10-in. suction pipe; with an additional 5 ft. of basket suction strainer; 50-hp. General Electric motor.

Analysis of a sample (Lab. No. 110,517) collected June 3, 1947, after 25-min. pumping at 980 gpm. showed this water to have a hardness of 30.8 gr. per gal., a residue of 621 ppm., and a trace of iron.

The metered pumpage from Aug. "1, 1943 to Aug. 1, 1945 averaged 583,900 gpd., varyingfrom a minimum winter average of 537,000 to a maximum summer average of 703,000 gpd.

DURAND
Winnebago County
Oct. 23, 1947

A water supply was installed by the village of Durand (592) in 1928.

Water is obtained from a well located in the village hall 5 ft. south of Howard St. and about 210 ft. east of Center St. (or approximately 900 ft. N. and 2350 ft. W. of the S. E. corner of Section 10, T. 28 N., R. 10 E.). This well was drilled in 1920 by A. McMahon and used by a creamery for a number of years. It was repaired in 1928 and put into service as the source of supply for the village. It was cased with 10-in. pipe and was 576 ft. deep below a ground surface elevation of 772t ft.

Correlated driller's log of Well No. 1 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Dirt	17	17
Quicksand	35	52
Gravel	15	67
Sand	113	180
Ordovician system		
St. Peter formation		
Sandstone	below	180
Ordovician and Cambrian (?) systems		
No record	396	576

The pump installation in service is: Aurora Pump Co. centrifugal pump, No. H6-B 212473-BF, rated at a capacity of 75 gpm. against a pressure of 50 psi.; 7 1/2-hp. General Electric motor.

Water was pumped with a centrifugal pump rated at 350 gpm., directly connected to a 25-hp. Fairbanks-Morse electric motor operating at 3500 rpm., until the treating plant was placed in operation. It is still in place for emergency purposes.

In 1938, the non-pumping water level was reported to be 5 to 6 ft. below the ground surface. At the end of Aug. 1947 the non-pumping water level was at the top of the casing which is 6.7 ft. below the concrete floor of the village hall - about ground level. At that time when pumping for. an hr. at 350 gpm. the drawdown was 11 ft. and remained constant during another hr.of pumping at the same rate.

Analysis of a sample (Lab. No. 112,316) collected Oct. 23, 1947 when pumping at. 75 gpm. showed this water to have a hardness of 17.6 gr. per gal., a residue of 295 ppm., and an iron content of 0.1 ppm.

All water is chlorinated and treated for iron removal.

Analysis of a sample (Lab. No. 112,425) collected Oct. 23, 1947 showed the treated water to have a hardness of 18.3 gr.per gal., a total mineral content of 315 ppm., and an iron content of 0.16 ppm.

Pumpage is estimated 25,000 gpd.

LABORATORY NO. 112,316

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.16		Silica	SiO_2	13.6	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	55.8	2.79	Chloride	Cl	1.0	0.03
Magnesium	Mg	39.3	3.23	Nitrate	NO_3	5.0	0.01
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	14.0	0.29
Sodium	Na	1.6	0.07	Alkalinity (as $CaCO_3$)		288.	5.76
Turbidity		5		Hardness (as $CaCO_3$)		301.	6.02
Color		0		Residue		295.	
Odor		0		Free CO_2 (calc.)		19.	
Temperature		52.5° F.		pH = 7.6			

DWIGHT
Livingston County
May 20, 1947

The public water supply for the village of Dwight (2499) was installed in 1891.

Five wells have been drilled at the pumping station on the triangular-shaped block at the northwest corner of Franklin and Chippewa St. (or approximately 700 ft. S. and 1650 ft. W. of the N. E. corner of Section 9, T. 30 N., R. 7 E.).

The elevation of the ground surface at this location is 635± ft., and the floor of the pump station is at ground level. All wells are in sand and gravel.

Well No. 1 was drilled in 1891, and is located in the front of the building, to the west of the main doorway. It was drilled originally to a depth of 136 ft. and cased with 8-in. pipe; but in 1923 J. Eyer installed 118 ft. of 10-in. casing and 11 ft. of No. 10 Cook screen, because of holes in the old 8-in. casing. In 1930 the well was cleaned out and deepened to 140 ft. A new pump was installed.

The pumping equipment, installed in 1937, consists of: 100 ft. of 6-in. column pipe; 7 1/2-in., 5-stage Deming turbine pump, No. DC-15082, rated at 3 75 gpm. against 100 ft. of head; the overall length of the pump is 3 ft. 9 in.; 100 ft. of air line; 10 ft. of 5-in. suction pipe; 15-hp., 1800 rpm. U. S. electric motor.

In 1923 the water level in this well was 35 ft. below the top when the pumps in Wells No. 2 and 3 were operating 24 hr. per day at a combined rate of about 450 gpm. In 1946 the pump was reported to produce 240 gpm.

Well No. 1, together with Well No. 4, is furnishing the village supply.

Well No. 2 was drilled in 1906 at a location about 25 ft. northeast of No. 1. It was drilled to a depth of 136 ft. and cased with 8-in. pipe with 12 ft. of Johnson No. 24 screen at the bottom. Due to interference in the maneuvering of fire department equipment, which was housed in the building, the well was abandoned about 1930. It has been filled, and a concrete floor constructed over it.

Well No. 3 was drilled in 1908 at a location about 50 ft. east of Well No. 1 and in the southeast corner of the building. The well was drilled to a depth of 136 ft. and cased with 6-in. pipe to a depth of 126 ft. below which an 8-ft. length of Cook screen was installed. In 1938 the well was not in service, and a later report stated that a wooden plug was bolted to the top of the casing.

Correlated driller's log of Well No. 3 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Loam and blue clay	15	15
Blue clay and shale	45	60
Hardpan	38	98
Sand and gravel (water-bearing)	28	126
Pennsylvanian system		
Shale	10	136

Well No. 4 was drilled in 1930. It is about 50 ft. northeast of Well No. 1 in an extension of the building. It is 140 ft. deep and cased with 12-in. pipe. The well was originally equipped with the Worthington pump taken from Well No. 1. The present pumping equipment, installed in 1937, consists of; 100 ft. of 6-in. column pipe; 9 1/2-in., 4-stage Deming turbine pump, No. DC-14947, rated at 450 gpm. against 100 ft. of head; the overall length of the pump is 3 ft. 10 in.; 10 ft. of suction pipe; 20-hp., 1800 rpm. U. S. electric motor. There is no air line.

The pump was overhauled in 1946 and replaced without any change in the assembly.

Well No. 5 was drilled in Mar. 1946 by John Bolliger, Fairbury. It is located about 6 ft. east of the old Well No. 3 and is 142 ft. deep with 10-in. casing and an 8-ft. length of brass screen. The specifications on file with the City Clerk stipulated a 12-ft. screen.

Well No. 5 is not yet in use. Some of the wiring has not been completed. It is equipped with 100 ft. of 6-in. column pipe; 10.-in., 7-stage Deming turbine pump rated at 450 gpm. at 200 ft. of head; 10 ft. of 6-in. suction pipe with Keystone type galvanized strainer; 100 ft. of 1/4-in. od. copper air line; 40-hp. U. S. motor.

The pumps in Wells No. 1 and 4 are operated simultaneously and discharge into an underground collecting reservoir. The two pumps operate about eight times daily for 45 min. each pumping period. The combined pumping rate is estimated at 825 gpm.

For the past 10 years, the water supply has been obtained from Wells No. 1 and 4. A history of water levels is given in Table 1, using, as the reference point, the floor level, inasmuch as all wells are in close proximity to each other:

TABLE 1

Water Levels

Year	Non-pumping ft.	Pumping ft.	Pumping Rate gpm.
1914	36		
1919	34		
1923	35		
1930		130	250
1946	35		

On May 20, 1947, Wells No. 2 and 3 had been abandoned. Well No. 5 had not yet been placed in service. Wells No. 1 and 4 were furnishing the entire village water supply. Some water level observations were made by the State Water Survey in Well No. 1 under various static and pumping conditions inboth wells, 1 and 4. All measurements were referred to the top of the casing of Well No. 1 which is 2 ft. above floor level. After neither pump had been operating for 1 1/2 hr., the water level was 32 ft. below the top of the casing. The No. 4 pump was started; and after 8-min. pumping at 450 gpm., the drawdown was 6 ft. The No. 1 pump was then started, and at the end of a 10-min. pumping period at a combined rate of 825 gpm. under apparent equilibrium conditions, the drawdown was 53 ft. One minute after stopping the pumps, the water level returned to within 6 ft. of the starting level. After 1 1/2 hr. of no pumping, the water level was 32 ft., and a second set of observations were made with similar results.

Analysis of a sample (Lab. No. 110,368) collected May 20, 1947 from the reservoir, showed this water to have a hardness of 26.2 gr. per gal., a residue of 995 ppm., and an iron content of 1.4 ppm.

The estimated pumpage is 297,000 gpd.

LABORATORY NO. 110,368

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.4		Silica	SiO_2	16.0	
Manganese	Mn	0.0		Fluoride	F	0.6	
Calcium	Ca	108.5	5.43	Chloride	Cl	50.0	1.41
Magnesium	Mg	43.1	3.55	Nitrate	NO_3	0.6	0.01
Ammonium	NH_4	3.6	.20	Sulfate	SO_4	406.7	8.46
Sodium	Na	154.1	6.70	Alkalinity	(as $CaCO_3$)	300.	6.00
Color		0		Hardness	(as $CaCO_3$)	449.	8.98
Odor		0		Residue		995.	
Turbidity		10					

EARLVILLE
La Salle County
June 11, 1947

A public water supply was installed by the city of Earlville (1103) in 1894.

Until 1911 water was obtained from 2 wells located at the pumping station, near the center of the city 30 ft. west of Ottawa St. and 40 ft. north of the Chicago, Burlington & Quincy R. R. tracks (or approximately 2120 ft. N. and 2100 ft. W. of the S.E. corner of Section 18, T. 36 N., R. 3 E.).

The two wells of 150-ft. depth were reported to be 10 in. in diameter and were spaced about 12 ft. apart. Sandstone was encountered at 40 ft. The ground surface elevation is 700± ft.

In 1911, one pump was producing at a rate of 100 gpm. and the other at 150 gpm. The East Well has not been used since 1917, and the West Well is equipped with an American Well Works double-acting pump, No. J 11.104, with an 8-in. cylinder attached to 80 ft. of 9-in. drop pipe. The cylinder is 6 ft. in length and was designed to be operated at an 18-in. stroke at a rate of 29 strokes per min. This pump was installed in 1922.

The West Well is maintained for emergency use.

Analysis of a sample (Lab. No. 83930) collected July 21, 1938, showed the water from this well to have a hardness of 16.1 gr. per gal., a mineral content of 322 ppm., and an iron content of 1.6 ppm. Analysis of a sample (Lab. No. 37765) collected in 1917 showed the water to have an iron content of 0.8 ppm.

Between 1911 and 1917 a third well was drilled at the pump station, and located 17 ft. southeast from one of the old wells and 25 ft. east of the other. The well was drilled to a depth of 625 ft. and was cased with 16-in. pipe from the surface to a depth of 60 ft. and with 12-in. pipe from 60 to 239 1/2 ft. The hole is 8 in. in diameter to 625 ft.

The well is equipped with: 150 ft. of 6-in. column pipe; 9-stage Fairbanks-Morse turbine * pump, No. SW 25736, rated at 500 gpm.; the overall length of the pump is 6 ft.; 150 ft. of air line; 20 ft. of 6-in. suction pipe with a short strainer; 20-hp., 1765 rpm. Fairbanks-Morse electric motor, No. 462621.

Analysis of a sample (Lab. No. 110,626) collected June 11, 1947 after 30-min. pumping at 500 gpm., showed the water in this well to have a hardness of 14.6 gr. per gal., a residue of 279 ppm., and an iron content of 0.5 ppm.

The water is not treated.

The water levels given in Table 1 have been reported, in feet, below the pump base.

LABORATORY NO. 110,626

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.5		Silica	SiO_2	16.4	
Manganese	Mn	0.0		Fluoride	F	0.4	
Calcium	Ca	56.3	2.82	Chloride	Cl	4.0	0.11
Magnesium	Mg	26.5	2.18	Nitrate	NO_3	2.5	0.04
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	3.5	0.07
Sodium	Na	13.3	0.58	Alkalinity (as $CaCO_3$)		268.	5.36
Color		0		Hardness (as $CaCO_3$)		250.	5.00
Odor		0		Residue		279.	
Turbidity		0		Temperature 52.5° F.			

TABLE 1

Water Level Record

Date	Pumping Rate gpm.		Water Levels			
			Non-pumping		Pumping	
	150-ft. Well	625-ft. Well	150-ft. Well	625-ft. Well	150-ft. Well	625-ft. Well
1911						
1922	0	180-190	17.0	17.5	21.0	46.5
1926				20.6		
1936				19.0		
1938						
1947		500		18.0		78.0

A public water supply was installed for East Alton (4680) about 1916.

Water has been obtained from wells owned by Western Cartridge Co., Division of Olin Industries, Inc., East Alton. Wells No. 1 and 2 were located on the west side of Broadway Ave. north of Fourth St. and Wells No. 3 to 14, inclusive, were located at the Monroe Station west of Monroe Ave. and south of Third St., about 1000 ft. southeast of the Broadway wells, (or approximately 2600 ft. due E. of the N. W. corner of Section 21, T. 5 N., R. 9 W.). The elevation of the ground surface at the plant site is 442t ft.

Correlated driller's log of Well No. 1 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Sand	20	20
Sand and gravel	46	66
Sand, gravel and clay	6	72
Sand and g ravel	18	90
Clay	2	92
Mississippian or Pennsylvanian system		
Rock	at	92

Wells No. 1 to 11, inclusive, and No. 17, have been abandoned and water is now obtained from Wells No. 12, 13, 14, 15, 16 and 18. Each of these wells has approximately 48 ft. of 26-in. id. by 36-in. od. porous concrete pipe screen manufactured by Western Cartridge Co. From the top of the screen to the surface is blank concrete pipe casing of the same dimensions. All of these wells were constructed by Western Cartridge Co.

Well No. 12 was constructed to a depth of 83 ft. 8 in. and was put in service Oct. 30, 1939. In a production test on June 26, 1944, it was reported that, when pumping at 485 gpm. against a pressure of 70 psi., the drawdown was 2 ft. 7 in. The pumping equipment includes a Peerless turbine pump rated at 500 gpm., and a 30-hp., 1800 rpm., U. S. electric motor.

Well No. 13 was constructed to a depth of 93 ft. 10 in. and was put in service Jan. 24, 1940. In a production test on June 23, 1944, it was reported that, when pumping at 385 gpm. against a pressure of 70 psi., the drawdown was 6 ft. 1 in. The pumping equipment includes a Peerless turbine pump rated at 500 gpm., and a 40-hp., 1800 rpm. U.S. electric motor.

Well No. 14 was constructed to a depth of 95 ft. 2 in. and was put in service July 20, 1940. In a production test on June 23, 1944, it was reported that, when pumping at 320 gpm. against a pressure of 66 psi., the drawdown was 2 ft. 2 in. The pumping equipment includes a Peerless turbine pump, rated at 500 gpm., and a 30-hp., 1800 rpm. U. S. electric motor.

Wells No. 15 and 16 are located at the Washington Station at the southeast corner of Third St. and Washington Ave. about two blocks, or 840 ft., east of the Monroe station wells.

Well No. 15 was constructed to a depth of 92 ft. 11 in. and put in service on Sept. 29, 1940. In a production test on June 28, 1944, it was reported that, when pumping at 490 gpm. against a pump pressure of 73 psi., the drawdown was 4 ft. 10 in. The pumping equipment includes an American Well Works turbine pump, rated at 600 gpm. against 180 ft. of head, and a 40-hp., 1800 rpm., U. S. electric motor.

Well No. 16 was constructed to a depth of 95 ft. 1 in. and put in service on Oct. 11, 1940. In a production test on June 7, 1944, it was reported that, when pumping at 510 gpm. against a pump pressure of 79 psi., the drawdown was 2 ft. 1 in. The pumping equipment includes an American Well Works, turbine pump rated at 500 gpm. against 204 ft. of head, and a 40-hp., 1800 rpm. U. S. electric motor.

Well No. 18 is located at the Lincoln Station on the north side of Third St. and west of Lincoln Ave. The well was constructed to a depth of 84 ft. 6 in. and put in service Mar. 15, 1941. In a production test on June 29, 1944, it was reported that, when pumping at 480 gpm. against a pump pressure of 71 psi., the drawdown was 2 ft. 5 in. The pumping equipment includes an American Well Works turbine pump rated at 500 gpm. against 204 ft. of head, and a 40-hp., 1800 rpm., U. S. electric motor.

In 1923 the non-pumping water level in one of the Broadway wells was reported to be 36 ft. below ground level and after three or four hours pumping the drawdown was 10 ft. Beginning Jan. 1, 1933, monthly average water levels in the Broadway well, used as an observation well, have been reported in feet below B. M. elevation 443.03, as given in Table 1.

In July 1941, the Western Cartridge Co. commenced usage of Mississippi River water at time of completion of a filter plant of 6 MGD capacity.

After July 1941, and with the reduction in use of ground water, a steady rise in the water level in the observation well occurred. During Nov. 1943, the monthly average water level was 40.5 ft. below elevation 443.03 and during June 1945 the monthly average water level was 40.6 ft. A State Water Survey water level recorder was installed in the Broadway well Oct. 6, 1948 at which time the water level was 39.75 ft. below elevation 443.03. On Mar. 9, 1949 the water level was 42.2 ft. Mr. Paul Buxton reports that on July 6, 1949, the water level was "41.35. ft. below elevation 443.03."

Analysis of a sample (Lab. No. 116,786) collected Dec. 16, 1948 showed the water from Well No. 15 to have a hardness of 23.2 gr. per gal., a residue of 538 ppm., and an iron content of 0.2 ppm.

All water for the public supply is chlorinated.

For the past seven years, ground-water pumpage of the Western Cartridge Co. has averaged 1.095 mgd. of which an average of 321,102 gpd. has been furnished to East Alton.

TABLE 1

Date	Water Level Below B.M. Elevation 443.03 ft.	Pumpage From All Wells mgd.
Jan. 1933	42.5	1.04
Apr. 1935	50.2	1.61
Sept. 1935	44.7	1.71
Apr. 1937	49.9	1.94
Dec. 1938	44.7	1.58
Sept. 1939	45.1	1.58
July 1941	55.5	2.65

LABORATORY NO. 116,786

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	33.6	
Manganese	Mn	0.3		Fluoride	F	0.4	
Calcium	Ca	108.7	5.44	Chloride	Cl	27.0	0.76
Magnesium	Mg	30.5	2.51	Nitrate	NO_3	11.5	0.19
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	171.1	3.56
Sodium	Na	23.9	1.04	Alkalinity	(as $CaCO_3$)	224.	4.48
Turbidity		5		Hardness	(as $CaCO_3$)	398.	7.95
Color		0		Residue		538.	
Odor		0					

A public water supply was installed by the city of East Dubuque (1475) in 1885.

At that time a well was drilled to a depth of 940 ft. below a ground surface elevation of 612± ft. The well was located in the northeast corner of Sinsiniwa Ave. and Montgomery St.

In "The Illinois Glacial Hole" by Leverett, a statement is made about this well: "The water is obtained from Potsdam sandstone and has a head nearly 100 ft. above the surface, and a capacity estimated at 420 gpm."

About 1903 the 6-in. well casing became badly corroded, the tools, used in repair work, were lost in the well. A 4-in. casing was placed to a depth of 165 ft., and water was reported to escape through a cavity below the 4-in. casing. In 1913 the well was reported to have an artesian flow of 60 gpm. Beneath the concrete floor of the pumping plant, there was a rectangular concrete collecting basin, 8 ft. deep and about 35,000 gal. capacity. The top of the well casing terminated near the bottom of the collecting basin. The artesian flow was received into the basin directly from the well, and any overflow from the basin was wasted into a nearby sewer.

In 1914 the well was reconstructed to a depth of 1343 ft. The upper 285 ft. of the hole was 8 in. in diameter and cased with 6-in. wi. pipe with sleeve couplings and packed at the lower end with a steel shoe. From 285 ft. to 426 ft., the hole was 5 5/8 in. in diameter and cased with 4 1/2-in. inserted joint pipe, packed at the lower end with a steel shoe. The 4 1/2-in. casing extended 7 ft. up into the 6-in. casing, and a rubber expansion packer was placed between the 2 casings. A tapered lead sleeve was also drawn between the 2 casings.

From 426 to 948 ft., the hole diameter was 5 in., and from 948 to 1343 ft. the diameter was 4 in. After completion of the repair work, the artesian flow was reported to be about 300 gpm.

Sample-study log of well completed in 193 7 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Surface fill and sand"	29	29
Ordovician system		
Decorah formation		
Dolomite, shaly	26	55
Clay	5	60
Platteville formation		
Dolomite	70	130
Dolomite and sandstone	10	140
St. Peter formation		
Sandstone, incoherent	30	170
Clayey sandstone and clay	100	270
Clay, sandstone, dolomite and chert	132	402
Oneota dolomite		
Cambrian system		
Jordon sandstone and dolomite	118	520
Trempealeau dolomite	120	640
Franconia dolomitic sandstone, some shale	85	725
Galesville sandstone	150	875
Eau Claire formation		
Dolomitic sandstone, some shale and dolomite	355	1230
Sandstone, incoherent	30	1260
Mt. Simon sandstone	125	1385
Pre-Cambrian system		
Fond-du-Lac sandstone	117	1502

In 1923 the artesian flow was approximately 123 gpm., and in Sept. 1927 the flow was approximately 95 gpm. In the summer of 1936 the flow ceased, and an air lift was installed. In Mar. 1937 the flow was estimated to be 45 gpm., and the flow increased after a new well was completed later on in 1937. In June 1940 the flow ceased, the well was plugged, and the old reservoir around the well was abandoned. The old pumping equipment was sold.

Anew well was completed in Oct. 1937 and is located about 60 ft. southeast of the old well (or approximately 450 ft. N. and 50 ft. E. of the southwest corner of Section 20, T. 29 N., R. 2 W.). It was drilled to a depth of 1502 ft. by the Varner Well Drilling Co., Dubuque, Iowa.

The hole and casing diameter record is given in Table 1.

TABLE 1

Hole Record

23-in. from 0 to 259 ft.
19-in. from 259 to 412 ft.
17-in. from 412 to 930 ft.
13-in. from 930 to 1502 ft.

Casing Record

20-in. od. casing from 198 1/2 to 259 ft.
18-in. od. casing from 249 1/2 to 412 ft.
12-in. id. from 4 1/2 to 425 ft.

When the drilling reached 70 ft., the static water level was at 30 ft.; and from then on during the course of the drilling, the water level steadily raised until at 1502 ft. depth, the water level was 5 ft. below the ground surface.

It was reported that the reason the water level was at a depth of 5 ft. below the surface, before the annular space outside of the 12-in. casing was cement-grouted, was due to its flow through the upper limestone crevices to waste in an excavated basement south of Montgomery St. causing considerable trouble. The rate of this flow was never determined by the driller. The 12-in. casing was cemented in after which the static water level was 8 1/2 ft. above the ground surface. The well was tested by the driller on Oct. 18, 1937, and pumping levels were reported to be at 23 ft. 8 in. and at 6 ft. 8 in. below the ground surface when pumping at rates of 492 and 215 gpm. respectively.

After the well was completed and in service, it flowed to waste, when not pumped, from a connection made to the 12-in. casing about 4 1/2 ft. below the surface. This flow continued for only about 2 years, or ceased shortly after several deeper wells were drilled across the Mississippi River in Dubuque, Iowa. The non-pumping water level then gradually receded to 18 ft. below the surface until 1944 and has remained at this level.

The following pump installation, made on June 10, 1940, is in service: 50 ft. of 6-in. column pipe; 8-in., 13-stage Fairbanks-Morse turbine pump, No. 7441, rated at a capacity of 300 gpm. against 329 ft. of head; 50 ft. of air line; 20 ft. of 6-in. suction pipe;40-hp. Fairbanks-Morse electric motor.

On Dec. 4, 1946 the following water levels below the pump base were reported: A pumping level of 28 ft. after 1 1/2-hr. pumping at about 300 gpm. and a non-pumping level of 18 ft. after a 30 min. idle period. The pump base is about 3 ft. above the existing ground, surface, or elevation

LABORATORY NO. 108,575

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.3		Silica	SiO_2	12.7	
Manganese	Mn	Tr.		Fluoride	F	0.2	
Calcium	Ca	54.3	2.72	Chloride	Cl	3.0	.08
Magnesium	Mg	32.2	2.65	Nitrate	NO_3	1.0	.02
Ammonium	NH_4	0.1	.01	Sulfate	SO_4	20.0	.42
Sodium	Na	2.3	0.10	Alkalinity (as $CaCO_3$)		248.	4.96
Color		0		Hardness (as $CaCO_3$)		269.	5.38
Odor		0		Residue		272.	
Turbidity		10-		Free CO_2 (calc.)		33.	
Temperature		61.6° F.		pH = 7.25			

615± ft.

Water is discharged directly into the distribution system, and, when the pump is not operating, the artesian flow is shut off.

Analysis of a sample (Lab. No. 108,575) collected Dec. 4, 1946 after 1 1/2-hr. pumping at about 300 gpm., showed this water to have a hardness of 15.7 gr. per gal., a residue of 272 ppm., and an iron content of 0.3 ppm. The quality is of general composition similar to that found by analysis of samples collected in 1908, 1914, and 1923 from the old well and to that from the No. 2 well in 1938.

The pumpage is not metered but is estimated to average 100,000 gpd. Water is supplied to residences located outside of the village limits.

EAST DUNDEE
Kane County
Aug. 27, 1947

Waterworks were installed by the village of East Dundee (1306) in 1902.

The original water supply was obtained from a dug well 9 ft. in diameter and 25 ft. deep located about 25 ft. south of Barrington Ave. and 40 ft. west of Third St. (or approximately 1950 ft. N. and 300 ft. E. of the S. W. corner of Section 23, T. 42 N., R. 8 E.).

A check of the productive capacity of the well, made on June 2 7, 1923, indicated an average rate of inflow of 48 gpm.

The well was continued in service until shortly after a new well was drilled in 1931, when it was abandoned and filled.

In 1915 some springs on a hillside near the east village limits were developed as a source of supply. About 400 to 500 ft. of vitrified sewer pipe were laid with open joints at a depth of nearly 20 ft. The pipes discharged into a concrete surface reservoir having a capacity of 340,000 gal. The flow when tested on July 6, 1915 was 78 gpm.

The collection tile is laid between the curb and the sidewalk on the south side of Barrington Ave. about 270 to 700 ft. east of Van Buren St. (or approximately 2100 to 2200 ft. N. and 1260 to 1700 ft. E. of the S. W. corner of Section 23). The tile discharges to the reservoir 75 ft. south of Barrington Ave. Water flows by gravity from the reservoir to the pumping station about 1000 ft. west on Barrington Ave. where a pressure of 18 to 18 1/2 psi. is shown. The springs still continue to supply the major part of the public supply at an estimated rate of flow of 75 to 80 gpm.

Water from the springs, in 1923, was found to have a mineral content of 523 ppm., a hardness of 18.2 gr. per gal., and no iron content. A nitrate concentration of 131 ppm. was recorded.

A new well was drilled in 1931 to a depth of 130 ft. and located about 110 ft. south of the center of Barrington Ave. and 210 ft. east of the center of Van Buren St. (approximately 2000 ft. N. and 1200 ft. E. of the S. W. corner of Section 23). The elevation of the ground surface is 765t ft.

The well is reported cased with 6-in. pipe to limestone at a depth of 100 ft. Water-bearing gravel and limestone were encountered.

The well serves as an auxiliary and emergency supply unit. It is seldom used in the winter months.

The existing pump installation is 94 ft. of 4-in. column pipe; 6-in., 3-stage American Well Works turbine pump, No. 56682, rated at a capacity of 125 gpm. against 120 ft. of head at 3500 rpm.; 20 ft. of 3 1/2-in. suction pipe; 100 ft. of 1/4-in. gi. air line; 7 1/2-hp. U. S. electric motor.

On Aug. 4, 1947, the non-pumping water level was 51 1/2 ft. after a 42-hr. idle period and the drawdown was 30 ft. after pumping 30 min. at 125 gpm.

Analysis of a sample (Lab. No. 111,398) collected Aug. 4, 1947 after 1/2-hr. pumping at 125 gpm., showed this water to have a hardness of 21.7 gr. per gal., a residue of 414 ppm., and an iron content of 1.6 ppm.

LABORATORY NO. 111,398

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.6		Silica	SiO_2	23.4	
Manganese	Mn	0.0		Fluoride	F	0.3	
Calcium	Ca	85.7	4.29	Chloride	Cl	6.0	0.17
Magnesium	Mg	38.2	3.14	Nitrate	NO_3	1.2	0.02
Ammonium	NH_4	5.6	0.31	Sulfate	SO_4	42.4	0.88
Sodium	Na	3.0	0.13	Alkalinity	(as $CaCO_3$)	340.	6.80
Turbidity		20		Hardness	(as $CaCO_3$)	372.	7.43
Color		0		Residue		414.	
Odor		0		Free CO_2	(calc.)	28.	
Temperature		52.6° F.		pH = 7.5			

All water is chlorinated at the pumping station.

Metered pumpage from Jan. 1, 1947to Aug. 1, 1947 averaged 134,000 gpd. The maximum pumpage occurred between Aug. 1 to 25, 1947 when the average was 161,000 gpd.

The public water supply was installed by the city of East Moline (12,359) about 1913 and the water works improvements were completed in 1916. The source of supply has been from 5 wells.

Well No. 1 was constructed in 1895 for the East Moline Land Co. and was drilled by J. P. Miller Artesian Well Co., Brookfield, to a depth of 1340 ft. It is located at the rear of the pumping station on the west side of 9th St. and about 350 ft. north of the north line of 15th Ave. In 1913 when the city acquired the well, it was repaired by the same driller and a 6-in. hole was drilled to a depth of 1532 ft. The elevation of the ground surface is 576.5 ft.

The well was cased with 16-in. steel drive pipe of unknown length.

In 1913 during the repair work when the drilling was 800 ft. deep, the artesian flow was reported at 400 gpm.; and at 1500 ft., the flow increased to 500 gpm. In 1923, the water level was reported to be 16 ft. below the ground surface. On May 10, 1933, the water level, after a 10-hr. idle period, was 10.7 ft. below the ground surface, and, after pumping 2-hr. at 484 gpm., the drawdown was 31.0 ft.

Analysis of a sample (Lab. No. 80020), collected April 27, 1933 showed the water from this well to have a hardness of 17.3 gr. per gal., a residue of 116 ppm., and a trace of iron content.

Well No. 1 has been abandoned.

Well No. 2 is located to the west of the city hall on 16th ave. between 9th and 10th St., and about 1050 ft. south of Well No. 1. It was drilled in 1911 to a depth of 1371 ft. by J. P. Miller Artesian Well Co. and was deepened to 1850 ft. in 1913 by the same driller. The elevation of the ground surface is 575± ft.

The well was cased with 10-in. pipe to rock, with 8-in. pipe from the ground surface to a depth of 153 ft., and with a 6 1/4-in. liner, 82 ft. long, set with the bottom at 1115 ft.

When the drilling of the well was 820 ft.

Sample-study log of Well No. 3 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
No record	15	15
Soil and till	15	30
Devonian system		
Limestone	55	85
Silurian system		
Niagaran-Alexandrian dolomites	346	431
Ordovician system		
Maquoketa shale, some dolomite	210	641
Galena-Platteville formations		
Dolomite	229	870
Limestone, shaly, thin shale beds	40	910
Limestone	52	962
Glenwood shale and dolomitic sandstone	43	1005
St. Peter sandstone	55	1060
Shakopee dolomite	195	1255
New Richmond dolomite and dolomitic sandstone	15	1270
Oneota dolomite and dolomitic sandstone in basal portion	315	1585
Cambrian system		
Trempealeau dolomite	20	1605

deep, water flowed over the top; and when completed at 1371 ft., in 1911, the free flow rate was 109 gpm. This decreased to 70 gpm. in 1913. After deepening the well, in that same year to 1850 ft., the free flow was 250 gpm.

On May 10, 1933, the water level was 17 1/2 ft. below the ground surface; and after pumping 2 1/2-hr. at 283 gpm., the drawdown was 95.4 ft.

Due to the low specific capacity of Well No. 2 in comparison to that of Well No. 1, the air lift pumping equipment in No. 2 was removed, and new equipment, installed in Dec. 1933, consisted of 190 ft. of 7-in. column pipe; 7 1/2-in., 14-stage American Well Works L. C. turbine pump rated at 450 gpm. against 198 ft. of head at 1750 rpm.; the overall length of the pump is 90 in.; 190 ft. of air line; 20 ft. of 7-in. suction pipe; 40-hp. General Electric motor.

The base of the pump is about 3 1/2 ft. lower than the general ground surface.

After the new pump installation, a production test was made by the pump manufacturers. The water level, before pumping but after a 5-day idle period, was 19 1/2 ft. below the base plate. After pumping 3 hr. at 411 gpm. into the reservoir through 800 ft. of 8-in. pipe, the drawdown was 170 ft.

During the test, the pump in Well No. 1 was not in operation.

Analysis of a sample (Lab. No. 80019), collected Dec. 23, 1933, showed the water from Well No. 2 to have a hardness of 9.9 gr. per gal., a residue of 1152 ppm., and no iron content.

Well No. 2 has been abandoned.

Well No. 3 was completed July 1937 by Thorpe Well Co., Des Moines, Iowa, and located 50 ft. south of Well No. 1, about 50 ft. north of the Rock Island R. R. tracks, 20 ft. west of 9th St. (or approximately 875 ft. N. and 2370 ft. W. of the S.E. corner of Section 25, T. 18 N., R. 1 W.).

This well was drilled to a depth of 1500 ft. below a ground surface elevation of 576t ft.

The record of diameter of the hole and casing is given in Table 1.

On Nov. 15, 1937, a production test was made with the permanent pump assembly. Well No. 1 was not in service at the time. The water level in No. 3 was 38 ft., and the drawdown was 66 1/2 ft. when pumping at 1212 gpm.

TABLE 1

Hole Record

32-in. from surface to 34 ft.
28-in. from 34 to 150 ft.
25-in. from 150 to 215 ft.
24-in. from 215 to 656 ft.
19-in. from 656 to 930 ft.
16 3/8-in. from 930 to 1150 ft.
13-in. from 1150 to 1600 ft.

Casing and Liner Record

30-in. id. casing from surface to 34 ft.
20-in. id. casing from surface to 150 ft.
18-in. od. liner from 420 to 656 ft.
14-in. od. liner from 955 to 1150 ft.
The 14-in. liner was perforated between 1010 and 1070 ft. opposite the St. Peter sandstone.

During a 24-hr. production test of Well No. 3 on May 23, 1937, the pump in No. 1 was operated during the entire time. The production rate from No. 1 decreased, during the period, from 350 gpm. and 8 1/4 specific capacity, to 282 gpm. and 5.4 specific capacity. During the period, the production from No. 3 was 945 gpm. and 12.7 specific capacity; also 209 gpm. and 17.4 specific capacity. In Oct. 1947 the non-pumping water level was 70 ft. below the pump base and after 1-week pumping at 950 gpm. the drawdown was 119 ft.

The pumping installation consists of 220 ft. of 9 and 10-in. column pipe; 12-in., 5-stage Pomona turbine pump, rated at 1600 gpm.; 20 ft. of 10-in. suction pipe; 75-hp. Westinghouse motor. Serial No. 3 EM 4218.

Analysis of a sample (Lab. No. 112,249), collected Oct. 17, 1947 after 1-week pumping at 950 gpm., showed the water from Well No. 3 to have a hardness of 17.7 gr. per gal., a residue of 1006 ppm., and an iron content of 0.1 ppm.

In Oct. 1947 Well No. 3 was in operation 24 hours per day.

Well No. 4 was drilled to a depth of 1600 ft. in 1940 by Thorpe Well Co. and located just north of Well No. 2, at the city hall, (or approximately 400 ft. N. and 2050 ft. W. of the S. E. corner of Section 25).

LABORATORY NO. 112,249

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	13.9	
Manganese	Mn	0.0		Fluoride	F	0.9	
Calcium	Ca	71.2	3.56	Chloride	Cl	285.0	8.04
Magnesium	Mg	30.6	2.51	Nitrate	NO_3	7.0	0.11
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	192.1	3.99
Sodium	Na	255.5	11.11	Alkalinity	(as $CaCO_3$)	252.	5.04
Turbidity		Tr.		Hardness	(as $CaCO_3$)	304.	6.07
Color		0		Residue		1006.	
Odor		0					
Temperature 61.5° F.							

The hole, casing and liner record is shown in Table 2.

TABLE 2

Hole Record

40-in. from surface to 30 ft.
28-in. from 30 to 150 ft. 7 in.
25-in. from 150 ft. 7 in. to 644 ft.
24-in. from 644 to 658 ft.
19-in. from 658 to 995 ft.
17-in. from 995 to 1120 ft.
13 1/2-in. from 1120 to 1600 ft.

Casing and Liner Record

30-in. casing from surface to 30 ft.
20-in. casing from surface to 150 ft. 7 in.
20-in. liner from 418 to 658 ft.
14-in. liner from 964 ft. 10-in. to 1120 ft.
The 14-in. liner was perforated between 1005 ft. 8 in. and 1092 ft. 6 in. opposite the St. Peter sandstone.

Cement grout was placed in the annular space between the 30 and 20-in. casings and outside the 20-in. casing to 150 ft. 7 in.

In Mar. 1940, when the drilling had reached the final depth of 1600 ft. but before the 20-in. casing or the 20-in. liner or the 14-in. perforated liner had been placed in the well, a production test was made by the driller. The non-pumping water level was 48 ft. below the ground surface; and after pumping at 550 gpm. for 11 hr., the drawdown was 117 ft.

In April 1943 the pump in Well No. 4 was being operated continuously.

In October 1947 the water level was 210 ft. when pumping at 750 gpm.

The pump assembly consists of 220 ft. of 10-in. column pipe; 12-in., 5-stage Pomona turbine pump, rated at 1600 gpm.; 20 ft. of 10-in. suction pipe; 75-hp. Westinghouse motor.

This well is maintained for emergency use.

Analysis of a sample (Lab. No. 87737) collected April 20, 1940 after 21-hours pumping at 1007 gpm., showed the water from Well No. 4 to have a hardness of 16.7 gr. per gal., a residue of 991 ppm., and no iron.

Well No. 5 was completed in February 1943 by Thorpe Well Co. and located on Outlot 15 of East Moline Manufacturers' Addition, south of the Burlington Railway and east of 10th St. (or approximately 1085 ft. N. and 1850 ft. W. of the S. E. corner of Section 25). The well is about 750 ft. northeast of Well No. 3 and 900 ft. northeast of Well No. 4 and was drilled to a depth of 1600 ft. below a ground surface elevation of 576± ft. The hole, casing, and liner record were reported by the driller as given in Table 3.

The top of the 30-in. casing is 2 ft. above ground level.

The 20-in. casing was cemented in place, and the 14-in. liner was perforated between depths of 989.3 and 1058 ft. opposite the St. Peter sandstone. A packer was placed at 987 ft. and the 14-in. liner was grouted in from the packer to the top of the liner.

The water level, 7 days after completion of the drilling operations, was 49 ft.

Between March 20 and April 9, the water level

in Well No. 5 was reported to range from49 to 60 ft. below the top of the 30-in. casing. The fluctuations were apparently caused by the intermittent pumping in Well No. 3. Pumping in Well No. 4 was continuous every day.

TABLE 3

Hole Record

40-in. from surface to 18 ft.
32-in. from 18 to 28 ft.
26-in. from 28 to 150 ft.
20-in. from 150 to 658 ft.
17-in. from 658 to 987 ft.
14-in. from 987 to 1072 ft.
Tapered to 13 3/4-in. at 1600 ft.

Casing and Liner Record

30-in. steel casing from surface to 32 ft.
20-in. id. cast iron casing from surface to 152 ft. 8 in.
20-in. od. liner from 444 to 658 ft.
14-in. wi. liner from 936 ft. 4 in. to 1078 ft. 4 in.

A production test was made by the State Water Survey on April 9 and 10, 1943. Temporary pumping equipment was assembled for the test. On April 9 before starting the test, the water level in Well No. 5 was 60 ft. The pumping rate was started at 875 gpm. and gradually increased to 1492 gpm. after 18 hours at which time the drawdown was 114.8 ft. After an additional 4-hr. pumping at 1492 gpm., the drawdown was 116.7 ft.

Before and during the test in No. 5, some water level observations were made in Well No. 3. On April 3, after a 3/4-hr. rest in Well No. 3, the water level was 66.9 ft. below the pump base. Well No. 5 was idle at the time and pumping in Well No. 4 was continuous. On April 10 after a 1 1/2-hr.rest in Well No. 3, but pumping in Well No. 5 at 1485 gpm., the water level in No. 3 was 84.1.

The pumping equipment consists of 190 ft. of 10-in. column pipe; 5-stage, Fairbanks-Morse water lubricated turbine pump having an overall length of about 8 ft.; 20 ft. of 10-in. suction pipe; 75-hp. Fairbanks-Morse electric motor, No. 456972.

Analysis of a sample (Lab. No. 95810), collected April 10, 1943 after 22-hr. pumping at 1492 gpm., showed the water in Well No. 5 to have a hardness of 17.3 gr. per gal., a residue of 746 ppm., and an iron content of 0.1 ppm.

This well is in operation 6 to 8 hours per day.

Water is chlorinated but not otherwise treated.

Pumpage for the city of East Moline, is estimated to average 2.6 mgd., inclusive of 7 industries and 75,000 to 125,000 gpd. to the East Moline State Hospital.

URBANDALE SUBDIVISION, an unincorporated community, situated south of East Moline, has a public water supply. The property is owned by Earl Collinson.

The source of water is a well drilled in 1938 to a depth of 430 ft. by C. F. Teeple, Moline; and located 100 ft. east of 12th St., on C St. extended (or approximately 2415 ft. S. and 250 ft. W. of the N. E. corner of Section 1, T. 17 N., R. 1 W.). The ground elevation at the well-site is 705± ft.

Sample-study and driller's log furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Clay"	120	120
Pennsylvanian system		
"Shale"	7	127
Devonian system		
Wapsipinicon limestone, some dolomite	93	220
Silurian system		
Niagaran dolomite, little crevice clay at top	210	430

The well is cased with 142 ft. of 8-in. pipe with no screen. The hole diameter, below the casing is 8 in. The pumping installation consists of 180 ft. of 4 1/2-in. column pipe; 8-in., 9-stage American Well Works turbine pump, No. 61936, rated at 75 gpm. against 280 ft. of head at 1750 rpm.; 180 ft. of 1/4-in. air line; 10 ft. of 5-in. od. suction pipe; 10 hp. General Electric motor. The air line is defective.

The pump base is 6 ft. below the ground surface.

In a production test, made by the driller in 1938, the drawdown was 27 ft. below a non-pumping water level of 163 ft. below the pump base after pumping 10 hours at 200 gpm.

Analysis of a sample (Lab. No. 112,322), collected October 22, 1947, showed the water from this well to have a hardness of 17.9 gr. per gal., a residue of 430 ppm. and an iron content of 0.6 ppm.

The water is not treated.

LABORATORY NO. 112,322

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.6		Silica	SiO_2	16.3	
Manganese	Mn	0.0		Fluoride	F	0.3	
Calcium	Ca	69.8	3.49	Chloride	Cl	5.0	0.14
Magnesium	Mg	32.2	2.65	Nitrate	NO_3	0.3	Tr.
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	39.7	0.83
Sodium	Na	43.0	1.87	Alkalinity	(as $CaCO_3$)	352.	7.84
Turbidity		5		Hardness	(as $CaCO_3$)	307.	6.14
Color		0		Residue		430.	
Odor		0					

EAST MOLINE
STATE HOSPITAL
Rock Island County
Feb. 16, 1948

Water for East Moline State Hospital, formerly Watertown State Hospital, was originally obtained from a well drilled about 1903 to a depth of 1391 ft. and located in the power-house, about 1300 ft. N. and 1050 ft. W. of the S. E. corner of Section 19, T. 18 N., R. 1 E. This well was the principal source of supply until about 1947. In 1946 the yield averaged about 325,000 gpd. and in 1947 the Hospital purchased 75,000 to 125,000 gpd. from East Moline.

Three wells ranging from 276 to 349 ft. in depth and located in the Mississippi River flood plain about 3/8 mile northwest of the power-house, were drilled about 1931. The No. 1 well of this group, located south of the reservoir has been abandoned and is plugged. The other 2 wells have decreased in productive capacity, probably due to clogged screens and are now maintained for emergency use only.

Well No. 5 was drilled in 1947 to a depth of 720 ft. by Thorpe Well Co., Des Moines, Iowa, and located 2000 ft. N. and 1150 ft. W. of the S.E. corner of Section 19. A production test was made by the State Water Survey on October 8, 1947, using temporary pumping equipment. Before the test the water level was 114 ft. below the top of the 16-in. casing, at ground level. After 9-hr. pumping at 81 gpm., the drawdown was 100.5 ft. Pumping was then continued at varying rates, 78 to 90 gpm., and at 24 hr., when pumping at 78 gpm. the drawdown was 114 ft. After a 2-hr. shutdown the water level was 128.5 ft.

Analysis of a sample (Lab. No. 112,241) collected Oct. 9, 1947 after 14-hr. pumping at 78 gpm. showed this water to have a hardness of 19.1 gr. per gal., a total mineral content of 359 ppm., and an iron content of 12.9 ppm.

Well No. 5 was deepened to 1904 ft. and the hole and casing record were reported as shown in Table 1.

TABLE 1

Hole Record

36-in.	from	0 to	51 ft.
30-in.	from	51 to	55 ft.
24-in.	from	55 to	150 ft.
15-in.	from	150 to	260 ft.
13-in.	from	260 to	1165 ft.
10-in.	from	1165 to	1904 ft.

Casing Record

38-in. od.	from	0 to	42 ft.
16-in. od.	from	0 to	152 ft. 8 in.
14-in. od.	from	133 to	260 ft.
10-in. liner	from	473 to	712 ft.
10-in. liner	from	1029 ft. 6 in. to	1165 ft.

The 16-in. casing, the upper liner and the upper 33 ft. of the lower liner were cemented in. The lower 100 ft. of the lower liner was perforated. The ground surface elevation is 630± ft.

When the deepening was started, the water level was 121 ft. below the surface. When drilling from 770 to 830 ft. the water level raised to 116 ft. Between 1570 and 1580 ft. the water level dropped 1 1/2 ft. At 1620 ft. the water level dropped to 143 ft. and at 1700 ft. the water level was 145 ft. below the surface.

A production test was made by the State Water Survey on Feb. 5-7, 1948, after completion of the deepening. Before the test was started, the water level was 143.8 ft. below the reference

LABORATORY NO. 113,406

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.8		Silica	SiO_2	16.6	
Manganese	Mn	Tr.		Fluoride	F	0.3	
Calcium	Ca	88.8	4.44	Chloride	Cl	210.0	5.92
Magnesium	Mg	38.3	3.15	Nitrate	NO_3	Tr.	Tr.
Ammonium	NH_4	1.8	0.10	Sulfate	SO_4	105.9	2.20
Sodium	Na	173.7	7.55	Alkalinity	(as $CaCO_3$)	356.	7.12
Turbidity		10		Hardness	(as $CaCO_3$)	380.	7.59
Color		0		Residue		868.	
Odor		Tr.		Free CO_2	(calc.)	44.	
Temperature		59.2° F.		pH = 7.3			

point which was 3 in. above the top of the 16-in. casing. After 7 1/2-hr. pumping at 360 gpm., the drawdown was 68.4 ft. and after 36-hr. pumping at a final rate of 505 gpm. the drawdown was 102.6 ft. One hr. after shutdown the water level was 156.3 ft.

Analysis of a sample (Lab. No. 113,406) collected Feb. 7, 1948 after 36-hr. pumping at 505 gpm. showed this water to have a hardness of 22.2 gr. per gal., a residue of 868 ppm., and an iron content of 0.8 ppm.

Pumpage is estimated to average 325,000 gpd.

EAST PEORIA
Tazewell County
Feb. 28, 1949

The water supply for the city of East Peoria (6806) is described in Bulletin No. 33, published in 1940.

Each of the 4 wells constructed in 1917 on the Washington St. side of the station is 6 in. in diameter and 28 to 30 ft. in depth, with 10 ft. of 6-in., No. 10 slot Cook screen in the bottom of the well.

The 4 wells, constructed in 1918, are on the Flora St. side and are, otherwise, as described in Bulletin No. 33.

Casings of 2 of the 4 wells, drilled in 1927 by John Cummings, East Peoria, were pulled in 1940 because of too much interference between the wells for satisfactory pumping.

In 1940 M. Ebert Co., Washington, drilled 4 wells near the northwesterly side of the Washington St." station. All of the wells were 28 to 30 ft. deep and each was 6 in. in diameter.

In 1942 M. Ebert Co. drilled 3 wells at the foot of Moschel St., 1100 ft. east of the Washington St. station (or approximately 1800 ft. N. and 700 ft. W.of the S. E. corner of Section 33, T. 26 N., R. 4W.).

There are now 14 wells in service at the Washington St. pumping station, and 3 wells in service at the Moschel St. station. Each group of wells has its common suction header, and the groups are inter-connected to permit pumping from any one or all groups at the same time.

In Feb. 1949, M. Ebert completed a well to a depth of 51 ft. and located about 5/8 mile northeast of the Moschel St. wells (or approximately 195,0 ft. S. and 2050 ft. E. of the N. W. corner of Section 34). The driller reported that sand was encountered at a depth of 14 ft. In a test hole drilled to a depth of 61 ft., at a point several feet from the finished well, the sand and gravel encountered below 51 ft. was reported to have a high content of clay and silt.

The well was cased with 31 ft. of 10-in. id. pipe and with 20 ft. of Johnson Everdur wire-wound screen, having No. 30 slot openings. A production test was made on Feb. 28, 1949 by the State Water Survey, using temporary pumping equipment. Before pumping, the water level was 13 ft. below ground level and after 2-hr. pumping at 284 gpm. the drawdown was 14 ft. One hour after stopping the pump, the water level was 13.2 ft.

The "water from all the wells varies seasonally but the general character is represented by analysis of a sample (Lab. No. 117,268) collected Feb. 10, 1949 from the new well. The water is shown to have a hardness of 27.3 gr. per gal., a residue of 557 ppm. and an iron content of 0.04 ppm.

Pumpage is estimated to average 1.0 mgd.

LABORATORY NO. 117,268

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.04		Silica	SiO_2	15.8	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	118.4	5.92	Chloride	Cl	10.0	0.28
Magnesium	Mg	41.7	3.43	Nitrate	NO_3	13.7	0.22
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	155.3	3.23
Sodium	Na	14.3	0.62	Alkalinity	(as $CaCO_3$)	312.	6.24
Turbidity		2		Hardness	(as $CaCO_3$)	468.	9.35
Color		0		Residue		557.	
Odor		0					
Temperature 48° F.							

EDINBURG
Christian County
Aug. 6, 1948

A public water supply was installed in 1939 by the village of Edinburg (919). Water is obtained from wells located on the west bank of South Fork, Sangamon River, about 2 1/2 miles west of the village.

Well No. 1 was completed in 1939 by Layne-Western Co., Chicago, and located 60 ft. N. and 2400 ft. E. of the S.W. corner of Section 16, T. 14 N.,R. 3 W. The well is 30 ft. deep and is gravel-packed. A 16-in. outer casing and an 8-in. inner casing extends to 20-ft. depth, with an 8-in. Layne stainless steel screen set from 20 to 30 ft. The elevation of the ground surface is 549.5 ft. Since 1939, the top of the casing has been raised to elevation 560.0.

On May 9, 1939, a production test was made by the State Water Survey. The static level, before the test, was 10 ft. below the ground surface. After 5-hr. pumping at 43 gpm.,the drawdown was 12 ft. The water was turbid throughout the test and a considerable amount of fine sand was pumped. A concrete plug was then placed in the base of the screen and about 15 cu. ft. of gravel added through the annular space between the casings. A second production test was made by the State Water Survey on May 12, 1939. The static water level was 10 ft. After 1 1/2-hr. pumping at 48 gpm., the drawdown was 14 1/2 ft. and after an additional 3 1/2-hr. pumping at rates gradually decelerated to 43 gpm., the drawdown was 14 1/2 ft. The water was turbid throughout the 5-hr. pumping period. The pumping rate was immediately reduced to 34 gpm. and after 2 1/2-hr. pumping at rates gradually accelerated to 41 gpm., the drawdown was 14 1/2 ft. The water was clear when the discharge was less than 41 gpm. The water level in a test hole about 9 ft. from the well, was lowered 2 ft. during the test. The river stage was 2 ft. lower than the non-pumping water level in the well.

The well is equipped with: 30 ft. of 5-in. column pipe; 6-in., 7-stage Layne turbine pump, No. 9805, rated at 60 gpm.; the length of the pump is 4 1/2 ft.; 5 ft. of suction pipe; 3-hp. U. S. electric motor. In Oct. 1946, the pump was throttled to 3-5 gpm. to avoid breaking suction.

Analysis of a sample (Lab. No. 107,922) collected Oct. 14, 1946, showed this water to have a hardness of 13.4 gr. per gal., a residue of 275 ppm., and an iron content of 2.3 ppm.

Well No. 1 has not been in service since Nov. 1948. Several futile attempts have been made to pump water.

Well No. 2 was drilled in 1941 by Layne-Western Co. and located 225 ft. north and 60 ft. west of Well No. 1. The well is gravel-packed, with a 26-in. od. outer casing; 11 ft. of 8-in. inner casing and an 8-in. Layne shutter screen with the bottom set at 37 3/4 ft. below the pump base.

The pump assembly consists of: 30 ft. of 5-in. column pipe; 6-in., 7-stage Layne turbine pump, No. 10332, (new impellers installed in 1944); the length of the pump is 4 1/2 ft.; 3 ft. of suction pipe; 3-hp. electric motor.

In 1946, both wells produced about 9000 gpd. about one-half of the normal demand. The pumps were chemically treated about every 3 months which gave only a temporary increase in discharge but did obviate the necessity of frequent pulling of the pumps to be cleaned.

Well No. 2 has been abandoned and the pump removed.

Early in 1946, three test holes were drilled by Hayes and Sims, Champaign, following an electrical earth resistivity survey made by the State Geological Survey.

Well No. 3 was then drilled in Oct. 1946 at the site of Test Hole No. 2, about 600 ft. west of village Well No. 1 (or approximately 60 ft. N. and 1800 ft. E. of the S.W. corner of Section 16). The well was drilled to a depth of 44 ft. below a surface elevation of 551.7 ft. and was finished as a gravel-pack with 39 ft. 7 1/2 in. of 16-in. od. outer casing from 21 in. above to 37 ft. 10 1/2 in. below ground level and with 45 ft. of 8-in. inner casing and screen from 15 in. above to 43 3/4 ft. below ground level. The screen was Johnson Armco-iron, 6 2/3 ft. in length with 6 ft. exposed, having No. 60 slot openings. The bottom of the screen was driven to bed rock, and the top of the well was finished at 5 1/4 ft. above ground level. The pump base is about 7 ft. above ground level.

On Oct. 14, 1946, a production test was made by the State Water Survey using a rig-operated plunger pump for test purposes. The static water level was 14.6 ft. below the existing top of the 16-in. casing, (elev. 553.5) and, after 5-hr. pumping at 50 gpm., the drawdown was 15 1/4 ft. Equilibrium conditions were not attained nor closely approached. Thirty min. after stopping the pump, the water level had returned to within 1 ft. of the static level.

Well No. 3 is the sole source of public supply. Water is pumped by a Burks jet pump, No.

160115, operated against a pressure of 40 psi. and estimated to discharge 20 gpm. over the aerator of the treating plant, 2 1/4 miles east of the well.

Analysis of a sample (Lab. No. 107,923) collected Oct. 14, 1946 after 4-hr. pumping at 51 gpm. showed this water to have a hardness of 15.5 gr. per gal., a residue of 353 ppm., and an iron content of 22.5 ppm.

All water is aerated and filtered for iron removel. Analysis of a sample (Lab. No. 115,510) collected July 29, 1948 showed the treated water to have a hardness of 14.7 gr. per gal., a mineral content of 280 ppm., and an iron content of 0.06 ppm.

Pumpage is estimated to average 24,000 gpd.

LABORATORY NO. 107,923

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	22.5		Silica	SiO_2	38.4	
Manganese	Mn	0.9		Chloride	Cl	6.0	0.17
Calcium	Ca	63.3	3.17	Nitrate	NO_3	0.4	0.01
Magnesium	Mg	26.0	2.14	Sulfate	SO_4	3.3	0.07
Ammonium	NH_4	1.7	0.10	Alkalinity	(as $CaCO_3$)	304.	6.08
Sodium	Na	21.2	0.92	Hardness	(as $CaCO_3$)	266.	5.32
Turbidity		100		Residue		353.	
Odor (at well)		H_2S		Free CO_2 (calc.)		196.	
Temperature 53.8° F.				pH = 6.6			

A public water supply was installed for the city of Edwardsville (1008) in 1898 and a franchise granted to the Edwardsville Water Works Co. In 1948, the public water system was purchased by the city from the Illinois Cities Water Co.

Water has always been obtained from drift wells located at the pumping station in the American Bottoms, near Poag, on the Wabash R. R., five miles west of Edwardsville. The ground surface elevation at the wells is 440± ft.

The initial supply was obtained from two 6-in; and two 8-in. tubular wells, each well 55 ft. deep. Later a 9-in. and a 10-in. tubular well were drilled, each to a depth of 60 ft. About 1912, two open-top wells were constructed to a depth of 70 to 80 ft. and cased with porous concrete rings 28-in. inner and 36-in. outer diameters. The uncovered tops of the casings extended 5 ft. above ground level to prevent entrance of surface wash. A ninth well was cased with porous concrete rings to a depth of 40 ft. below which a 12-in. pipe extended 20 ft. to a total depth of 60 ft. Water was pumped from this well by air lift and 'only used in cases of extreme emergency.

In 1914, it was reported that a 32-ft. well, cased with porous concrete pipe furnished water of softer quality which was used only in boilers at the pumping station.

Water was pumped from the eight wells by two suction pumps set in a pit, 7 ft. deep below the pumping station floor. In 1914 the non-pumping water level was 22 ft. below the pumping station floor, which was at ground level.

All of the wells were abandoned prior to 1923, due to clogged strainers. The concrete casings became cracked and let fine sand in, filling up these wells nearly to their tops.

In 1922, two wells were drilled and located in the pumping station.

Well No. 1 was located in the southwest part of the building and was reported to be 113 1/2 ft. deep with 42 ft. of 18-in. Johnson screen, having No. 14 slot openings. The pumping assembly consists of 64 ft. of 10-in. column pipe; 22 1/2-in., 1-stage American Well Works turbine pump, No. 55623, rated at 1300 gpm. against 80 ft. of head; the overall length of the pump is 3 ft. 8 in.; 20-hp., General Electric motor No. 394899.

In Feb. 1940, Well No. 1 was reported to yield 300 to 350 gpm. The well is now maintained for emergency use.

Well No. 2 was located in the northeast part of the pumping station building. It was reported to be 114 1/2 ft. deep and cased with 36-in. pipe from the surface to 70 ft.; 20-in. pipe from 70 to 74 ft. and with 42 ft. of 18-in. Johnson screen having No. 14 slot openings. At the same time the pumping assembly consisted of 24 ft. of 9-in. column pipe; 19 5/8-in., 1-stage American Well Works turbine pump, No. 39856, rated at 700 gpm. against 60 ft. of head; 20-hp., 870 rpm. General Electric motor.

In 1940, old Well No. 2 was abandoned and plugged.

A third well, now known as Well No. 2, was drilled in July 1939 by Harold Watson, East St. Louis, and located 75 ft. south of Well No. 1 and 122 ft. southwest of old Well No. 2 (or approximately 2000 ft. N. and 500 ft. W. of the S. E. corner of Section 13, T. 4 N., R. 9 W.). Well No. 2 was cased with 16-in. pipe and with 40 ft. 8 in. of 15-in. Johnson Everdur screen having No. 30 slot openings. The bottom of the screen is 111 1/2 ft. below the ground surface.

The pump assembly consists of 55 ft. of 9-in. column pipe; 14-in. 2-stage Pomona turbine pump, No. SU 1033, rated at 1300 gpm. against 75 ft. of head; 15 ft. of 9-in. od. suction pipe; 40-hp., 1760 rpm. Westinghouse electric motor, No. 36 TL 221.

In Feb. 1940, the non-pumping water level in Well No. 2 was 25 ft. 7 in. below ground level and after 45-minutes pumping at approximately 1650 gpm., the drawdown was 19 ft. At the same time the water level in old Well No. 2 was lowered 5 in. and in Well No. 4 it was lowered 1 ft. 7 in.

Well No. 2 furnishes the principal portion of the city water supply.

Analysis of a sample (Lab. No. 116,489) collected Nov. 17, 1948 after all-day pumping, showed the water from Well No. 2 to have a hardness of 12.4 gr. per gal., a residue of 264 ppm., and an iron content of 2.8 ppm.

All water is chlorinated.

In May 1944 the well was rehabilitated with 580 lb. of Calgon and 30 lb. of HTH. The treatment did not improve the capacity of the well as anticipated, but considerable iron deposit was removed from the inside of the pump and probably

from the inside of the casing and screen.

Well No. 4 was drilled in Sept. 1939 by Harold Watson and was located 106 ft. southeast of Well No. 2. The well construction, casing, screen size, and depth were the same as for Well No. 2. The pump discharged gravel and it was believed that the screen was worn out. When the screen and casing were removed, the screen was found to be in good condition, but a leak was found in the packer between the casing and screen. The well was abandoned.

A well, now known as Well No. 3 was drilled in 1945 to a depth of 113 ft. 7 in. by Harold Watson, and located about 175 ft. west of the present Well No. 2. The well is cased with 75 1/2 ft. of 16-in. casing and 42 ft. exposed length of Cook screen having No. 30 slot openings. The driller reported the formation penetrated as follows: fine sand from 0 to 65 ft.; fair sand from 65 to 95 ft. and good sand and gravel from 95 to 114 ft.

The pumping equipment, removed from abandoned well No. 4, consists of 60 ft. of 8-in. column pipe; 9-stage Byron Jackson turbine pump, Serial No. 159249, rated at 700 gpm. against 400 ft. of head at 1750 rpm.; 10 ft. of 8-in. suction pipe; 100-hp. General Electric motor, No. 5448008.

The pump delivers 850 gpm. against a pressure of 175 psi.

Water is pumped directly from Well No. 3 to the mains. From Wells No. 1 and No. 2 water is pumped to an underground reservoir of 250,000-gal. capacity, located at the pumping station.

Pumpage is estimated to average 0.9 mgd.

LABORATORY NO. 116,489

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.8		Silica	SiO_2	27.1	
Manganese	Mn	0.3		Fluoride	F	0.5	
Calcium	Ca	59.9	2.99	Chloride	Cl	5.0	0.14
Magnesium	Mg	15.0	1.23	Nitrate	NO_3	8.1	0.13
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	51.8	1.08
Turbidity		13		Alkalinity	(as $CaCO_3$)	144.	2.88
Color		0		Hardness	(as $CaCO_3$)	211.	4.22
Odor		0		Residue		264.	
Temperature 57.5° F.							

ELBURN
Kane County
Aug. 28, 1947

A public water supply was installed by the village of Elburn (624) about 1900.

The initial supply was obtained from a well drilled to a depth of 1450 ft. by Mr. Phildot of St. Charles. It is located on First St. and 225 ft. south of North St. (approximately 1450 ft. S. and 275 ft. E. of the N. W. corner of Section 5, T. 39 N., R. 7 E.). The elevation of the ground surface is 850± ft. The well was reported to have a diameter of 10 in. at the top and 4 in. at the bottom.

On May 3, 1928 the non-pumping water level was about 75 ft. below the pump base. Water was pumped by an American Well Works plunger pump having a 7-in. cylinder setting of 156 ft. and a 24-in. stroke. It was operated at a speed of 20 spm. giving a theoretical displacement of 80 gpm. and belt-driven by a 15-hp. General Electric motor.

This well was the source of the entire public water supply until another well was placed in service in 1937. It has not been used since 1937 and the motor is disconnected.

A new well was drilled in 1937 to a depth of 153 ft. by M. L. Reichart, Batavia, and located about 50 ft. west of First St. and 85 ft. south of NorthSt. (or approximately 1300 ft. S. and 250 ft. E. of the N. W. corner of Section 5.). The pump base has an elevation of 850± ft. Water is obtained from a water-bearing formation at the bottom of the well consisting of coarse angular sand.

The well is cased with 10-in. pipe from the surface to a depth of 140 ft. below which an 11-ft. length of 8-in. No. 8 Clayton Mark brass screen was installed through the water-bearing formation.

A 24-hr. production test was made by the State Water Survey on Mar. 22-23, 1937. Before the test the standing water level was 85 ft. below the ground surface. Pumping was started at a rate of 75 gpm. and continued for 9 hr. at the end of which period the drawdown was 65 ft. The rate of pumping was gradually decreased to 40 gpm. and continued at that rate. The drawdown remained constant at 65 ft. during the remainder of the test.

A treatment plant was installed and placed in operation in Nov., 1937. The water is pumped from the well at a rate of about 100 gpm. and is discharged over a coke-tray aerator into a detention basin from which it is then pumped at a rate of 100 gpm. through either of 2 Permutit pressure sand filters.

The pump installation in service consists of 140 ft. of 5-in. column pipe; 8-in., 5-stage American Well Works turbine pump, No. 60567, rated at a capacity of 100 gpm. against 145 ft. of head; 7 1/2 ft. of 5-in. suction pipe with 1 1/2 ft. of tapered strainer; 148 1/2 ft. of 1/4-in. air line; 7 1/2-hp. U. S. electric motor.

On Aug. 7, 1947, the non-pumping water level was 102 1/2 ft. below the pump base after a 30-min. idle period. The average estimated pumpage is 22,000 gpd.

Analysis of a sample (Lab. No. 111,420) collected Aug. 7, 1947 after 1/4-hr. pumping at 100 gpm., showed this water to have a hardness of 14.8 gr. per gal., a residue of 350 ppm., and an iron content of 1.8 ppm.

The municipality owns an iron removal plant.

LABORATORY NO. 111,420

		epm.	epm.			ppm.	epm.
Iron (total)	Fe	1.8		Silica	SiO_2	23.8	
Manganese	Mn	Tr.		Fluoride	F	0.3	
Calcium	Ca	53.9	2.70	Chloride	Cl	2.0	0.06
Magnesium	Mg	28.8	2.37	Nitrate	NO_3	1.0	0.02
Ammonium	NH_4	2.5	0.14	Sulfate	SO_4	1.6	0.03
Sodium	Na	35.4	1.54	Alkalinity	(as $CaCO_3$)	332.	6.64
Color		0		Hardness	(as $CaCO_3$)	254.	5.07
Odor		0		Residue		350.	
Turbidity		30+		Temperature 51.5° F.			

ELGIN
Kane County
June 30, 1948

The system of water works was originally installed by the city of Elgin (38,333) in 1887-1888.

Water was obtained from the Fox River. The pumping station and filtration plant are located between the east bank of Fox River and the Chicago and Northwestern Railway about 1000 ft. north of Slade Ave. Pressure filters were installed in the original plant and all water drawn from the river was filtered and treated. Because of adverse public opinion in obtaining water from this source a group of 4 deep wells, 1300 to 2000 ft. in depth, were drilled at the plant site on Slade Ave. and placed in service in 1904. The supply from these wells and other wells subsequently drilled was not always adequate to furnish the entire water demands of the city and the original pumping station and filter plant was maintained for service to supplement the well supply with filtered river water until about 1920.

To meet the increased water consumption a system of shallow wells was constructed. Four of these wells were located about 110 to 200 ft. southwest of the pumping station. The first well in this group was a dug well located about 110 ft. southwest of the pumping station, completed to a reported depth of 19 ft. in 1914. This was followed by three 6-in. wells drilled about 1921 to depths of about 37 ft. and spaced about 22 ft. apart, the nearest well being about 45 ft. from the dug well.

In 1921, a well was drilled in the southern part of the city on the west side of St. Charles St. between Dixon and Elgin Ave. The depth of the well was about 100 ft. and water was obtained from a coarse sand and gravel stratum near the bottom. Another well was drilled in 1926 on North State St. at the northwest corner of Washington St. to a reported depth of about 43 ft. penetrating water-bearing sand.

Two other shallow wells penetrating water-bearing sand and gravel deposits were drilled in 1928. One of these wells, located on the west side of Crighton Ave. between West Chicago St. and Pennsylvania Ave., was 48 1/2 ft. in depth, and the other well at the east end of Laurel St. at the southwest intersection of Illinois Ave. was 59 ft. deep.

To alleviate a water shortage, in the summer of 1931, a group of 4 shallow wells owned by the Borden Milk Co. were purchased by the City. These wells were located on the east bank of Fox River, about 375 to 450 ft. south of the center of Kimball St. and varied in depth from 36 to 46 ft. They obtained water from sand and gravel formations.

An attempt to develop a gravel well at a depth of 85 ft. in the southeastern part of the city near the southeast corner of Lavoie and Elgin Ave. was unsuccessful. The drilling was continued to a penetration of the upper sandstone and completed at a depth of 677 1/2 ft. in Sept., 1931. It was placed in service in 1932. In 1945 it was deepened to 1978 ft.

In 1931 a well was drilled to a depth of 1940 ft. near the southwest corner of Schuler St. and Commonwealth Ave. This well was placed in service in 1932.

Another well was constructed at the northwest corner of Clifton Ave. and Erie St. which was called the Erie St. Well. It was reported having a depth of about 40 ft. and small productive capacity.

The original group of deep wells, No. 1 to 4, at the Slade Ave. plant site are still in service. The approximate location of the center of this group is 800 ft.S. and 700 ft. W. of the N. E. corner of Section 11, T. 41 N., R. 8 E. These wells are located nearly in a straight line extending from southwest to northeast. The measured distances in ft. between the wells are as follows:

Well No. 1 to No. 2 = 205.4
Well No. 2 to No. 3 = 333.6
Well No. 3 to No. 4 = 501.4

Elevations established at their existing pump bases are:

No. 1	740.67 ft.
No. 2	743.33
No. 3	744.88
No.4	740.11

These wells were drilled by Frank M. Gray, Milwaukee, Wis., and placed in service in 1904. The depths as originally drilled respectively were Well No. 1, 2000 ft. and Wells 2, 3, and 4, 1300 ft. The drillers original hole size and casing record are not available but the wells were all reported 12 in. in diameter at the top and 8 in. in diameter at the bottom.

The well was tested for production after completed and it was determined that its specific capacity when plugged at a depth of 1400 ft. was as high as when drawing from the entire well. The other 3 wells were then drilled to 1300 ft.

Water was originally pumped by a shaft and tunnel system connecting the 4 existing wells at a depth of 115 ft. below the surface. When the wells were drilled, the depth to water was about 11 ft. A pump installed in the bottom of the shaft in 1911 was reported to discharge at a rate of 2.5 mgd.

On Mar. 19 and 23, 1917 tests were made which showed a rate of production of 2.138 mgd. from the 4 wells when operated simultaneously by the shaft and tunnel system. The non-pumping water level below the pumping station floor was 52.6 ft. after several hr. idle period and the water level was 124 1/2 ft. after 4-hr. pumping. At this time a 25-lb. weight was lowered to depths of 1159, 1272, 1178, and 589 ft. in Wells 1, 2, 3, and 4, respectively, indicating bridging or filling of the wells since construction.

In 1924 the combined production of all 4 wells had decreased to an estimated 1.2 mgd. Wells No. 2, 3, and 4 were cleaned out in 1924-1925 and extended as 8-in. holes to depths of 1950, 1960, and 1880 ft., respectively. No casings were placed or replaced in the upper parts of the wells. The wells were reported cased with 12-in. pipe to a seat in the Galena-Platteville dolomite at a depth of at least 115 ft. By June 1, 1928 the non-pumping water level in the wells was lowered to about 79 ft. below the surface and the combined production of the wells was limited to about 1 mgd. by the existing shaft and tunnel system of pumping. This system was then supplemented by the installation of air lifts in Wells 2, 3, and 4, to boost the water up to the tunnel pumps, thereby increasing the delivery to 1.7 mgd.

In 1931, Well No. 1 which had been out of service for a few years was repaired. It was reported cleaned out and "shot" at depths of 1525, 1450, 1200, and 1100 ft. An air lift was installed in the well in Mar., 1931. Weir box measurements showed a production of 360 gpm. with a drawdown of 36 ft. from a non-pumping water level of 87 ft. below the surface.

By 1932 the shaft and tunnel system of pumping with supplementary air lifts was abandoned. The wells were equipped with vertical shaft turbine pumps set at depths of 250 ft. below the surface. A 48-hr. test of continuous pumping of the turbines installed in Wells No. 1, 2, and 3 was made in Aug. 1931. At the end of the test a combined production of 2.9 mgd. and an average pumping water level of 191 ft. below the surface was reported.

Water levels for the wells in this group arrangement have been difficult to obtain because of the interference among the 4 wells by the operation of any of the pumps.

Average water levels are shown in ft. below ground level in Table 1.

TABLE 1

Year	Non-Pumping ft.	Pumping ft.	Pumping Rate gpm.
1904	11		
1911	40	105.	
1917	52.6	124.5	1416 X
1928	79		
1931		191	2000 XX
1934	94		
1946	145	207	2282 XX
1947 (May)	155	246	3328 XX

X Combined production of all 4 wells.
XX Combined production of Wells 1, 2, and 3.

In 1943, Well No. 1 was reported "shot" with a 500 lb. charge of 100% blasting gelatin, between depths of 1120 and 1160 ft. Approximately 30 cu. yd. of sand were removed from the well. A sounding at that time revealed an 11 1/2-in.

LABORATORY NO. 115,155

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	12.2	
Manganese	Mn	0.0		Fluoride	F	0.4	
Calcium	Ca	67.5	3.38	Chloride	Cl	7.0	0.20
Magnesium	Mg	23.8	1.96	Nitrate	NO_3	0.2	Tr.
Ammonium	NH_4	0.5	0.03	Sulfate	SO_4	13.0	0.27
Sodium	Na	21.6	0.94	Alkalinity	(as $CaCO_3$)	292.	5.84
Turbidity		Tr.		Hardness	(as $CaCO_3$)	267.	5.34
Color		0		Residue		332.	
Odor		0		Temperature 57° F.			

hole to 404 ft.; an unknown length of 10-in. liner at a depth of about 800 ft. below which the hole was 8 in. in diameter to the bottom.

A production test was made on Mar. 21 and 22, 1946. Before the test, the non-pumping water level was 147 ft. below the pump base with no pumping in Wells No. 2 and 3. While pumping at 685 gpm. the drawdown was 95 ft. with pumping in Wells No. 2 and 3.

Analysis of a sample (Lab. No. 115,155) collected June 29, 1948 after 18-hr. pumping at 1076 gpm. showed the water to have a hardness of 15.5 gr. per gal., a residue of 332 ppm., and an iron content of 0.1 ppm.

In Apr., 1945, the well was cleaned out to a depth of 1945 ft. Bridges were encountered at depths of 1145 and 1560 ft. which were removed.

In Apr., 1947, while making a new pump installation in the well the turbine could not be lowered beyond a depth of 396 ft. because pf an obstruction. The following pump installation was then made: 380 ft. of 8-in. column pipe; 12-in., 17-stage Aurora Pump Co. turbine pump having an overall length of 13 ft. and a rated capacity of 1000 gpd. against 390 ft. of head; 20 ft. of 8-in. suction pipe with tapered strainer; 302 ft. of 1/4-in. gi. air line; 150-hp. U. S. electric motor.

On Apr. 23, 1947, when pumping at 1124 gpm. the water level was below the 302-ft. air line after 4-hr. pumping. The non-pumping water level on Apr. 2 4 and May 2, 1947 was 157 ft. below the pump base.

This well was in daily service in Aug. 1947.

In 1941, Well No. 2 was reported "shot" at depths of 1375 and 1800 ft. The well was rehabilitated by the Layne Western Co., Chicago, Jan. to Mar., 1946. It was found filled to the 1221 ft. level with a quantity of hard blue sandy shale which was drilled and baled out and the hole cleaned to a depth of 1965 ft. The hole diameters were reported as given in Table 2.

TABLE 2

12-in. hole to 695 ft. 4 in.
10-in. hole from 695 ft. 4 in. to 861 ft. 8 in.
8-in. hole from 861 ft. 8 in. to 1965 ft.

A leak was also reported in the upper 12 in. well-casing at a depth of 135 ft. A 6-in., slotted liner was installed between depths of 1147 and 1264 ft. Following the rehabilitation work, production tests were made on Feb. 7 and Mar. 12, 1946. Before the test, the water level was 133 ft. below the pump base when all pumps were idle. When pumping at 675 gpm. the drawdown was 117 ft. with the pumps in Wells No. 1 and 3 in operation and No. 4 idle. Before the test, the water level in Well No. 4 was 140 ft. below the pump base and 209 ft. after 12 hr. of rest period with pumps No. 2 and 3 in operation.

Analysis of a sample (Lab. No. 115,121), while pumping at a rate of 1056 gpm., showed this water to have a hardness of 14.8 gr. per gal., a residue of 327 ppm., and an iron content of 0.2 ppm.

The existing pump installation, made Apr. 25, 1947, is 400 ft. of 8-in. column pipe; 12-in., 17-stage Aurora Pump Co. turbine pump having an overall length of 13 ft. and a rated capacity of 1000 gpm. against 390 ft. of head; 20 ft. of 8-in. suction pipe with tapered strainer; 400 ft. of 1/4-in. gi. air line (defective); 150-hp. U. S. electric motor.

Following this installation a pumping test was made which showed a uniform discharge of 1058

LABORATORY NO. 115,121

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	11.0	
Manganese	Mn	0.0		Fluoride	F	0.4	
Calcium	Ca	64.0	3.20	Chloride	Cl	11.0	0.31
Magnesium	Mg	22.5	1.85	Nitrate	NO_3	0.4	0.01
Ammonium	NH_4	0.6	0.03	Sulfate	SO_4	13.0	0.27
Sodium	Na	18.2	0.79	Alkalinity	(as $CaCO_3$)	264.	5.28
Turbidity		Tr.		Hardness	(as $CaCO_3$)	253.	5.05
Color		0		Residue		327.	
Odor		0		Temperature 59° F.			

gpm. during a 24-hr. pumping period. The drawdown could not be determined because the air line was defective. All water levels previously observed for Well No. 2 have been identical with Well No. 1 under similar operating conditions.

This well was in daily service in Aug. 1947.

The upper vertical alignment of Well No. 3 was checked on May 6, 1947 by lowering dummies into the well. A dummy having a length of 20 ft. and an od. of 11 1/2 in. was lowered to a depth of 3 1 ft. where it stopped. This was followed by another dummy of 40 ft. length and 9 1/2 in. od. which was lowered to a depth of 509 ft. 7 in. where it came to a stop. At a depth of 375 ft. the dummy was tight in the hole.

The existing pump installation, made on May 7, 1947, is 400 ft. of 8-in. column pipe; 12-in., 17-stage Aurora Pump Co. turbine pump having a rated capacity of 1000 gpd. against 390 ft. of head; the overall length of the pump is 13 ft.; a suction screen; 400 ft. of 1/4-in. air line; 150-hp. U. S. electric motor.

During a 24-hr. test run with the above equipment pumping at a rate of 1146 gpm., considerable sand was discharged which cleared up during the test. However, subsequent operations have shown periodical discharges of sand which could only be cleared up by continuous periods of operation. On May 12, 1947 the non-pumping water level was 155 ft. below the pump base after a 12-hr. idle period for all wells in this group. On that date the pumping water level was 245 ft. below the pump base with none of the other pumps in this group in operation.

In Aug. 1947 the operation of Well No. 3 was alternated with Well No. 4.

Analysis of a sample (Lab. No. 115,156) collected June 29, 1948, while pumping at a rate of 1000 gpm., showed this water to have a hardness of 16.9 gr.per gal., a residue of 350 ppm. and an iron content of 0.2 ppm.

In May, 1942, Well No. 4 was checked for hole sizes and depth by S. B. Geiger & Co., Chicago. A bridge was found in the well at a depth of 590 ft. which was removed. The information was reported by the driller as given in Table 3.

TABLE 3

12-in. casing from the surface to a depth of 300 ft.
12-in. hole between depths of 300 and 591 ft.
10-in. hole between depths of 591 and 860 ft.
8-in. hole between depths of 860 and 1880 ft.

The existing pump installation, made on May 16, 1947, is 350 ft. of 8-in. column pipe; 12-in., 17-stage Aurora Pump Co. turbine pump having a rated capacity of 1000 gpm. against 390 ft. of head; the overall length of the pump is 13 ft.; 20 ft. of 8-in. suction pipe with tapered strainer; 350 ft. of 1/8-in. gi. air line; 150-hp. U. S. electric motor.

Following this installation, a 24-hr. pumping test was made. When pumping at 1146 gpm. the drawdown was 92 ft. from a non-pumping water level of 156 ft. below the pump base. No other pumps in this group were in operation at this time.

The same difficulty of pumping sand with a lowered turbine setting that was experienced with Well No. 3 was also encountered in Well No. 4. The water would clear up only after long periods of continuous pumping.

This well serves as an auxiliary supply unit and operated during the summer months, alternating with Well No. 3.

LABORATORY NO. 115,156

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	13.4	
Manganese	Mn	0.0		Fluoride	F	0.4	
Calcium	Ca	70.4	3.52	Chloride	Cl	7.0	0.20
Magnesium	Mg	27.6	2.27	Nitrate	NO_3	0.8	0.01
Ammonium	NH_4	0.4	0.02	Sulfate	SO_4	19.5	0.41
Sodium	Na	18.6	0.81	Alkalinity	(as $CaCO_3$)	300.	6.00
Turbidity		Tr.		Hardness	(as $CaCO_3$)	290.	5.79
Color		0		Residue		350.	
Odor		0		Temperature 55° F.			

LABORATORY NO. 115,122

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	12.2	
Manganese	Mn	0.2		Fluoride	F	0.4	
Calcium	Ca	68.7	3.44	Chloride	Cl	5.0	0.14
Magnesium	Mg	26.8	2.20	Nitrate	NO_3	0.2	Tr.
Ammonium	NH_4	0.6	0.03	Sulfate	SO_4	17.1	0.36
Sodium	Na	20.9	0.91	Alkalinity (as $CaCO_3$)		304.	6.08
Turbidity		Tr.		Hardness (as $CaCO_3$)		282.	5.64
Color		0		Residue		347.	
Odor		0		Temperature 54° F.			

Analysis of a sample (Lab. No. 115,122) collected June 28, 1948, while pumping at a rate of 1000 gpm., showed the water to have a hardness of 16.4 gr. per gal., a residue of 347 ppm. and an iron content of 0.2 ppm.

The group of shallow wells at the Slade Ave. plant site comprising the dug well and three 6-in. drilled wells are no longer in service. These wells obtained water from the sand and gravel formations overlying bedrock.

The dug well furnished about 6 mgd. in 1916 but when the 6-in. drilled wells were placed in service in 1921 the water level was drawn to the bottom of the well.

The pumps in the 6-in. wells were placed in pits about 15 ft. below the ground surface. Their combined production was reported to be 1/2 mgd. in Dec. 1921. Only one of the pumps was operated continuously at a rate of 350 gpm. in Jan., 1925 because little additional water could be obtained by the operation of additional pumps. By Aug., 1931 the continuous operation of a single well in the group produced 1/4 mgd. These wells were abandoned in 1932. Two of the 6-in. wells are now filled and the other one is capped.

The 19-ft. dug well was extended in 1934 as a drilled well to a reported depth of 53 1/2 ft. below the surface. It was constructed by the city as a gravel-packed well and cased with 12-in. pipe with a 12-in. screen at the bottom. This well is now called No. 5 and is in service as an auxiliary supply unit.

The pump installation is 40 ft. of 6-in. od. column pipe; 8-in., 3-stage American Well Works turbine pump, No. 58154, having a rated capacity of 200 gpm. against 65 ft. of head; 6 ft. of 5-in. od. suction pipe; 40. ft. of 1/4-in. gi. air line; 7 1/2-hp. U. S. electric motor.

On Sept. 28, 1946 the non-pumping water level was 12 ft. below the pump base after an idle period of a month. When pumping at a rate of 200 gpm., the drawdown was 10 to 12 ft.

The well is reported to have a capacity greater than 200 gpm.

Analysis of a sample (Lab. No. 115,123) collected June 28, 1948, while pumping at a rate of

LABORATORY NO. 115,123

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.5		Silica	SiO_2	16.2	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	79.9	4.00	Chloride	Cl	11.0	0.31
Magnesium	Mg	32.0	2.63	Nitrate	NO_3	0.8	0.01
Ammonium	NH_4	0.7	0.04	Sulfate	SO_4	85.4	1.78
Sodium	Na	9.0	0.39	Alkalinity (as $CaCO_3$)		248.	4.96
Turbidity		5		Hardness (as $CaCO_3$)		332.	6.63
Color		0		Residue		386.	
Odor		0		Temperature 54° F.			

LABORATORY NO. 112,421

	ppm.	epm.			ppm.	epm.
Iron (total) Fe	.04		Fluoride	F	0.4	
Turbidity	0		Chloride	Cl	7.0	0.20
Color	0		Alkalinity	(as $CaCO_3$)	96.	1.92
Odor	0		Hardness	(as $CaCO_3$)	86.	1.72
Temperature 57.5° F.			Total Mineral Content		155.	
pH = 9.0			Free CO_2 (calc.)		Tr.	

200 gpm., showed this water to have a hardness of 19.3 gr. per gal., a residue of 386 ppm. and an iron content of 0.5 ppm.

All water pumped from the Slade Ave. plant is aerated, softened, and chlorinated.

Analysis of a sample (Lab. No. 112,421) collected Aug. 21, 1947 showed the treated water to have a hardness of 5.0 gr. per gal., a mineral content of 155 ppm., and an iron content of 0.04 ppm.

The original St. Charles St. well located approximately 700 ft. N. and 1500 ft. W. of the S. E. corner of Section 24, was the most productive of the shallow wells constructed for the city. It was drilled to a depth of 101 ft. in 1921 by the Kelly Well Co., Grand Island, Neb.

The elevation of the surface of the ground is 728±ft. The well was cased with 24 in. (18 in. id.) concrete pipe with 22 ft. of concrete screen at the bottom. The top of the casing was in a pit about 11 ft. below the ground surface. Upon its completion the well was tested four days by pumping 7 hr. each day. It produced 1080 gpm. with a maximum drawdown of 24 ft. from a non-pumping water level at the top of the casing.

In 1924, pumpage from this well averaged 643,225 gpd. The production rate of the well gradually decreased to 860 gpm. in 1925, 685 gpm. in June, 1928 and 133 gpm. in Aug., 1931. No recession in the non-pumping water level had occurred during the 10 year operation of the well and the diminished capacity was attributed to a blocking of the water passages in the concrete screen or the gravel filter surrounding it.

About Oct., 1931, the well was surged with an 8-in. drill and tools wrapped in wire and rope. After 3 days surging, considerable sand was removed and a test was made showing an increase in production of 250 gpm. Surging was continued but after another day nothing but pea-sized gravel was removed and upon testing the production decreased to the pre-surging capacity of 100 gpm. The well was abandoned shortly after the new well at the site was placed in service.

In 1933, a new well was drilled by the Kelly Well Co. on the St. Charles site about 35 ft. from the other well. The test hole indicated identical formations and the well was constructed similar to the other well except that the concrete casing and screen was 16 in. in diameter and the depth of the well 105 ft. The elevation of the pump base is 728.4 ft. When the well was completed, the standing water level was 13 ft. below the ground surface.

In 1934, the pumping water level was 42 ft. below the surface and the production averaged 300,000 gpd.

In 1944, pumpage from this well averaged 187,740 gpd. During the year 1944 weekly observations of non-pumping water levels showed levels of 24 to 25 ft. below the pump base.

The existing pump installation, made in May 1945, is 70 ft. 5 in. of 8-in. column pipe; 12-in., 4-stage American Well Works turbine pump, head No. 58076 and bowl assembly No. 57434, having a rated capacity of 450 gpm. against 237 ft. of head; the overall length of the pump is 4 ft.; 12 ft. of 8-in. suction pipe; 85 ft. of 1/4-in. gi. air line; 40-hp. U. S. electric motor.

Following this installation the pumping water level was 73 ft. below the pump base when pumping at 950 gpm. The water levels in this well are influenced by industrial pumpage in the adjacent territory as evidenced by the following recorded non-pumping water levels: 16 ft. on Nov. 16, 1946; 13 1/2 ft. on Jan. 30, 1947; and 15.6 ft. on Feb. 26, 1947.

The well is used only as an auxiliary supply

LABORATORY NO. 115,158

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	4.4		Silica	SiO_2	19.7	
Manganese	Mn	0.1		Fluoride	F	0.1	
Calcium	Ca	132.9	6.65	Chloride	Cl	11.0	0.31
Magnesium	Mg	53.3	4.38	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	0.7	0.04	Sulfate	SO_4	214.1	4.46
Sodium	Na	18.9	0.82	Alkalinity (as $CaCO_3$)		356.	7.12
Turbidity		90		Hardness (as $CaCO_3$)		552.	11.03
Color		0		Residue		652.	
Odor		Tr.		Temperature 52° F.			

unit. It was out of service in 1946 but was operated again in Aug. 1947.

Analysis of a sample (Lab. No. 115,158) collected June 30, 1948, while pumping at a rate of 900 gpm., showed this water to have a hardness of 32.3 gr. per gal., a residue of 652 ppm. and an iron content of 4.4 ppm.

All water pumped to the distribution system from this plant is chlorinated and treated for iron removal. In Sept. 1947 a softening plant was being constructed at this station.

The North State St. Well was drilled in 1926 by the Kelly Well Co. and located about 40 ft. north of Washington St. and 60 ft. west of State St. (or approximately 2000 ft. S. and 1950 ft. W. of the N. E. corner of Section 14). The well was completed at a depth of 43 ft., and penetrated sand and gravel from the surface. The well was cased with 25-in. concrete pipe and screen with the top of the casing in a pit about 18 ft. below a ground surface elevation of 725± ft.

On May 30, 1928, after the pump had been idle 12 hr., the water level was 15.7 ft. below the floor level of the pit. The well was operated only during the summer months.

In a test made in Aug. 1931 when pumping at 84 gpm. the drawdown was 1.4 ft. from a non-pumping water level of 12.3 ft. below the pump pit floor.

Water was pumped by suction lift until about 1932. The existing pump installation, made in 1942, is 16 ft. 9 in. of 6-in. column pipe; 8-in., 10-stage American Well Works turbine pump, No. 65477, having a rated capacity of 215gpm. against 215 ft. of head; the overall length of the pump is 6 ft. 3 in.; 15-hp. U. S. electric motor.

In 1946 the non-pumping water levels averaged 12 1/2 ft. below the pump base or 28 1/2 ft. below the ground surface and when pumping at a rate of 215 gpm. the drawdown was 5 1/2 ft.

-Analysis of a sample (Lab. No. 115,157) collected June 28, 1948, while pumping at a rate of 225 gpm., showed the water to have a hardness of 27.6 gr. per gal., a residue of 594 ppm., and an iron content of 0.1 ppm.

LABORATORY NO. 115,157

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	22.4	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	104.8	5.24	Chloride	Cl	16.0	0.45
Magnesium	Mg	51.2	4.21	Nitrate	NO_3	25.2	0.41
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	131.6	2.74
Sodium	Na	10.8	0.47	Alkalinity (as $CaCO_3$)		316.	6.32
Turbidity		0		Hardness (as $CaCO_3$)		473.	9.45
Color		0		Residue		594.	
Odor		0		Temperature 52° F.			

The well is used as an auxiliary supply unit and was being operated in Aug. 1947.

The Crighton Ave. Well was drilled by the Kelly Well Co. in 1928 and located approximately 2050 ft. N. and 1230 ft. E. of the S. W. corner of Section 14. The well was constructed to a reported depth of 53 ft. and sand and gravel was encountered 12 ft. below a ground surface elevation of 800± ft. It was cased with 25-in. concrete pipe and screen.

A turbine pump was installed with an attached suction pipe the end of which was placed at a depth of 43 ft. On May 30, 1928 the flow meter indicated a discharge of 218 gpm.

In a test made in Aug. 1931 when pumping at 203 gpm. the drawdown was 23 ft. from a non-pumping water level of 19 ft. below the surface. The same water levels were reported in 1934 when the well was producing 300,000 gpd.

The existing pump installation, made in 1935 is 40 ft. of 6-in. column pipe; 8-in., 6-stage American Well Works turbine pump No. 55175, rated at a capacity of 200 gpm. against 152 ft. of head; 7 ft. of 5-in. suction pipe; 15-hp. U. S. electric motor.

In 1946 the non-pumping water levels averaged 8 ft. 4 in. below the pump base and the pumping levels averaged 36 ft. during continuous operating periods.

Analysis of a sample (Lab. No. 115,154) collected June 30, 1948, while pumping at a rate of 200 gpm., showed the water to have a hardness of 33.6 gr. per gal., a residue of 628 ppm., and an iron content of 0.1 ppm.

All water pumped from this well is chlorinated.

The well is reported as an auxiliary supply unit and is in service principally during the summer months.

The Laurel St. Well was constructed by the Kelly Well Co. in 1928 and located approximately 1300 ft. N. and 700 ft. W. of the S. E. corner of Section 13. The driller reported the depth of the well to be 53 ft. below a ground surface elevation of 730± ft.

The well was cased with 25-in. concrete pipe and screen with the top of the casing about 1 ft. below ground level. The length of the screen was reported to be 35 ft. The standing water level was 34 in. below the top of casing on June 29, 1928 after the well was completed.

During a test made on Aug. 6, 1928 when pumping at a rate of 750 gpm. by suction lift against a pressure of 75 psi. the drawdown was 10 ft.

During the summer pumping period in 1931 the estimated production was 200 gpm. but after an inoperative period the well produced 540 gpm. in a test in Oct. 1931.

The well was abandoned as a public supply source in the fall of 1931 because of a danger of contamination from changes in surface conditions to the adjacent area.

The Borden Milk Co. wells were purchased by the city to relieve a water shortage in the summer of 1931. They are located about 30 ft. east of the Fox River and 375 to 450 ft. south of the center of Kimball Ave. (or approximately 1330 ft. S. and 1520 ft. W. of the N. E. corner of Section 14). Three of these wells are 6 in. in diameter and 46 ft. deep, and one is 12 in. in diameter and 36 ft. deep. The capacity of these

LABORATORY NO. 115,154

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	19.7	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	123.5	6.18	Chloride	Cl	21.0	0.59
Magnesium	Mg	65.0	5.34	Nitrate	NO_3	24.3	0.39
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	155.3	3.23
Sodium	Na	3.0	0.13	Alkalinity (as $CaCO_3$)		372.	7.44
Turbidity		Tr.		Hardness (as $CaCO_3$)		576.	11.52
Color		0		Residue		628.	
Odor		0		Temperature 52° F.			

wells in 1931 was reported to be 2/3 mgd. The wells are still equipped with an American Well Works centrifugal 2-stage 6 in. by 5 in. pump for emergency use.

These wells were maintained as a source of an emergency supply but the records do not indicate their use after 1934.

The Erie St. Well, located at the northwest corner of Clifton Ave. and Erie St. (or approximately 50 ft. N. and 2000 ft. W. of the S. E. corner of Section 15), was another shallow well similar in construction to the Crighton Ave. and Laurel Ave. Wells. The productive capacity was very small and the pumping equipment was removed and installed in the Crighton Ave. Well in 1931. The Erie St. Well has been abandoned.

The Lavoie Ave. Well is located approximately 183 ft. N. and 270 ft. W. of the S. E. corner of Section 24, and the elevation of the pump house floor is 732.7 ft.

This well was originally planned as a sand and gravel well but when a depth of 85 ft. was reached rock was encountered and the overlying gravel formation failed to produce a sufficient quantity of water. Drilling was continued and at a depth of 365 ft. the well was tested and produced 500 gpm. with a drawdown of 160 ft. from a non-pumping water level of 2 ft. below the ground surface. The well was completed to a depth of 677 1/2 ft. by Sept. 23, 1931. A production test was made on Sept. 24, 1931. After 18-hr. pumping at 690 to 700 gpm. the drawdown was 181 ft. from a non-pumping water level of 7 ft. below the ground surface.

A turbine pump having a rated capacity of 750 gpm. with 250 ft. of 8-in. discharge column was installed in 1932.

Pumpage for the year 1940 averaged 592,485 gpd. Pumping water levels of 233 to 238 1/2 ft. below the pump base were observed between June 25 and Dec. 30, 1942. The turbine pump was re-

Sample-study log of Lavoie Ave. Well furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Clay"	4	4
"Sand"	26	30
Gravel, clean	55	85
Ordovician system		
Maquoketa shale and dolomite	190	275
Galena - Platteville dolomites	335	610
Glenwood formation		
"Sandstone, hard"	55	665
"Sandstone and shale"	12 1/2	677 1/2
St. Peter formation		
Sandstone	122 1/2	800
Conglomerate of sandstone, shale and chert	38	838
Oneota dolomite, some shale and sandstone	40	878
Cambrian system		
Trempealeau dolomite	102	980
Franconia shale, some sandstone and dolomite	75	1055
Galesville formation		
Sandstone, some dolomite	85	1140
Sandstone, incoherent	65	1205
Sandstone and dolomite	20	1225
Eau Claire shale, sandstone and dolomite	425	1650
Cambrian and Pre-Cambrian systems		
Mt. Simon and Fond du Lac sandstones	328	1978

ported to be set at 280 ft. and discharged 560 gpm.

The well was electrically logged on Nov. 22, 1943 and the following observations were reported: depth 654 ft., non-pumping water level 20 ft. below ground surface, 16 in. od. casing 6 to 87 ft. below ground surface, a large quantity of water entering well at rock crevices 2 to 4 ft. below end of casing, and pump column and air line found coated with crenothrix.

This well was rehabilitated and deepened by S. B. Geiger & Co., Chicago, in 1945.

The hole size, casing and liner record is shown in Table 4.

TABLE 4

Hole Record

15-in.	from	87 1/3	to 867 ft.
12-in.	from	867	to 1070 ft.
10-in.	from	1070	to 1414 ft.
8-in.	from	1414	to 1978 ft.

Casing and Liner Record

30-in.	from	0	to 8 ft.
24-in.	from	0	to 40 ft.
16-in.	from	0	to 87 1/3 ft.
12-in.	from	805	to 867 ft.
10-in.	from	966	to 1070 ft.
8-in.	from	1230	to 1414 ft.

Analysis of a sample (Lab. No. 115,120) collected June 28, 1948, while pumping at a rate of 700 gpm., showed this water to have a hardness of 15.0 gr. per gal., a mineral content pf 360 ppm., and an iron content of 0.1 ppm.

The old pump was overhauled and the following installation made in Nov. 1945: 360 ft. of 8-in. column pipe; a 12-in., 6-stage American Well Works turbine pump, No. 57433, having a rated capacity of 750 gpm. against 360 ft. of head; 20 ft. of 8-in. suction pipe; 360 ft. of 1/4-in. gi. air line; 100-hp. Westinghouse electric motor.'

On Dec. 31, 1945 the non-pumping water level was 75 ft. below the pump base. In Aug. 1946 after continuous pumping at a rate of about 1000 gpm., the drawdown was 212 ft. from a non-pumping water level of 73 ft. below the pump base. On Mar. 1, 1947 the water level was 60 ft. after a 6-hr. idle period.

All water is pumped to the aerator at the St. Charles St. pumping station where it is also chlorinated.

The well has been in daily operation since Nov. 1945 and in Aug. 1947, the production was 940 to 960 gpm.

The Shuler St. Well was drilled in 1931 to a depth of 1940 ft. by Varner Well Drilling Co., Inc., Dubuque, Iowa, and located approximately 800 ft. N. and 250 ft. E. of the S. W. corner of Section 14. The elevation at the pump base is 839.24 ft.

The following water levels below the top of casing were reported during drilling operations: 110 ft. at depth of 850 ft., 95 ft. at depth of 1160 ft. and 90 ft. at the 1780 ft. depth. When drilling had reached a depth of 1852 ft. a 26-hr. production test was made. When pumping at 850 to 900 gpm. for 5 hr., the drawdown was 197 ft. from a standing water level of 93 ft. below the top of casing. However, the water level did not return to its prior level of 93 ft., but remained at 180 ft. while drilling was continued to the 1940 ft. depth.

Upon completion of the well a 48-hr. pro-

LABORATORY NO. 115,120

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	13.9	
Manganese	Mn	0.0		Fluoride	F	0.7	
Calcium	Ca	61.9	3.10	Chloride	Cl	9.0	0.25
Magnesium	Mg	25.0	2.06	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	0.9	0.05	Sulfate	SO_4	13.2	0.27
Sodium	Na	35.7	1.55	Alkalinity (as $CaCO_3$)		312.	6.24
Turbidity		Tr.		Hardness (as $CaCO_3$)		258.	5.16
Color		0		Residue		360.	
Odor		0		Temperature 55° F.			

duction test was made. After pumping 8 hr. at a rate of nearly 800 gpm. the drawdown was 158 ft. from a non-pumping water level of 180 ft. below the top of casing. Pumping was continued at about the same rate during the test without additional drawdown. A turbine pump, 750 gpm. rated capacity was installed with the top of the bowls at adepth of 350 ft. and the well was placed in service in 1932.

The production of the well dropped to 460 gpm. in 1933 and the pump was removed for inspection. It was found in good condition and replaced but the production continued to diminish until in Sept., 1944 the pump broke suction at the end of 5-min. operation. The pump was removed and a water level recorder installed in the well on Mar. 13, 1946. The distance to water on that date was 110.1 ft. below the top of casing and in Nov. 1946 the depth of water was 109.0.

In 1946 total pumpage from all municipal pumping stations averaged 2.7 mgd. and total industrial pumpage for the immediate Elgin area averaged 1.2 mgd. from drift and limestone wells and 1.4 mgd. from sandstone wells.

The hole, casing and liner record of Shuler St. Well is shown in Table 5.

TABLE 5

Hole Record

20-in.	from	106 1/3	to	210 ft.
17-in.	from	210	to	955 ft.
15-in.	from	955	to	1463 ft.
12-in.	from	1463	to	1940 ft.

Casing and Liner Record

22-in.	from	0	to	106 1/3 ft.
18-in.	from	0	to	210. ft.
16-in.	from	890	to	955 ft.
12-in.	from	1280	to	1463 ft.

ELGIN STATE HOSPITAL
Kane County
Sept. 21, 1948

Prior to 1932, Elgin State Hospital obtained water from 2 dug wells, each 22 ft. in diameter and 20 ft. deep. The wells were located 40 and 110 ft. from the water's edge of the Fox River.

In Sept. 1932, a well, now called No. 1, was completed to a depth of 2000 ft. by Gray-Milaeger Co., Milwaukee, Wis., and located about 2700 ft. west of the old wells or approximately 1275 ft. N. and 1775 ft. W. of the S. E. corner of Section 23, T. 41 N., R. 8 E.). The hole and casing record were reported as shown in Table 1.

TABLE 1

Hole Record

17-in. from 300 to 1060 ft.
15-in. from 1060 to 2000 ft.

Casing Record

20-in. od. drive pipe from 0 to 64 ft.
18-in. od. welded casing from 0 to 300 ft.
16-in. od. liner from 816 to 1060 ft.

A production test was made by the owner in October 1932. It was reported that, after 48-hr. pumping at an average rate of 1365 gpm., the drawdown was 90 ft. from a water level of 45 ft. below a ground surface elevation of 750± ft. The pumping equipment consists of 230 ft. of 8-in. column pipe; 12-in., 4-stage American Well Works turbine pump, No. 58443, having a rated capacity of 925 gpm. against 190 ft. of head and an overall length of 5 ft. 9 in.; 28 ft. of 8-in. suction pipe; 246 ft. of air line below the pump base; the elevation of the bottom of the air line is 501.6 ft.

Analysis of a sample (Lab. No. 111,322) collected July 31, 1947, after 18-hr. pumping at 750 gpm., showed this water to have a hardness of 26.7 gr. per gal., a mineral content of 506 ppm., and an iron content of 0.2 ppm.

Well No. 2 -was completed in July 1947 to a depth of 1290 ft. by Layne-Western Co., Chicago and located about 1850 ft. southwest of Well No. 1 (or approximately 915 ft. N. and 1575 ft. E. of the S.W. corner of Section 23). The driller reported the hole and casing record as shown in Table 2.

TABLE 2

Hole Record

24-in. from 0 to 440 ft.
19-in. from 440 to 940 ft.
15 1/4-in. from 940 to 1290 ft.

Casing Record

30-in. od. drive pipe from 0 to 74 ft.
24-in. od. casing from 0 to 440 ft.
16-in. od. liner from 840 to 940 ft.

The 24-in. casing was pressure-grouted, using 750 sacks of cement. The 16-in. liner was slotted with a cutting torch, each slot about 3/8 in. by 24 in. and spaced 6 in. apart. A production test was made July 30-31, 1947 under the supervision of the State Water Survey. Before and during the test, Well No. 1 was in continuous use. Before starting the test the water level in Well No. 2 was 191 ft. below the top of the 20-in. casing (Elev. 760t ft.). After 24-hr. pumping at rates increasing from 600 gpm. at the start to 1100 gpm. during the final 4 hr. of the test the drawdown was 51 ft. Three hr. after the shutdown the water level in Well No. 2 was 212 1/2 ft.

The well is said to be equipped with 325 ft. of column pipe; 12-in., 11-stage Pomona turbine pump, Shop No. SH 662; 325 ft. of air line; 150-hp. General Electric motor.

LABORATORY NO. 111,322

	ppm.	epm.			ppm.	epm.
Iron (total) Fe	0.2		Chloride	Cl	25.0	0.70
			Alkalinity	(as $CaCO_3$)	288.	5.7
Turbidity	0		Total Hardness	(as $CaCO_3$)	458.	9.16
Color	0		Residue		506.	
Odor	0		pH = 7.2			
Temperature 54.5° F.						

Analysis of a sample (Lab. No. 111,321) collected July 31, 1947 after 24-hr. pumping at 1100 gpm. showed this water to have a hardness of 15.5 gr. per gal., a total mineral content of 332 ppm., and an iron content of 0.6 ppm.

The well was not yet in service in Sept. 1948.

Metered pumpage at the Hospital averages 956,000 gpd.

ELIZABETH
Jo Daviess County
Jan. 10, 1947

A public water supply was installed by the village of Elizabeth (694) in 1904.

A well was drilled to a depth of 260 ft. and located in the pumping station in the northwest part of the business district (or approximately 2150 ft N. and 1750 ft. W. of the S. E. corner of Section 24, T. 27 N., R. 2 E.). The elevation of the ground surface at the well-site is 810t ft. The well was cased with 8-in. pipe to a depth of 40 ft., penetrating 20 ft. of rock.

The well was originally equipped with a Keystone Driller Co. double-acting deep-well pump with a working barrel of 4 3/4 in. in diameter and 18-in. stroke operating at 22 1/2 spm. and attached to 230 ft. of 5-in. column pipe. Below the cylinder was 12 ft. of 5-in. suction pipe and 12 in. of sand screen. In June 1934, the cylinder was set at 236 ft. with no suction pipe attached. Power was furnished by a 20-hp. Fairbanks-Morse oil engine, No. 159596, belt-connected to the pump.

In 1934 the column pipe was found to be cracked, and the village leased a well of the Chicago Great Western R. R., abandoning the village well. Increased consumer demand, due to the drought, and a village sewer system installed in 1930 made it necessary to set up an auxiliary supply. In Apr. 1940 a new pump was installed in the old village well, now known as No. 1, and the well was returned to service because the railroad well was not furnishing an adequate supply for the village.

The following pump installation, made in Apr. 1940, is in service: 230 ft. of 4 1/2-in. od. column pipe; 6-in., 28-stage Pomona turbine pump, rated at a capacity of 100 gpm. against 355 ft. of head; the overall length of the pump is 11± ft.; 230 ft. of air line (now defective); 10 ft. of 4 1/2-in. od. suction pipe; 15-hp. General Electric motor.

The pump base is located in a pit about 10 ft. below the surface of the ground. In June 1933 the non-pumping water level was reported to be 140 ft., and at the time the above installation was made, a non-pumping water level of 181 ft. below the pump base and a drawdown of 40 ft. were reported.

Analysis of a sample (Lab. No. 108,629) collected on Dec. 9, 1946 after 6-hr. pumping at an estimated rate of 50 gpm., showed the water to have a hardness of 28.7 gr. per gal., a residue of 534 ppm., and an iron content of 0.1 ppm.

The pump was operated daily for a period of 12 to 14 hr.

The well of the Chicago Great Western R. R. Co., now called Village Well No. 2, leased and operated by the Village, was drilled in 1900 by W. H. Gray & Bros., Milwaukee, Wis. The well is located on the westerly side of the railroad right-of-way, about 100 ft. east of the village post office (or approximately 1600 ft. north and 900 ft. west of the southeast corner of Section 24). The well was drilled to a depth of 317 ft. below a ground surface elevation of 790± ft.

The Pomona turbine pump, No. S. C. 427, installed July 13, 1934, was pulled and overhauled (L 1405, replacement parts) in 1943. The following installation is in place: 200 ft. of 5-in. od. column pipe; 8-in., 16-stage Pomona turbine pump rated at a capacity of 100 gpm. against 340 ft. of head; the overall length of the pump is 7 1/2 ft.; 10 ft. of suction pipe; 15-hp. Westinghouse electric motor.

LABORATORY NO. 108,629

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.1		Silica	SiO_2	13.5	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	102.7	5.14	Chloride	Cl	26.0	.73
Magnesium	Mg	57.0	4.69	Nitrate	NO_3	1.9	.03
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	110.9	2.31
Sodium	Na	8.3	.36	Alkalinity (as $CaCO_3$)		356.	7.12
Color		0		Hardness (as $CaCO_3$)		492.	9.84
Odor		0		Residue		534.	
Turbidity		Tr.		Free CO_2 (calc.)		124.	
Temperature		57.5° F.		pH = 6.85			

Correlated driller's log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Blue Clay	25	25
Ordovician system		
Maquoketa formation		
Shale	10	35
Galena-Platteville formations		
Limestone	282	317

The non-pumping water level was reported to be 138 ft. at the time the well was drilled. The top of the 12-in. casing extends about 1 ft. above the ground surface to which a 12-in'. tee connection permits a free flow from the well through a 12-in. pipe to the aerator. This rate of flow, when checked at the aerator after the well was placed in service in 1938, amounted to 328 gpm. and in June 1934 it was 135 gpm. In Mar. 1937the non-pumping water level was reported to be 130 ft., and the water was drawn down 10 ft. when pumping at a rate of 100 gpm. for a period of 4 to 5 hr.

Analysis of a sample (Lab. No. 108,630) collected Dec. 10, 1946 after 20-min. pumping at an estimated rate of 100 gpm., showed this water to have a hardness of 20.5 gr. per gal., a residue of 361 ppm., and an iron content of 0.7 ppm.

The pump was not operated regularly.

The village has a sanitary sewer system. The water demand is principally from residential users, 2 creameries, and the Chicago Great Western R. R. stock pens. The estimated average normal pumpage is 42,000 gpd.

LABORATORY NO. 108,630

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.7		Silica	SiO_2	11.7	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	74.0	3.73	Chloride	Cl	3.0	.08
Magnesium	Mg	39.9	3.28	Nitrate	NO_3	1.3	.02
Ammonium	NH_4	0.1	.01	Sulfate	SO_4	39.3	.82
Sodium	Na	2.3	.10	Alkalinity (as $CaCO_3$)		310.	6.20
Color		0		Hardness (as $CaCO_3$)		351.	7.02
Odor		0		Residue		361.	
Turbidity		Tr.		Free CO_2 (calc.)		81.	
Temperature 52.5° F.				pH = 7.0			

ELKHART CITY
Logan County
Sept. 18, 1948

The town of Elkhart City (436) installed a public water supply in 1941.

Water is obtained from a well drilled in 1941, to a "depth of 76 ft. by Otis Woollen, Wapella, and located about 630 ft. south of the southeast corporate limits (or approximately 2000 ft. S. and 100 ft. E. of the N. W. corner of Section 18, T. 18 N., R. 3 W.). The ground elevation at the well site is 595± ft. The top of the pump base is 2 ft. above ground level.

The well is cased with 8-in. pipe and 10 ft. of Johnson screen, having No. 40 slot openings. The pumping equipment includes a 7-in. American Well Works turbine pump, No. 63810, having a rated capacity of 100 gpm. against 185 ft. of head; an air line of unknown length and a 7 1/2-hp. General Electric motor.

The driller reported that when the well was completed, water was pumped, not continuously, on several successive days at a rate of 75 gpm. The drawdown, in a 6-in. test hole 50 ft. distant, was 15 to 20 ft. On Sept. 14, 1948, after 16-min. pumping at 153 gpm., the water level was 4 ft. above the bottom of the air line and 20 min. after stopping the pump, the water level was 32 ft., as observed on the altitude gauge.

Analysis of a sample (Lab. No. 115,818) collected Sept. 14, 1948 after 16-min. pumping, showed the water to have a hardness of 22.2 gr. per gal., a residue of 462 ppm., and an iron content of 2.4 ppm.

All water is aerated and filtered.

Analysis of a sample (Lab. No. 116,034) collected Sept. 14, 1948 showed the treated water to have a hardnessof 21.5 gr. per gal., a total mineral content of 451 ppm., and an iron content of 0.14 ppm.

Pumpage is estimated to average 14,000 gpd.

LABORATORY NO. 115,818

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.4		Silica	SiO_2	29.8	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	89.8	4.49	Chloride	Cl	17.0	0.48
Magnesium	Mg	38.1	3.13	Nitrate	NO_3	0.2	Tr.
Ammonium	NH_4	0.8	0.04	Sulfate	SO_4	2.7	0.06
Sodium	Na	35.0	1.52	Alkalinity (as $CaCO_3$)		432.	8.64
Turbidity		20		Hardness (as $CaCO_3$)		381.	7.62
Color		15		Residue		462.	
Odor		0		Free CO_2 (calc.)		97.	
Temperature 55° F.				pH = 7.05			

ELMHURST
Du Page County
Mar. 17, 1949

The original water works for the city of Elmhurst (15,458) was installed in 1890 under private ownership and operation of the Elmhurst Spring Valley Water Co.

Water was obtained from a spring known as Mammoth Spring located on Spring Road about 3 miles south of Elmhurst College (approximately 2300 ft. N. and 2550 ft. W. of the S. E. corner of Section 23, T. 39 N., R. 11 E.). In 1914, the estimated pumpage for public consumption, from this source of supply, averaged 200,000 gpd. The flow from the spring became insufficient to meet a growing public demand and to provide adequate fire protection. This source of supply was abandoned in 1920 when the franchise of the private water company expired.

A public water supply from Wells was developed by the city from 1915 to 1919 to replace the spring supply.

Well No. 1 was drilled to a depth of 958 ft. in Sept. 1915 and located about 80 ft. south of Schiller St. and 200 ft. east of York St. (approximately 2000 ft. S. and 200 ft. E. of the N. W. corner of Section 1). The elevation of the pump base is 678.2 ft., about 8 ft. below the normal ground surface. It was originally cased with 18-in. pipe from the surface to a depth of 72 ft. below which the hole was 17-in. diameter to a depth of 297 ft. and 13-in. diameter from 297 ft. to the bottom. During drilling operations, below the depth of 534 ft., soft grey creviced limestone was encountered through which water was escaping from the well. To prevent this loss, 93 ft. of 10-in. liner was placed between depths of 537 and 630 ft., with rubber packing at top and bottom.

A production test was made Sept. 2, 1915 before the 10-in. liner was placed. While pumping at 325 gpm., the drawdown was 8.6 ft. from a non-pumping water level of 33 ft. below the pump base. Another test was made after the crevices were cased off. After pumping at 410 gpm. for 8 hr., the drawdown was 9.1 ft. from a non-pumping water level of 25 ft. below the pump base.

Water levels below the pump base on Jan. 14, 1924, were 62 ft. non-pumping level and 74 ft. pumping level.

By 1936, the production rate had decreased to 250 gpm. with a 260 ft. pump setting and the well was reconditioned. The 10-in. liner, originally installed, was removed and the non-pumping water level immediately dropped from 80 ft. to 265 ft. An increase in the production rate to 600 gpm was reported, after a new pump was installed, which remained fairly constant during about 10-hr. daily operation.

In 1939, the well was deepened from 958 to 1480 ft. and reamed between depths of 297 and 466 ft. by the J. P. Miller Artesian Well Co., Brookfield.

A pit, 9 ft. 7 in. deep, surrounds the top of the casing.

The hole and casing record is shown in Table 1.

TABLE 1

Hole Record

17-in. from 9 ft. 7 in. to 297 ft.
15 1/4-in. from 297 to 466 ft.
13-in. from 466 to 1244 ft.
10 1/2-in. from 1244 to 1480 ft.

Casing Record

13-in. od. casing from 0 to 466 ft.
10-in. liner from 833 to 1244 ft.

After completion of the repair work in Feb. 1940, water was pumped at a rate of 680 gpm. and the pumping water level was 334 ft. below the pump base.

The pump installation on May 28, 1947 was: 500 ft. of 8-in. column pipe; 12-in., 7-stage Peerless turbine pump having a rated capacity of 600 gpm. against 400 ft. of head; the overall length of the pump is 5 1/2 ft.; 27 ft. of 8-in. suction pipe having 2 ft. of tapered strainer; 500 ft. of 1/4-in, brass air line; 125-hp. U. S. electric motor.

On Nov. 21, 1944, the non-pumping water level was 364 ft. below the pump base after a non-pumping period of 9 hr. After 2-hr. pumping at 625 gpm., the drawdown was 56 ft.

The water quality changes appreciably over a continued pumping period. On Nov. 21, the following data (Laboratory Nos. 101,912-101,919) were obtained while pumping at a rate of 625 gpm., after a 9-hr. idle period. Well No. 2 was idle and 3A stopped at 3:15 P.M.

The data indicate that the first water obtained was predominantly limestone water with some Galesville water, this being followed by a period in which a high proportion of lime stone with some

LABORATORY NOS. 101,912 - 101,919

Time	Water Elev. MSL.	Temp. °F.	Fe ppm.	Cl ppm.	SO_4 ppm.	Alk. (ppm. as $CaCO_3$)	Hd.	Res. ppm.
1:45	314							
1:46	274	57.5	7.0	148	121.6	278	361	754
1:50	268	55.5	4.5	22	220.5	310	452	625
1:55	266	55.7	1.0	23	214.3	308	452	623
2:00	265	56.5	0.9	26	209.6	310	452	635
2:05	264	56.8	1.5	29	206.3	312	452	656
2:15	263	57.2	1.7	36	204.9	348	490	701
2:45	260	58.3	0.5	129	138.8	298	391	737
4:45	263	59.8	0.3	160	106.1	286	348	750

Mt. Simon water was obtained. The quality at the end of three hr. pumping indicated a mixture of waters fromall three formations. The exceptional hardness of the samples collected from 1:50 to 2:05 p.m. were indicative of the limestone and Galesville mixture and the higher hardness and increasing chloride content being indicative of a greater amount of limestone water with some Mt. Simon water in the 2:15 p.m. sample. The subsequent decrease in hardness and increase in chlorides was indicative of a decrease in limestone water and an increase in Mt. Simon and Galesville sandstone water in the 2:45 and 4:45 p.m. samples.

It is very probable that the Mt. Simon water, may enter Well No. 1 through the reported cave in the Galena formation at elevation 167. This cave has also been noted in the geophysical log of Well No. 2 at about elevation 150. This interpretationis preferred to a crevice in the Trempealeau formation since the geophysical log showed no such crevice to be present in the No. 2 well.

While the pump was out for repairs in Apr. 1947, the depth of the well was sounded 1480 ft. below ground level, and the water level was 364 1/2 ft. below the pump base. Well No. 2, located 100 ft. east, was idle at the time of measurement.

The estimated pumpage, based on pumping time and checked against pumpage from the reservoir, from Aug. 1, 1943 to Aug. 1, 1945, was 377,400 gpd., or 32.7% of the total pumpage for the public supply.

In 1918-1919, Well No. 2 was drilled to a depth of 1398 ft. by F. M.Gray, Jr., Milwaukee, Wis. and located about 100 ft. east of Well No. 1. The ground surface elevation is 686t ft. and the pump base elevation the pit is 679.5 ft. There is no available record of its original construction. The information in Table 2 was reported on June 23, 1920:

TABLE 2

Hole Diameter

16-in. to a depth of 278 ft. below the surface
12-in. from 278 to 600 ft.
10-in. from 600 to 1000 ft.
8-in. from 1000 ft. to the bottom.

The "pumping record for the months of Nov. and D e c . , 1923 indicated an average production of 528 gpm. At that time, the non-pumping water level was 62 ft. below the ground surface.

During the latter part of 1926 and the early part of 1927, the well was deepened to a depth of 2227 ft. by S. B. Geiger & Co., Chicago. Between the depths of 2077 and 2218 ft. soft red sand was encountered and the water level rose from a depth of 130 ft. to 80 ft. Below the depth of 2218 ft. a 5-ft. formation of soft white sand was encountered and the water level rose to 72 ft. Below the white sand, red sand was again entered and the drilling was stopped. Following a 10-day production test at an average discharge of 1000 gpm., the non-pumping water level was reduced to 135 ft. On Oct. 27, 1927, a test indicated a yield of 920 gpm. but no water levels were obtained. By the summer of 1935, the yield of the well had decreased to 550 gpm. and it was reconditioned. A bridge was found about the 1300 ft. depth, and removed; a 14-in. liner was used to case off the Maquoketa shale, and the well was "shot" in the water-bearing sand rock. After the completion of this work, a production of 1000 gpm. was reported.

A turbine pump setting was made at a depth of

385 ft. in the spring of 1939. At this time considerable corrosion was observed at the junction of the bronze pump bowls and steel column pipe.

A geophysical log of the well was made on June 7, 1944. A depth of 2194 ft. was reported indicating a 33-ft. fill in the water-bearing sand. The well was found cased with 16-in. casing to a depth of 61 ft. and liners were found between depths of 258 and 463 ft. and 934 and 974 ft. A projection of squeeze rock was also found in the well.

The following pump installation was made in Aug. 1944: 500 ft. of 8-in. column pipe; 12-in., 10-stage Peerless turbine pump (all bronze bowls) having a rated capacity of 1000 gpm. against 465 ft. of head; the overall length of the pump is 10 ft. 6 in.; 32 ft. of 8-in. suction pipe having 2 ft. of tapered strainer; 498 ft. of 1/4-in. brass air line; 150-hp. Ideal electric motor.

On Nov. 21, 1944, the non-pumping water level was 315 ft. after an idle period of 18 h'r. After 3-hr. pumping at 700 gpm., the drawdown was 109 ft. On July 12, 1945, the pumping water level was 426 ft. with Well No. 1 idle and Well No. 3a in operation.

From Aug. 1943 to Aug. 1, 1945, this well furnished 15.8% of the total public water supply on the basis of turbine and booster pump operations. During that period, the well was in service about 15 months.

The following data (Laboratory Nos. 101,920-101,927) were obtained on Nov. 21, 1944 from a quality source test while pumping at a rate of 700 gpm. after a 42-hr. idle period. Well No. 1 was idle and pumping in Well No. 3A was stopped at 11:35 A.M.

The data show that limestone water is obtained immediately after starting the well and that a large proportion of Mt. Simon sandstone is obtained after a short period of pumping. At the end of about an hour's pumping, a blend of all three water is obtained. The exceptional high hardness of the 10:15 a.m. sample is indicative of the limestone water and the exceptional high chloride content of the 10:20 and 10:25 a.m. samples are indicative of the Mt. Simon sandstone. These data may be interpreted to indicate that during the non-pumping periods limestone water is entering the well from the top and the Mt. Simon sandstone water is entering the well from the bottom, both by virtue of their higher static heads than that of the St. Peter and Galesville formations.

Well No. 3 was drilled to a depth of 2077 ft. by S. B. Geiger & Co., Chicago, in 1925 and located about 80 ft. east of Larch Ave. about 350 ft. north of the center line of the Chicago and Northwestern Railway (approximately 2000 ft. S. and 750 ft. W. of the N. E. corner of Section 2). The ground surface elevation is 690± ft. The well was 18 in. in diameter to a depth of 450 ft., 12 in., to 1110 ft., and 10 in. to the bottom. It was cased with 18-in. od. pipe from the surface to a depth of 79 ft. The Maquoketa shale was cased off with 16-in. od. welded pipe between depths of 226 ft. 9 in. and 455 ft. and a 10-in. liner was placed between depths of 947 and 1110 ft.

On Apr. 27, 1926, the production rate was reported to be 800 gpm. with a drawdown of 242 ft. from a non-pumping water level of 138 ft. below the surface. Well No. 3 was the principal source of the public supply until the summer of 1927 when its production rate decreased to 400 gpm. A further loss in the production rate to 150 gpm. was later reported and the well was out of service for sev-

LABORATORY NOS. 101,920 - 101,927

Time	Water Elev. MSL.	Temp. °F.	Fe ppm.	Cl ppm.	SO_4 ppm.	Alk. (ppm. as $CaCO_3$)	Hd. (ppm. as $CaCO_3$)	Res. ppm.
10:10 AM	371							
10:11	276	53.0	6.6	140	170.3	312	452	838
10:15	274	53.7	2.2	9	223.8	354	530	643
10:20	268	53.3	2.0	365	124.9	308	439	1226
10:25	267	60.1	0.8	375	112.5	274	404	1189
10:30	267	60.5	0.6	300	108.2	302	378	1063
10:40	266	61.5	0.6	275	111.1	286	361	1009
11:10	264	62.0	0.3	280	108.6	304	387	1031
1:10 PM	262	62.2	0.5	285	109.4	286	370	1038

eral years.

In the fall and winter of 1933, the well was repaired and deepened to a depth of 2221 ft. by W. L. Thorne Co., Des Plaines. A bridge was removed and a 6-in. perforated liner which had been placed at the bottom was also removed. The well was "shot" at depths of 2220, 2030, 1975, 1920, 1840, 1460, 1440, 1400, and 1300 ft. Following this work, the well was again placed in service and water was pumped 12 to 18 hr. daily at a rate of 950 to 1000 gpm.

By 1940, the production rate dropped off again and repairs were attempted. Many difficulties were encountered, and the well was abandoned. Later, the well was partially filled with drill cuttings from Well No. 3a.

Well No. 3a was drilled to a depth of 1502 ft. by the J. P. Miller Artesian Well Co. and finished about Apr. 16, 1943. It is located about 30 ft. west of Well No. 3 and the elevation of the top of the concrete pump foundation is 690.0± ft.

The well was "shot" with a total of 2050 lb. of nitro-gelatine at 8 levels between 1340 and 1420 ft. depths.

The hole, casing and liner record is shown in Table 3.

TABLE 3

Hole Record

24-in. from surface to 79 ft.
18-in. from 79 to 460 ft.
15-in. from 460 to 1260 ft.
12 1/4-in. from 1260 to 1502 ft.

Casing and Liner Record

24-in. drive pipe to depth of 79 ft.
1 in.
20-in. od. casing from surface to 89 1/2 ft.
16-in. od. casing from surface to 460 ft. 3 1/2 in.
13-in. od. liner from 744 to 1260 ft.

The 20-in. casing was cemented in place between depths of 12 and 89 1/2 ft.

On June 22, 1943, the non-pumping water level was 346 ft. below the pump base. Just before a production test was started by the State Water Survey on June 24, 1943, the water level was 356 1/2 ft. The difference may possibly be due to interference by the operation of the pumps in the other city wells, particularly Wells No. 1 and No. 2 which are located about 950 ft. east. On June 24, 1943, after pumping for 9 1/2 hr. to free discharge at rates of 1085 to 1170 gpm. the drawdown was 102ft. On June 25, 1943, after a 12-hr. idle period, the water level was 358 ft. below the pump base, and, after 7-hr. pumping to free discharge at rates of 1100 to 1150 gpm., the drawdown was 95 1/2 ft. Conditions of equilibrium were not attained during either test. The temperature of the water continued to rise and was 54.6° F. at the end of the second test run.

The pump installation made in June, 1943 is: 500 ft. of 9 1/2-in. od. column pipe; 14-in., 16-stage Sterling turbine pump having a rated capacity of 1000 gpm. against 450 ft. of head at 1150 rpm.; the overall length of the pump is 14 ft. 5 in.; 39 ft. of 8-in. suction pipe; 500 ft. of 1/4-in. brass air line; 200-hp. Ideal electric motor.

The pump installed in the well is the one removed from Well No. 3 and reconditioned.

On Oct. 29, 1943, the water level was 380 ft. below the pump base after 17 1/2-hr. non-pumping, and after 7-hr. pumping at 950 gpm., the drawdown was 84 ft. From Sept. 1943 until Aug. 1, 1945, the estimated pumpage averaged 321,200 gpd. or about 26.6% of the total pumpage.

The following tabulation (Laboratory Nos. 97,922-97,929) indicates the data obtained from the samples collected Oct. 29, 1943, while pumping at a rate of 950 gpm. after a 17-hr. idle period:

The chemical data indicate that about 10,000 gal. of non-sandstone water were pumped from the well, indicating the rate of entrance of this water during 18 hr. to be about 9 gpm.

Well No. 4, known as the Scott St. Well, was drilled to a depth of 2219 ft. by S. B. Geiger & Co. in 1927 and located about 100 ft. south of St. Charles Road and 60 ft. west of the center of Scott St. (approximately 100 ft. S. and 550 ft. W. of the N. E. corner of Section 10). The elevation at the top of the pump base is 669.5 ft.

The well was reported to be cased from the surface to a depth of 65 ft. with 22-in. od. pipe, below which the hole is 18-in. diameter to about 1000 ft. and 12-in. diameter from 1000 ft. to the bottom. The shale formation was cased off with 230 ft. of 18-in. od. pipe and 170 ft. of 14-in. liner

LABORATORY NOS. 97,922 - 97.929

Time	Water Elev. MSL.	Temp. °F.	Fe ppm.	Cl ppm.	SO_4 ppm.	Alk. (ppm. as $CaCO_3$)	Hd.	Res. ppm.
8:39 AM	310			Start pumping.				
8:40	250	54	4.3	10	289	352	597	713
8:45	243	56.5	2.9	13	246.4	314	537	650
8:50	240	57.5	2.8	15	173.	306	418	542
9:00	238	58	1.6	14	114.6	288	336	463
9:10	236	58	1.4	13	89.9	280	306	432
9:40	231.5	58.2	0.4	14	91.3	280	306	434
10:40 A.M.	230.5	58.6	0.3	14	86.8	280	302	434
3:37 P.M.	226	59.1	0.3	14	89.9	278	306	428

was installed at a depth of 1130 ft. to case off 60 ft. of shale at the bottom of the St. Peter sandstone and a 30 ft. cave in the Trempealeau formation. When drilling reached a depth of 2067 ft., a production test showed a yield of 1200 gpm., but the drawdown was considered excessive. Drilling was continued through the white sand, and the water level rose 5 ft. Red sand was penetrated at a depth of 2219 ft. where it was "shot" with 800 lb. of nitroglycerine, followed by a shot of 350 lb. at a depth of 2100 ft. and 350 lb. at a higher elevation. On May 1, 1928, after pumping for 90 min., discharging to waste, connection was made to the mains, and, pumping against a pressure of 80 lb., the flow meter indicated a discharge of 1310 gpm. Atthattime the non-pumping water level was 135 ft. below the; pump base, and the pumping water level was 320 ft. The water was reported to have a temperature of 62° F., and a very pronounced salt flavor and a strong odor of hydrogen sulfide.

In 193 7 and 1938, attempts were made to improve the quality by plugging the lower portion of the well. It was "shot" at depths of 1810, 1360, and 1300 ft. and the sand filled the well to a level of 2130 ft. Concrete was placed above the sand to a level of 2100 ft. After considerable pumping, analyses indicated that the plug did not decrease the salt content. The pump was removed, and the well "shot" at 900 and 800 ft. After these shots, the well became bridged at 900 ft., and the water rose to a point 85 ft. below the pump base. Upon breaking this bridge, another bridge was encountered at 1200 ft., and the water level dropped to 325 ft. Upon breaking this bridge, the water level rose to 255 ft.

A second seal was then made, and the hole was then filled with Lumnite concrete between the depths of 2025 and 1985 ft. The pump was reinstalled and operated at rates of 960 to 1060 gpm. for 4 1/2 hr. The tests showed that the salt content increased with continued pumping from 205 to 640 ppm. while the temperature increased from 62° to 64° F.

The third and final plug was placed between depths of 1560 and 1500 ft. Pumping was resumed at a rate of 800 gpm. After 3 days of intermittent pumping of about 12 hr. per day, the chloride content again reached the maximum of 800 ppm. There is no record of any further work having been done on this well until 1947. A new pump was installed in the well about 1939 consisting of 380 ft. of 8-in. column pipe; 12-in., 11-stage Peerless turbine pump having a rated capacity of 550 gpm. against a head of 360 ft.; 30 ft. of 8-in. suction pipe.

In Feb. 1947, the well was cleaned outto a depth of 1545 ft., and a temporary continuous string of casing was set at 1251 ft. with a disk wall packer. The water level was at a depth of 351 ft.

Well No. 4 was rehabilitated in June 1948 by J. P. Miller Artesian Well Co. The well was plugged at 1400 ft. depth and "shot" with 318 lb. of 100% nitro-gelatin between depths of 1369 and 1382 ft. New casing was set as follows: 12-in. id. Byers wi. pipe from the surface to 700 ft.; 10-in. id. Byers wi. pipe from 700 to 1226 ft. with a swedge nipple at the joint between the 12-in. and 10-in. casing. Below the 10-in. casing the hole was finished 13-in. diameter to 1400 ft., the top of the fresh plug.

On June 9, 1948 a production test was completed by the driller. After 56-hr. pumping at 620 gpm. the drawdown was reported to be 55 ft. from a static water level of 365 ft. In Jan. 1949 the J. P. Miller Artesian Well Co. removed 44 ft. of material that had accumulated in the bottom of

LABORATORY NO. 118,442

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.4		Silica	SiO_2	13.5	
Manganese	Mn	0.0		Fluoride	F	1.1	
Calcium	Ca	90.3	4.52	Chloride	Cl	98.0	2.76
Magnesium	Mg	21.0	1.72	Nitrate	NO_4	Tr.	Tr.
Ammonium	NH_4	.5	.03	Sulfate	SO_4	83.5	1.74
Sodium	Na	77.1	3.35	Alkalinity (as $CaCO_3$)		256.	5.12
Turbidity		2		Hardness (as $CaCO_3$)		312.	6.24
Color		0		Residue		540.	
Odor		0					

Temperature (reported) = 60.0° F.

the well. The pumping installation, made in Feb. 1949, consists of 500 ft. of 8-in. column pipe; 11 3/4-in., 14-stage Peerless turbine pump, No. 50977, having an overall length of 12 ft. 9 in. and rated at 1000 gpm.; 500 ft. of 1/4-in. copper air line; 10 ft. 8 in. of 8-in. suction pipe with strainer; 200-hp. U. S. electric motor operated at 1800 rpm.

Analysis of a sample (Lab. No. 118,442), collected June 9, 1949 after pumping 1 1/2-hr. at 1000 gpm. showed this water to have a hardness of 17.1 gr. per gal., a residue of 540 ppm., and an iron content of 0.4 ppm. No hydrogen sulfide was noted.

Well No. 5, called the Vallette St. Well, was drilled to a depth of 1480 ft. by the J. P. Miller Artesian Well Co. in 1940 and located about 135 ft. north of Vallette St. and 255 ft. east of the center of York St. (approximately 2500 ft. S. and 255 ft. E. of the N. W. corner of Section 12). The elevation at the top of the pump base is 676.9 ft.

The driller reported several tests made during

Sample-study log of Well No. 5 furnished by State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Clay, yellow and blue, quicksand"	14	14
"Gravel"	2	16
"Glacial drift"	65	81
Silurian system		
Niagaran - Alexandrian dolomites	124	205
Ordovician system		
Maquoketa shale, some dolomite	227	432
Galena - Platteville dolomite and limestone	320	752
Glenwood sandstone and dolomite	3	755
St. Peter formation		
Sandstone	153	908
Sandstone, shale, and chert	42	950
Oneota dolomite	132	1082
Cambrian system		
Trempealeau dolomite	76	1158
Franconia sandstone, some dolomite	82	1240
Galesville sandstone	198	1438
Eau Claire shale and sandstone	42	1480

LABORATORY NOS. 110,050 - 110,057

Time	Water Elev. MSL.	Temp. °F.	Fe ppm.	Cl ppm.	SO_4 ppm.	Alk. (ppm. as $CaCO_3$)	Hd.	Res. ppm.
8:19 AM	324							
8:22	Started pump							
8:24		56.4	1.5	19	108	270	263	460
8:29	244	58.0	0.7	25	128.3	270	292	496
8:34	237	58.7	0.4	18	85.3	270	255	426
8:39	234	58.7	0.5	17	84.2	268	255	431
8:44	233	58.7	0.4	17	81.1	268	255	455
8:54	231	58.8	0.5	16	81.3	268	251	450
9:24	227	59.2	0.3	16	77.1	264	251	419
10:24	223	59.3	0.4	16	79.4	262	251	419

the construction of the well. When drilling between depths of 129 and 135 ft., the well would not yield or take water. In a test made with a 16-in. bailer in the Niagaran limestone, the water level was lowered to 160 ft. and recovered at a rate of about 6 to 7 gpm. At a depth of 970 ft., the well produced 60 gpm. with a drawdown of 142 ft. below a non-pumping water level of 228 ft. and the temperature of the water was 55° F. On Sept. 16,1940, with no casing in the well except the 24-in. drive pipe to rock, a production of 750 gpm. was obtained with a drawdown of 95 ft. below a non-pumping water level of 280 ft. After the completion on Dec. 30, 1940, the well produced at a rate of 1020 gpm. with a pumping water level of 394 ft. below the pump base.

The well was reported producing 980 to 1000 gpm. on Apr. 12, 1941 with a drawdown of 102 ft. from a non-pumping water level of 278 ft. below the pump base.

The following pump installation was made in Mar. 1944: 500 ft. of 10-in. column pipe; 12-in., 10-stage Peerless turbine pump having a rated capacity of 850 gpm. against 520 ft. of head; the overall length of the pump is 9 ft. 5 in.; 40 ft. of 10-in. suction pipe; 500 ft. of 1/4-in. brass air line; 200-hp. U. S. electric motor.

On May 4, 1944 before pumping, the water level after a 20-hr. rest was 353 ft. below the pump base, and after 2 hr. at 920 gpm., the drawdown was 101 ft. During an exceptionally heavy pumping period between May 4 and July 17, 1944, both non-pumping and pumping water levels dropped 17 ft.

The above tabulation (Laboratory Nos. 110,050-110,057) indicates the data obtained from the samples collected at timed intervals from Well No. 5 after a 20-hr. idle period:

The hole, casing and liner record is shown in Table 4.

TABLE 4

Hole Diameter

30-in. from 0 to 16 ft.
24-in. from 16 to 82 ft. 4 in.
23-in. from 82 ft. 4 in. to 102 ft.
19 1/2-in. from 102 to 446 ft. 7 1/2 in.
15-in. from 446 ft. 7 1/2 in. to 1205 ft.
12 1/4-in. from 1205 to 1480 ft.

Casing and Liner Diameter

24-in. od. from 0 to 82 ft. 4 in.
20-in. od. from 0 to 102 ft.
16-in. from 0 to 446 ft. 7 1/2 in.
12 1/2-in. from 871 to 1235 ft. 2 1/2 in.

The annular space outside the 24-in. casing was mud grouted from 0 to 82 ft. 4 in. and outside the 20-in. casing was cement grouted from 82 ft. 4 in. to 102 ft.

The analyses indicate merely a trace of limestone water to be evident in the sample of water collected after 5-min. pumping. Comparisons with analyses made on samples collected from Well No. 3A Oct. 29, 1943 show this water to be of appreciably less hardness and to reach its natural temperature of 59-59.5° F. in a much shorter time.

Analysis of a sample (Lab. No. 95,271), collected Feb. 9, 1943 showed this water to have a hardness of 14.2 gr. per gal., a mineral content

of 380 ppm., and an iron content of 0.0 ppm.

From Aug. 1, 1943 to Aug. 1, 1945, this well furnished 24.85% of the total estimated pumpage, or an average metered pumpage of 286,800 gpd.

The combined total average estimated pumpage from Aug. 1, 1943 to Aug. 1, 1945 was 1.154 mgd., which varied from a winter average of 1.086 to a summer average of 1.318 mgd.

LABORATORY NO. 95,271

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.0		Silica	SiO_2	16.0	
Manganese	Mn	0.0		Chloride	Cl	15.0	0.42
Calcium	Ca	61.0	3.05	Nitrate	NO_3	3.6	0.06
Magnesium	Mg	21.9	1.81	Sulfate	SO_4	80.2	1.67
Ammonium	NH_4	0.2	0.01	Alkalinity (as CaC O_3)		230.	4.6
Sodium	Na	43.2	1.88				
Turbidity		Tr.		Hardness (as $CaCO_3$)		243.	4.86
Color		0		Residue		380.	
Odor		0					
Temperature 59 1/2° F.							

ELMWOOD
Peoria County
Feb. 17, 1948

A public water supply was installed by the city of Elmwood (1348) in 1896.

At that time a well was drilled at the southeast of the intersection of Rose and Hawthorn St. (or approximately 2000 ft. N. and 450 ft. E. of the S. W. corner of Section 8, T. 9 N., R. 5 E.). The well is 1498 ft. deep and cased as follows: 10-in. casing from 0 to 100 ft.; 8-in. casing from 100 to 447 ft.; 6-in. casing from 447 to 1157 ft. The elevation of the ground surface is 625± ft.

The well is equipped with an air lift with a 1 1/4-in. air pipe extending to a depth of 342 ft. Power is furnished by a 25-hp. Westinghouse electric motor. A gasoline motor is kept for emergency use. The well is crooked which,practically eliminates the use of any other type pump.

Non-pumping water levels, in ft. below the ground surface, have been reported as follows:

Year	Water Level
1914	72
1922	78 1/4
1938	97

The drawdown in 1938 was reported to be 18 ft.

Analysis of a sample (Lab. No. 109,034), collected Jan. 28, 1947, showed the water to have a hardness of 15.9 gr. per gal., a residue of 1606 ppm., and an iron content of 0.5 ppm.

Well No. 2 was completed at a depth of 47 ft. in Feb. 1948 by Peerless Service Co., Orion, and located about 3/4 mile west of Well No. 1 (or approximately 2215 ft. N. and 1950 ft. E. of the S. W. corner of Section 7). The well was cased with 10-in. id. pipe from 1 1/2 ft. above to 35 ft. below ground level, and with 12 ft. of Johnson screen exposed to a sand and gravel formation. The screen had slot openings of No. 60,80 and 60 but the lengths of the slotted sections are not known.

Production tests were made on Feb. 13-14, 1948, under the super vision of the State Water Survey. On the firstday pumping conditions could not be stabilized over a 9 1/2-hr. period. Following over night surging of the well, water was pumped for 2 1/2 hr. at a rate of 133 gpm., with a drawdown of 26.7 ft. from a non-pumping water level of 11.0 ft. below the top of the casing.

When pumping in Well No. 2, the water level, in a test hole 13 1/2 ft. south, was lowered from 9.6 to 19.0 ft., the bottom of the hole, after 35-minutes pumping. During the same period the drawdown in Well No. 2 was 11.6 ft. In a dug well, 153 ft. south of Well No. 2, the water level was not changed after 1 1/2-hr. pumping in Well No. 2, but after 8 1/2 hr. the water level was lowered 0.7 ft.

Analysis of a sample (Lab. No. 113,463) collected Feb. 13, 1948 after 9 1/2-hr. pumping showed this water to have a hardness of 19.4 gr. per gal., a residue of 354 ppm. and an iron content of 1.7 ppm.

Pumpage for Elmwood is estimated to average 110,000 gpd.

LABORATORY NO. 109,034

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.5		Silica	SiO_2	15.1	
Manganese	Mn	Tr.		Fluoride	F	3.0	
Calcium	Ca	64.5	3.23	Chloride	Cl	275.0	7.76
Magnesium	Mg	27.1	2.23	Nitrate	NO_3	2.5	.04
Ammonium	NH_4	1.0	.06	Sulfate	SO_4	587.3	12.22
Sodium	Na	453.1	19.70	Alkalinity	(as $CaCO_3$)	260.	5.20
Color		0		Hardness	(as $CaCO_3$)	273.	5.46
Odor		0		Residue		1606.	
Turbidity		Tr.					
Temperature		71° F.					

EL PASO
Woodford County
Mar. 4, 1947

A public water supply was installed by the city of El Paso (1621) about 1878.

At that time a well was constructed at a location just north of the Toledo, Peoria & Western R. R. and 3 1/2 blocks west of the Illinois Central R.R. (or approximately 450 ft. N. and 1000 ft. E. of the S. W. corner of Section 5, T. 26 N., R. 2 E.).

The well was dug to a diameter of 8 ft. and a depth of 60 ft. and lined with rock. Below 60 ft., three tubular wells extended to a depth of 120 to 123 ft. from the ground surface. One well was 4 in. in diameter, and two were 8 in. in diameter.

The elevation of the ground surface is 775± ft.

In 1912 the non-pumping water level was reported to be 49 ft. below the ground surface. In 1920 it was reported that during dry seasons, the water was lowered below the 60-ft. depth of the dug portion of the well. Some ground water entered the well through the rock wall. In 1924 the bottom of the dug portion had been paved with concrete, and the tops of the tubular wells sealed around the suction pipes. A Fairbanks-Morse pump was installed to de-water the upper part of the well. The discharge was wasted into a tile drain.

Water was pumped from the three tubular wells by a Goulds 8 x 10-in. triplex pump, No. 7564, rated at 225 gpm. The pump cylinders were placed near the bottom of the open well with the suction pipe extending into the tubular wells and provided with valves.

In 1941 a Fairbanks-Morse turbine pump, No. 10369, powered by a 20-hp. Fairbanks-Morse induction motor was installed. There is a screen but no suction pipe below the bowls. The bottom of the bowls are set 10 ft. above the bottom of the well.

The dug portion of this well has now been filled to the ground surface.

At present this well supplies all of the water while the pumping equipment in the West Well is being changed.

In 1927 a new well, called the West Well, was drilled by E. H. Johnson, Bloomington, about 30 ft. west of the old well. It is 8 in. in diameter and 120 ft. deep with 10 ft. of screen.

Correlated driller's log of West Well furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and clay	98	98
Sand and gravel	4	102
Gravel	23	125

The present pumping installation consists of 90 ft. of 6-in. od. column pipe; 7 5/8-in., 10-stage American Well Works turbine pump, rated at 200 gpm. against a head of 240 ft. at 1750 gpm.; the overall length of the pump is 5 ft. 7 1/16 in.; 20 ft. of 5-in. suction pipe.

The pump is belt-driven from a shaft, connected to a 20-hp. Fairbanks-Morse diesel engine. This pump will be direct-connected to an electric motor but will remain connected to the Diesel for emergency use.

Analysis of a sample (Lab. No. 109,423) collected Mar. 4, 1947 after 20-min. pumping, showed the water to have a hardness of 20.9 gr.per gal., a residue of 435 ppm., and an iron content of 1.0 ppm.

LABORATORY NO. 109,423

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.0		Silica	SiO_2	25.1	
Manganese	Mn	Tr.		Fluoride	F	0.2	
Calcium	Ca	86.2	4.31	Chloride	Cl	6.0	.17
Magnesium	Mg	34.9	2.87	Nitrate	NO_3	1.4	.02
Ammonium	NH_4	4.9	0.27	Sulfate	SO_4	3.9	.08
Sodium	Na	29.9	1.30	Alkalinity (as $CaCO_3$)		424.	8.48
Color		0		Hardness (as $CaCO_3$)		359.	7.18
Odor		0		Residue		435.	
Turbidity		40		Temperature 53° F.			

An aerator, filter, and softener were installed in 1946. The water is pumped from the wells over an aerator and into a clear well and then pumped from the clear well, through the filter and softener and to the elevated tank. The softener is operated at a rate of 170 gpm.

Analysis of a sample (Lab. No. 109,424) collected Mar. 4, 1947, showed the softened water to have a hardness of 0.6 gr. per gal., a mineral content of 467 ppm., and an iron content of .03 ppm.

Pumpage averages 150,000 gpd.

ELWOOD
Will County
Aug. 17, 1948

A public water supply was installed in the village of Elwood (248) by the Federal Works Agency in 1942 when many of the private residential wells failed to furnish water due to recessions in the ground water levels.

Water is obtained from a well drilled to a depth of 934 ft. by S. B. Geiger & Co., Chicago, and completed Nov. 18, 1942. It is located 124 ft. north of the center of Mississippi Ave. and 131 ft. westerly of the center line of the Chicago and Alton Railroad tracks (about 1250 ft. S. and 1850 ft.E.of the N. W. corner of Section 29, T. 34 N., R. 10 E.). The elevation of the pump base is 644 ft.

The hole and casing record were reported as shown in Table 1.

The lead seal on the upper end of the 10-in. casing was swedged out against the 12-in. casing.

From Dec. 17 to 19, 1942, a production test was made by the State Water Survey. After pumping for 22 1/2-hr.at 9.1 gpm.,the water level was 300 ft. or more below the pump base. Throughout the construction period and at the beginning of the test the water level was 20 ft. below the top of the well casing. However, following the production test, the water did not return to its previous level; and after 18 1/2 hr., the distance to water was 192 ft. below the pump base.

TABLE 1

Hole Record

16-in. from surface to 73 ft.
12-in. from 73 to 305 ft.
10-in. from 305 to 449 ft.
8-in. from 449 to 934 ft.

Casing Record

16-in. drive pipe from surface to 10 ft.
12-in. from surface to 72 ft. 3 in.
10-in. from 64 to 305 ft.
8-in. from 303 to 450 ft.

The water temperatures observed throughout the test varied from52.6° F.at the start to 54.1° F. at the end.

On June 1, 1944 the distance to water below the pump base measured 63 ft. after an idle period of3 weeks. On July 19, 1948, after a 7-da. period of repairing the pump shaft, the water level was 188 ft.

Analysisof a sample (Lab. No. 107,916), col-

Sample-study log of well drilled in 1942 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Glacial drift"	65	65
Silurian system		
Niagaran-Alexandrian series		
Dolomite, silty	115	180
Dolomite	22	202
Dolomite and siltstone	18	220
Ordovician system		
Maquoketa formation		
Shale and siltstone	83	303
Dolomite	34	337
Shale	75	412
Galena-Platteville dolomite, some limestone	338	750
Glenwood and St. Peter formations		
Sandstone, partly dolomitic, shale at base	70	820
Sandstone, incoherent	70	890
Sandstone, chert	13	903
Shakopee dolomite, thin shale and sandstone bed	31	934

lected Oct. 11, 1946 below the first aerator tray after 3-hr. pumping at 60 gpm., showed this water to have a hardness of 14.2 gr. per gal., a residue of 458 ppm., and an iron content of 0.6 ppm. The strong odor of hydrogen-sulphide indicates the presence of some water from the Galena-Platteville formation.

All water is aerated and chlorinated before being pumped to the distribution system. Aeration is provided for the removal of hydrogen-sulphide by means of 3 coke trays.

The estimated average pumpage for the public supply is about 11,000 gpd.

LABORATORY NO. 107,916

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.6		Silica	SiO_2	15.2	
Manganese	Mn	0.0		Fluoride	F	0.9	
Calcium	Ca	54.1	2.71	Chloride	Cl	14.0	.39
Magnesium	Mg	26.2	2.16	Nitrate	NO_3	0.5	.01
Ammonium	NH_4	0.5	.03	Sulfate	SO_4	48.8	1.01
Sodium	Na	89.0	3.87	Alkalinity	(as $CaCO_3$)	368.0	7.36
Turbidity		20		Hardness	(as $CaCO_3$)	244.	4.88
Color		0		Residue		458.	
Odor at well		H_2S		Free CO_2 (calc.)		38.	
Temperature 54° F.				pH = 7.4			

EMDEN
Logan County
Sept. 21, 1948

The village of Emden (396) installed a public water supply in 1941.

Water is obtained from a well drilled in 1940 to a depth of 124 ft. by Woollen Bros., Wapella, and located on Lincoln St., south of Market St. (or approximately 1140 ft. N. and 2300 ft. E. of the S. W. corner of Section 6, T. 21 N., R. 3 W.).

Sand was encountered at 100 ft. below a ground surface elevation of 598t ft. and the drilling did not completely penetrate the sand formation. The well was cased with 117 ft. of 10-in. pipe and with 7 ft., exposed length, of 10-in. Johnson screen, having No. 30 slot openings.

A production test was made by the State Water Survey on Oct. 2, 1940. Before the start of the test the water level was 41 ft. below the top of the casing and after 7-hr. pumping at a constant rate of 205 gpm. the drawdown was 14 ft. On Sept. 16, 1948 the altitude gauge reading was 19 1/2 ft. after a 2-hr. non-pumping period". The pumping equipment includes a 7-in. od. American Well Works turbine pump, No. 64013, having a rated capacity of 150 gpm. against 78 ft. of head; an air line of unknown length and a 5-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 115,827) collected Sept. 16, 1948 after aeration, showed this water to have a hardness of 19.0 gr. per gal., a residue of 384 ppm., and an iron content of 4.1 ppm. Methane gas is present in the water in a concentration of 1.3 cu. ft. per 1000 gal.

The water is aerated and filtered.

Analysis of a sample (Lab. No. 116,039) collected Sept. 16, 1948 showed the treated water to have a hardness of 19.3 gr. per gal., a total mineral content of 361 ppm., and an iron content of 0.13 ppm.

Pumpage is estimated to average 14,000 gpd.

LABORATORY NO. 115,827

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	4.1		Silica	SiO_2	33.8	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	76.2	3.81	Chloride	Cl	4.0	0.11
Magnesium	Mg	32.8	2.69	Nitrate	NO_3	4.7	0.08
Ammonium	NH_4	2.8	0.16	Sulfate	SO_4	0.0	0.00
Sodium	Na	18.6	0.81	Alkalinity	(as $CaCO_3$)	364.	7.28
Turbidity		30		Hardness	(as $CaCO_3$)	325.	6.50
Color		15		Residue		384.	
Odor		0		Free CO_2 (calc.)		35.	
				pH = 7.35			

EQUALITY
Gallatin County
Feb. 29, 1948

The village of Equality (971) has no public water system at the present time.

An electrical earth resistivity survey was made by the State Geological Survey near Equality in Dec, 1944. The area covered by the survey extended 1 mile west, 1 1/2 miles south and 5 miles east of Equality.

Correlated driller's log of Well No. 1 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Drift	10	10
Pennsylvanian system		
Shale	25	35
Coal	5	40
Sandstone	135	175
Coal	3	178
Sandstone	22	200
Black shale	at	200

Well No. 1, known as the high school well, was drilled in 1947 to a depth of 200 ft. by Endicott and Pittman, Ridgway, on the east side of School St. and north of the high school (or approximately 1600 ft. S. and 2100 ft. W. of the N. E. corner of Section 17, T. 9 S., R. 8 E.). The surface elevation is 420± ft.

The well is cased with 8-in. pipe to sandstone below which the hole is 8-in. in diameter. During drilling operations, water was encountered at 90 and 147 ft. depths. It was reported by the driller that when bailing at a rate of 7 gpm., the drawdown was about 122 ft. from a static water level of 27.65 ft. below the top of the casing. The well is not ready for service. A plunger pump has been installed, and a motor is available.

Analysis of a sample (Lab. No. 112,092), collected Oct. 2, 1947, showed the water to have a hardness of 14.7 gr. per gal., a residue of 555 ppm., and an iron content of 15.4 ppm. Much of the iron noted is due to the high turbidity of the sample.

LABORATORY NO. 112,092

	ppm.	epm.		ppm.
Iron (total) Fe	15.4		Chloride Cl	31.0
Turbidity	100+		Alkalinity (as $CaCO_3$)	84.
Color	0		Hardness (as $CaCO_3$)	253.
Odor	0		Total Mineral Content	555.
Temperature 58° F.				

ERIE
Whiteside County
Oct. 9, 1947

The public water supply was installed by the village of Erie (1052) in 1920.

Water is obtained from a well located in the rear of the city hall, and water works building at the southeast corner of Main and River St. (or approximately 100 ft. N. and 1350 ft. W. of the S. E. corner of Section 6, T. 19 N., R. 4 E.).

The well was drilled in 1920 by Wallace Eatinger, Dixon, and was reported to be 567 ft. deep with the top of the well at 8 ft. below ground level. The elevation of the ground surface is 585± ft. The well was cased with 10-in. pipe to a depth of 175 ft. extending 8 ft. into rock. The diameter of the well was reported to be 8 in. at the bottom.

Water is pumped by 2 Kewanee triplex suction pumps, No. 75-Y and 75-R, rated at 180 and 100 gpm. respectively. Power is furnished to the larger pump, No. 75-Y, by a 20-hp. General Electric Co. induction motor and to the smaller pump, No. 75-R, by a 10-hp. General Electric induction motor. Both motors are connected by chain belt to the pump.

The pumps were installed in 1921, setting side by side and equipped with extended drive shafts with clutch and pulley arrangement between, so that in emergency, they can be driven by a single gasoline engine located in line with center pulley and clutch. This arrangement is such that the motors can be disengaged and the gas unit can supply power for either or both pumps at the same time. The pumping equipment is set in a pit about 8 ft. deep. The suction side of each pump is connected by a 4-in. pipe into a 4-in. cross-head, and this in turn is connected to a 6-in. drop pipe that extends 34 ft. into the well.

In 1921, water just overflowed the top of the casing, and in 1933 the water level was very close to the top.

Mr. Charles Withrow, chairman of the Water Committee, stated that the lowest the non-pumping water level had been measured, was 26 ft. below the top of the well. In Oct. 1947, the water level was also estimated to be at that level.

Analysis of a sample (Lab. No. 112,153) collected Oct. 9, 1947 from the pressure tank, showed this water to have a hardness of 12.4 gr. per gal., a residue of 245 ppm., and an iron content of 0.3 ppm.

Including a cheese factory demand of 15,000 gpd., the total pumpage is estimated to be approximately 45,000 gpd.

LABORATORY NO. 112,153

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.3		Silica	SiO_2	25.1	
Manganese	Mn	1.6		Fluoride	F	0.2	
Calcium	Ca	54.6	2.73	Chloride	Cl	10.0	0.28
Magnesium	Mg	18.2	1.50	Nitrate	NO_3	20.1	0.32
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	24.3	0.51
Sodium	Na	0.0	0.00	Alkalinity	(as $CaCO_3$)	156.	3.12
Turbidity		10-		Hardness	(as $CaCO_3$)	212.	4.23
Color		0		Residue		245.	
Odor		0					

FAIRBURY
Livingston County
May 12, 1947

A public water supply was installed by the city of Fairbury (2300) about 1887.

Until 1935, water was obtained from three deep wells located at the old water plant in the northwest corner of North First and West Locust St. (or approximately 1090 ft. N. and 2600 ft. E. of the S. W. corner of Section 3, T. 26 N., R. 6 E.).

The first well was drilled in 1892 by J. P. Miller Artesian Well Co., Brookfield, to a depth of 2002 ft. below a ground surface elevation of 685±ft., and was located 75 ft. north of Locust St. and 40 ft. west of First St. It was cased with 8-in. iron pipe to a depth of 394 ft. A salt water-bearing strata, penetrated at 1500-ft. depth, was shut off by 60 ft. of 6-in. liner.

In 1896 the depth to water was reported to be 60 ft.; 80 ft. in 1914; 87 ft. in 1918; and when pumping at 100 gpm., the water was drawn down 187 ft. The discharge was estimated to average 85 gpm. during regular pumping operations. In 1922, after the second well had been constructed 35 ft. distant, water level in this well was 122 ft. while pumping in the second well at a rate of 74 to 84 gpm.

Analysis of a sample (Lab. No. 74746) collected June 23, 1934, showed the water to have a hardness of 11.3 gr. per gal., and a mineral content of 1180 ppm.

The well was abandoned Jan. 1, 1936, when new wells and the water works plant south of the city were placed in operation.

The second well was constructed in 1916 but not equipped until 1919 or 1920. It was located 35 ft. south of the first well and was drilled by Cambridge Driller Co. to a depth of 2172 ft.

The hole and casing record was reported as given in Table 1.

TABLE 1

Hole Record

8-in. from 1615 to 2172 ft.

Casing Record

18-in. od. casing from surface to 41 ft.
14-in. od. casing from surface to 407 ft.
10-in. liner from 725 to 920 ft.
8-in. liner from 1568 to 1615 ft.

During drilling operations in 1916, water was encountered at depths of 30 ft., and at 130 and

Sample-study log of the third well furnished by the State Geological Survey:

Formation	Thickness	Depth
Pleistocene system		
No record	36	36
Pennsylvanian system		
Shale and sandstone, thin beds of coal, limestone and siltstone	329	365
Silurian system		
Niagaran-Alexandrian series		
Dolomite, partly shaley	155	520
Dolomite and limestone	230	750
Sandstone and limestone, siltstone at base	50	800
Ordovician system		
Maquoketa shale and limestone	140	940
Galena-Platteville limestone, and few thin shale beds	390	1330
Glenwood sandstone, calcareous at top, shaley at base	70	1400
St. Peter formation		
Sandstone	170	1570
Conglomerate of chert, shale and sandstone	16	1586

525 ft.

In 1918 the depth to water was reported to be 109 ft. During a test, the production decreased from 125 to 75 gpm., and the water was drawn down to 300 ft. In 1920 and 1921 several tests were made by Mr. Burns, Water Works Superintendent, and the production was reported to be 74 to 84 gpm., depending partly upon the time of pumping in the other well.

In 1923 the production from both wells, after 12-hr. pumping, was 154 gpm. In Mar. 1924, both pumps were operated 16to 18 hr.per day, and the combined production was 118 gpm. In Apr. 1928, after a third well had been placed in service, the water level in this well was measured at 236 ft. below the floor level. The pumps in the firstand third wells had been operating all night.

The second well was abandoned Jan. 1, 1936.

The third well was drilled in 1926 by Ira French, Fairbury, and was located 17 ft. south and 75 ft. west of the second well and was 1586 ft. deep.

The hole and casing record is given in Table 2.

TABLE 2

Hole Record

10-in. from surface to 381 ft. 2 in.
8-in. from 381 ft. 2 in. to 1215 ft.

Casing Record

10-in. casing from surface to 42 ft.
8-in. casing from surface to 381 ft. 2 in.
6-in. liner from 745 to 955 ft.

After the well was completed, 300 lb. of 100% gelatine was placed in the well and exploded with dynamite. It was not known where the charge exploded, but the 8-in. casing was cracked, and the packer at the lower end of the 8-in. casing was loosened. Some pipe was dropped in the well and not removed.

During drilling operations, water was encountered at depths of 522 and 527 ft. In bailing with a sand bucket, the yield was estimated at 38 gpm.

Analysis of a sample (Lab. No. 74747) collected June 23, 1934, showed the water to have a hardness of 7.2 gr. per gal., and a mineral content of 1791 ppm.

The well was abandoned Jan. 1, 1936.

In July 1933, because the water from the old deep wells had long been objectionable in its taste and in its effect on plumbing, the city made attempts to find a more desirable water supply. A test well was drilled by Ira French on Lot 6 Block 20, at Sixth and Locust St. (or approximately 1030 ft. N. and 300 ft. W. of the S. E. corner of Section 3).

The test well was 36 ft. deep, finished in gravel, and cased with 8-in. pipe with the top of the casing 2 1/2 ft. above the ground surface. A production test was made by the driller with a 6-in. cylinder pump. The top of the working barrel was 11 ft. below the ground surface. Static water levelwas 5 ft.; and after 190-hr. pumping at 150 gpm., the drawdown was below the top of the pump. On stopping the pump, the water level raised 1 ft. after 10 min. and was very slow in recovery.

Analysis of a sample (Lab. No. 73288) collected July 25, 1923, showed the water from this test well to have a hardness of 50.2 gr. per gal., a mineral content of 1329 ppm., and an iron content of 0.8 ppm.

In 1935, two wells were drilled by John Bolliger & Sons, Fairbury, on south First St. extended to where it crosses Indian Creek beyond the city limits.

Well No. 1, South Well, was drilled at a location 2750 ft. S. and 1270 ft. W. of the N. E. corner of Section 10. It is 39 ft. deep, penetrating 35 ft. of water-bearing sand and gravel, and cased with 24 ft. of 12-in. pipe and 15 ft. of Johnson 12-in. screen. The screen is slotted as follows: top 1 ft. has No. 40 slot openings; the next ft. has No. 60; the third ft. has No. 100; and the bottom 12 ft. has No. 125. A gravel wall was developed around the screen by the use of a solid surge block.

A production test was made with a 4-in. horizontal centrifugal pump, powered by a gasoline engine. After equilibrium had been established at a pumping rate of 300 gpm., the drawdown was measured at 5.9 ft. below a static level of 5 1/2 ft. below the ground surface, a specific capacity of 50.8 gpm. per foot of drawdown. Mr. J. J. Woltmann, consulting engineer, reported that, in a later test, when pumping at a rate of 500 gpm., the drawdown was 12.8 ft.

LABORATORY NO. 110,259

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.4		Silica	SiO_2	18.3	
Manganese	Mn	0.2		Fluoride	F	0.2	
Calcium	Ca	86.5	4.33	Chloride	Cl	6.0	0.17
Magnesium	Mg	36.1	2.97	Nitrate	NO_3	10.9	0.17
Ammonium	NH_4	3.8	0.21	Sulfate	SO_4	115.6	2.41
Sodium	Na	0.9	0.04	Alkalinity (as $CaCO_3$)		240.	4.80
Color		0		Hardness (as $CaCO_3$)		365.	7.30
Odor		0		Residue		410.	
Turbidity		10-		Temperature 52° F.			

In 1944, after the rate of pumping had diminished considerably, the well was acidized, with the result that it was restored to its approximate original specific capacity. When the pump was pulled, preparatory to the acidizing process, it was found that the shaft in the 3-stage bowl assembly was worn badly, and the two lower sections of column pipe were corroded at the threads. The pump and 30 ft. of column pipe were replaced with new equipment.

The pump installation consists of 35 ft. of asphaltum-coated 6-in. screw column pipe; 8-in., 2-stage Fairbanks-Morse turbine pump, No. 6920, rated at 300 gpm. against 50 ft. of head; the No. 1113 impellers are bronze and the shaft is stainless steel; 7 1/2-hp., 1740 rpm. Fairbanks-Morse electric motor.

On Apr 25, 1946, the water level was 11.7 ft. when pumping at 300 gpm.; and after stopping the pump, the water level raised to 6.8 ft. immediately, a recovery of 4.9 ft.

An analysis of a sample (Lab. No. 110,259) collected May 12, 1947, showed the untreated water to have a hardness of 21.2 gr. per gal., a residue of 410 ppm., and an iron content of 0.4 ppm.

Well No. 2, North Well, was drilled in June 1935. It is located 100 ft. north of Well No. 1 and is 40 ft. deep into the same water-bearing formation as No. 1.

The well is cased with 25 ft. of 12-in.pipe and 15 ft. of 12-in. Cook screen. The upper 6 ft. of the screen has No. 40 slot openings, and the lower 9 ft. has No. 125. A gravel wall was developed around the screen as in No. 1.

Upon completion of the well, a production test was made with a 4-in. horizontal centrifugal pump and gasoline engine. Static water level was 6 ft.; and when pumping at 300 gpm., the drawdown was 15.4ft., a specific capacity of 19.65 gpm. per foot of drawdown.

On Apr. 25, 1946 a short production test was made by the State Water Survey. The static level was 6.7 ft.; and after 20-min. pumping at 160 gpm., the drawdown was 14.1 ft., a specific capacity of 11.6 compared to the specific capacity of 19.65 in June 1935.

On Apr. 26, 1946, a total of eight carboys (1000 lb.) of 18° muriatic acid was poured into the well after which water was pumped at the maximum capacity of 195 gpm. After 20 min., the drawdown was 11.6 ft., a specific capacity of 16.8, an increase of 50% above that before acidizing but 85% of the original value of 19.65 when the well was new.

After the acidizing, the old pumping equipment was reconditioned, and was to be replaced in the well. The pump and assembly consists of 35 ft. of 6-in. column pipe; 8-in., 3-stage Fairbanks-Morse turbine pump, Type B 401 M-1, rated at 310 gpm; 7 1/2-hp., 1740 Fairbanks-Morse electric motor.

Analysis of a sample (Lab. No. 76176) collected June 8, 1935, showed the water to have a hardness of 18.6 gr. per gal., a mineral content of 400.1 ppm., and an iron content of 0.4 ppm.

The water is filtered, aerated, softened and chlorinated.

Analysis of a sample (Lab. No. 110,260) collected May 12, 1947, showed the treated water to have a hardness of 6.1 gr. per gal., a mineral content of 211 ppm., and no iron content.

In Apr. 1946 pumpage was estimated at 125,000 gpd. During summer months the pumpage averages 200,000 gpd.

LABORATORY NO. 110.260

		ppm.	epm.			ppm.	epm.
Iron	Fe	0.0		Fluoride	F	0.2	
Turbidity		10		Chloride	Cl	8.0	.22
Color		0		Alkalinity	(as $CaCO_3$)	40.	.80
Odor		0		Hardness	(as $CaCO_3$)	104.	2.08
				Total Mineral Content		211.	

FAIRVIEW
Fulton County
June 4, 1948

The village of Fairview (528) is installing a public water supply.

After drilling several test wells in 1946, two permanent 10-in. diameter wells were completed by John Bolliger, Fairbury. The North Well was drilled to a depth of 302 ft. and located in the pumping station on the north side of the public park, about 25 ft. south of Wilson St. (or approximately 3000 ft. S. and 700 ft. W. of the N. E. corner of Section 33, T. 8 N., R. 3 E.). The ground elevation at the well-site is 740± ft. The pumping equipment, installed in June 1948, consists of a Jacuzzi jet pump Type T 3 H.,No. 159174, with 147 ft. of 2-in. air pipe and 2 1/2-in. eductor pipe; the pump is operated at 1715 rpm.; 3-hp. General Electric motor, No. NDJ 6723539. There is no air line in the well.

Analysis of a sample (Lab. No. 114,922) collected June 3, 1948 showed this water to have a hardness of 27.1 gr. per gal., a residue of 590 ppm., and an iron content of 1.0 ppm.

The South Well was drilled to a depth of 100 ft. and located on the south side of the park about 150 ft. south and 75 ft. east of the North Well. In June 1948, this well was not equipped for pumping. The municipal water system was not complete. Water was available for fire protection.

LABORATORY NO. 114,922

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.0		Silica	SiO_2	28.3	
Manganese	Mn	0.0		Fluoride	F	0.2	
Calcium	Ca	92.4	4.62	Chloride	Cl	6.0	0.17
Magnesium	Mg	56.8	4.67	Nitrate	NO_3	1.5	0.02
Ammonium	NH_4	0.2	0.01	Sulfate	SO_4	36.8	0.77
Sodium	Na	41.9	1.82	Alkalinity	(as $CaCO_3$)	508.	10.16
Turbidity		Tr.		Hardness	(as $CaCO_3$)	465.	9.29
Color		0		Residue		590.	
Odor		0					

FARINA
Fayette County
Feb. 28, 1949

The village of Farina (804) is installing a public water supply.

Test Well No. 1-48 was drilled in 1948 by E. A. Howell, Farina, at a location 20 ft. south of the center line of Mulberry St., and 40 ft. east of the center line of Van Buren St. (or approximately 2875 ft. S. and 2520 ft. W. of the N. E. corner of Section 32, T. 5 N., R. 4 E.). The well was 280 ft. in depth below a ground surface elevation of 587± ft.

The well was drilled 11 in. in diameter to a depth of 105 ft., and 8 in. in diameter from 105 to 205 ft. below the ground surface, and was cased with 8 1/4-in. od. pipe from one foot above to 82 ft. below ground level.

A production test was made by the State Water Survey on Jan. 7, 1948. For test purposes, a gasoline engine-driven deep-well turbine pump, with the bottom of the suction pipe at a depth of 90 ft., was installed. After 15 minute pumping at 24 gpm. the drawdown was 3 9 ft. from a water level of 13 ft. below ground level. After 2 1/2-hr. pumping with the yield rate gradually decreased to 6.2 gpm. the drawdown was 54 ft. Twenty-five minutes after stopping the pump, the water level was 24.5 ft. below the pre-pumping level of 13 ft.

Analysis of a sample (Lab. No. 113,285) collected Jan. 27, 1948, after 2-hr. pumping showed the water to have a hardness of 17.2 gr.per gal., and a residue of 869 ppm.

Allen Well, originally called Test Well 2-48 was drilled in Mar. 1948 to a depth of 170 ft. by E. A. Howell at a location about 300 ft. north and 520 ft. east of the intersection of Mulberry and Washington St. (or approximately 875 ft. S. and 370 ft. W. of the N. E. corner of Section 32). The ground elevation at the well-site is 590± ft. The water-bearing formation was reported to be a "white" sandstone between 65 and 117 ft. depth.

The hole was cased with 10-in. pipe from 0.2 ft. above to 28 ft. below ground level and the 10-in. hole extended to 122 ft. below which the hole was finished 8 in. in diameter. A production test was made by the State Water Survey on Mar. 23-24, 1948. For test purposes, an engine-driven, 7-stage turbine pump was attached to 120 ft. of 4-in. column pipe. Before starting the pump, the water level was 13 ft. below the top of the casing. The periods of pumping, rates and drawdowns were, in order, as follows:

Period hr.	Pumping Rate gpm.	Drawdown ft.
5.2	25.5	22.0
6.0	47.0	52.0
6.5	56.0	76.0
4.0	54.5	87.0

Thirty minutes after stopping the pump, the water level was 38.0 ft. below the top of the casing. During the test, water level observations made in the Burge Well, 570 ft. west of Test Well 2-48 and in the Crandall Well, 875 ft. west of the Test Well 2-48. At the end of the 22-hr. test, the water level in the Burge Well had lowered 5.1 ft. and in the Crandall Well, the water level lowered 2.9 ft.

On Aug. 19, 1948 the water level in Test Well 2-48 was 15.3 ft.

Analysis of a sample (Lab. No. 113,907) collected Mar. 24, 1948 after 20-hr. pumping showed this water to have a hardness of 21.4 gr. per gal., a residue of 496 ppm., and an iron content of 0.5

LABORATORY NO. 113,907

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.5		Silica	SiO_2	30.2	
Manganese	Mn	0.4		Fluoride	F	0.4	
Calcium	Ca	77.5	3.88	Chloride	Cl	42.0	1.18
Magnesium	Mg	31.0	2.55	Nitrate	NO_3	0.2	Tr.
Ammonium	NH_4	1.2	0.07	Sulfate	SO_4	3.9	0.08
Sodium	Na	72.7	3.16	Alkalinity	(as $CaCO_3$)	420.	8.40
Turbidity		Tr.		Hardness	(as $CaCO_3$)	367.	7.33
Color		0		Residue		496.	
Odor		Tr.					
Temperature	56° F.						

ppm.

Test Well No. 2-48 was renamed Allen Well in the winter of 1948-49, and was selected for the initial source of supply for Farina. A concrete blockhouse was constructed over the well and the well equipped for pumping with 75 ft. of 3-in. column pipe; Cook turbine pump, No. 11433, with bronze impellers and stainless steel shaft, and rated at 25 gpm. against 250 ft. of head; 2-hp. U.S. electric motor, No. 714796. A 3-in. Eureka meter is installed in the discharge line.

Test Well No. 3-48 was drilled to 170 ft. at a location north of the La Grove Community High School, and about one-half mile northwest of Test Well 2-48 (or approximately 850 ft. N. and 2600 ft. west of the S. E. corner of Section 29). The yield was too low to justify further development.

Test Well No. 4-48 was drilled in May 1948 to a depth of 125 ft. at a location about 1200 ft. southeast of Test Well No. 2-48 (or approximately 1600 ft. S. and 500 ft. E. of the N. W. corner of Section 33). The ground elevation at the well site is 590± ft. The yield was extremely low.

Sample-study log of Test Well No. 4-48 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Till	35	35
Pennsylvanian system		
Shale	5	40
Sandstone, silty	15	55
Sandstone, incoherent	65	120
Sandstone, calcareous	5	125

A well, called Boston No. 1, was drilled for the village in Aug. 1948, by J. H. Smith, Farina, at a location near the northeast corner of Madison and Vine St. (or approximately 1580 ft. S. and 2020 ft. W. of the N. E. corner of Section 32). This is about one quarter mile northerly of Test Well No. 1-48 and about 1800 ft. west-southwest of Test Well No. 2-48.

The well was drilled to a depth of 445 ft. When the drilling reached 255 ft., an analysis (Lab. No. 115,635) showed a chloride content of 3150 ppm. The hole was left open to 445 ft. for thirty days after which it was filled and a concrete plug placed with the top of the plug at 135 ft. depth. The well is cased with 42 ft. of 12-in. id. pipe below which the hole is 10 in. in diameter.

A production test was made on Sept. 23, 1948 by Heldt-Monroe Co., Evansville, Ind. Before the test the water level was reported to be 22.5 ft. below the top of the casing. Water was pumped for the first five hours at 20 gpm. and the drawdown gradually increased from 24 ft. to 89 ft. The pumping rate was decreased to 15 gpm. and equilibrium was maintained for 12 hr. with a drawdown of 58 ft. Thirty minutes after stopping the pump, the water level was 10 ft. below the starting level of 22.5 ft.

A brief production test was made on Feb. 24, 1949 by Heldt-Monroe Co. Before the test was started, the water level was 17 ft. 8 in. below the top of the casing. When pumping at 18 gpm. the drawdown was 95 ft. 4 in. Twenty minutes after stopping the pump, the water level was 56 ft. or 38 ft. 4 in. below the starting level.

Analysis of a sample (Lab. No. 116,052) collected Oct. 13, 1948, showed this water to have a hardness of 22.6 gr. per gal., and a residue of 494 ppm.

Wade Well No. 1 was originally an oil test well and drilled to over 1500 ft. in depth at a location 2180 ft. N. and 2118 ft. E. of the S. W. corner of Section 32. In Aug. 1948, J. H. Smith cleaned the hole to a depth of 455 ft. The well is reported to be cased with 10-in. pipe from the surface to 200 ft.

A water production test was made on Sept. 21, 1948 by Heldt-Monroe Co. The water level at 1:25 P.M., before any pumping, was 10.5 ft. below the top of the casing. From 1:30 P.M. to 5:30 P.M. water was pumped intermittently at various rates from 55 to 10 gpm. At 5:30 P.M. the principal test was started. Two hours later a cave-in occurred resulting in an increased water production. Water was then pumped for 12 hr. at a rate of 20 gpm. with a final drawdown of 83 ft. below the starting water level of 10.5 ft. Four hours after stopping the pump, the water level was 18 ft.

Analysis of a sample (Lab. No. 116,053) collected Oct. 13, 1948 after 15-hr. pumping showed this water to have a hardness of 16.5 gr. per gal., a residue of 401 ppm., and an iron content of 1.9 ppm.

Curry, Well No. 1, was drilled for the village of Farina in Feb. 1949 by J. H. Smith and located on the southerly side of Vine St. about 600 ft. west

of the Allen Well and 1360 ft. northeasterly from the Boston No. 1 Well (or approximately 750 ft. S. and 950 ft. W. of the N. E. corner of Section 32).

The well was drilled to a depth of 125 ft. and was cased with 8-in. pipe from 2 ft. 4 in. above to 32 ft. 8 in. below ground level. A production test was made by the State Water Survey on Feb. 26, 1949. For test purposes, an engine-driven turbine pump was set at 114 ft. below the top of the casing. Before the test was started the water level was 13.0 ft. below ground level and after 6 1/2-hr. pumping at 9.9 gpm. the drawdown was 47.7 ft. After the next 5-hr. pumping at 14.0 gpm. the drawdown was 88.7 ft. Eleven minutes after stopping the pump, the water level was 40.7 ft.

During the test of Curry Well No. 1 observations were made in Crandall Well, 350 ft. southwest and in Boston No. 1 Well, 1360 ft. southwest on about the same line as the Crandall Well. The water was lowered 1.72 ft. in the Crandall Well and 0.5 ft. in the Boston No. 1 Well. The pump in the latter well had been in operation for several hours on the rnorning of the previous day.

Analysis of a sample (Lab. No. 117,407) collected Feb. 26, 1949, showed this water to have a hardness of 20.0 gr. per gal., a residue of 490 ppm., and an iron content of 5.0 ppm.

The distribution system is not completely installed and the Allen Well is reported to be ready for service when needed. Boston No. 1 and Wade No. 1 Wells are being considered as sources for the public supply.

A public water supply was installed for the city of Farmer City (1835) in 1891.

A well, which flowed, was drilled in 1894 and was abandoned because of a crooked hole. In Jan. 1907 the water level was 20 ft. below the ground surface.

The North Well was drilled in 1907 and located in the northern part of the city, at the northwest corner of Allen and Center St. It was 8 in.in diameter and 176 ft. deep. The South Well was drilled in 1910 and located 8 ft. from the North Well, and was the same depth and diameter. Both wells were reported to be in a formation of fine sand and gravel below a depth of 156 ft. and each well had a 20-ft. length of Cook screen. In 1913, the non-pumping water level was 30 ft. below the ground surface elevation of 730± ft. In Apr. 1923 while pumping in one well, the water level in the other well, which was being repaired, was 80 ft.

The wells were abandoned and filled about 1932, at which time the numbering of the wells was revised.

Well No. 1 was drilled in 1925 to a depth of 173 1/2 ft. by Chris Ebert, Washington, and located in the pumping station, 22 ft. north and 80 ft. west of the old North Well (or approximately 2440 ft. S. and 1880 ft. W. of the N. E. corner of Section 28, T. 21 N., R. 5 E.).

The well was cased with 156 ft. of 12-in. pipe and 17 ft. exposed length of Cook screen, having No. 16 slot openings.

When the well was completed, the static water level was 25 ft. below the ground surface and in 1934 the water level was 80 ft.

This well was abandoned about 1945, when the new pumping and electric light plant was constructed. The yield of the well had decreased and pumping, with the existing equipment, was uneconomical. The well was filled and capped.

Two wells, drilled in 1931 by E. H. Johnson and Son, Bloomington were not developed. They were located in the. pumping station, north of the old wells. When completed, the static water level was 25 ft. and in 1934 the water level was 80 ft.

Well No. 2, now called No. 1, was drilled in 1932 to a depth of 173 ft. by Chris Ebert, Washington, and located 25 ft. southwest of old Well No. 1 at the pumping station at State and Allen St.

Correlated driller's log of one of the wells furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and clay	53	53
Streak of gravel	at	53
Clay	22	75
Water Sand	4	79
Clay	26	105
Streak of sand	at	105
Clay	55	160
Sand, muddy	12	172
Clay	2	174

The well was cased with 156 ft. of 12-in. pipe and 17 ft. exposed length of screen, having No. 16 slot openings.

The pump assembly, installed in Nov. 1947, consists of 140 ft. of 6-in. column pipe; 8-in., 9-stage Cook turbine pump, No. 8804, rated at 300 gpm. against 120 ft. of head; air line of unknown length; 9 ft. of 5-in. suction pipe; 20-hp. U. S. electric motor.

The pump is in daily service at a metered discharge rate of 160 gpm. When the pump was installed in Nov. 1947 the red hand on the air line altitude gauge was set at 35 ft. On Aug. 25, 1948, the altitude gauge indicated a pumping water level reading of 20 ft.

Analysis of a sample (Lab. No. 115,684) collected Aug. 25, 1948 after 5.-hr. pumping showed this water to have a hardness of 17.2 gr. per gal., a residue of 765 ppm., and an iron content of 5.0 ppm. Methane gas has been noted to be present in the water from these wells.

Well No. 2 was drilled in 1945 by Hayes and Sims, Champaign and located 50 ft. south and 50 ft. west of the center of the intersection of State and AllenSt. (or approximately 2560 ft. S. and 1740 ft. W. of the N. E. corner of Section 28.).

The well was cased with 154 ft. pf 12-in. black pipe from 1 ft. above ground level, and 15 ft. exposed length of Johnson Everdur screen. The top 7 ft. of the screen had No. 16 slot openings and the bottom 8 ft. had No. 25 slot openings. An 18-in. plug was placed in the bottom of the screen and the finished depth of the well was 165 ft. 7 in. from the top of the casing to the top of the plug. Static water level, at the time, was 63 ft. 4 in. below the top of the casing.

A production test was made by the State Water Survey on Oct. 1, 1945. For test purposes a temporary pump assembly was used, consisting of 100 ft. of 5-in. column pipe and a 14-stage turbine pump, 8 ft. in length. No suction pipe was installed. Before the test was started, the water level was 59 ft. After 8-hr. pumping at a final rate of 67 gpm., the drawdown was 46 ft.

Analysis of a sample (Lab. No. 104,400) collected Oct. 1, 1945 showed this water to have a hardness of 14.3 gr. per gal., a residue of 659 ppm., and an iron content of 2.4 ppm.

The present pump installation, removed from old Well No. 1, was made in Oct. 1945 and consists of 130 ft. of 5-in. column pipe; 7-in., 14-stage Fairbanks-Morse turbine pump, No. 25852, having a rated capacity of 250 gpm.; 10 ft. of 5-in. suction pipe; 25-hp. Fairbanks-Morse electric motor.

The pump is in daily service and discharges at a metered rate of 75 gpm.

From Jan. 3 to Aug. 25, 1948, pumpage averaged 188,270 gpd. of which about 18,725 gpd. is used by commercial concerns.

LABORATORY NO. 115,684

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	5.0		Silica	SiO_2	25.1	
Manganese	Mn	0.1		Fluoride	F	0.3	
Calcium	Ca	72.3	3.62	Chloride	Cl	96.0	2.71
Magnesium	Mg	27.4	2.25	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	5.7	0.32	Sulfate	SO_4	0.0	0.00
Sodium	Na	177.6	7.72	Alkalinity	(as $CaCO_3$)	560.0	11.20
Turbidity		50		Hardness	(as $CaCO_3$)	294.	5.87
Color		25		Residue		765.	
Odor		0		Temperature	54.5° F.		

FARMINGTON
Fulton County
Jan. 27, 1948

A public water supply was installed by the city of Farmington (5225) in 1893.

At that time, water was obtained from a well located at the old water works south of Vernon St. and west of Main St. (or approximately 700 ft. S. and 350 ft. W. of the N. E. corner of Section 11, T. 8 N., R. 4 E.). The well was drilled by S. Swanson, Minneapolis, Minn., to a depth of 1461 ft. below a ground surface elevation of 720t ft., and was reported to be cased from the surface to 269 ft. with 8-in. pipe, and from 269 to 1145 ft. with 6-in. pipe. Below the casing, the hole was 6 in. in diameter. At a depth of 160 ft., the well passed through an old coal mine entry. At that point, the casing was embedded in concrete.

When the well was completed in 1893, the water level was 82 ft. below the surface; and after pumping several hr. at 120 gpm., there was no drawdown. In Mar., 1914, the water level was reported to be 135 ft.; and when pumping at about 175 gpm., the drawdown was 15 ft. The well was originally equipped with a deep-well 6-in. id. cylinder pump. In 1912, when an air lift pump was being installed, it was found that the old cylinder was tightly wedged in the casing at a depth of about 260 ft. and could not be removed. The 5-in. eductor pipe for the air lift was extended down through the old cylinder. About 1915, because of a decline in the production of the well, an attempt was made to reinstall a deep-well pump, and 400 ft. of air lift eductor pipe was accidently dropped and became tightly jammed in the bottom of the hole.

The air lift had produced about 135 gpm., but after the series of accidents the production rate was about 37 gpm., and in Aug., 1915 had declined to 30 gpm. The well could not be cleaned out because there was no substitute supply available.

Analysis of a sample (Lab. No. 38956), collected Feb. 13, 1918, showed the water from this well to have a hardness of 14.2 gr. per gal., a residue of 2285 ppm., and an iron content of 1.6 ppm.

A well was completed in Mar., 1918 to a depth of 1710 ft. by C. P. Brandt, Chicago, and located approximately 275 ft. north of East Fort St. (State Highway No. 116) and 1/4 mile east of Elmwood Road(or approximately 100 ft. N. and 1320 ft. W. of the S. E. corner of Section 1). The g round surface elevation is 788± ft.

The well is cased with 10-in. steel pipe from the surface to 1020 ft. and with 8-in. iron pipe from 1020 to 1260 ft. At the top of the 8-in. casing, a bell nipple was swedged to fit the inside of the 10-in. casing.

In Mar. 1918, the water level was 202 ft. be-

Sample-study log of a well completed in 1918 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Glacial drift	40	40
Pennsylvanian system		
Shale, some coal	365	405
Sandstone, fine, water	20	425
Shale	45	470
Mississippian system		
Keokuk - Burlington limestones	160	630
Kinderhook shale	240	870
Devonian system		
Limestone and dolomite	65	935
Silurian system		
Niagaran - Alexandrian dolomite	140	1075
Ordovician system		
Maquoketa shale and dolomite	160	1235
Galena - Platteville dolomites	335	1570
St. Peter sandstone	130	1700

low the surface, and Feb. 27, 1939, the water level was 245 ft.

The pumping assembly consists of: 340 ft. of 4-in. column pipe; 8-in., 18-stage Pomona turbine pump, No. H-2922, rated at 150 gpm.; overall length of pump is 8 ft.; 10 ft. of 4-in. suction pipe; 25-hp., 1760 rpm. Westinghouse electric motor.

Analysis of a sample (Lab. No. 113,288), collected Jan. 27, 1948 after 4-hr. pumping showed this water to have a hardness of 7.2 gr. per gal., a residue of 2161 ppm., and an iron content of 0.3 ppm.

Pumpage is estimated to be 130,000 gpd.

LABORATORY NO. 113,288

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.3		Silica	SiO_2	14.1	
Manganese	Mn	Tr.		Fluoride	F	2.5	
Calcium	Ca	31.3	1.57	Chloride	Cl	630.0	17.77
Magnesium	Mg	11.0	0.91	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	1.2	0.07	Sulfate	SO_4	371.5	7.73
Sodium	Na	763.4	33.19	Alkalinity	(as $CaCO_3$)	512.	10.24
Turbidity		Tr.		Hardness	(as $CaCO_3$)	124.	2.48
Color		0		Residue		2161.	
Odor		0					
Temperature 68° F.							

The village of Findlay (688) installed a public water supply in 1935.

In 1935, two test wells were drilled by John Bolliger and Sons, Fairbury. Test Well No. 1, located west of the center of the village, entered shale at a depth of 116 ft. No sand or gravel was encountered. Test Well No. 2 was located on the southeast side of the Chicago and Eastern Illinois R. R. and on the north side of Lincoln St. at its intersection with the railroad (or approximately 1000 ft. S., and 600 ft. E. of the N. W. corner of Section 3, T.12 N., R. 4 E.). The ground surface elevation at the site is 680t ft.

This well was 6 in. in diameter and 167 ft. deep. Sand and gravel were encountered between the depths of 127 and 167 ft., and a 20-ft. screen, with No. 20 slot openings, was placed between 147 and 167 ft. A production test was made on Mar. 1, 1935. A 4-in. Pomona pump driven by a gasoline engine, was installed for test purposes.- The well produced 107 gpm. with a drawdown of 7 1/2 ft. from a non-pumping water level of 99 1/2 ft.

Analysis of a sample (Lab. No. 75739) collected Mar. 1, 1935, showed the water to. have a hardness of 13.7 gr. per gal., a residue of 659 ppm., and an iron content of 2.8 ppm.

Test Well No. 3 was drilled in 1935 to a depth of 176 ft. by L. R. Burt, Decatur, and located about 350 ft. southwest of Test Well No. 2 near the intersection of Jefferson St. and the railroad approximately 1300 ft. S. and 330 ft. E. of the N. W. corner of Section 3).

Correlated driller's log of Test Well No. 3 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil, silt and till	122	122
Sand and gravel, silty	20	142
Gravel, sandy	2	144
Sand	6	150
Sand and gravel, clean	12	162
Gravel, silty	9	171
Pennsylvanian system		
Shale	5	176

The well was cased with 6-in. pipe to a depth of 149 ft. 8 in. A 5 1/2-in. Cook screen, having No. 20 slot openings, was set from the bottom of the casing to a depth of 171 ft.

A production test was made on Mar. 29, 1935. For test purposes, a 4-in., 18-stage Pomona turbine pump, driven by a gasoline engine, was installed. The bottom of the suction pipe was set at a depth of 134 ft. 7 in. The non-pumping water level was 96 ft. 4 in., and test results were reported as follows:

Discharge gpm.	Drawdown ft.
137	7.08
126	6.58
110	6.08
91	4.08

The permanent village well was installed in 1935 at the site of Test Well No. 3 by L. R. Burt.

The well was completed at a depth of 154 ft., and is of the gravel-walled type. The 26-in. outer casing extends to a depth of 128 ft., and the 12-in. inner casing to a depth of 129 ft. below the ground surface. A 25-ft. length of 12-in. Cook screen, having No. 187 slot openings, is installed below the 12-in. casing between 129 and 154 ft.

A production test was made by the State Water Survey on June 26, 1935. The well produced 150 gpm. with a drawdown of 14.3 ft. from a non-pumping water level of 96 ft. below the ground surface.

The well is equipped as follows: 120 ft. of 6-in. column pipe; 7-in., 11-stage Cook deep-well turbine pump, No. 1750, having an overall length of 4 ft. 7 1/2 in. and rated at 150 gpm. against 240 ft. of head; 10 ft. of 6-in. suction pipe, 20-hp. U. S. electric motor operating at 1800 rpm.

This well is the sole source of the public supply. Water levels observed by air line and altitude gauge are doubtful. An altitude reading of 12 ft. was observed after 5 min. and after 10 hr. of non-pumping. A reading of 5 ft. was observed after 5 min. and again after 10 hr. of pumping. The pump is throttled to a 75 gpm. rate to synchronize with the capacity of the treatment plant.

Analysis of a sample (Lab. No. 115,228) collected July 9, 1948 after 30-min. pumping at 75 gpm. showed the water to have a hardness of 15.3 gr. per gal., a residue of 642 ppm., and an iron content of 4.8 ppm. Methane gas is present in this water in a concentration of 8.1 cu. ft. per 1000 gal.

The water is aerated, filtered, softened, and

chlorinated.

Analysis of a sample (Lab. No. 115,512) collected July 9, 1948 showed the treated water to have a hardness of 6.5 gr. per gal., a mineral content of 673 ppm., and an iron content of 0.4 ppm.

Pumpage for June 1948 was estimated to average 28,640 gpd.

LABORATORY NO. 115,228

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	4.8		Silica	SiO_2	23.4	
Manganese	Mn	0.0		Fluoride	F	0.3	
Calcium	Ca	58.9	2.95	Chloride	Cl	82.0	2.31
Magnesium	Mg	27.9	2.30	Nitrate	NO_3	0.4	0.01
Ammonium	NH_4	11.3	0.63	Sulfate	SO_4	0.0	0.00
Sodium	Na	148.1	6.44	Alkalinity (as $CaCO_3$)		500.	10.00
Turbidity		40		Hardness (as $CaCO_3$)		263.	5.25
Color		35		Residue		642.	
Odor		0		Free CO_2 (calc.)		62.	
Temperature 57.8° F.							

LABORATORY NO. 115,512

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.4		Fluoride	F	0.3	
				Chloride	Cl	85.0	2.40
Turbidity		Tr.		Alkalinity (as $CaCO_3$)		500.	10.00
Color		Tr.		Hardness (as $CaCO_3$)		111.	2.22
Odor		0		Total Mineral Content		673.	
Temperature 59.2° F.				Free CO_2 (calc.)		48.	
				pH = 7.4			

A public water supply was installed by the village of Fisher (754) in 1936.

Well No. 1 was drilled in 1936 to a depth of 204 ft. by L. R. Burt, Decatur, and refinished in Jan. 1949 to a depth of 236 ft. It is located on the north side of Front St. about 720 ft. west of Third St. (or approximately 2565 ft. N. and 1000 ft. W. of the S.E. corner of Section 36, T. 22 N., R. 7 E.). The ground surface elevation at the well-site is 720± ft.

The well was originally cased with 8-in. pipe and with 20 ft. of 8-in. Johnson screen. The lower 10 ft. of the screen had No. 12 slot openings and the upper 10 ft. had No. 10 slot openings. The lower 18 ft. of the screen was exposed to a water-bearing sand formation. A production test was made by the State Water Survey on Apr. 10, 1936. Pumping was started at a rate of 182 gpm., and after 5 minutes the drawdown was stable at 26 ft. from a static water level of 30 ft. below ground level. After 8-hr. pumping at an average rate pf 182 gpm. the drawdown remained at 26 ft. Mr. Verl Zook, Water Superintendent, reported in July 1949 that in Jan. 1949 the well was cased with 8-in. pipe from the surface to 204 ft.; with 6-in. pipe from 204 to 226 ft. and 10 ft. of Johnson Everdur screen. The bottom of the screen is set at 236 ft. The size of slot openings was not reported.

In Mar. 1947, the pump became sand-locked and was removed and repaired. During the pump repair period, about one month, water was pumped by an air lift, having an air pipe extending to a depth of about 190 ft. The sand-lock was probably caused by a break-through of sand from the formation and not from a rupture in the casing, as the well was cleared up very shortly after the air lift was installed. Very little sand deposit was found in the well bore. The static water level at the time was 31 1/2 ft. below ground level. On Dec. 17, 1948 the water level in Well No. 1 was 35.1 ft. below the top of the concrete pump base after 6 1/2-hr. pumping in Well No. 2 at 125 gpm.

From Nov. 1947 to Feb. 1949, Well No. 1 was not equipped for pumping. The equipment has been removed from Well No. 1 to Well No. 2. Mr. Zook reported that in Feb. 1949, after the refinishing of Well No. 1, the pumping equipment installed consisted of 80 ft. of 4-in. column pipe; 6-in., 10-stage Aurora turbine pump, No. 42781, rated at 125 gpm. against 90 ft. of head at 1750 rpm.; the overall length of the pump is 3 ft. 1 in.; 80 ft. of 1/4-in. air line; 5-hp. U. S. electric motor. The pump base is 2 ft. above ground level.

When pumping at 125 gpm. in Feb. 1949, the drawdown was reported to be 20 ft. In June 1949 the pumping rate was reported to be about 90 gpm. and the water lowered below the air line.

Analysis of a sample (Lab. No. 110,158) collected May 5, 1947 showed the water in Well No. 1 to have a hardness of 21.5 gr. per gal., a residue of 386 ppm., and an iron content of 1.6 ppm.

Well No. 2 was completed in Nov. 1947 by Hayes and Sims, Champaign, and is located at the west end of Front St., 10 ft. north of Test Hole No. 1 and 275 ft. west of Well No. 1.

Test Hole No. 1 was drilled to a depth of 271 1/2 ft.

Sample-study log of Test Hole No. 1 furnished by the State Geological Survey:

Formation	Thickness ft.	Thickness in.	Depth ft.	Depth in.
Pleistocene system				
No record	35		35	
Till	10		45	
Sand and granule gravel, dirty	5		50	
Till	15		65	
Sand, partly dirty	5		70	
Till	5		75	
Sand, mostly clean	15		90	
Sand, dirty, with clay	20		110	
Sand, clean	25		135	
Sand, some clay	70		205	
Till	5		210	
Sand, dirty at top, soil at 225'	20		230	
Sand and granule gravel, clean	41	6	271	6

The driller reported some gas was encountered in Well No. 2 at 80 ft. causing some caving of the material. The well was finished at a depth of 240 ft. and was cased with 10-in. pipe from the surface to 190 ft.; with 8-in. pipe from 190 to 230 ft. and with 10 ft. of Johnson Everdur screen set with the bottom at 240 ft. The screen had No. 30 (?) slot openings.

A production test was made by the State Water Survey on June 26, 1948. Before pumping, the water level was 26 1/2 ft. below ground level. After 3 1/2-hr. pumping at rates gradually accelerated from 41 1/2 to 205 gpm. the final drawdown was 14.8 ft. During the test, a water level recorder was installed in Well No. 1, located 275 ft. to the

LABORATORY NO. 116,783

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.9		Silica	SiO_2	28.7	
Manganese	Mn	Tr.		Fluoride	F	0.2	
Calcium	Ca	92.9	4.65	Chloride	Cl	2.0	0.06
Magnesium	Mg	34.9	2.87	Nitrate	NO_3	0.3	Tr.
Ammonium	NH_4	14.0	0.78	Sulfate	SO_4	90.5	1.88
Sodium	Na	8.3	0.36	Alkalinity (as $CaCO_3$)		336.	6.72
Turbidity		11		Hardness (as $CaCO_3$)		376.	7.52
Color		0		Residue		461.	
Odor		0		Free CO_2 (calc.)		49.	
Temperature 54.5° F.				pH = 7.25			

east. Maximum drawdown in Well No. 1 was 0.1 ft.

The pumping equipment, installed May 26, 1948, consists of 80 ft. of 5-in. column pipe; 7-in., 4-stage American Well Works turbine pump, No. 71303, rated at 125 gpm. against 86 ft. of head at 1735 rpm., and having an overall length of 3 ft. 3 in.; 78 1/2 ft. of 1/4-in. air line below the pump base which is 2 1/2 ft. above ground level; 10 ft. of 5-in. od. suction pipe and strainer; 5-hp., U.S. electric motor.

On Nov. 10, 1948, a production test was made by the State Water Survey. The water level, after a 1 1/2-hr. non-pumping period, was 27.3 ft. After 1 1/2-hr. pumping at rates gradually accelerated from 40 to 73 gpm. the final drawdown was 49.4 ft. Complete recovery of the water level occurred in 15 minutes. The results of the test showed a decline in specific capacity of the well from 13.8 in June 1948 to 1.5 gpm. per foot of drawdown in Nov. 1948. No sand was pumped during the test but at the start the discharge contained a reddish-brown fluffy material, a sample of which tended to settle slowly in the container.

On Nov. 22, 1948, seventy pounds of chlorine was placed in the well and the yield rate decreased from 73 to 25 gpm. Operations continued at this rate until Dec. 2, 1948 when the well was surged with a bailer. A considerable quantity of fine sand having a reddish color and flakes of iron precipitate was removed. The well was placed in service Dec. 4, 1948 and now yields at a rate of about 110 gpm. to the aerator.

Analysis of a sample (Lab. No. 116,783) collected Dec. 17, 1948 after 8 1/2-hr. pumping at 110 gpm., showed the water to have a hardness of 21.9 gr. per gal., a residue of 461 ppm., and an iron content of 1.9 ppm.

The water is aerated, filtered and softened. Aralysis of a sample (Lab. No. 116,784) collected Dec. 17, 1948 showed the treated water to have a hardness of 4.9 gr. per gal., a mineral content of 640 ppm., and an iron content of 0.2 ppm.

From Jan. 1 to June 1, 1948 metered pumpage averaged 31,500 gpd.

LABORATORY NO. 116,784

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Fluoride	F	1.2	
				Chloride	Cl	83.0	2.34
Turbidity		2		Alkalinity (as $CaCO_3$)		364.	7.28
Color		0		Hardness (as $CaCO_3$)		84.	1.68
Odor		0		Total Mineral Content		640.	
Temperature 55° F.				Free CO_2 (calc.)		23.	
				pH = 7.6			

FLANAGAN
Livingston County
May 3, 1947

A public water supply was installed by the village of Flanagan (663) about 1892.

A well was drilled on the south side of Lumber St. between Main and Jackson St. (or approximately 2485 ft. N., and 2080 ft. W. of the S. E. corner of Section 22, T. 28 N., R. 3 E.).

Correlated driller's log of well drilled about 1892 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Drift	135	135
Pennsylvanian system		
Rock	20	155

The well was 170 ft. deep below a ground surface elevation of 676± ft., and was cased with 6-in. pipe to 164 ft., below which was placed a 6-in. screen to a depth of 170 ft.

When the well was completed, the peak of the artesian flow was 11 ft. above the ground surface. In 1917 the flow was piped into a fountain and watering trough on Main St. about 1/2 block distant. There were 9 other flowing wells in the village at that time.

In 1919 a Gould's 7 by 8-in. single-acting triplex pump was installed with 20 ft. of 5-in. suction pipe extending into the well. Power was furnished by a 10-hp. electric motor. The pump was used about 4 hr. each day, and during that time, there was no flow into the fountain and trough. In 1924 the well was sealed to prevent the free flow when not pumping because the 9 other flowing wells ceased flowing if the village well was allowed to flow. One of those wells, 100 ft. west of the village well, ceased flowing when the village well pump was operating.

Prior to 1913, a second well had been constructed, adjacent to the first well, and was of the same depth and diameter and was cased similarly. Both wells were interconnected, and water was pumped simultaneously from both wells. In 1930 the free flow was estimated at 1 gpm.

Analysis of a sample (Lab. No. 67048), collected July 30, 1930 from 1/2-in. pipe at fountain, showed the water from the wells to have a hardness of 96 ppm., a mineral content of 611 ppm., and an iron content of 0.6 ppm.

One of the wells has been abandoned, and the other well is capped with the pump removed.

In May 1944 a new well was drilled 40 ft. west of the old wells by Mike Ebert, Washington. It is 168 ft. deep and cased with 163 ft. of 6-in. pipe and 5 ft. of screen. The pump installation consists of 145 ft. of 6-in. column pipe; Pomona turbine pump, No. 2798; 15-hp. Westinghouse electric motor. The pumping rate is approximately 117 gpm.

The driller reported that the pumping rate when the well was completed was 100 gpm. The artesian flow was estimated by the driller to be 20 gpm.

Analysis of a sample (Lab. No. 110,150) collected May3, 1947 after 10-min.«pumping, showed the water to have a hardness of 7.0 gr. per gal., a residue of 614 ppm., and an iron content of 0.2 ppm.

Pumpage is estimated to average 24,000 gpd.

LABORATORY NO. 110,150

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	17.9	
Manganese	Mn	0.0		Fluoride	F	0.5	
Calcium	Ca	25.0	1.25	Chloride	Cl	15.0	0.42
Magnesium	Mg	14.1	1.16	Nitrate	NO_3	0.2	Tr.
Ammonium	NH_4	28.8	1.61	Sulfate	SO_4	120.5	2.51
Sodium	Na	157.1	6.83	Alkalinity	(as $CaCO_3$)	396.	7.92
Color		0		Hardness	(as $CaCO_3$)	121.	2.42
Odor		0		Residue		614.	
Turbidity		10-					
Temperature		54° F.					

Flossmoor (1270) was incorporated as a village in 1925. Before its incorporation, parts of the area were supplied with water from wells owned by the Illinois Central Railroad Co. and the Merrick Construction Co. The public water supply is now obtained from wells which are municipally owned.

The Illinois Central Railroad Co. has 2 wells on the west side of the right-of-way, north of the depot. The south well, drilled in 1892, was abandoned in 1926. The north well (now called Village Well No. 1) was drilled by the J. P. Miller Artesian Well Co., Brookfield, in 1922 and is located approximately 1500 ft. N. and 600 ft. W. of the S. E. corner of Section 1, T. 35 N., R. 13 E.

Well No. 1 was originally drilled to a depth of 152 ft. and cased to bedrock with 85 ft. of 10-in. pipe below which the hole was 10 in. in diameter to the bottom. The ground surface elevation is 680t ft. This well was reported to have filled in. It was cleaned out, deepened to a total depth of 275 ft. and new 10-in. casing installed by S. B. Geiger, Chicago, in Oct. 1939.

The existing pumping equipment was installed in 1940: 110 ft. of 6-in. wi. column pipe; 8-in. American Well Works turbine pump, No. 63224, rated at 300 gpm. against 220 ft. of head; 110 ft. of airline; 10 ft. of 6-in. wi. suction pipe; 25-hp. General Electric motor.

In 1940 a non-pumping water level of 47 ft. below the pump base was reported. When pumping at 300 gpm., the water level was 85 ft. below the pump base and dissolved gas appeared in the water, which could only be eliminated by reducing the rate of pumpage.

On Apr. 25, 1945, the non-pumping water level was 90 ft. below the pump base, and after 3-min. pumping at 300 gpm., the water level was below the airline. Analysis of a sample (Lab. No. 103161), collected in 1945 after 4-min. pumping showed this water to have a hardness of 29.0 gr. per gal., a mineral content of 571 ppm., and an iron content of 3.1 ppm.

In July 1946 the pump was operated daily for 4-hr. periods and delivered approximately 290 gpm.

The Merrick Construction Co. well (now known as Park Well or Village Well No. 2) is located near the northeast limits of the village approximately 2600 ft. N. and 1300 ft. E. of the S. W. corner of Section 6, T. 35 N., R. 14 E. The elevation of the ground surface at the well is 665t ft. This well was drilled to a depth of 351 ft. and is reported cased to rock with 105 ft. of 12-in. id. pipe below which the hole is 10 in. in diameter to the bottom.

The existing pump installation was made in Aug. 1939: 80 ft. of 8-in. wi. column pipe; 12-in., 11-stage American Well Works turbine pump, No. 55065, rated at 350 gpm. against 226 ft. of head; 88 ft. of airline; 20 ft. of 8-in. suction; 40-hp. Howell electric motor.

On Aug. 6, 1941, the non-pumping water level was 36 ft. below the pump base, and the pump discharge was 390 gpm. On Apr. 25, 1945, the water level was 40 ft., and after 8-min. pumping at 420 to 425 gpm. the drawdown was 20 ft.

This well has been the main producing unit in the public water supply since its construction sometime before 1926. It was originally constructed to serve an area of 165 acres known as Flossmoor Park, but on June 13, 1939 it was reported that the well supplied all of the public demand at that time. In July 1946 the pump was operated daily for 6-hr. periods at an estimated rate of 290 gpm.

Analysis of a sample (Lab. No. 112,007), collected Sept. 17, 1947, showed this water to have a hardness of 29.1 gr. per gal., a residue of 652 ppm., and an iron content of 1.5 ppm.

LABORATORY NO. 103,161

	ppm.		ppm.
Iron (total) Fe	3.1	Chloride Cl	4.0
		Alkalinity (as $CaCO_3$)	330.
Turbidity	10	Hardness (as $CaCO_3$)	498.
Color	0	Total Mineral Content	571.
Odor	Tr.		
Temperature 52.5° F.			

LABORATORY NO. 112,007

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.5		Silica	SiO_2	22.2	
Manganese	Mn	0.0		Fluoride	F	0.4	
Calcium	Ca	112.9	5.65	Chloride	Cl	3.0	0.08
Magnesium	Mg	52.7	4.34	Nitrate	NO_3	2.0	0.03
Ammonium	NH_4	0.2	0.01	Sulfate	SO_4	209.8	4.37
Sodium	Na	31.3	1.36	Alkalinity	(as $CaCO_3$)	344.	6.88
Turbidity		10-		Hardness	(as $CaCO_3$)	500.	9.99
Color		0		Residue		652.	
Odor		M					
Temperature 52° F.							

Village Well No. 3 (deepened Illinois Central Well No. 2) now called Garage Well, is located about 200 ft. northwest of Well No. 1 (or approximately 1550 ft. N. and 750 ft. W. of the S. E. corner of Section 1). This well was originally drilled in 1925 for the Illinois Central Railroad Co. by Thorpe Bros. Well Co., Des Moines, Iowa. It was drilled to a depth of 160 ft. and cased with 16-in. od. pipe to a depth of 88 ft. below which the bore was 14-in. diameter to the bottom.

The well was originally equipped with a double-acting plunger pump having a capacity of 150 gpm. and was operated alternately with Well No. 1 which had similar equipment. On Aug. 27, 1926 when the pump in No. 1 was operated alone, the water level in Well No. 3 was at a depth of 46 ft. With both pumps operating, the water level lowered to a depth of 94 ft. When the pump in No. 1 was stopped, the water level in No. 3 was 89 ft. It was reported June 13, 1939 that the well had not been used for 5 years.

A sample collected in August 1926 after 2-hours pumping was found to have a hardness of 29.2 gr. per gal. and a mineral content of 741 ppm. A sample collected in April 1940 after one-hour pumping at 300 gpm. was found to have a hardness of 28.3 gr. per gal. and a mineral content of 708 ppm.

This well was deepened by S.B. Geiger & Co. in July 1941 to a total depth of 467 ft.

The driller's hole and casing diameter record shows: 16-in. casing to a depth of 88 ft.; 14-in. hole between the depths of 88 and 160 ft.; 12-in. hole from 160 to 467 ft.

A 26-hr. production test was conducted by the State Water Survey on Aug. 5 and 6, 1941. The well produced 390 to 395 gpm. during the last 4 hr. of the test with a drawdown of 89 1/2 ft. from a non-pumping water level of 64 1/2 ft. below the concrete pump base. The water level in Well No. 1, located about 200 ft. southeast, was observed to recede 2 ft. during the last few hours of the test. The pump in Well No. 1 was not operating at any time during the test.

Sample-study and driller's log of Well No. 3 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Clay, gravel, and boulders"	65	65
Silurian system		
Niagaran-Alexandrian series		
"Lime and broken lime"	23	88
"Red and mixed shale, thin bed of lime rock"	60	148
"Lime rock"	12	160
Dolomite	250	410
Dolomite, silty and thin shale bed at base	57	467

Analysis of a sample (Lab. No. 112,006) collected Sept. 17, 1947, after 25-min. pumping showed this water to have a hardness of 39.2 gr. per gal., a residue of 929 ppm., and an iron content of 0.5 ppm. This quality is similar to that noted in a sample collected Aug. 6, 1941.

The existing pump installation was made in 1943: 200 ft. of 6-in. column pipe; 10-in., 8-stage Pomona turbine pump No. SA 2714 rated at 400 gpm. against 308 ft. of head; the overall length of the pump is 5 ft. 9 in.; 200 ft. of 1/4-in. air line; 30 ft. of 6-in. suction pipe; 40-hp. West-

inghouse electric motor.

In July 1946 the pump was operated daily for a period of 8 hr. at an estimated rate of 330 gpm.

The pumpage for the public supply is not metered. An estimate of the maximum pumpage is 313,000 gpd. The minimum pumpage for the winter months is estimated to be 150,000 gpd.

LABORATORY NO. 112,006

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.5		Silica	SiO_2	17.1	
Manganese	Mn	0.0		Fluoride	F	0.5	
Calcium	Ca	153.5	7.68	Chloride	Cl	4.0	0.11
Magnesium	Mg	70.4	5.79	Nitrate	NO_3	2.7	0.04
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	437.7	9.11
Sodium	Na	43.0	1.87	Alkalinity	(as $CaCO_3$)	304.	6.08
Turbidity		10-		Hardness	(as $CaCO_3$)	674.	13.47
Color		0		Residue		929.	
Odor		0					
Temperature 52.8° F.							

FORREST
Livingston County
Apr. 28, 1947

A public water supply was installed by the village of Forrest (947) about 1895.

A well was dug near the center of the village and used as a source of supply until about 1901 when 2 coal shafts were leased by the village. The shafts had been recently dug and then abandoned because of too much quicksand and water. They were located on the south side of the Toledo Peoria & Western R. R. near the southwest corner of the village and about 75 ft. from the south branch of the Vermillion River (or approximately 1200 ft. N. and 1200 ft. W. of the S. E. corner of Section 4, T. 26 N., R. 7'E.).

The depth of the shafts was 80 ft. below a surface elevation of 680t ft. The upper part of the shaft was about 7 ft. by 14 ft. and cased with heavy lumber. Originally they were covered with plank, but prior to 1926, flat concrete roofs were placed over the shafts.

A Gould triplex pump, with a 5-in. suction and 4-in. discharge pipe, was installed in the pump station with the pump base about 4 ft. below the ground surface. The pump was belt-connected to a 10-hp., 1165 rpm. General Electric motor.

In 1916 the water level was reported to be 4 ft. below the well cover; and after long continued pumping, the water was drawn down 5 ft. In 1922 the water level was 6 ft.; and after pumping several hours, the water level was drawn down 22 ft. In 1930 the depths of the shafts was reported to be 48 or 49 ft. below the top of the concrete curb, and the depth of water was 35 or 36 ft. It was reported that in the summer of 1931, on a day when considerable water was used, the water level was lowered 11 ft.; and on the following day, it had raised 10 ft. The level for the day before pumping was not reported.

Analysis of a sample (Lab. No. 70857), collected on May 4, 1932, showed the water to have a hardness of 26.1 gr. per gal., a mineral content of 667.4 ppm., and an iron content of 4.0 ppm.

In 1934 because the hardness and iron content of the water was becoming more and more unsatisfactory to the public, efforts were made to find another source of supply. Layne North Central Co. drilled a number of test holes about 1 1/2 mi. south of town.

A well was drilled in Mar. 1935 at a site about 1/2 mi. south of the corporation line (or approximately 2610 ft. S. and 1500 ft. E. of the N. W. corner of Section 10, T. 26 N., R. 7 E.).

The well is 114 ft. deep below a ground elevation of 675± ft. MSL. datum. The floor of the pump house is 6 ft. above the natural ground surface. The casing record is: a 30-in. outer casing extends from the pump house floor to 99 ft., and an 18-in. inner casing extends from the floor to 99 ft. below which is 25 ft. of 18-in. Layne screen, having 3/16-in. slot openings. A 12-in. gravel wall was placed around the screen.

On Apr. 8, 1935 a short production test was made by the State Water Survey. Prior to the test the pump had been operated for 5 1/2 hr. at rates exceeding 250 gpm. The non-pumping level, on starting the test, was 33 ft. 4 in. below the base plate; and after pumping 2 1/2 hr. at 245 gpm., the drawdown was 13.2 ft. On May 27, 1935 the State Water Survey made another test: The non-pumping water level was 36 ft. 6 in., and the drawdowns for different pumping rates were:

Pumping Rate gpm.	Drawdown ft.
143	8.2
200	13.5
250	17.0

In 1946 the pump assembly was overhauled by the Layne Bowler Co., Chicago. After repairs the assembly was replaced the same as originally installed, that is: 99 ft. of 6-in. column pipe; 8-stage, 8-in. Layne turbine pump, No. 7134, rated at 250 gpm. against 154 ft. of head; the overall length of the pump is 5 ft. 3 in.; 6-in. length of 6-in. suction pipe with a strainer attached; 20-hp., 1755-rpm. General Electric motor.

Analysis of a sample (Lab. No. 110,083), collected Apr. 28, 1947 after the pump had been operating 10 min., showed the untreated water to have a hardness of 19.0 gr. per gal., a residue of 358 ppm., and an iron content of 2.1 ppm.

The water is aerated and filtered for iron removal.

A sample of treated water collected Apr. 28, 1947 showed the iron content to be .03 ppm.

Consumption is estimated at 100,000 gpd.

LABORATORY NO. 110,083

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.1		Silica	SiO_2	21.8	
Manganese	Mn	0.0		Fluoride	F	0.5	
Calcium	Ca	72.1	3.61	Chloride	Cl	3.0	.08
Magnesium	Mg	35.3	2.90	Nitrate	NO_3	0.2	Tr.
Ammonium	NH_4	3.6	.20	Sulfate	SO_4	1.2	0.03
Sodium	Na	13.8	.60	Alkalinity	(as $CaCO_3$)	360.	7.20
Color		0		Hardness	(as $CaCO_3$)	326.	6.52
Odor		0		Residue		358.	
Turbidity		10					
Temperature 53° F.							

FORRESTON
Ogle County
Nov. 20, 1947

The village of Forreston (992) established a public water supply in 1894.

Water is obtained from a well drilled to a depth of 300 ft. in 1894 and located at the intersection of Front St. and Walnut St. (or approximately 200 ft. S. and 2600 ft. W. of the N. E. corner of Section 16, T. 25 N., R. 8 E.). The surface elevation is 920t ft.

The well is 8 in. in diameter through the glacial drift from the surface to 40 ft., and 6 in. in diameter through limestone from 40 to 300 ft.

Water is pumped by air lift with 200 ft. of air pipe and 200 ft. of 1 1/4-in. eductor pipe. On Nov. 20, 1947, the non-pumping water level was estimated to be 25 or 30 ft. below the ground surface.

Analysis of a sample (Lab. No. 112,650) collected Nov. 20, 1947 after 2-hr. pumping showed this water to have a hardness of 24.8 gr. per gal., a residue of 530 ppm.,and no iron content.

Pumpage is estimated to be 45,000 gpd.

LABORATORY NO. 112,650

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.0		Silica	SiO_2	22.6	
Manganese	Mn	Tr.		Fluoride	F	0.1	
Calcium	Ca	99.5	4.98	Chloride	Cl	42.0	1.18
Magnesium	Mg	42.7	3.51	Nitrate	NO_3	22.7	0.37
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	75.7	1.58
Sodium	Na	23.0	1.00	Alkalinity	(as $CaCO_3$)	318.	6.36
Turbidity		Tr.		Hardness	(as $CaCO_3$)	425.	8.49
Color		0		Residue		530.	
Odor		0		Temperature	51.8° F.		

FOX LAKE
Lake County
Sept. 11, 1946

The installation of a public water supply was completed by the village of Fox Lake (1110) early in 1928.

Water is obtained from 2 wells located about 175 ft. north of the Chicago, Milwaukee. & St. Paul R. R. station and 500 ft. east of the railroad track.

Well No. 1 was drilled to a depth of 945 ft. in 1928 by W. L. Thorne & Co., Des Plaines. It is located about 60 ft. north of the center of Ernest Ave. and 90 ft. west of the center of Grace Ave. (or approximately 700 ft. S. and 700 ft. W. of the N. E. corner of Section 9, T. 45 N., R. 9 E.). The elevation at the g round surface is 770i ft.

The well was drilled as a 12-in. hole from the surface to a depth of 545 ft., and the balance or lower 400 ft. as a 10-in. hole. It is cased with 12-in. pipe from the surface to a depth of 255 ft. and 10-in. pipe between the depths of 237 and 545 ft. The lap between the 2 sizes of casing was filled with a lead packer.

The well is reported to have a "dog-leg" limiting the setting of the pump. The present pump installation, placed in 1937, consists of 200 ft. of 5-in. column pipe; 8-in., 12-stage Sterling turbine pump rated at 200 gpm. against 325 ft. of head; the overall length of the pump is 6 ft. 10 3/16 in.; 10 ft. of 5-in. suction pipe with a 5-in. tapered strainer, 13 in. long; 25-hp. U. S. electric motor.

When pumped with the above equipment the well produced 240 gpm. at ground level and delivered 200 gpm. to the elevated storage tank.

Before the turbine pump was installed, the old Keystone pump rode required frequent replacements at which times water levels were reported to be 40 ft. below the pump base.

This well has not been in service since 1943 but is held as an emergency supply unit.

Analysis of a sample (Lab. No. 62540) collected Sept. 11, 1928, showed this water to have a hardness of 18.5 gr. per gal., a residue of 336 ppm., and an iron content of 0.6 ppm.

Well No. 2 was drilled to a depth of 135 ft. by Ray Feuerborn, Batavia, in 1941. It is located 13 ft. south of Well No. 1 and has practically the same elevation at the ground surface. The well is cased from the surface to a depth of 119 ft. with 16-in. pipe below which it has 16 ft. of 15-in. diameter No. 30 slot Johnson brass screen.

A production test was made by the State Water Survey on Aug. 12, 1941. The depth to water before starting the pump was 35 3/4 ft. below the top of the well casing. After 2 1/2-hr. pumping at 284 gpm., the drawdown was 4 1/4 ft. Pumping was continued at a rate of 281 gpm. to the end of the 4-hr. test with no additional drawdown. A recovery in the water level of 3 3/4 ft. was reported 5 min. after the pump was stopped.

Sample-study log of Well No. 1 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Sand and gravel	20	20
Silt and glacial till	40	60
Sand and gravel	175	235
"Hardpan"	10	245
Silurian system		
Niagaran-Alexandrian dolomites	100	345
Maquoketa shale, some dolomite	150	495
Galena-Platteville and Glenwood formations		
Dolomite	303	798
Dolomite, thin shale beds	12	810
St. Peter formation		
Sandstone	90	900
Conglomerate of sandstone, chert and shale	20	920
No record	25	945

The existing pump installation, made in Aug. 1941, consists of 100 ft. of 5-in. column pipe; 10-in., 7-stage Sterling turbine pump, No. S 3901; the overall length of the pump is 5 ft.; 10 ft. of 5-in. suction pipe fitted with a strainer 1 ft. long; 100 ft. of air line (now defective); 40-hp. U. S. electric motor.

Although selected gravel was worked around the well through 4 pilot wells, spread equally about the well at 3-ft. radii, the pump has been bringing up fine sand which is carried through the distribution system and clogs the meters. During the drilling of Well No. 1, a deposit of quicksand was encountered between the depths of 125 and 155 ft. below the surface. This well has furnished the entire water supply since 1943.

Analysis of a sample (Lab. No. 107,552) collected Aug. 30, 1946 after 4-hr. pumping at 284 gpm., showed this water to have a hardness of 22.6 gr. per gal., a residue of 402 ppm., and an iron content of 0.9 ppm.

Two iron removal units, having a capacity of 8,000 to 10,000 gal. per hr. each, were installed June 9, 1946. The water receives no other treatment.

A sample collected Aug. 30, 1946 from a tap in the Village Hall was found to have 0.04 ppm. of iron content.

The 2 wells supply the entire public demand, and the Chicago, Milwaukee, and St. Paul R. R. There is no record of metered pumpage, which reaches its peak during summer demands. It is estimated that the average pumpage is 125,000 gpd. which varied from an average winter minimum of 110,000 gpd. to an average summer maximum of 175,000 gpd.

LABORATORY NO. 107,552

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.9		Silica	SiO_2	26.9	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	85.1	4.26	Chloride	Cl	10.0	0.28
Magnesium	Mg	42.2	3.47	Nitrate	NO_3	0.4	Tr.
Ammonium	NH_4	0.0	0.0	Sulfate	SO_4	30.6	0.64
Sodium	Na	5.3	0.23	Alkalinity (as $CaCO_3$)		352.	7.04
Color		0		Hardness (as $CaCO_3$)		387.	7.74
Odor		0		Residue		402.	
Turbidity		20		Temperature 51.6° F.			

FOX RIVER GROVE
McHenry County
July 23, 1947

A public water supply was installed by the village of Fox River Grove (693) in 1928.

Water is obtained from a well located in the public park bounded by the thoroughfares known as Beach Way and River Way (approximately 450 ft. N. and 1650 ft. W. of the S. E. corner of Section 18, T. 43 N., R. 9 E.). This well was drilled in 1928 to a depth of 145 ft. by W. L. Thorne, Des Plaines, and completed. The ground elevation is 738t ft. The well is cased to rock at a depth of 102 ft. with 13-in. od. pipe and is 12 in. in diameter at the bottom. Several 6-hr. production tests were made soon after the completion of the well which indicated a capacity of 210 gpm. with a drawdown of 22 ft. from a non-pumping water level of 6 ft. below the top of the well. On July 1, 1947, the water level was 9 ft. below the pump base after a 3-hr. idle period and was 32 ft. after 30-min. pumping at 250 gpm.

The existing pump installation, made in Sept. 1944, is 80 ft. of 5-in. column pipe; 8-in., 7-stage American Well Works turbine pump, Shop No. 70615, having a rated capacity of 250 gpm. against 210 ft. of head; 10 ft. of 5-in. suction pipe; 80 ft. of 1/4-in. gi. air line; 20-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 110,887) collected July 1, 1947 after 40-min. pumping at 250 gpm. showed this water to have a hardness of 21.4 gr. per gal., a residue of 415 ppm., and an iron content of 0.3 ppm.

The estimated average pumpage is 40,000 gpd. which varies from a minimum average of 30,000 gpd. in the winter to a maximum average of 60,000 gpd. for the summer.

LABORATORY NO. 110,887

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.3		Silica	SiO_2	21.4	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	80.6	4.03	Chloride	Cl	10.0	0.28
Magnesium	Mg	40.4	3.32	Nitrate	NO_3	0.7	0.01
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	81.5	1.69
Sodium	Na	6.9	0.30	Alkalinity	(as $CaCO_3$)	284.	5.68
Turbidity		10+		Hardness	(as $CaCO_3$)	368.	7.35
Color		0		Residue		415.	
Odor		0		Free CO_2 (calc.)		21.	
Temperature 51.5° F.				pH = 7.55			

FRANKFORT
Will County
Oct. 26, 1946

A public water supply was installed by the village of Frankfort (568) about 1905.

Water is obtained from a well 165 ft. deep located about 75 ft. north of Kansas St. at the north end of Hickory St. (or approximately 150 ft. S. and 4400 ft. E. of the N. W. corner of Section 28, T. 35 N., R. 12 E.). The elevation of the ground surface is 762± ft;

The well is reported to be cased with 8-in. pipe into limestone and to penetrate 102 ft. of drift, 20 ft. of limestone, and a hard blue rock in the lower 43 ft.

On Dec. 22, 1931, the depth of the well measured 156 ft., and the distance to water 64 ft., both measurements from the top of casing which is about 5 ft. below the ground surface.

The pump installation, made on Dec. 22, 1931, is as follows: 96 ft. of 5-in. column pipe; 8-in., 13-stage Deming turbine pump rated at a capacity of 240 gpm. against 210 ft. of head; the overall length of the pump is 8 ft. 5 in.; 10 ft. of 5-in. suction pipe; 20-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 107,859), collected Oct. 4, 1946 after 40-min. pumping at 240 gpm., showed this water to have a hardness of 26.6 gr. per gal., a residue of 495 ppm., and an iron content of 1.1 ppm.

The water used for the public supply is not treated.

The estimated average pumpage is 30,000 gpd.

The Elgin, Joliet, & Eastern R. R. obtains its water supply from a well 365 ft. deep located approximately 2800 ft. north and 250 ft. west of the southeast corner of Section 28, T. 35 N., R. 12 E. The elevation at the ground surface is 765i ft. The well is reported to be cased from the surface to a depth of 125 ft. with 16-in. diameter casing below which it has a 12-in. diameter. Limestone was encountered at a depth of 120 ft.

A non-pumping water level of 64 ft. and a pumping water level of 73 ft., both below the pump base, were reported in Sept. 1943.

The estimated average pumpage is 125,000 gpd. which varies from a minimum of 75,000 gpd. to a maximum of 225,000 gpd.

Another well, reported to be the original well, is located about 15 ft. east of the 365-ft. well. It was drilled to a depth of 203 ft. 4 in. and is cased from the surface to a depth of 136 ft. with 8-in. diameter pipe. The distance to water below the top was reported to be 90 ft. in 1932, and the capacity of the well is 50 gpm. It is equipped with a hand pump and is used for drinking purposes.

LABORATORY NO. 107,859

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.1		Silica	SiO_2	21.8	
Manganese	Mn	0.0		Fluoride	F	0.4	
Calcium	Ca	101.2	5.06	Chloride	Cl	7.0	0.20
Magnesium	Mg	49.4	4.06	Nitrate	NO_3	0.0	0.00
Ammonium	NH_4	0.5	0.03	Sulfate	SO_4	89.5	1.86
Sodium	Na	6.2	0.27	Alkalinity (as $CaCO_3$)		368.	7.36
Turbidity		Tr.		Hardness (as $CaCO_3$)		456.	9.12
Color		0		Residue		495.	
Odor		0		Free CO_2 (calc.)		77.	
Temperature		51.4° F.		pH = 7.1			

FRANKLIN GROVE
Lee County
Dec. 11, 1947

The public water supply system for the village of Franklin Grove (645) was installed in 1902.

Water is obtained from a well drilled in 1902 to a depth of 298 ft. by E. R. Chitty, Milledgeville, and located in the center of the business district on the north side of South St. between Elm and Walnut St. (or approximately 1375 ft. S.and 1330 ft. E.of the S. W. corner of Section 1, T. 21 N., R. 10 E.). The surface elevation is 810± ft.

Correlated driller's log of well drilled in 1902 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Glacial drift	30	30
Ordovician system		
Plateeville (?), St. Peter (?), Shakopee, New Richmond, and Oneota formations		
Rock	268	298

The well was cased with 10-in. pipe to a depth of 60 ft. below which the diameter of the hole is not known. In 1923, the pump cylinder was reported to be wedged in a 6-in. casing at a depth of 75 ft.

The pump installation, made in 1947, is 100 ft. of 5-in. column pipe; 11-stage, water-lubricated, American Well Works turbine pump, No. 72532; overall length of pump is 8 ft.; 20 ft. of 5-in. suction pipe; 100 ft. of 1/4-in. air line; 15-hp. U. S. electric motor, No. 534234.

In Oct. 1923, the non-pumping water level was reported to be 30 ft. below the ground surface, and the production was estimated at 100 gpm. In June, 1947, the non-pumping water level was 35 ft. below the top of the well and in Dec, 1947, the water level was 20 ft. below the pump base.

Analysis of a sample (Lab. No. 112,905) collected Dec. 11, 1947, showed water from this well to have a hardness of 25.8 gr. per gal., a residue of 493 ppm., and an iron content of 1.2 ppm.

In 1923 or 1924 a new well was drilled about 50 ft. north of the old well. This well is 10 in. in diameter and 150 ft. deep. It is equipped as follows: 83 ft. of 8-in. column pipe; 7 1/2-in. by 24-in. double-acting American Well Works cylinder pump having an overall length of 5 ft. 8 in.; 11 ft. 5 in. of 6-in. suction pipe; 20-hp. Fairbanks-Morse gasoline engine operating at 300 rpm.

In Apr. 1938, the non-pumping water level was reported to be 31 ft. below the ground surface.

This well is maintained for emergency use.

Analysis of a sample (Lab. No. 83973) collected July 26, 1938, showed water from Well No. 2 to have a hardness of 27.9 gr. per gal., a residue of 514 ppm., and an iron content of 1.1 ppm.

P.E.Millis, Byron, worked on both wells during the winter of 1937-1938.

In Dec. 1947, pumpage was estimated at 30,000 gpd.

LABORATORY NO. 112,905

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.2		Silica	SiO_2	19.0	
Manganese	Mn	0.1		Fluoride	F	0.1	
Calcium	Ca	103.8	5.19	Chloride	Cl	19.0	0.54
Magnesium	Mg	44.6	3.66	Nitrate	NO_3	1.4	0.02
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	91.1	1.90
Sodium	Na	9.4	0.41	Alkalinity	(as $CaCO_3$)	340.	6.80
Turbidity		Tr.		Hardness	(as $CaCO_3$)	443.	8.85
Color		0		Residue		493.	
Odor		0					

FREEPORT
Stephenson County
Dec. 10, 1948

The public water supply for the city of Freeport (22,366) was installed by the Freeport Water Co. in 1882. The city purchased the system in 1937.

Water was first obtained from a spring flowing from a bluff near the river on the north edge of town. When this supply became inadequate, water was pumped directly from the Pecatonica River for some years.

Since about 1890, nearly all the supply has come from wells. Between 1890 and 1915, twenty-five wells were drilled in a line north of the filter house, and extending westward a distance of about 300 ft. The filter house and pumping station are located north of the Illinois Central R. R. and near the end of Brick St. (or approximately 950 ft. N. and 1300 ft. E. of the S. W. corner of Section 30, T. 27 N., R. 8 E.). The surface elevation is 760± ft. These wells ranged in depth from 35 to 45 ft. and from 2 1/2 to 8 in. in diameter. They were all connected to a 16-in. pipe leading to the pump.

These wells penetrated from 30 to 40 ft. of drift and from 5 to 10 ft. of limestone below which the drills dropped about 2 ft. and entered a layer of coarse, water-bearing sand and gravel. The wells penetrated only to the base of the limestone and took the water from the natural reservoir between the stone and the drift.

In 1912 water was pumped from the wells to the purification plant by 2 duplex, tandem compound steam pumps. One was a Snow pump, rated at 1300 gpm. installed in 1903. The other was an Epping-Carpenter pump, rated at 2100 gpm. installed in 1912.

There is no available information on the yield of these wells except that in 1915 there was sufficient capacity to supply a maximum demand of over 2 mgd.

Analysis of a sample (Lab. No. 53373) collected Mar. 16, 1925, showed water from the shallow wells to have a hardness of 17.8 gr. per gal., a residue of 380 ppm., and an iron content of 0.8 ppm.

All 25 of the shallow wells had been abandoned and plugged by 1931. The casings had been pulled.

A well, known as Well No. 1, was drilled in 1900 and was located about 50 ft. north of the plant. The well was 265 ft. deep and was 8 in. in diameter at the top and 6 in. at the bottom. It was cased to a depth of 150 ft. into hard limestone. Sandstone was encountered from 165 to 265 ft.

In 1920 the well was equipped with an air lift having 140 ft. of air pipe. By 1931, this well was out of service and was later plugged and abandoned.

Analysis of a sample collected July 19, 1909, showed water from this well to have a hardness of 20.2 gr. per gal., a residue of 356 ppm., and an iron content of 0.3 ppm.

Well No. 2 was drilled in 1914 by P.E.Millis, Byron and located at the west end of the line of shallow wells, 450 ft. west of Well No. 4, (or approximately 1000 ft. N. and 600 ft. E.-of the S. W. corner of Section 30). The well is 303 ft. deep and 16 in. in diameter. The elevation of the top of the well is 765± ft.

The pump assembly now consists of 60 ft. of 10-in. column pipe; 16-in., 2-stage Sterling turbine pump No. S-573, having an overall length of 3.41 ft.; 21 ft. of 10-in. suction-pipe; 30-hp. General Electric motor, full load speed, 1150 rpm.

LABORATORY NO. 112,588

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.6		Silica	SiO_2	21.8	
Manganese	Mn	0.1		Fluoride	F	0.1	
Calcium	Ca	108.0	5.40	Chloride	Cl	45.0	1.27
Magnesium	Mg	53.3	4.38	Nitrate	NO_3	21.2	0.34
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	104.5	2.18
Sodium	Na	13.1	0.57	Alkalinity (as $CaCO_3$)		328.	6.56
Turbidity		10-		Hardness (as $CaCO_3$)		489.	9.78
Color		0		Residue		556.	
Odor		0		Temperature 50.5° F.			

In Apr. 1947 when pumping at a rate of about 1130 gpm. the drawdown was 18 ft. from a non-pumping water level of 25 ft. below the top of the well.

Analysis of a sample (Lab. No. 112,588) collected Nov. 14, 1947 after 1-hr. pumping at 1130 gpm., showed the water to have a hardness of 28.5 gr. per gal., a residue of 556 ppm., and an iron content of 0.6 ppm. Previous analyses of samples from this well showed the hardness to have increased from 370 ppm. in 1920 to 472 ppm. in 1945 indicating a decreasing proportion of the water to be of St. Peter sandstone origin.

Well No. 3 was drilled in 1921 by P. E. Millis and located 40 ft. east of the pump house (or approximately 1000 ft. N. and 1370 ft. E. of the S. W. corner of Section 30). Well No. 3 is 370 ft. east of Well No. 4 and was originally 503 ft. deep below an elevation of 764± ft. Later the well was "shot" to increase the yield, but is still about 500 ft. deep.

Sample-study log of Well No. 3 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Silt	34	34
Ordovician system		
Galena-Platteville dolomites	96	130
Glenwood dolomite and sandstone	18	148
St. Peter formation		
Sandstone, incoherent	262	410
Sandstone, partly incoherent, and chert	90	500
Cambrian system		
Trempealeau dolomite	3	503

The original hole and casing record was as shown in Table 1.

TABLE 1

Hole Record

16-in. hole from surface to 400 ft.
8-in. hole from 400 to 503 ft.

Casing Record

16-in. pipe from surface to 60 ft.
10-in. pipe from surface to the sand.

The well is to be bridged, cleaned, and recased as soon as work is completed on Well No. 4.

Pump equipment consists of 60 ft. of 12-in. column pipe; Aurora single-stage turbine rated at 2000 gpm. at 1750 rpm.; 15 ft. of 12-in. suction pipe; overall length of pump is 3.2 ft.; powered by 60-hp. General Electric motor. No air line.

In 1921 when pumping at a rate of 1500 gpm. the drawdown was 92 ft. from a non-pumping water level of 20 ft. In 1947, when pumping at 2000 gpm., the drawdown was 15 ft. from a non-pumping water level of 25 ft.

Analysis of a sample (Lab. No. 89227) collected Nov. 6, 1940, showed this water to have a hardness of 23.5 gr. per gal., a residue of 432 ppm., and an iron content of 1.2 ppm.

Well No. 4 was drilledby the Ohio Well Drilling Co. in 1928 and located near the pumping station (or approximately 1000 ft. N. and 1050 ft. E. of the S.W. corner of Section 30). The well was 100 ft. deep but is now being drilled deeper and recased by the J. P. Miller Artesian Well Co.

In Nov. 1947 the well had been deepened to

LABORATORY NO. 112,962

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.6		Silica	SiO_2	7.6	
Calcium	Ca	61.6	3.08	Fluoride	F	0.0	
Magnesium	Mg	36.3	2.98	Chloride	Cl	1.0	0.03
Ammonium	NH_4	Tr.	Tr.	Nitrate	NO_3	0.2	Tr.
Sodium	Na	6.0	0.26	Sulfate	SO_4	10.1	0.21
Turbidity		Tr.		Alkalinity (as $CaCO_3$)		304.	6.08
Color		0		Hardness (as $CaCO_3$)		303.	6.06
Odor		0		Residue		310.	

446 ft. and cased with 24-in. pipe to sandstone with 160 ft. of 16-in. casing inside the 24-in. casing. The annular space between the casing and the 24-in. hole was filled with cement.

A new pump is to be installed.

Analysis of a sample (Lab. No. 112,962) collected Nov. 13, 1947, showed this water to have a hardness of 17.7 gr. per gal., a residue of 310 ppm., and an iron content of 0.6 ppm. The depth of the well, at this time was 446 ft. This water appears to be typical of water from the St. Peter sandstone and similar to that obtained from the wells when this sandstone was first penetrated.

All water is chlorinated and treated for iron removal.

Analysis of a sample (Lab. No. 112,580) collected Nov. 14, 1947 showed the treated water to have a hardness of 23.3 gr.per gal., a total mineral content of 400 ppm., and no iron content.

Pumpage for 1947 averaged 2.0 mgd.

A public water supply was installed by the city of Fulton (2585) about 1887, and the water works system is owned and operated by the city.

Water was first obtained from a well located a few feet from the pumping station at the southeast corner of 4th St. and 13th Ave. It was drilled in 1890 by J. P. Miller Artesian Well Co., Brookfield, to a depth of 1246 ft. below a ground surface elevation of 595± ft. The well was cased with 6-in. pipe to a depth of 160 ft. below which the diameter of the hole was 5 in.

Leverett, in his "Illinois Glacial Lobe" published in 1899, stated: "A flow of sulphurous water was struck at about 475 ft. Another flow was obtained from the Potsdam at 940 to 1050 ft. The head is sufficient to carry the water 60 ft. above the surface. The estimated capacity is 300 gpm." Later, the free flow decreased, and in 1913 water was obtained by pumping. The production was about 100 gpm.

The well was subsequently abandoned, and in 1938 was reported to have been filled in.

Well No. 2 was drilled in 1908 by Mr. Shaw, Sioux City, Iowa, and located about 300 ft. west of the pumping station (or approximately 2360 ft. N. and 4330 ft. W. of the S. E. corner of Section 28, T. 22 N., R. 3 E.). It was 1260 ft. deep and cased with 8-in. pipe to a depth of 337 ft. The elevation of the top of the well is 600t ft.

The pumping equipment was replaced in 1939 by 80 ft. of 4-in. column pipe; 8-in., 2-stage American Well Works turbine pump, No. 62841, Size 8 MC, rated at 350 gpm. against 60 ft. of head at 1750 rpm.; 20 ft. of 4-in. suction pipe; 80 ft. of air line; 7 1/2-hp. electric motor.

In 1908, the free flow was 270 gpm.; in 1912 was 80 gpm., and in 1919 was 44 gpm. The free flow stopped about 1923. In 1919 the pump discharge was 1090 gpm. at 74 psi. pressure and in 1938 the production was about 750 gpm. In Oct., 1947, the non-pumping water level was 30 ft. below the top of the well, and when pumping at 350 gpm., the drawdown was 35 ft.

Analysis of a sample (Lab. No. 112,156) collected Oct. 8, 1947 after pumping 1 hr. at 200 gpm. showed this water to have a hardness of 16.2 gr. per gal., a residue of 308 ppm., and an iron content of 0.1 ppm.

Well No. 3 is located in the new pump house (or approximately 2280 ft. N. and 3980 ft. W. of the S. E. corner of Section 28). The well was completed by Jos. Egerer, Milwaukee, Wis., in May 1931 to a depth of 1943 ft. below a ground elevation of 600± ft.

The hole and casing record is as shown in Table 1.

TABLE 1

Hole Record

15-in. from 191 ft. 9 in. to 345 ft.
12-in. from 345 to 760 ft.
10-in. from 760 to 1943 ft.

Casing Record

16-in. casing from 0 to 191 ft. 9 in.
12 1/2-in. casing from 191 ft. 9 in. to 357 ft. 5 in.
10-in. wi. liner from 654 1/2 to 760 ft.

The original air lift pumping equipment was replaced in 1939 by: 90 ft. of 6-in. column pipe;

LABORATORY NO. 112,156

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	12.3	
Manganese	Mn	0.0		Fluoride	F	0.4	
Calcium	Ca	59.6	2.98	Chloride	Cl	5.0	0.14
Magnesium	Mg	31.0	2.55	Nitrate	NO_3	2.2	0.04
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	22.0	0.46
Sodium	Na	1.6	0.07	Alkalinity	(as $CaCO_3$)	248.	4.96
Turbidity		Tr.		Hardness	(as $CaCO_3$)	277.	5.53
Color		0		Residue		308.	
Odor		0		Temperature 58° F.			

Sample-study log of Well No. 3 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
No record	100	100
Clay	10	110
Sand, gravel at top	50	160
Clay	10	170
Sand	20	190
Ordovician system		
Maquoketa shale and dolomite	152	342
Galena-Platteville dolomites	330	672
Glenwood shale and sandstone	18	690
St. Peter formation		
Sandstone, incoherent	50	740
Shale, sand, and chert	15	755
Shakopee, New Richmond and Oneota dolomites, thin sandstone beds	415	1170
Cambrian system		
Trempealeau dolomite	160	1330
Franconia sandstone	100	1430
Galesville sandstone		
Sandstone, partly dolomitic	50	1480
Sandstone, incoherent	50	1530
Sandstone, dolomitic	20	1550
Eau Claire sandstone, thin shale beds	260	1810
Eau Claire and Mt. Simon (?) sandstones, incoherent	133	1943

10-in., 2-stage American Well Works turbine pump, No. 62842, Size 10 MC, rated at 500 gpm. at 60 ft. head at 1755 rpm.; 90 ft. of air line; 20 ft. of 6-in, suction pipe; 10-hp. General Electric motor. Turbine is equipped with Johnson right-angle drive connected to a gasoline engine for emergency use.

When the well was completed, the head was 15 ft. above the surface, and the free flow at the surface was estimated to be 200 gpm. In 1938, the production rate from this well was about 600 gpm., and the combined production rate from Wells No. 2 and 3 was 1300 to 1400 gpm. In Oct., 1947 the non-pumping water level was 45 ft. below the pump base and when pumping at about 500 gpm. the drawdown was 30 ft.

Analysis of a sample (Lab. No. 83702) collected June 7, 1938, showed the water from this well to have a hardness of 16.3 gr. per gal., a residue of 333 ppm., and an iron content of 0.44 ppm.

The water is not treated.

Average pumpage for the year 1946 was 92,250 gpd. Average pumpage for Aug., 1947 was 122,544 gpd.

GALENA
Jo Daviess County
Dec. 24, 1946

The Galena Water Works was originally installed in 1886 by a private company and operated under a franchise until 1918 when purchased by the city of Galena (4126).

The initial supply was obtained from a well drilled in 1886 located at the northeast corner of Park Ave. and Bouthillier St. Since then, the city has drilled 2 more wells at this location and a fourth well in Grant Park about 410 ft. northeast of the original well. These wells have all been flowing wells and range in depth from 1513 to 1575 ft.

. Water is pumped by 2 Pomona turbine pumps installed in Aug. 1942 which are powered by 30-hp. Westinghouse electric motors. No. S. B. 319 is a 10-in., 6-stage turbine pump rated at a capacity of 485 gpm. against 221 ft. of head, having an overall length of 4 ft. 3 in., and is attached to 10 3/4 in. of 7-in. od. column pipe. No. S. B. 320 is a 10-in., 8-stage turbine pump rated at a capacity of 350 gpm. against 221 ft. of head, having an overall length of 7 1/2 ft., and is attached to 1 ft. 3 in. of 6-in. column pipe. These turbines are mounted on concrete foundations about 3 ft. above ground level and are set in 10-in. stand-pipes having connections to a 10-in. suction line from the aerator pit. All wells also have pipe connections to the turbine suction line and may be pumped independently of the aerator free flow pits. The waste outlet from the aerator is 2 ft. above the pump bases. On Dec. 2, 1946 these turbines were operated at a combined discharge rate of 628 gpm. against a pressure of 92 lb.

Well No. 1 was drilled in 1886 at the pumping station site at the northeast corner of Park Ave. and Bouthillier St. (or approximately 1380 ft. S. and 165 ft'. E. of the N. W. corner of fractional Section 20, T. 28 N., R. 1 E.).

The well was drilled to a depth of 1530 ft. below a ground surface elevation of 620± ft., and was cased to rock at 60 ft. with 12-in. pipe. An artesian flow of 480 gpm. was reported when the well was drilled, and about 1896 a valve placed on the discharge pipe forced the water through a vertical pipe about 32 ft. above the ground surface. The water company records gave the flow as 450 gpm. in 1916, and in 1918 it was 250 gpm. The casing had deteriorated, and water was escaping through and around the casing into other outlets. In July 1922 new casing was placed by C. W. Varner, Dubuque, Iowa, to a depth of 260 ft. with 6-in. pipe, coated on both sides with asphalt and with a rubber packer at the bottom of the casing. Because of the roughness of the hole, the 6-in. casing could not be set deeper. A 5-in. casing was set between depths of 260 and 475 ft. to prevent caving, and the hole was cleaned to a depth of 1547 ft. In 1933 the casing was pulled, treated again, and re-installed. At that time very little corrosion was noticed.

In Mar. 1937 the artesian flow was reported to be 275 gpm., and in Aug. 1938 it was 175 gpm. A check of the flow from the well through the aerator made after Well No. 3 was completed in 1939 showed a rate of 39 gpm. The well has been abandoned and is plugged with concrete at a depth of 700 ft. and filled to the surface.

Analysis of a sample (Lab. No. 79690) collected Mar. 12, 1937, showed the water from Well No. 1 to have a hardness of 14.0 gr. per gal., a residue of 244 ppm., and an iron content of 0.4 ppm.

Well No. 2 was drilled by W. L. Thorne, Des Plaines, in 1923 on the pumping station site about 85 ft. westerly from Well No. 1 at a ground elevation of 607± ft. The well was drilled to a depth of 1513 ft. and cased to 65 ft. with 16-in. pipe, with 10-in. pipe from the surface to 150 ft., and finished as an 8-in. hole. The annular space outside the 10-in. casing was cement grouted from the surface to 150 ft. In 1933 a new 8-in. casing was set within the old casings from the surface to 448 ft., and the annular space outside the 8-in. casing was filled with cement.

The well began to flow at a rate of 2 gpm. at a depth of 400 ft. after penetrating the St. Peter sandstone. The day after a depth of 720 ft. was reached, the flow measured 175 gpm. When a depth of 1370 ft. was reached, the flow was 475 gpm. There was no appreciable increase in flow below a depth of 1370 ft. and none below a depth of 1445 ft. where the flow was 560 gpm. The various rates of flow reported during its construction may have been influenced by the flow in Well No. 1 located about 80 ft. east, water flowing part way up in the older well from near its bottom and then through the porous strata into the new well.

In Mar. 193 7 the artesian flow was 635 gpm., and in Aug. 1938 it was 500 gpm. An artesian flowof 334 gpm. through the aerator was reported in a check made after Well No. 3 was completed in 1938. During 1946 the free flow to the aerator was estimated not to exceed 100 gpm. The well is still in service.

Well No. 3 was completed in 1938 by Varner Well Drilling Co., Dubuque, Iowa, to a depth of 1575 ft. and located about 20 ft. northeasterly from Well No. 1 (or approximately 1380 ft. S. and 185 ft. E. of the N. W. corner of fractional Section 20). The ground surface elevation is 610± ft.

The hole diameter and casing record is shown in Table 1.

TABLE 1

Hole Record

25-in. from 60 to 475 ft.
23-in. from 475 to 508 ft.
19-in. from 508 to 520 ft.
12-in. from 520 to 1575 ft.

Casing Record

26-in. wrought-iron drive pipe from 0 to 60 ft.
20-in. liner from 414 to 508 ft.
12-in. casing from +1 to 520 ft.

The annular space outside the 12-in. casing was cement grouted to 520 ft.

Analysis of a sample (Lab. No. 108,526) collected Dec. 3, 1946 from a tap at the top of the tee over the well, showed the water from Well No. 3 to have a hardness of 14.7 gr. per gal., a residue of 265 ppm., and an iron content of 0.2 ppm.

Well No. 4 was drilled to a depth of 1516 ft. by Varner Well Drilling Co. Inc., in Dec. 1942. It, is located about 20 ft. south of Van Buren St. and 71 ft. west of the center of Park Ave. (or approximately 1050 ft. S. and 135 ft. E. of the N. W. corner of Section 20). The elevation of the ground surface is 610t ft.

The hole and casing diameter record is shown in Table 2.

TABLE 2

Hole Record

33-in. from 102 to 526 ft.
25-in. from 526 to 596 ft.
20-in. from 596 to 1516 ft.

Casing Record

42-in. wi. drive pipe from surface to 102 ft.
30-in. liner from 367 to 477 ft.
26-in. liner from 477 to 526 ft.
20-in. casing from surface to 596 ft.

The annular space outside the 20-in. casing was cement grouted.

The driller's record reports a flow over the top of the well on June 1, 1942 when penetrating the sandstone between depths of 742 and 762 ft., which increased when a depth of 1469 ft. was reached. At the latter depth, the water flowed out of a pipe 3 ft. 2 in. above the ground surface. The records do not indicate the rate of this free flow from the well, but it is reported that a check was made on Dec. 24, 1942 of the total flow of all wells (No. 2, 3, and 4) into the aerator pits. At that time both pumps were adjusted to pump all of the water except a little which flowed to waste. The pump discharge meter indicated a pumping rate of 680 gpm., and the waste was estimated to be about 15 gpm.

Analysis of a sample (Lab. No. 108,527) collected Dec. 3, 1946 from a tap on the 10-in. pipe about 430 ft. from the well, showed this water to have a hardness of 16.1 gr. per gal., a residue of 269 ppm., and an iron content of 0.5 ppm.

LABORATORY NO. 108,526

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.2		Silica	SiO_2	11.8	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	49.0	2.45	Chloride	Cl	1.0	.03
Magnesium	Mg	31.6	2.61	Nitrate	NO_3	3.9	.06
Ammonium	NH_4	0.1	.01	Sulfate	SO_4	18.5	.39
Sodium	Na	3.0	.13	Alkalinity (as $CaCO_3$)		236.	4.72
Color		0		Hardness (as $CaCO_3$)		253.	5.06
Odor		0		Residue		265.	
Turbidity		Tr.		Free CO_2 (calc.)		82.	
Temperature		57.6° F.		pH = 6.85			

Sample-study log of Well No. 4 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Silt	58	58
Gravel	12	70
Gravel and clay	10	80
Gravel	7	87
Ordovician system		
Platteville dolomite	45	132
Glenwood shale	8	140
St. Peter formation		
Sandstone	295	435
Shale and sandstone	65	500
Oneota chert	18	518
Cambrian system		
Jordan sandstone	52	570
Trempealeau dolomite	87	657
Franconia shale and sandstone	88	745
Galesville sandstone		
Sandstone, partly dolomitic	30	775
Sandstone, incoherent	85	860
Eau Claire formation		
Sandstone, partly dolomitic and shaly	196	1056
Sandstone and dolomite	137	1193
Sandstone, incoherent	52	1245
Mt. Simon sandstone	90	1335
Pre-Cambrian system		
Fond du Lac sandstone, some shale	180	1515

A 3-tray aluminum aerator built in 1938 was used until Apr. 1, 1946. The water now flows from the wells to a riser pipe about 13 ft. above the bottom of the aerator pit into a baffled chamber from which it passes through 3 other baffled chambers to waste when not pumping. It is estimated that about 15 gpm. will flow to waste when the pumps are operating.

Table 3 is a record of metered pumpage.

LABORATORY NO. 108,527

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.5		Silica	SiO_2	11.8	
Manganese	Mn	0.0		Fluoride	F	0.2	
Calcium	Ca	48.9	2.45	Chloride	Cl	1.0	.03
Magnesium	Mg	31.2	2.57	Nitrate	NO_3	2.6	.04
Ammonium	NH_4	0.1	.01	Sulfate	SO_4	19.5	.41
Sodium	Na	3.9	.17	Alkalinity (as $CaCO_3$)		236.	4.72
Color		0		Hardness (as $CaCO_3$)		251.	5.02
Odor		0		Residue		269.	
Turbidity		10-		Temperature 57.2° F.			

TABLE 3

Year (Jan. 1 to Jan. 1)	Ave. G.P.D. (thousands gallons)	Remarks
1932	292	Wells No. 1 & 2
1940	423	Wells No. 2 & 3
1943	544	Wells No. 2, 3, & 4
1945	625	Wells No. 2, 3, & 4
Jan. 1-Dec. 1, 1946	608	Wells No. 2, 3, & 4

GALESBURG
Knox County
Mar. 20, 1947

A public water supply was installed by the city of Galesburg (28,876) in 1890.

Water was obtained by suction lift from wells 70 to 80 ft. deep, and located along the bank of Cedar Creek near the old water works building. Additional wells were drilled as needed until the total numbered about 80 but continued sand trouble caused the ultimate abandonment of these wells.

In 1896, two wells were drilled in the same location to depths of about 1226 ft., and water was pumped by air lift. In 1911 the water level in these wells, when there was no pumping, was reported to be 100 ft. below the surface elevation of 655± ft. At the same time there were five 8-in. wells and one 10-in. well in service. All of the wells were about 70 ft. deep. The water level in these wells, with no pumping, was about 45 or 50 ft. below the surface.

In 1921 the drift wells had not been used for years, and the sandstone wells were not being used" because their operation would not be economical.

In 1917 the water supply became insufficient, brought about largely by the delay in completing the Henderson St. No. 1 Well which had been started in 1915. The Central Fire Station Well, or Bradley No. 1 Well, was drilled and completed Dec. 1917 to a depth of 1252 ft. by Thorpe Well Drilling Co., Des Moines, Iowa. The well is located at the fire station on the east side of Cherry St., south of Simmons St. (or approximately 500 ft. S. and 1280 ft. W. of the N. E. corner of Section 15, T. 11 N., R. 1 E.).

The well was reported to be cased as given in Table 1.

TABLE 1

24-in. heavy steel pipe from the surface to 40 ft.
20-in. heavy steel pipe from 40 to 146 ft.
16-in. heavy steel pipe from 146 to 276 ft.
12-in. heavy steel pipe from 276 to 626 ft.
10-in. wrought iron pipe from 626 to 1087 ft.

The 12-in. casing was sealed to the rock and the 10-in. casing was sealed to the 12-in. and was reported to extend to within three feet of sandstone. Below the 10-in. casing, the hole was 10 in. in diameter to the bottom of the well. The elevation of the top of the casing is 772.78 ft.

The well was "shot" with two 200-lb. charges of 100% gelatin covering the entire sand-rock stratum, and the well was carefully cleaned out after the "shooting."

The well is equipped with an air lift pump with a 2 1/2-in. air pipe extending to 566 ft. below the top of the well. The discharge is seven feet above the ground.

In 1918 when a production test was made by the driller, the non-pumping water level was 186 ft. below ground level; and, while pumping at 450 gpm., the drawdown was 118 ft.

On Feb. 11, 1944, the production of the well was measured on the weir at 220-225 gpm.

The well is in service, but since 1921 it has been used principally when some of the other wells are shut down for repairs or when the demand exceeds the production from the other well. In the spring of 1944, this well was operated continuously for several months when the water supply situation became critical. The Brooks St.

LABORATORY NO. 99153

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.6		Silica	SiO_2	10.0	
Manganese	Mn	0.0		Chloride	Cl	184.0	5.19
Calcium	Ca	112.6	5.63	Nitrate	NO_3	1.6	0.03
Magnesium	Mg	53.4	4.39	Sulfate	SO_4	929.6	19.34
Ammonium	NH_4	1.6	0.09	Alkalinity	(as $CaCO_3$)	216.	4.32
Sodium	Na	431.7	18.77	Hardness	(as $CaCO_3$)	501.	10.02
Color		0		Residue		1885.	
Odor		0		pH = 7.8			
Turbidity		Tr.		Temperature 62.8° F.			

Well was being overhauled; the Henderson St. No. 2 well was being repaired; and the Florence Ave. well was under construction.

Analysis of a sample (Lab. No. 99153) collected Feb. 11, 1944 after one-half hour pumping at 225 gpm., showed the water from the Central Fire Station Well to have a hardness of 29.2 gr. per gal., a residue of 1885, and an iron content of 0.6 ppm.

This water is chlorinated at the well and pumped directly into the distribution system.

The Brooks St. Well (or Bradley No. 2) was completed about Sept. 1919 by Thorpe Well Drilling Co. to a depth of 1245 ft. and deepened to 2450 ft. by Thorpe in 1944. The well is located at the Fire Station No. 2 on East Brooks St. at Churchill St. (or approximately 2325 ft. S. and 900 ft. E. of the N. W. corner of Section 14).

When the original well was completed, it was equipped with an air lift pump with 600 ft. of three-inch air pipe. In Feb. 1944 it was reported that there was also a 1 1/2-in. air pipe entering the eductor pipe over 100 ft. below where the three-inch air pipe entered. The record is not clear whether both air pipes were included in the original installation. The purpose of the dual air pipes was intended to permit the starting of the pump with the higher level air pipe, and then continue with the lower level air pipe, making lossible a lower operating air pressure.

On Mar. 8, 1919 a production test was made by the driller. Before the test started, the water level was 190 ft. below a ground surface elevation 782.7ft.; and when pumping at 650 gpm., the drawdown was 157 ft.

In 1921 because of discharging much sand, the pump was operated for short periods only, at 10 to 15-day intervals. On May 5, 1921 the discharge from the pump was 820 gpm.

In Aug. 1932 this well was being used, with the Henderson St. Well No. 1, to supply the entire city demand, while the Henderson St. Well No. 2 was shut down for repairs. Atthattime the Brooks St. well was producing an estimated 700 gpm. but still discharging considerable sand.

In Nov. 1943 the 1 1/2-in. air pipe broke causing air and water to rise outside the eductor pipe and flood the station. Thorpe Co. was constructing the Florence Ave. well and was called in to repair the Brooks St. well. After removing the air lift equipment, it was observed that, at a depth of 60 ft., considerable water was entering the well through holes in the casing. The holes may have been made when the well was constructed in order to take advantage of the water found at that depth.

After the pump had been removed and before any repair work was undertaken, the water level was reported to be 253 ft. below the top of the 16-in. casing.

Originally the well was cased with 16-in. od. pipe from the surface to 360 ft. and with 15-in. od. pipe from 360 to 610 ft. Below the casing the hole was 14 in. in diameter. In the repair work of 1944 new casing was set as follows: 12-in. wrought-iron pipe from the surface to 319 ft. 8 in.; 10-in. wrought-iron pipe from 319 ft. 8 in. to 569 ft. 3 in. and connected to the 12-in. with a swedge nipple.

An 8-in. drive pipe was set from the surface to 1259 1/2 ft. during the deepening work after which the top 522 ft. was ripped out, cut off, and removed. From 1259 1/2 to 2450 ft. the hole is 8 in. in diameter. Cement grout was placed in the annular space between the 12-in. and the old 16-in. casing. No grout was placed outside the 8-in. casing.

When the 12 and 10-in. casing had been set, and before the deepening work was started, the inflow at the 60-ft. level was completely shut off. Two production tests, one of 48-hr. and one of 18-hr. duration, were made by the driller. With a pump setting of 400 ft., the production was reported to be 120 gpm., indicating that the higher production rate, obtained before the shut-down for repairs, had come from the upper formations. Prior to the repairs, so much sand was pumped from the well that it was necessary to construct a baffled settling basin to eliminate the sand before it could enter the distribution system.

Subsequent to the production tests, the well was deepened to 2450 ft., and the 8-in. casing was installed.

The pumping assembly, installed July 14, 1944, consists of: 350 ft. of 6-in. column pipe; 9 1/2-in. od., 10-stage American Well Works turbine pump, No. 69921, rated at 545 gpm. against 350 ft. of head; the overall length of the pump is 7.54 ft.; 350 ft. of 1/4-in. galvanized air line; 20 ft. of 6-in. suction pipe; 100-hp. U. S. electric motor, No. 337616.

LABORATORY NO. 105,249

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.1		Silica	SiO_2	12.0	
Manganese	Mn	0.0		Fluoride	F	2.5	
Calcium	Ca	72.5	3.63	Chloride	Cl	195.0	5.50
Magnesium	Mg	32.7	2.69	Nitrate	NO_3	1.1	.02
Ammonium	NH_4	1.3	.07	Sulfate	SO_4	559.7	11.65
Sodium	Na	358.3	15.58	Alkalinity	(as $CaCO_3$)	240.	4.80
Color		0.		Hardness	(as $CaCO_3$)	316.	6.32
Odor (at well)		H_2S		Residue		1387.	
Turbidity		10		Temperature 67.5° F.			

On July 14, 1944 a production test was made of the Brooks St. well by the State Water Survey. Before the test started, the water level was 258 ft. below the top of the 12-in. casing, elevation 782.75 ft. After 8 1/2-hr. pumping at 519 gpm., the drawdown was 19 ft. Equilibrium had been maintained throughout the last seven hours of the test. The test could not be continued for a longer time because of the critical shortage in the city's water supply.

Analysis of a sample (Lab. No. 100,722) collected July 14, 1944 after 8-hr. pumping at 519 gpm., showed the water to have a hardness of 14.7 gr. per gal., a mineral content of 1170 ppm., and an iron content of 1.6 ppm., and a temperature of 69.5° F. The water at this time was noted to be similar to that from the Henderson St. wells.

Analysis of a sample (Lab. No. 105,249) collected Jan. 9, 1946, showed this water to have a hardness of 18.4 gr. per gal., a mineral content of 1387 ppm., an iron content of 2.1 ppm., and a temperature of 67.5° F.

This water is chlorinated at the well and pumped directly into the distribution system.

Henderson St. Well No. 1, sometimes called - Geiger Well, was started in Dec. 1915, but was not completed until July 1919. The well was constructed by S. B. Geiger Co., Chicago, to a depth of 2414 ft. and is located about 200 ft. south of the water works pump station, 550 ft. west of Henderson St. (or approximately 540 ft. S. and 640 ft. W. of the N. E. corner of Section 16).

The original hole and casing diameter record is given in Table 2.

The elevation of the top of the pump base plate is 755.6 ft. The top of the plate is 4 in. above floor level. The pumping equipment consists of: 283.17 ft. of 8-in. column pipe and discharge "T"; 12-in., 14-stage American Well Works turbine pump, No. 51235, rated at 1000 gpm. against 300 ft. of head; the overall length of the pump is 13 ft.; 283.2 ft. of air line; 20 ft. of 6-in. suction pipe; 150-hp., 1160 rpm. Westinghouse electric motor, No. 4649281.

TABLE 2

Hole Record

15-in. from 573 to 1225 ft.
12-in. from 1225 to 2101 ft.
11-in. from 2100 to 2176 ft.
10-in. from 2176 to 2414 ft.

Casing Record

26-in. od. from 0 to 125 ft.
22-in. od. from 0 to 201 ft. 4 in.
16-in. od. from 201 ft. 4 in. to 1225 ft.

Non-pumping water levels have been reported in ft. below the base plate as follows:

Date	Water Level ft.
1919	156
Mar. 1936	205.5
July 22, 1945	247.8

In May 1944 the production from this well was estimated to be 300 gpm. by Mr. Graham, water superintendent. Although repairs were necessary, it was impossible to take this well out of production, owing to the extremely critical shortage of the city's water supply. The Florence Ave. well was not completed, the Brooks St. well was being repaired and deepened, and the Hender-

LABORATORY NO. 105,243

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.3		Silica	SiO_2	10.5	
Manganese	Mn	0.		Fluoride	F	2.0	
Calcium	Ca	55.6	2.78	Chloride	Cl	185.0	5.22
Magnesium	Mg	21.8	1.79	Nitrate	NO_3	5.4	.09
Ammonium	NH_4	0.1	Tr.	Sulfate	SO_4	333.2	6.93
Sodium	Na	282.2	12.27	Alkalinity (as $CaCO_3$)		230.	4.60
Color		0		Hardness (as $CaCO_3$)		229.	4.58
Odor		0		Residue		1026.	
Turbidity		0		Temperature 69° F.			

son St. Well No. 2 pump was in need of an overhauling.

In June 1945 when the Henderson St. Well No. 1 pump was pulled for repairs, it was found that the top 80 ft. of the column pipe and three-inch oil tube were badly blistered with red rust. There were small holes in the oil tube.

Analysis of a sample (Lab. No. 105,243) collected Jan. 9, 1946 showed the water from Henderson St. Well No. 1 to have a hardness of 13.4 gr. per gal., a residue of 1026 ppm., and an iron content of 0.3 ppm.

The water from this well is chlorinated at the Main Pumping station.

The Henderson St. Well No. 2, sometimes called Thorpe Well No. 2, was constructed in 1928 by Thorpe Well Drilling Co., and located on the west side of Henderson St., about 500 ft. east of the Water Works station (or approximately 390 ft. S. and 140 ft. W. of the N. E. corner of Section 16).

The well was drilled to a depth of 2408 ft. and cased with 22-in. od. pipe from the surface to 412 ft. and with 14-in. pipe from 406 to 1479 ft. Below the 14-in. casing, the hole is 12 in. in diameter to the bottom of the well.

The elevation of the top of the cast-iron pump base plate is 756.3 ft. This is 4 in. above floor and ground levels.

The pump assembly, installed June 6, 1944, consists of 299.17 ft. of 10-in. column pipe and "T"; 20-in. od., 4-stage American Well Works turbine pump, No. 52059, rated at 1200 gpm. against 300 ft. of head; the overall length of the pump is 6.33 ft.; 305 1/4 ft. of air line; 20 ft. of 10-in. suction pipe; 200-hp., 1176 rpm. Westinghouse electric motor, No. 154 C 3947.

A series of mechanical troubles beset the pumping equipment in this well for several years following the completion of the well. The well has been very productive and has been the principal source of supply, frequently operated for extremely long periods, particularly during 1943-

TABLE 3

Date	Water Levels Non-pumping ft.	Pumping ft.	Pumping Rate gpm.	Draw-down ft.
Sept. 1928	197		1600	57
Jan. 1929	Pump and assembly repaired			
Aug. 1931	Pump and assembly repaired			
Mar. 1932	Pump repaired			
June 1933	202 1/2		1580	39.1
May 1936	211			
Feb. 1940	New pump installed			
Feb. 1940	222			65.0
June 1944	Pump and assembly overhauled			
June 1944	230.9		1000	69.3+
June 1945		305+	1000	

LABORATORY NO. 105,245

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	13.0	
Manganese	Mn	0.0		Fluoride	F	2.0	
Calcium	Ca	55.7	2.79	Chloride	Cl	190.0	5.36
Magnesium	Mg	21.3	1.75	Nitrate	NO_3	0.5	.01
Ammonium	NH_4	1.2	.07	Sulfate	SO_4	364.3	7.58
Sodium	Na	297.6	12.94	Alkalinity	(as $CaCO_3$)	230.	4.60
Color		0		Hardness	(as $CaCO_3$)	227.	4.54
Odor		0		Residue		1086.	
Turbidity		0		Temperature 69.5° F.			

1944 when the Florence Ave. well was being constructed and while the Brooks St. well was being repaired and deepened.

The water levels in ft. below the base plate, pumping rates, and drawdowns in Henderson St. Well No. 2 have been reported as shown in Table 3.

Analysis of a sample (Lab. No. 105,245) collected Jan. 9, 1946, showed the water from Henderson St. Well No. 2 to have a hardness of 13.2 gr. per gal., a residue of 1086 ppm., and an iron content of 0.1 ppm.

The water from this well is chlorinated at the Main Pumping station.

In May and June 1944, during the critical water shortage, the city used a well of the Western Illinois Ice Co., located on the south side of the Atkinson, Topeka & Santa Fe R. R. Co. right-of-way and 500 ft. west of Main St. (or approximately 300 ft. S. and 1125 ft. E. of the N. W. corner of Section 15).

The well is 80 ft. deep; 16-ft. diameter; cased with concrete pipe; and equipped with a Pomona turbine pump, No. H 259 and a 60-hp., 1750 rpm. Westinghouse electric motor, No. 8017889.

On June 7, 1944 the pump was producing 400 to 425 gpm. with no drawdown from a non-pumping water level of 15 ft. below the pump base. The city was being supplied with approximately 600,000 gpd. as indicated by a Sparling meter.

Analysis of a sample (Lab. No. 100,322) collected June 4, 1944, showed the water to have a hardness of 41.0 gr. per gal., a mineral content of 907 ppm., and an iron content of 0.4 ppm.

The water was chlorinated at the well and pumped directly into the system.

The Florence Ave. Well, sometimes called Thorpe Well No. 3, was completed in June 1944 by Thorpe Well Drilling Co. The well was 2473 ft. deep and located 500 ft. west of Florence Ave. and 160 ft. south of Walsh St. (or approximately 2500 ft. N. and 1500 ft. E. of the S. W. corner of Section 2).

The hole and casing diameter record is shown in Table 4.

The elevation of the top of the 24-in. casing is 789.91 ft.

In Apr. 1944 when the drilling had reached 2473 ft. depth, a production of 300 gpm. was reported by the driller. The hole was then dyna-

LABORATORY NO. 100,322

		ppm.			ppm.
Iron (total)	Fe	3.4	Chloride	Cl	67.0
Turbidity		Tr.	Alkalinity	(as $CaCO_3$)	376.0
Color		20	Hardness	(as $CaCO_3$)	700.0
Odor		0	Total Mineral Content		907.0
Temperature 55° F.					

Sample-study log of Florence Ave. well furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil, silt and till	25	25
Gravel, sand and silt	9	34
Till	41	75
Sand and gravel	7	82
Pennsylvanian system		
Shale, thin siltstone, limestone and coal beds	256	338
Mississippian system		
Kinderhook shale, thin sandstone bed	40	378
Devonian system		
Cedar Valley dolomite, limestone and shale	80	458
Wapsipinicon limestone	32	490
Silurian system		
Niagaran-Alexandrian series		
Siltstone and dolomite	64	554
Dolomite	68	622
Ordovician system		
Maquoketa shale, some dolomite	198	820
Galena-Platteville dolomite	295	1115
Glenwood sandstone, dolomite and shale	5	1120
St. Peter formation		
Sandstone, incoherent	143	1263
Shale and chert	10	1273
Shakopee dolomite, some shale, thin sandstone beds	232	1505
New Richmond sandstone and dolomite	80	1585
Oneota dolomite, thin sandstone and shale beds	267	1852
Cambrian system		
Trempealeau dolomite	231	2083
Franconia dolomite, sandstone, thin shale bed	187	2270
Galesville sandstone, partly dolomitic	120	2390
Eau Claire sandstone, shale, thin dolomite bed	83	2473

mited in two series of shots. The first series of nine shots, of 125 lb. each, was spaced between depths of 2278 and 2392 ft. The second series of five shots, of 175 lb. each, was spaced between depths of 2293 and 2402 ft.

On May 31, 1944 a production test was started by the driller and extended until noon of June 4 with numerous shut-downs due to power trouble. The driller installed a weir for measuring discharge, and observations were made by the State Water Survey representative. Before the test, the water level was 255 ft. below the top of the 24-in. casing, and drawdowns and pumping rates for various continuous pumping periods were recorded as given in Table 5.

During the last 6 1/2 hr., the pumping rate was steady at 663 gpm., but the drawdown increased from 117 to 130 ft. without reaching equilibrium.

TABLE 4

Hole Record

23-in. from 410 to 843 ft.
18-in. from 843 to 1285 ft.
12-in. from 1285 to 2473 ft.

Casing Record

24-in. od. casing from 0 to 410 ft.
16-in. od. liner from 477 ft. 3 in. to 843 ft. 4 in.
12-in. id. liner from 1031 1/2 ft. to 1285 ft. 1 in.

The pumping assembly, installed in June 1944, consists of: 400 ft. of 10-in. column pipe; 11-in. od.,9-stage American Well Works turbine pump. No. 68796, rated at 1000 gpm. against 466 ft. of head; the overall length of the pump is 9 ft. 1 1/2 in.; 400 ft. of air line; 20 ft. of 10-in. suction pipe; 150-hp., 1770 rpm. U. S. electric motor, No. 326809.

TABLE 5

Pumping Period hr.	Pumping Rate gpm.	Drawdown ft.
9	483	83
15	640	121
32	700	140

Analysis of a sample (Lab. No. 105,246) collected Jan. 9, 1946 after ten-days pumping at 650 gpm., showed the water from Florence Ave. Well to have a hardness of 16.3 gr. per gal., a residue of 1399 ppm., and an iron content of 0.5 ppm.

This water is aerated at the top of the elevated tank and chlorinated.

In 1946 the average water consumption for the city was estimated at 2.9 mgd.

LABORATORY NO. 105,246

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.5		Silica	SiO_2	10.5	
Manganese	Mn	0.0		Fluoride	F	3.0	
Calcium	Ca	68.1	3.41	Chloride	Cl	215.0	6.06
Magnesium	Mg	26.2	2.16	Nitrate	NO_3	1.2	.02
Ammonium	NH_4	1.3	.07	Sulfate	SO_4	558.9	11.63
Sodium	Na	382.5	16.63	Alkalinity (as $CaCO_3$)		228.	4.56
Color		Tr.		Hardness (as $CaCO_3$)		279.	5.58
Odor (at well)		H_2S		Residue		1399.	
Turbidity		Tr.		Temperature 68.2° F.			

A public water supply was installed by the city of Galva (2812) in 1894.

At that time Well No. 1 was drilled at the water works immediately east of the public square (or approximately 1235 ft. N. and 50 ft. E. of the S. W. corner of Section 27, T. 14 N., R. 4 E.). The well was drilled to a depth of 1477 ft. below a ground surface elevation of 850t ft.

When the well was first completed, it was cased in the same manner as reported for Well No. 2. The well was recased in 1918 with 12-in. pipe from the surface to a depth of 110 ft.; with 9-in. pipe from the surface to a depth of about 455 ft.; and with 6-in. pipe from the bottom of the 9-in. to the top of the sandstone. The top of the casing was in the floor of the pumping station.

The well was equipped with a Newell steam head pump with a 6 3/4-in. cylinder placed at a depth of 300 ft. In July 1912 the non-pumping water level was reported to be 235 ft. below the top of the well, and in 1916 it was 250 ft.

Well No. 2 was drilled in 1899 to a depth of 1535 ft. at a point about 15 ft. east of Well No. 1. It was cased with 12-in. pipe to a depth of 110 ft.; with 9-in. pipe from 110 to 500 ft.; and with a 6-in. liner reported to be set between 610 ft. and the top of the sandstone.

The well was originally equipped with an American Well Works steam head pump, which was replaced in July 1920 by an air lift with 660 ft. of 2-in. air pipe and with discharge pipe of 4, 4 1/2, and 5-in. diameters. The non-pumping water level in July 1920 was 268 ft. below the surface, and the drawdown was 76 ft. when pumping, during a test, at a rate of 125 gpm.

Use of Wells No. 1 and 2 was discontinued some time prior to 1934.

Well No. 3 was drilled in 1920 - 1921 by the Whitney Well Drilling Co., Chicago, to a depth of 1524 ft. It is located about 40 ft. west of Well No. 1. A sand stratum, 20 to 25 ft. in thickness, was encountered at a depth of 1255 to 1260 ft., and yielded "an abundant supply of water."

The well was cased with 15-in. pipe to a depth of 450 ft. and with 12-in. pipe from 450 to 1050 ft. The well, equipped with an air lift and with 464 ft. of air pipe, was tested and found to produce 230 gpm. The air pipe was extended 43 ft. after which the production was 250 gpm., during a 2-hour test. One of the other wells was operating at the time. The well was blasted with 300 pounds of nitro-glycerine after which the non-pumping water level was 270 ft. below the ground surface, and the drawdown was reported to be 60 to 70 ft. while pumping at 320 gpm.

Sample-study log of Well No. 4 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Loess and glacial till	50	50
Pennsylvanian system		
Shale, some limestone and sandstone	300	350
Mississippian system		
Kinderhook shale	100	450
Devonian system		
Cedar Valley limestone and dolomite	60	510
Wapsipinicon limestone	20	530
Silurian system		
Niagaran - Alexandrian dolomites, some shale at base	330	860
Ordovician system		
Maquoketa shale and dolomite	165	1025
Galena - Platteville dolomite	335	1360
Glenwood - St. Peter formations		
Sandstone	140	1500
Shale and chert	10	1510
Shakopee dolomite	177	1687

On Jan. 23, 1934 the non-pumping water level was measured at 294 ft., and a drawdown of 33 ft. was observed while pumping at 207 gpm. The air line was reported to be 540 ft. long. During the same test, the pump in Well No. 4 was started up and after 2 1/2 hr., the pumping level in No. 3 was drawn down an additional 2 ft.

Well No. 4 was drilled in 1933 by Thorpe Bros., Des Moines, Iowa to a depth of 1687ft. below a ground surface elevation of 845± ft. The well is located 175 ft. south and 100 ft. east of the intersection of Ohio and First St. (or approximately 1185 ft. N. and 215 ft. E. of the S. W. corner of Section 27).

The well was cased with 24-in. pipe from 0 to 64 1/2 ft.; with 20-in. pipe from 0 to 359 ft.; with 16-in. pipe from 320 to 502 ft.; and with 12-in. liner from 840 to 1040 ft. The bore hole was 12 in. in diameter from 1040 ft. to the bottom.

The well is equipped with: 380 ft. of 8-in. column pipe; 13-stage, 12-in. od. American Well Works turbine pump, No. 69260, having 10.6 ft. overall length; 380 ft. of 1/4-in. air line; 20 ft. of 8-in. suction pipe; 60-hp., 1175 rpm. induction motor.

Originally the column pipe and air line were each 30 ft. shorter, but the pump was overhauled in May 1945, and the setting lowered to 380 ft. On Jan. 18, 1934 the non-pumping water level was 286 ft. and the drawdown was 50 ft. when pumping at 490 gpm. On Nov. 21, 1945 the non-pumping water level was 304ft., and the drawdown was 36 ft. after 21-min. pumping at 500 gpm.

Well No. 4 is the principal source of supply.

Analysis of a sample (Lab. No. 112,718), collected Nov. 26, 1947 after pumping 2 hr. at 500 gpm., showed the water from Well No. 4 to have a hardness of 7.4 gr. per gal., a mineral content of 898 ppm., and an iron content of 0.1 ppm.

Pumping is estimated to average 140,000 gpd.

LABORATORY NO. 112,718

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	12.4	
Manganese	Mn	0.0		Fluoride	F	3.0	
Calcium	Ca	29.2	1.46	Chloride	Cl	148.0	4.17
Magnesium	Mg	13.0	1.07	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	1.1	0.06	Sulfate	SO_4	219.7	4.57
Sodium	Na	281.	12.23	Alkalinity	(as $CaCO_3$)	304.	6.08
Turbidity		Tr.		Hardness	(as $CaCO_3$)	127.	2.53
Color		0.		Residue		898.	
Odor		0.					
Temperature 65° F.							

Attempts were made in 1925 and 1939 to install a public water system for the town of Gardner (864) but the system was apparently not put into service until 1941.

In 1925 M. T. Peterson, Madison, Wis., drilled a well located on lot 8, Block 17 of the town of Gardner.

The well is 972 ft. deep below a surface elevation of 588± ft.

The hole and casing record is shown in Table 1.

TABLE 1

Hole Record

12-in. from surface to 290 ft.
10-in. from 290 to 800± ft.
8-in. bottom.

Casing Record

12-in. drive pipe from surface to 70 ft.
10-in. from surface to 290 ft.
8-in. liner from 300 to 800 ft.

The well was tested by Marr, Green, & Co. on July 10, 1925 using a 5 3/4-in. by 18-in. pump, It was reported that when pumping at 44 gpm., the drawdown was about 225 ft. below a non-pumping water level of 59 ft. below the top of the casing.

C. S. Cumming, Gardner, made another test on May 24, 1928. It was reported that when pumping at 21 gpm., the drawdown was 114 ft. from a non-pumping water level of 62.7 ft. below the top of the casing.

Analysis of a sample (Lab. No. 61868) collected May 24, 1928, showed the water to have a hardness of 5.7 gr. per gal., a residue of 980 ppm., and an iron content of 0.8 ppm.

This well was not equipped for service because its capacity was insufficient to supply public demands.

In Nov. 1938 the State Geological Survey conducted an electrical earth resistivity survey. As a result of the survey, C. S. Cumming drilled a well, now known as East Well, in 1939 and located near the northeast corner of Main St. and U. S. Route 66 (or approximately 170 ft. N. and 140 ft. W. of the S. E. corner of Section 4, T. 31 N., R. 8 E.). This well was drilled to a depth of 173 ft. below a surface elevation of 583± ft. and was cased with 6-in. pipe to a depth of 61 1/2 ft.

The State Water Survey made a production test on July 5, 1939. Before the test, the water level was 14 ft. below the surface. The pumping rate was started at 50 gpm. with a drawdown of 28 1/2 ft. After 5 hr. the pumping rate had gradually decreased to 32 gpm. and the drawdown increased to 39 1/2 ft.

Another test of this well was made by the State Water Survey on Sept. 11-12, 1939. After pumping at 55-59 gpm. for 22 hr., the drawdown was 101 ft. from a non-pumping water level of 15

Sample-study log of well drilled in 1925 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Silt and till	45	45
Gravel, sandy, clean	10	55
Pennsylvanian system		
Shale, some siltstone, sandstone, limestone and coal	135	190
Ordovician system		
Maquoketa shale, some limestone	155	345
Galena-Platteville limestone, some dolomite	380	725
Glenwood sandstone, some dolomite	100	825
St. Peter formation		
Sandstone	140	965
Shale, some dolomite	8	973

ft.

This well is equipped with 140 ft. of 3 1/2-in. steel column pipe; 6-in., 13-stage American Well Works turbine pump, No. 63493, rated at 50 gpm. against 163 ft. of head, operating at 1750 rpm.; 10 ft. of 3 1/2-in. suction pipe; 150 ft. of 1/4-in. brass pipe air line; 5-hp. U. S. electric motor. -

The non-pumping water level in 1944 was 60 ft., but pumping quickly lowered the water level to the top of the bowls.

Recent water levels have been reported as is given in Table 2.

TABLE 2

Sept. 11, 1947..93 ft. after 12 hr. idle period.
Oct. 10, 1947..80 ft. after 11 hr. idle period.
Nov. 19, 1947..97 ft. after 2 hr. idle period.

Analysis of a sample (Lab. No. 86320) collected Sept. 12, 1939, showed the water to have a total hardness of 2.2 gr. per gal., a residue of 501 ppm., and an iron content of 0.8 ppm.

In 1944, R. O. Cumming, Gardner, drilled a well called Park Well, and located about 50 ft. east of the center of Jackson St. and 250 ft. south of Washington Ave. (or approximately 1200 ft. N. and 2000 ft. W. of the S. E. corner of Section 4). The well was drilled to a depth of 161 ft. below a surface elevation of 583± ft. Coal was entered at a depth of 161 ft.

The hole and casing record is shown in Table 3.

It was reported that there was little water in the well until the well had been "shot" with 100 lb. of dynamite.

TABLE 3

Hole Record

12-in. from surface to 57 1/2 ft.
10-in. from 57 1/2 to 161 ft.

Casing Record

10-in. from surface to 65 ft. 4 in.

The American Well Works Co., Aurora, made a production test in Oct. 1944. It was reported that after 24-hr. pumping at a rate of 160 gpm., the drawdown was 38 ft. from a non-pumping water level of 26ft. For the production test, a temporary pump was installed.

The existing pump installation, made in the early part of 1945, consists of 130 ft. of 4-in. steel column pipe; 6-in., 18-stage American Well Works turbine pump, No. 70802, having a rated capacity of 75 gpm. against 228 ft. of head; 130 ft. of 1/4-in. gi. air line; 10 ft. of 3 1/2-in. id. suction pipe; 7 1/2-hp. U. S. electric motor.

The following fluctuations in water levels have been observed: 77 ft. on Aug. 14, 1947 after 2 hr. idle period; 79 ft. on Sept. 11, 1947 after 1 hr. idle period; 83 ft. on Nov. 19, 1947 after 2 hr. idle period. On Nov. 19, 1947 after 4 1/2-hr. pumping at 75 gpm. the water level was 86 ft.

Analysis of a sample (Lab. No. 112,625) collected Nov. 19, 1947 after pumping 4 1/2 hr. at 75 gpm., showed the water to have a total hardness of 10.9 gr. per gal., a residue of 1392 ppm., and an iron content of 0.7 ppm.

The reservoir water is chlorinated about every 2 weeks.

From Jan. 1 to Oct. 1, 1947 the pumpage was estimated to average 26,400 gpd.

LABORATORY NO. 112,625

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.7		Silica	SiO_2	14.0	
Manganese	Mn	0.1		Fluoride	F	2.2	
Calcium	Ca	51.7	2.59	Chloride	Cl	58.0	1.64
Magnesium	Mg	13.7	1.12	Nitrate	NO_3	Tr.	Tr.
Ammonium	NH_4	0.4	0.02	Sulfate	SO_4	368.8	7.67
Sodium	Na	454.0	19.74	Alkalinity	(as $CaCO_3$)	708.	14.16
Turbidity		10+		Hardness	(as $CaCO_3$)	186.	3.71
Color		0		Residue		1392.	
Odor (at well)		H_2S		Free CO_2	(calc.)	145.	
Temperature 53.7° F.				pH = 7.1			

GENESEO
Henry County
July 15, 1947

The first source of public water supply, for the city of Geneseo (3824) was a well about 400 ft. deep located near the center of town.

In 1887 an artesian well was drilled by J. P. Miller Artesian Well Co., Brookfield, into the Potsdam sandstone at a depth of 2252 ft. The elevation of the ground surface is 645t ft. This well was located at approximately 650 ft. S. and 1650 ft. W. of the N. E. corner of Section 21, T. 17 N., R. 3 E.

During the drilling operation, water was encountered at the following depths with the estimated rate of flow shown at each depth:

Depth ft.	Estimated Flow gpm.
980	18
1300	40
1400	75
1640	200

The salinity of the water increased below 1640-ft. depth, and for that reason, drilling ceased at 2252 ft.

Mr. D. M. Stamm, Geneseo, made the water analysis given in Table 1.

In 1892 the peak of the flow was reported to be 21 ft. above the curb, and the water temperature was 65° F. The elevation of the curb was 645 ft.

In 1902, due to an inadequate supply of water from the deep well, the city's water works were moved 1 1/2 miles due north of Geneseo. Water was obtained from a series of springs, located on an 8-acre tract of land in Section 9, upon which the city has a perpetual lease. There were 16 springs, and at each spring two lengths of 18 or 24-in. diameter sewer pipe were placed vertically and covered. A side outlet in the pipe at each spring was connected to a sewer-pipe line which carried the discharge from all of the springs to

Correlated driller's log of well drilled in 1887 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay	35	35
Sand and gravel	7	42
Pennsylvanian system		
Shale, some lime	82	124
Devonian (?) and Silurian systems		
Lime, gray	426	550
Ordovician system		
Maquoketa and Galena - Platteville formations		
Shale	95	645
Lime	430	1075
Glenwood formation		
Sandstone	35	1110
Shale	5	1115
St. Peter formation		
Sandstone	67	1182
Shale	8	1190
Ordovician and Cambrian systems		
Shakopee, New Richmond, Oneota, Trempealeau and Franconia formations		
Sandstone, mixed with lime	410	1600
Limestone	435	2035
Cambrian system		
Galesville formation		
Sandstone	125	2160
Eau Claire formation		
Limestone, shale, and sand	90	2250

TABLE 1

		Gr. per Gal.	ppm.
Sodium Chloride	(NaCL)	90.403	1540
Sodium sulphate	(Na_2SO_4)	11.340	194
Calcium sulphate	($CaCO_4$)	24.105	412
Calcium carbonate	($CaCO_3$)	4.583	78
Magnesium carbonate	($MgCO_3$)	10.231	175
Ferrous carbonate	($FeCO_3$)	.200	3.4
Alumina	(Al_2O_3)	1.806	30.8 (?)
Silica	(SiO_2)	8.550	146. (?)
Carbon dioxide	(CO_2)	6.497	111
Chlorides			935
		Total	3625.2

the collecting reservoir, from which the water flowed by syphonic action into a pumping well, 10 ft. in diameter and 20 ft. deep.

In 1922, only 2 springs were being used together with 2 new wells which were drilled by Julius Olson, Geneseo. All other springs had been abandoned. The wells were located on the pumping station 8-acre tract and were 8-in. in diameter and 17 to 19 ft. deep into sand and gravel.

In 1925, two additional shallow wells were added, and in 1931 a fifth well was constructed, all newer wells being of the same approximate depth, 15 ft., and penetrating a layer of 7 ft. of water-bearing sand. The 5 wells were in 2 groups, 2 wells known as the "A" wells were located in a small ravine about 450 ft. west - southwest of the pump house, and 3 wells known as the "B" wells were in another ravine about 500 ft. south - southwest of the pump house. The water from the wells was syphoned through the original pipe line to the collecting reservoir.

In 1931 the springs had been abandoned as a source of supply, and water was obtained from the 5 wells.

In 1932, two more shallow wells, known as "C" wells, were drilled in the vicinity of the older wells: and in 1939, two more wells were drilled by Floyd Teeple, Moline. These latter wells were called D-1 and DA-3.

In August 1939, Well D-1 was constructed to a depth of 34 ft. about 800 ft. west of the pumping station (or approximately 2800 ft. N. and 3500 ft. E. of the S. W. corner of Section 9).

The elevation of the ground surface is 645± ft. The top of the 16 in. casing is 8 ft. below the ground surface and housed within a brick curb which is 5 1/2 ft. id. and 10 ft. high. The well is cased with 21 ft. of 16-in. pipe with 5 ft. of 14 3/4-in. od. Cook screen, with No. 100 slot openings, attached to the bottom of the casing. The screen is in gravel and coarse sand, and the bottom of the screen sets on hard-pan. A 6-in. suction pipe extends to within 1 ft. of the bottom of the screen. The production of this well, September 5, 1939, was 393 gpm., and the non-pumping water level was 23 1/2 ft. below the top of the curb which is at ground surface level.

Analysis of a sample (Lab. No. 102,242), collected Jan. 3, 1945, showed the water from Well D-1 to have a hardness of 25.2 gr. per gal., a mineral content of 501 ppm., and an iron content of 1.3 ppm.

Well DA-3 was constructed in October 1939 ap-

LABORATORY NO. 102,242

	ppm.		ppm.
Iron (total) Fe	1.3	Chloride	21.0
		Alkalinity (as $CaCO_3$)	288.
Turbidity	10-	Hardness (as $CaCO_3$)	431.
Color	0	Total Mineral Content	501.
Odor	0		

proximately 112 ft. north and 110 ft. west of D-1 and is 39 ft. deep below the top of the curb which is 2 ft. above a ground surface elevation of 650± ft. The top of the 16-in. casing is 12 ft. 7 in. below the top of the curb and is 4 ft. above the base of the brick curb which is 5 ft. id. There is 22 ft. of casing with 4 ft. of 14 3/4-in. diameter Cook screen, having No. 100 slot openings, attached to the bottom of the casing. The screen sets on hard pan. A 5-in. suction pipe extends to within 1 ft. of the bottom of the screen. The production of this well, November 1, 1939, was 257 gpm., and the non-pumping water level was 29 ft. 10 in. below the top of the curb.

Well BD-2 is a reconstruction of old B-1 in August 1939 and is located in the old "B" group of wells, south-southwest of the pump house and 175 ft. south and 375 ft. east of Well D-1. This well was originally a curbed spring with outlet connected to the reservoir by sewer pipe. Later an 8-in. screen, 6 ft. in length and having No. 20 slot openings was installed and water syphoned through 4-in. and 5-in. iron pipe. The screen and 4 ft. of 8-in. diameter casing were pulled in August 1939, and the screen was replaced by a 5-ft. length of 14 3/4-in. diameter Cook screen, having No. 80 slot openings. The production of this well, Sept. 5, 1939, was 147 gpm., and the non-pumping water level was about 8 ft. below the top of the curb.

As a result of the city's water works improvement project, carried on in 1939, the following 5 wells were discontinued: A-1, A-2, B-2, B-3, C-d. These wells were abandoned because of clogged screens. Four wells were continued in service as follows:

BD-2
C-1
D-1
DA-3

Due to an insufficient supply of water, 14 test holes were drilled during 1946 by Layne-Western Co., Chicago, under the supervision of Warren & Van Praag, Inc., Decatur. As a result, 3 wells were drilled, namely: E-1, E-2, and E-3.

Well E-1 was constructed in the forepart of 1947 about 90 ft. north and 100 ft. west of Well BD-2 (or approximately 2730 ft. N. and 3780 ft. E. of the S. W. corner of Section 9). The well is 13 ft. deep and cased with 38-in. od. steel pipe from the surface to 8 ft. and with 16-in. od. steel pipe from the surface to 8 ft., below which is 5 ft. of Layne shutter-type screen exposed to coarse sand. The driller made a production test of the well and reported 100 gpm. When pumping at 70 gpm., the pumping water level was at the top of the screen.

Well E-2 was constructed shortly after E-1 and located about 200 ft. south of E-1. The well was constructed in the same manner as E-1, having the same depth and same size casings and screen. The driller reported the production at 75 gpm.

Well E-3 was constructed by Layne-Western Co. in July 1947 at a location 1310 ft. south and 1660 ft. west of BD-2 (or approximately 1340 ft. N. and 2220 ft. E. of the S. W. corner of Section 9).

The well was completed to a depth of 65 ft. 4 in. below a ground surface elevation of 662.5 ft.

The driller's casing and screen record is given in Table 2.

TABLE 2

52-in. od. steel pipe from +0.5 to 19.5 ft.
48-in. od. steel pipe from +3.0 to 52.0 ft.
18-in. od. steel pipe from +3.0 to 57.0 ft.
18-in. od. Layne Armco-iron shutter-type No. 5 screen from 57.0 to 65.0 ft.

A concrete plug of about 4-in. thickness was poured in the base of the screen. The lower 5 ft. of screen was bailed in, and about 16 cu. yd. of selected gravel (approximately 1/2 in. by 1/4 in.) was used to fill the annular space between the inner and outer casings to 37 ft. below the top of the 48-in. casing.

On July 15, 1947 a production test was made by the State Water Survey. For test purposes, a turbine pump, belt-driven from a gasoline engine, was installed. Before the test, the water level was 49.8 ft. below the top of the 48-in. casing. Pumping was started at 222 gpm. and gradually accelerated. After 5 1/4 hours, the pumping rate was 400 gpm. and the drawdown was 5.9 ft. After 6 1/4 hours, the pumping rate was 605 gpm., and the drawdown was 10.4 ft. The pump was shut down, and 30 min. later the water level was 51.3 ft. or 1 1/2 ft. lower than the starting level.

Analysis of a sample (Lab. No. 111,087), collected July 15, 1947 after 6 1/2-hr. pumping at 500 gpm., showed the water from Well E-3 to have a hardness of 38.5 gr. per gal., a residue of 840 ppm., and an iron content of 1.5 ppm.

The water is chlorinated. Pumpage is estimated to average 200,000 gpd.

LABORATORY NO. 111,087

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.5		Silica	SiO_2	21.8	
Manganese	Mn	0.2		Fluoride	F	Tr.	
Calcium	Ca	154.4	7.72	Chloride	Cl	49.0	1.38
Magnesium	Mg	66.5	5.47	Nitrate	NO_3	0.7	0.01
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	272.3	5.67
Sodium	Na	24.6	1.07	Alkalinity	(as $CaCO_3$)	360.	7.20
Color		0		Hardness	(as $CaCO_3$)	660.	13.20
Odor		0		Residue		840.	
Turbidity		40		Free CO_2 (calc.)		95.	
Temperature		52.0° F.		pH = 7.0			

Waterworks were first installed by the city of Geneva (4101) in 1896. The initial supply was obtained from a well drilled to a depth of about 850 ft. It is located on the west bank of Fox River about 45 ft. south of State St. and 45 ft. east of River St. (approximately 1170 ft. N. and 590 ft. W. of the S.E. corner of Section 3, T. 39 N. R. 8 E.). The elevation at the top of the casing is 679.2 ft. The well was reported to have a diameter of 12 in. at the top and 8 in. at the bottom.

On Oct. 19, 1911, the free flow was 50 gpm. and the production rate was 500 gpm. when pumping with an air lift, having 170 ft. of 2-in. air pipe.

In Jan. 1922 the non-pumping water level was 29 ft. below the surface and the pumping water level was 50 ft. on Apr. 17, 1922. At that time the length of the air pipe was 229 ft. and the air lift was delivering 234 gpm.

This well was the source of the entire public supply until a second well was completed at the site in 1924.

In the fall of 1927 the air pipe was extended to a depth of 352 ft. and the operating pressure increased to 90 psi., increasing the discharge of the air lift to 350 gpm. when operated alone. Following the changes the well furnished the entire public supply during the winter of 1927-28 when the second well was out of service.

When repairs were being made in May 1928, the depth was found to be 843 ft. and there was 8 ft. of 12-in. casing at the top. At that time a 10-in. casing was installed to the 8-in. hole at a depth of 105 ft. The well was re-equipped with an old air lift and continued in service as an auxiliary supply unit until 1938 when the air lift equipment was removed and the following pump installation was made: 210 ft. of 4 1/2-in. column pipe; 7-in., 13-stage American Well Works turbine pump, No. 61973, rated at a capacity of 275 gpm. against 250 ft. of head; 20 ft. of 5-in. suction pipe; 210 ft. of 1/8-in. gi. air line; 30-hp. U. S. electric motor.

The well was continued in service as an auxiliary supply unit until Well No. 4 was placed in service in 1945. It is now seldom used but is maintained as a standby unit. On Aug. 14, 1947 the non-pumping water level was 122 ft. below the pump base when Well No. 2 was idle.

Well No. 2 was originally drilled to a depth of 1156 ft. by W. L. Thorne Co., Des Plaines, in 1924 and located about 130 ft. south of State St. and 70 ft. east of River St. The well was cased with 12-in. pipe to a depth of 224 ft. below which the hole was 12 in. in diameter to the bottom. The elevation of the top of the casing is 676.0 ft. After completion the well was tested for production and while pumping at 300 gpm. the drawdown was 40 ft. from a non-pumping water level of 60 ft. below the top of the casing. The well was equipped for service with an air lift having 412 ft. of eduction pipe and 381 ft. of 2-in. air pipe. Water was pumped at a rate of 340 gpm. and in Apr. 1925 the non-pumping water level was 62 ft. below the top of the casing and the pumping level 186 ft.

Tests of the productive capacities of both wells were made on Mar. 4, 1926. When operated together the combined production rate was 351 gpm., and when operated alone each well produced 366 gpm. At that time the non-pumping water level in Well No. 2 was at a depth of 66 ft. and the pumping level 208 ft.

The well was deepened by the J. P. Miller Artesian Well Co., Brookfield, during the winter of 1927-28. A 10-in. hole was drilled from the original depth to 2217 ft.

After deepening, the well was equipped with an air lift having 452 ft. of eduction pipe, 372 ft. of main air pipe, and 302 ft. of auxiliary starting air pipe. During a test, following this installation, the production was 525 gpm. with a drawdown of 78 ft. from a non-pumping water level of 50 ft. below the top of the casing. On Nov. 10, 1937 the non-pumping water level was reported at a depth of 66 ft. and when pumping at 800 gpm. the pumping level was 175 ft. below the top of the casing. In Jan. 1944 the non-pumping water levels averaged 96 ft. below the pump base and when pumping at 900 gpm., the pumping water levels averaged 196 ft. In 1947 the pump delivered 800 gpm. discharging over a coke tray aerator on the site. On Aug. 14, 1947 the non-pumping water level was 122 ft. below the pump base after an idle period of 1 month.

The existing pump installation is 220 ft. of 7-in. column pipe; 10-in., 11-stage American Well Works turbine pump, No. 59147, rated at a capacity of 800 gpm. against 236 ft. of head; 10 ft. of 8-in. suction pipe; 220 ft. of brass pipe air line; 75-hp. U. S. electric motor.

The well is maintained for service as an auxiliary supply unit.

Well No. 3 was drilled in 1930 to a depth of

985 ft. by William Cater, Chicago, and located in the northwestern part of the city about 45 ft. west of Logan Ave. and 210 ft. north of Center St. (approximately 1010 ft. S. and 530 ft. E. of the N. W. corner of Section 3). The elevation of the top of the casing is 758.6 ft.

The well was cased with 20-in. od. genuine wi. pipe from the surface to a depth of 65 ft., below which the hole was 19-in. diameter to the bottom. A capacity test of the well was conducted over a period of 4 days, beginning Mar. 13, 1930. Before the test, the water level was 48 ft. 9 in. below the top of the casing. Pumping water levels of 225, 260, and 305 ft. were recorded for pumping rates of 400, 500, and 620 gpm. respectively. The well was placed in service on Oct. 29, 1930 equipped with a turbine pump discharging 500 gpm. to a collecting basin. By Nov. 20, 1930 the non-pumping water level was 62 ft. below the pump base and the pumping level 286 ft. when pumping at a rate of 500 gpm.

In Mar. 1931 a 16-in. od. liner was installed between depths of 200 and 300 ft., intended to case off the Maquoketa shale. At this time 2 sections of 8-in. column pipe were added making the top of the turbine setting 326 ft. 10 in. below the pump base.

On Dec. 3, 1937 the non-pumping water level was 127 ft. and the pumping level was 278 ft.

A new 12-in., 14-stage American Well Works turbine pump, No. 62518, was installed in May, 1939. The old steel column pipe was used except 1 section between depths of 150 and 160 ft. This section was reported to be either corroded or eroded from the outside by water from the Niagaran dolomite which struck the pipe while entering the well. By Mar. 12, 1940, the non-pumping water level had receded to a depth of 135 ft. and the pumping level to about 238 ft. The pumping rate was 300 gpm.

The Gray Well Co., Chicago, attempted to rehabilitate the well June - Sept., 1940. The 16-in. liner through the Maquoketa shale was removed and a continuous string of 16-in. od. pipe was placed from the surface to a depth of 320 ft. The well was "shot" with 250 lb. of 80% blasting gelatin at a depth of 975 ft. and with 175 lb. at 969 ft. After the second shot a measurement showed a bridge at 960 ft. Ten charges, varying from 100 to 250 lb., were exploded in the zone of the St. Peter sandstone from 820 to 960 ft. The 16-in. casing was reset at a depth of 320 ft. and about 80 cu. yd. of sand was removed from the shot zone.

After the necessary cleanout work, a 62-hr. production test was made Sept. 21-23, 1940. Before the test, the water level was 92 ft. below the pump base. Pumping was started at a rate of 200 gpm. and gradually increased to 500 gpm. in 5 1/2 hr. After 53 hr. pumping at 500 gpm. the drawdown was 234 ft. Pumping was continued at a rate of 525 gpm. for 3 1/2 hr. at the end of which period the total drawdown was 250 ft. As the shooting and developing had only succeeded in restoring the productive capacity of the well to 500 gpm. the well was drilled to a greater depth.

The hole was drilled to 15-in. diameter from 977 to 1715 ft. and completed 12-in. diameter to the bottom at 2300 ft. A 10-in. liner was installed between 1576 and 1715 ft. After the deepening a production test was made starting on Dec. 22, 1941. Before the test the water level was 87 ft. below the pump base. After 4-hr. pumping at 1150 gpm. the drawdown was 213 ft., and after 40-hr. pumping at 1120 gpm. the drawdown was 225 ft. Considerable sand was pumped during the first part of the test and the well did not clear up entirely until after 32-hr. pumping. On removal of the test pump, the well was found filled to the 933 ft. level. Sand was bailed from Jan. 12, 1942 to May 5, 1942, and at that time the well had been cleaned out to a depth of 1301 ft. Up to that time it was estimated that approximately 100 cu. yd. of St. Peter sand had been removed from the well as the result of the shooting. With the approach of the heavier seasonal water demand the permanent turbine pump was reinstalled. A production test was started on May 12, 1942 and after 36-hr. pumping at 500 gpm. the drawdown was 200 ft. from a non-pumping water level of 92 ft.

On Sept. 17, 1942, the water level was 141 ft. after an idle period of 12 1/2 hr. and, after 6 1/2-hr. pumping at 480 gpm., the drawdown was 179 ft.

A geophysical log of the well, made in Apr., 1944, found holes in the 16-in. casing and the well bridged at a depth of 972 ft.

In Mar., 1946, S. B. Geiger & Son, Chicago, started rehabilitation of the well. On Mar. 25, 1946 the standing water level was 135 ft. and the hole bridged at a depth of 970 ft. below the pump house floor. The 16-in. casing was removed and the hole cleaned to a depth of 1410 ft. A 16-in. liner was temporarily set between depths of 741 and 1003 ft. and a total of 1400 lb. of 100% blasting gelatin was exploded at 6 levels between 1235 and 1325 ft.

The shooting back-filled the hole to 1300 ft. and the hole was cleaned out to the original bottom of 2300 ft. The 10-in. liner between depths of 1576 and 1715 ft. was found to be tight; 185 ft. of 16-in. od. perforated liner was set on drive shoes (top and bottom) from 810 to 995 ft.; and 338 ft. 7 in. of 16-in. od. casing was installed from the surface and cemented in by the Halliburton Co. The perforated liner had approximately 40 ft. of 1 ft. by 1/4 in. slots cut with a torch in 4 rows equally spaced around the pipe, but staggered in the vertical direction.

A production test was made on Sept. 5-6, 1946. Pumping was conducted at various rates of 755 to 1255 gpm. The test indicated a specific capacity of about 12.1 gpm. per foot of drawdown at production rates of 755 and 935 gpm. and 11.0 gpm. at a rate of 1170 gpm. When the test pump was removed, the hole was found bridged at a depth of 1278 ft. and was then cleaned out to a depth of 1540 ft. where hard material was encountered. Drilling was stopped at a depth of 1576 ft. on Oct. 27, 1946.

The following pump was reinstalled in Dec, 1946: 353 ft. of 8-in. column pipe; 12-in., 14-stage American Well Works turbine pump, No. 62518, having an overall length of 11 ft. 3 in. and rated capacity of 500 gpm.; 30 ft. of 8-in. suction pipe; 354 ft. of 1/4-in. gi. air line.

On July 28, 1947 the non-pumping water level was 212 ft. below the pump base after 36 hr. of idle period. The pumping water level was 262 ft. on Aug. 14, 1947 when pumping at 550 gpm.

The well was in daily service in July, 1947 and the pumpage averaged 459,550 gpd.

Analysis of a sample (Lab. No. 115,960) collected Sept. 28, 1948 after 30-hr. pumping at 520 gpm., showed this water to have a hardness of 15.6 gr. per gal., a total mineral content of 328 ppm., and an iron content of 0.2 ppm.

The water is treated for iron removal. Analysis of a sample (Lab. No. 109,996) collected Apr. 21, 1947 showed the treated water to have a hardness of 15.2 gr. per gal., a total mineral content of 325 ppm., and a trace of iron content.

Well No. 4 was drilled in 1944 to a depth of 2267 ft. by S. B. Geiger & Co. and located about 120 ft. north of James St. and 145 ft. west of First St. (approximately 1150 ft. N. and 1250 ft. W. of the S. E. corner of Section 3). The elevation of the top of the casing is 719.14 ft.

The hole and casing record is shown in Table 1.

TABLE 1

Hole Record

22-in.	from	55 1/3 to	275 ft.
19 1/4-in.	from	275 to	1116 ft.
16-in.	from	1116 to	1687 ft.
12-in.	from	1687 to	2267 ft.

Casing and Liner Record

24-in.	from	0 to 55 1/3	ft.
20-in.	from	0 to 275	ft.
16-in.	from	949 to 1116	ft.
12-in.	from	1485 to 1687	ft.

The annular space outside of the 20-in. casing was filled with "Bentonite."

A production test was made on June 26 and 27, 1944. Before the test the water level was 138 ft. below the pump base. Well No. 2, located about 660 ft. southeast, was operated intermittently during the test and was producing 900 gpm. The

LABORATORY NO. 115,960

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	11.1	
Manganese	Mn	0.0		Fluoride	F	0.6	
Calcium	Ca	68.2	3.41	Chloride	Cl	5.0	0.14
Magnesium	Mg	22.9	1.89	Nitrate	NO_3	0.5	0.01
Ammonium	NH_4	0.5	0.03	Sulfate	SO_4	4.9	0.10
Sodium	Na	19.3	0.84	Alkalinity (as $CaCO_3$)		296.	5.92
Turbidity		Tr.		Hardness (as $CaCO_3$)		265.	5.30
Color		0		Residue		328.	
Odor		Tr.		Temperature 56.5° F.			

Sample-study log of Well No. 4 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Silt and sand	5	5
Gravel, clean	29	34
Silurian system		
Niagaran-Alexandrian dolomites	71	105
Ordovician system		
Maquoketa dolomite and shale	135	240
Galena-Platteville dolomites	340	580
Glenwood sandstone and dolomite	5	585
St. Peter formation		
Sandstone	65	650
Shale	3	653
Sandstone	107	760
Sandstone, some shale	45	805
Sandstone	118	923
Conglomerate of sandstone, chert, shale and dolomite	169	1092
Cambrian system		
Franconia sandstone, dolomite and shale	30	1122
Galesville formation		
Sandstone, partly dolomitic	98	1220
Sandstone, some shale	50	1270
Sandstone, partly dolomitic	13	1283
Eau Claire shale, dolomite, sandstone and limestone	392	1675
Cambrian and Pre-Cambrian systems		
Mt. Simon and Fond du Lac sandstones	592	2267

mutual interference was slight but readily detected in the test data. Apparent equilibrium was attained after 9-hr. pumping at 990 gpm. with a drawdown of 172 ft. Pumping was continued at the same rate for the balance of 22-hr. test. The drawdown remained constant except for variations of 1 to 2 ft. when Well No. 2 was in operation.

The existing pump installation, made June 1945, is 360 ft. of 10-in. column pipe; 12-in., 10-stage Aurora Pump Co. turbine No. 24624, having an overall length of 11 ft. and a rated capacity of 1000 gpm. against 320 ft. of head at 1160 gpm.; 30 ft. of 10-in. suction pipe; 3 ft. of 10-in. strainer; 382 ft. of 1/4-in. gi. air line; 150-hp. U. S. electric motor.

This well has been in daily service since June, 1945.

On July 26, 1947 the water level was 322 ft. below the pump base after 3-hr. pumping, and on July 30, 1947 the water level was 137 ft. after 4 hr. of idle period.

Analysis of a sample (Lab. No. 115,959) collected Sept. 28, 1948 after 2 3/4-hr. pumping at 815 gpm., showed this water to have a hardness of 15.9 gr. per gal., a total mineral content of 368 ppm., and a trace of iron content.

A sample collected Apr. 21, 1947 after 3 1/2-hr. pumping was found to have a chloride content of 19 ppm. and a temperature of 56.2° F. indicating the presence of a lesser proportion of water from the bottom of the hole at this time.

All water for the public supply is chlorinated.

Metered pumpage for the calendar years of 1942 to 1946 inclusive averaged 881,260 gpd.

Industrial pumpage from limestone wells averages 108,000 gpd. and from sandstone wells --- 217,000 gpd.

LABORATORY NO. 115,959

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	Tr.		Silica	SiO_2	13.1	
Manganese	Mn	0.0		Fluoride	F	0.8	
Calcium	Ca	66.4	3.32	Chloride	Cl	24.0	0.68
Magnesium	Mg	25.3	2.08	Nitrate	NO_3	0.2	0.03
Ammonium	NH_4	0.2	0.01	Sulfate	SO_4	27.8	0.58
Sodium	Na	28.5	1.24	Alkalinity	(as $CaCO_3$)	268.	5.36
Turbidity		Tr.		Hardness	(as $CaCO_3$)	270.	5.40
Color		0		Residue		363.	
Odor		0		Temperature 58° F.			

Waterworks were first installed by the city of Genoa (1290) in 1900.

The initial supply was obtained from a well drilled to a reported depth of 1500 ft. A second well, drilled to a depth of 730 ft. was added to the supply in 1922. These 2 wells were spaced about 25 ft. apart and are located in the west part of the city about 50 ft. south of Main St. and 350 ft. west of S. State St. (approximately 900 ft. N. and 1550 ft. E. of the S. W. corner of Section 19, T. 42 N., R. 5 E.). The elevation of the ground surface is 820i ft.

The first well, called North Well, is reported cased with 12-in. pipe to rock at a depth of 73 ft. and ending with a 6-in. diameter hole at the bottom. A liner was installed to case off a stratum of loose limestone but the exact position is unknown.

On Oct. 24, 1913, a non-pumping water level of 50 ft. below the surface was reported and a drawdown of 2 ft. after 24 hr. of pumping at a rate of nearly 200 gpm. Mr. O. T. Bonne reported that the pump was overhauled in Apr. 1948 and, when reinstalled, was set at 200 ft. At the same time the static water level was 71 ft. and the drawdown was 9 ft.

The existing pump installation consists of 200 ft. of 6-in. column pipe; 8-in., 15-stage Fairbanks-Morse turbine pump, No. 30156, rated at 300 gpm. against a head of 273 ft.; the overall length of the pump is 92 in.; 10 ft. of 5-in. suction pipe; 120 ft. of air line (defective); 30-hp. Fairbanks-Morse electric motor. A 6-cylinder, 50-hp. Fairbanks-Morse gasoline engine is connected to the pump by a Johnston spiral gear right-angle drive.

Partial analysis of a sample (Lab. No. 112,031) collected Sept. 24, 1947 from a tap of the pump discharge after 15-minute pumping at an estimated rate of 300 gpm., showed this water to have a hardness of 17.3 gr. per gal., a mineral content of 324 ppm, and an iron content of 0.2 ppm.

The second well, called South Well, was drilled by W. L. Thorne Co., Des Plaines. The well is reported cased to 70 ft. with 12-in. pipe below which it has a diameter of 12 in. to a depth of 507 ft. and 10 in. from 507 ft. to the bottom. Upon completion of the well a standing water level of 47 ft. below the surface and a drawdown of 7 ft., when pumped continuously, were reported. A very short test made on June 26, 1923, indicated a production of 250 gpm.

The pump installation was made on Oct. 5, 1936: '130 ft. of 5-in. column pipe; an 8-in., 12-stage American Well Works turbine pump, No. 60409, rated at 300 gpm. against 270 ft. of head; the overall length of the pump is 6 ft. 9 13/16 in.; 10 ft. of 5-in. suction pipe; 130 ft. of 1/4-in. galvanized iron air line; 30-hp. U. S. electric motor.

On Sept. 24, 1947 the following water levels below the pump base were observed by air line: a non-pumping level of 62 ft. after 20 min. of idle period for both wells and 75 ft. after 15 min. of operation of the North Well, and a pumping level of 120 ft. after 20 min. of pumping at 300 gpm. of the South Well.

Analysis of a sample (Lab. No. 112,030) collected Sept. 24, 1947 after pumping 20 min. at 300 gpm., showed this water to have a hardness of 18.0 gr. per gal., a residue of 349 ppm., and an iron content of 0.4 ppm.

Large industrial consumers are Leich Electric Co., John Cater Mfg. Co., Falls Products Co., and Genoa Products Co. The average total estimated pumpage is 145,000 gpd.

The Illinois Central Railroad owns a well drilled to a depth of 700 ft. by the J. P. Miller Artesian Well Co., Brookfield, in 1943. It is located approximately 2300 ft. N. and 800 ft. W. of the S. E. corner of Section 24, T. 42 N., R. 4 E. The elevation of the ground surface is 795t ft.

LABORATORY NO. 112,031

	ppm.	epm.			ppm.	epm.
Iron (total) Fe	0.2		Fluoride	F	0.1	
Turbidity	Tr.		Chloride	Cl	1.0	0.03
Color	0		Alkalinity (as $CaCO_3$)		304.	6.08
Odor	0		Hardness (as $CaCO_3$)		296.	5.92
Temperature 51.5° F.			Total Mineral Content		324.	
pH = 7.15			Free CO_2 (calc.)		57.	

The well was cased with 12 1/2-in. pipe from the surface to 30 ft. and with 10-in. pipe from the surface to 137 ft. Below the 12 1/2-in. casing the well was drilled 12 1/2 in. in diameter to 137 ft., followed by a 10-in. hole to the bottom. Upon completion of the well the standing water level was 46 ft. below the surface. The pumping water levels were 88 ft. at 390 gpm., 92 ft. at 397 gpm., and 102 ft. at 455 gpm.

This well is in daily service and supplies about 100,000 gpd. for the use of locomotives.

LABORATORY NO. 112,030

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.4		Silica	SiO_2	24.4	
Manganese	Mn	0.0		Fluoride	F	0.2	
Calcium	Ca	70.4	3.52	Chloride	Cl	6.0	0.17
Magnesium	Mg	36.9	3.04	Nitrate	NO_3	2.7	0.04
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	22.0	0.46
Sodium	Na	6.2	0.27	Alkalinity	(as $CaCO_3$)	308.	6.16
Turbidity		10.		Hardness	(as $CaCO_3$)	328.	6.56
Color		5.		Residue		349.	
Odor		0.		Free CO_2 (calc.)		57.	
Temperature 52.1° F.				pH = 7.15			

Sample-study log of the Illinois Central Railroad well furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Gravel"	15	15
Glacial till	5	20
Gravel, coarse	8	28
Ordovician system		
Galena-Platteville dolomites	401	429
Glenwood dolomite, some sandstone	41	470
St. Peter formation		
Sandstone	215	685
Conglomerate of chert and sandstone	15	700

GERMANTOWN
Clinton County
Apr. 12, 1948

The village of Germantown (796) installed a public water supply in 1909.

Water is obtained from a well dug to a depth of 16 ft. and a diameter of 10 ft. by Frank Norrenberns and located near the southeast corner of Church and Prairie St., 2 1/2 blocks south and 1/2 block east of the railroad station (or approximately 550 ft. N. and 1200 ft. W. of the S. E. corner of Section 4, T. 1 N., R. 4 W.). The ground surface elevation at the well site is 435t ft.

This well is used primarily for fire protection purposes, for which it was constructed.

In 1928 it was reported that the pump was operated about 3/4 hr. per day, and that the well was nearly dry after this period. On Mar. 24, 1948, the static water level was 5 1/2 ft. below the top of the concrete well cap (1 ft. above ground level). At the same time, the pump was operated about 1/2 hr. daily.

The well is equipped with a Fairbanks-Morse centrifugal pump, rated at 70 gpm. against a pressure of 50 psi. and driven by a 5-hp. electric motor.

Analysis of a sample (Lab. No. 113,936) collected Mar. 24, 1948 from the top of the well, showed the water to have a hardness of 35.0 gr. per gal., a residue of 1018 ppm., and an iron content of 0.3 ppm.

Pumpage is estimated to average 2100 gpd.

Correlated driller's log of Germantown coal test hole drilled in 1897 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and clay	16	16
Sand, some gravel	13	29
Pennsylvanian system		
Shale, thin bed of coal	83	112
Gravel (?), sand and shale	48	160
Sandstone	68	228
Shale, thin beds of limestone and coal	126	354

LABORATORY NO. 113,936

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.3		Silica	SiO_2	17.9	
Manganese	Mn	0.4		Fluoride	F	0.2	
Calcium	Ca	150.	7.54	Chloride	Cl	52.0	1.47
Magnesium	Mg	54.5	4.48	Nitrate	NO_3	32.6	0.52
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	373.6	7.77
Sodium	Na	104.4	4.54	Alkalinity	(as $CaCO_3$)	340.	6.80
Turbidity		0		Hardness	(as $CaCO_3$)	601.	12.02
Color		0		Residue		1018.	
Odor		0		Free CO_2 (calc.)		43.	
Temperature 56° F.				pH = 7.3			

In 1897, a test-hole was drilled for a coal mine at Germantown and located 1400 ft. N. and 3600 ft. W. of the S. E. corner of Section 4. The ground elevation at the site is 438.55 ft.

Well A, called the Giant City Well, was drilled about 1926 to a depth of 131 ft. by J. B. Weigle, Murphysboro, and is located approximately 500 ft. S. and 100 ft. W. of the N. E. corner of Section 3, T. 11 S., R. 1 W. The surface elevation is 552± ft. The well is cased with 22 ft. of 8-in. pipe.

The non-pumping water level in 1939 was reported to be 20 ft. below the ground surface. In 1943, the use of this well was discontinued. The pump and motor were removed, but the eductor pipe is still in place. In the spring of 1947, water flowed from the well to a reservoir at 6 ft. below ground surface.

Analysis of a sample (Lab. No. 66030), collected Mar. 9, 1930, showed the water to have a hardness of 62.5 gr. per gal., a residue of 1487 ppm., and an iron content of 24.0 ppm.

Well B was drilled in 1929 to a depth of 175 ft. by J. B. Weigle and located at the park custodian's residence (or approximately 1200 ft. N. and 350 ft. E.of the S. W. corner of Section 35, T. 10 S., R. 1 W.). The surface elevation is 681 ft.

The casing extends to a depth of 34 ft. In 1933, the well was equipped with a Duro pump No. 70502-F941, operated by a 1/2-hp. electric motor and was reported to yield about 1/2 gpm.

Analysis of a sample (Lab. No. 65439), collected Nov. 17, 1929, showed the water to have a hardness of 30.6 gr. per gal., a residue of 892 ppm., and an iron content of 10.0 ppm.

The well has not been used since 1943. A water supply is furnished by a cistern collecting roof run-off.

Well No. 1, C. C. C. Camp Well, was drilled in 1933 to a depth of 344 ft. by C. W. Varner, Dubuque, Iowa, and is located about 1150 ft. south of the custodian's residence (or approximately 100 ft. N. and 500 ft. E. of the S. W. corner of Section 35). The surface elevation is 636t ft. The well is cased to a depth of 229 ft. with 6-in. pipe.

Pumping equipment consists of a Fairbanks-Morse deep well cylinder pump rated at 20 gpm., with the cylinder set at a depth of 300 ft., driven by a 5-hp. electric motor No. 284891, operating at 1740 rpm.

It was reported that the production was always adequate for the camp needs within the capacity of the pump.

Analysis of a sample (Lab. No. 73237), collected July 14, 1933, showed the water to have a hardness of 33.9 gr. per gal., a residue of 765 ppm., and a trace of iron'.

Sample study log of Well No. 4 furnished by the State Geological Surveyr

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Top soil and loess"	7 1/2	7 1/2
Pennsylvanian system		
"Sandstone"	62 1/2	70
Shale, siltstone and compact sandstone	175	245
Sandstone, incoherent, compact at base	60	305
Shale and sandstone	10	315
Sandstone, incoherent	30	345
Mississippian system		
Chester series		
Kinkaid limestone, thin shale beds	150	495
Degonia formation		
Sandstone and shale	30	525
Sandstone incoherent to compact	70	595
Chlore shale	5	600

This well has not been in service since Well No. 4 was placed in service in 1940.

Well No. 2, Stonefort Hollow, was drilled in 1933 to a depth of 135 ft. and is located in the northern part of the valley of Stone Fork Creek (or approximately 1400 ft. S. and 900 ft. W. of the N. E. corner of Section 27).- The surface elevation is 443± ft.

The well is cased with 6 in. pipe to a depth of 82 1/2 ft. and the hole is 6 in. in diameter below that depth.

In 1933, the non-pumping water level was reported to be 2 ft. 9 in. below the ground surface, and the production by hand pump about 20 gpm.

Analysis of a sample (Lab. No. 73383), collected Aug. 16, 1933 showed the water to have a hardness of 13.2 gr. per gal., and a residue of 326 ppm.

The pump was removed in 1943 and a wood plug driven in the top of the 6-in. casing.

Well No. 3, the Lodge Well, is located in the southeastern part of the park (or approximately 1700 ft. N. and 2500 ft. E. of the S. W. corner of Section 2, T. 11 S., R. 1 W.). This well is 393 1/2 ft. deep below a surface elevation of 752± ft.

The well is equipped with a Meyers deep well pump, rated at 6 gpm. and driven by a 3-hp., electric motor.

It was reported thatthe water had a total hardness of 32.7 gr. per gal. This well supplies lodge facilities and 12 cabins during season.

Well No. 4 was drilled in 1940 to a depth of 600 ft. by the Erie Drilling Co., Litchfield, and is located about 2500 ft. northwest of the Lodge (or 265 ft. S. and 1482 ft. E. of the N. W. corner of Section2). The ground surface elevation is 672.79 ft.

The hole and casing record is shown in Table 1.

TABLE 1

Hole Record

10-in. from surface to 140 ft.
8-in. from 140 to 514 ft.
6-in. from 514 to 600 ft.

Casing Record

10-in. from surface to 140 ft.
6-in. from surface to 521 ft.

The State Water Survey made a production test on Mar. 8, 1940. After bailing at an average rate of 21 1/2 gpm. for 30 minutes, the drawdown was about 100 ft. from a static water level of 66 ft. Equilibrium conditions were not established.

It was reported that whentested by the driller, the well yielded about 14 gpm. with a drawdown of 360 ft. from a non-pumping water level of 143 ft.

The well was then "shot" at 545 ft. and at 585 ft. levels. Another test was made, and it was reported that the well produced about 50 gpm. with a drawdown of 230 ft. from a non-pumping water level of 170 ft.

Pumping equipment, installed in 1941, consists of: 370 ft. of 5-in. column pipe; 5 5/8-in., 35-stage Fairbanks-Morse turbine pump, No. 10267, rated at 50 gpm. against 469 ft. of head, operating at 1750 rpm.; 10 ft. of 5-in. suction pipe and strainer; Buda gasoline engine.

In 1941, the pump yielded 60 gpm. when operating at 1650 rpm. against a 23 ft. head.

In Mar. 1948, the pump was pulled for repairs, and the Buda gas engine was to be replaced

LABORATORY NO. 103,558

	ppm.	epm.			ppm.	epm.
Iron (total) Fe	3.1		Chloride	Cl	17.0	.48
			Sulfate	SO_4	139.9	2.91
Turbidity	200.		Alkalinity	(as $CaCO_3$)	238.	4.76
Color	0		Hardness	(as $CaCO_3$)	330.	6.60
Odor	0		Total Mineral Content		510.	
Temperature 65° F.						

by a 25-hp. General Electric motor.

Analysis of a sample (Lab. No. 103,558), collected June 20, 1945, showed the water to have a hardness of 19.2 gr. per gal., a residue of 510 ppm., and an iron content of 3.1 ppm.

Pumpage from this well, during fruit-picking time, averages about 7000 gpd.

A water supply was installed by the city of Gibson (2401) in 1895.

Water was obtained originally from 3 wells, 55 ft. in depth and located at the old pumping station on the west side of Melvin St. south of the Illinois Central R. R. tracks, (or approximately 350 ft. S. and 1450 ft. W. of the N. E. corner of Section 11, T. 23 N., R. 7 E.). The ground surface elevation is 760t ft. The wells were located 100 ft. apart in an equilateral triangle arrangement, with 2 wells north and south and the third well at the apex of the triangle to the west. The wells were cased with 6-in. pipe; penetrating clay and hardpan and terminating in a sand stratum of 5 ft. thickness. The bottom 5 ft. was constructed with perforated pipe wrapped with woven wire.

About 1916, a 15-in. well was drilled to a depth of 55 ft. and located about 20 ft; west of the pumping station. In 1930 the well was cleaned and rebuilt. The 10-ft. length of No. 3-slot Johnson screen was cleaned and the slots enlarged to No. 6 size. In 1938 this well was furnishing most of the city supply. The well was later plugged at a depth of 15 ft. below the surface.

Analysis of a sample (Lab. No. 80150) collected Jan. 16, 1934 showed this water to have a hardness of 16.4 gr. per gal., a residue of 313 ppm., and an iron content of 1.0 ppm.

In 1918, the non-pumping water level was 10 ft. below the ground surface. In 1918, during pumping operations, fine sand was being drawn around the strainers of the 3 original wells and the yield of the wells was seriously reduced. In 1920, four additional wells were drilled by A. Swanson, Gibson, and located 30 ft. apart and in a line extending east from the apex or westerly well of the original 3 wells. The new wells were also 55 ft. deep but cased with 3-in. pipe and with 5-ft. length perforated pipe screens.

In 1927, Well No. 1 was drilled by American Water Corporation, Aurora, and located on the south side of Thirteenth St. between Lott and Church St. (approximately 70 ft. S. and 2000 ft. W. of the N. E. corner of Section 11).

The well is 58 ft. deep terminating in 20 ft. of sand. An outer 38-in. casing was set from ground surface to 38 ft. and an inner 24-in. casing, with 24-in. screen, was set from the ground surface to 58 ft. The annular space outside of the screen and between the casings was packed with gravel.

The pump assembly, installed in Nov. 1941, consists of 41 ft. of 8-in. column pipe; 12-in., 7-stage American Well Works turbine pump, No. 65293, rated at 500 gpm. against 190 ft. of head at 1140 rpm.; 5 ft. of 8-in. suction pipe; 40 1/2 ft. of 1/4-in. air line; 40-hp., 1200 rpm. General Electric motor.

The 12-in. bowlassembly that was replaced in Nov. 1941 was heavily coated with a soft brown deposit, which had caused a considerable reduction in the pump efficiency.

A production test was made by the State Water Survey on Nov. 19, 1941. Before the test, the water level was 11 3/4 ft. below ground level which is 3 ft. below the pump base. After 4-hr. pumping at 430 gpm. the drawdown was 23 1/4 ft. The pumping rate was then gradually increased to 600 gpm., and the drawdown after 2-hr. pumping was 37 3/4 ft.

In a production test made by the State Water Survey on May 2, 1939, after 2-hr. pumping at 380 gpm., the drawdown was 20.2 ft. from a water level of 9.8 ft. below the ground level. On Oct. 14, 1948 the water level was 13 1/2 ft. below ground level, after a 19-hr. non-pumping period. About the same date, the water level was 33 1/2 ft. after a 5-hr. pumping period.

The pump in Well No. 1 is operated alternately with the pump in Well No. 2.

Analysis of a sample (Lab. No. 105,168) collected Jan. 3, 1946 showed the water in Well No. 1 to have a hardness of 18.1 gr. per gal., a mineral content of 343 ppm., and an iron content of 2.0 ppm.

In Aug. 1939, a test well was drilled to a depth of 61 ft. 3 in. by Hayes & Sims, Champaign, and located on the south side of Thirteenth St. 550 ft. west of Well No. 1.

Analysis of a sample (Lab. No. 86117) showed this water to have a hardness of 13.1 gr.per gal., a residue of 346 ppm., and an iron content of 14.8 ppm.

Well No. 2 was drilled in Dec. 1939 to a depth of 56 ft. by Layne-Western Co., Chicago, and located at the southeast corner of Thirteenth and State St., 1050 ft. west of Well No. 1 (or approximately 75 ft. S. and 2280 ft. E. of the N. W. corner of Section 11).

A 30-in. outer casing was placed from 2 ft. above to 36 ft. below the ground surface and an

18-in. inner casing from 22 in. above to 36 ft. below the surface with an 18-in. Layne stainless steel shutter screen extending from 36 to 56 ft. The annular space between the casings and outside the screen was packed with gravel.

The pumping assembly made in Jan. 1948 consists of 40 ft. of 6-in. id. column pipe; 8-in. 9-stage Aurora Pump Co. turbine pump, No. 38164 having bronze bowls and rated at 300 gpm. against 220 ft. of head; the overall length of the pump is about 10 ft.; 50 ft. of 1/4 -in. gi. air line; 30-hp. U. S. electric motor, No. 178760.

A production test was made by the State Water Survey on Jan. 8, 1940 at which time the static water level was 15 1/2 ft. below the ground surface of 753± ft. After 8-hr. pumping at 500 gpm. with equilibrium conditions established, the drawdown was 20 1/2 ft.

A second production test was made by the State Water Survey on Sept. 3, 1940. Before the test the water level was 14 1/2 ft. below the top of the casing, or 3 ft. higher than in Jan. 1940. After 7-hr. pumping at 500 gpm. the drawdown was 19.9 ft. Thus after 8 months the capacity of this well was slightly improved. On Oct. 14, 1948, after 20-min. pumping at 375 gpm., the water level was 37 1/2 ft. below the pump base. On a recent date the water level was 20 ft. after a 24-hr. non-pumping period.

Analysis of a sample (Lab. No. 118,253), collected May 17, 1949, showed this water to have a hardness of 20.0 gr. per gal., a residue of 398 ppm., and an iron content of 1.7 ppm.

As a consequence of an electrical earth resistivity survey made by the State Geological Survey in 1939, four test holes were drilled in July, 1949, by Layne-Western Co. and located east of Sangamon St. and north of Fourteenth St. Test-hole No. 1 was reported to be 48 ft. deep and cased with 6-in. pipe and a 5 ft. length of 6-in. screen.

A production test was made of Test-hole No. 1 on July 21, 1949, by the State Water Survey. One hr. before starting the test, the pump in Well No. 1, 800 ft. south, was stopped. During that period the water level in Test-hole No. 1 raised 1.4 ft. to 20.5 ft., which was the depth to water at the start of the test. After 2-hr. pumping at 47 gpm. the drawdown was 8.6 ft. and then after the next 1 1/2-hr. pumping at 74 gpm. the drawdown was 16.5 ft. The pump in Well No. 1 was then started and after 1 1/2-hr. pumping in Test-hole No. 1 at 74 gpm. the drawdown was 17.9 ft. Three min. after stopping the Test-hole pump, but with the pump in Well No. 1 still operating, the water level in Test-hole No. 1 was 22.0 ft. When pumping in Well No. 1 the water level in Test-hole No. 1 was lowered 1.4 ft. When pumping in Test-hole No. 1 the water level in Test-hole No. 4, located 400 ft. east and 150 ft. south, was lowered from 14.4 to 14.7 ft.

Well No. 3 was completed in Sept., 1949, to a depth of 58 ft. by Layne-Western Co. and located at the site of Test-hole No. 1. The well casing consists of 30-in. outer casing extending from 2.0 ft. above to 38.0 ft. below ground level, and 18-in. inner casing extending from 2 ft. 3 in. above to 38.0 ft. below ground level. An 18-in. Layne No. 4 shutter-type screen, having 19 1/2 ft. of slot openings, is in place with the bottom set at 58 ft. The lower 28 in. of the screen is cone-shaped. Gravel was packed outside the screen and between the casings to about 15 ft. above the screen.

LABORATORY NO. 118,253

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.7		Silica	SiO_2	25.1	
Manganese	Mn	0.0		Fluoride	F	.2	
Calcium	Ca	81.8	4.09	Chloride	Cl	5.	.14
Magnesium	Mg	33.3	2.74	Nitrate	NO_3	1.8	.03
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	69.5	1.45
Sodium	Na	5.3	.23	Alkalinity (as $CaCO_3$)		272.	5.44
Turbidity		9		Hardness (as $CaCO_3$)		342.	6.83
Color		0		Residue		398.	
Odor		0					
Temperature 53.9° F.							

A production test was made by the State Water Survey on Sept. 20, 1949, using a Layne turbine pump, operated from a gasoline engine. The 6-in., 2-stage pump was 4 ft. long and set with the top of the pump at 47 ft. below the top of the casing or 7 ft. below the top of the screen. Before the test, the water level was 19.7 ft. below the top of the casing and after 8-hr. pumping at an average rate of about 400 gpm. the drawdown was 17.9 ft. During the test, when pumping at a maximum rate of 472 gpm., the drawdown was 19.9 ft. which was level with the top of the screen. Fifteen min. after stopping the pump, the water level was 22.8 ft., or 3.1 ft. below the level at the start of the test.

Analysis of a sample (Lab. No. 119,440) collected Sept. 20, 1949, after 6 3/4-hr. pumping showed this water to have a hardness of 17.7 gr. per gal., a residue of 341 ppm. and an iron content of 1.0 ppm.

Total pumpage is estimated to average 281,000 gpd., of which 128,000 gpd. is metered to industry.

LABORATORY NO. 119,440

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.0		Silica	SiO_2	18.3	
Manganese	Mn	0.0		Fluoride	F	0.2	
Calcium	Ca	64.7	3.24	Chloride	Cl	2.0	.06
Magnesium	Mg	33.9	2.78	Nitrate	NO_3	3.5	.06
Ammonium	NH_4	0.1	.01	Sulfate	SO_4	26.7	.56
Sodium	Na	5.8	.25	Alkalinity (as $CaCO_3$)		280.	5.60
Turbidity		5		Hardness (as $CaCO_3$)		301.	6.02
Color		0		Residue		341.	
Odor		0		Free CO_2 (calc.)		45.	
Temperature 53.5° F.				pH = 7.2			

Apublic water supply was installed in 1896 by the city of Gilman (1554). Until 1909, the water works plant was operated by the Gilman Electric Light Co.

A well was drilled in 1896 and prior to 1913, five additional wells were drilled, each to a depth of 120 ft. and located at the water works plant on the west side of Hartwell St., south of the Toledo, Peoria and Western R. R. (or approximately 140 ft. S. and 2210 ft. E. of the N. W. corner of Section 6, T. 26 N., R. 14 W.). The ground elevation is 654± ft.

Three of the wells were cased with 2-in. pipe and the other 3 with 6-in. pipe. At first, each well was fitted with a strainer having 3/8-in. perforations, but, because of the fineness of the water-bearing sand, the strainers were considered useless and were removed.

In 1913, water flowed from the tops of the wells into a collecting reservoir. Each well was equipped with an air pipe, in order to apply air pressure in case the flow slacked off.

In 1917, a 4-in. well was added to the group, and the city water supply was obtained from 2 of the 6-in. wells and the 4-in. well. The 2-in. wells had a slight flow but contributed a very small part of the supply, and were subsequently abandoned.

The south 6-in. well was equipped with an air lift, with 80 ft. of 3/4-in. air pipe. In 1918 the air lift was operated about 6 hr. daily at an estimated rate of 100 gpm. The measurement of discharge was made from the water levels in the reservoir but was not exact because of the measurements being made near the discharge pipe, where there was considerable turbulence. The south 6-in. well is still in service with the same air lift assembly. On Nov. 5, 1948 the discharge over the aerator was estimated to be 50-60 gpm.

The north 6-in. well failed on Oct. 15, 1948. Lowell French, Ashkum, reported that he bailed out 32 ft. of sand and corroded pieces of casing to a depth of 128 ft. The well has not been re-turned to service and may be abandoned because of its proximity to the new 5-in. well, about 8 ft. east.

The 4-in. well failed on Oct. 15, 1948 and will probably be abandoned.

In 1921, two 8-in. wells were drilled by O. H. Stiegman, Roberts, and located - one at 10 ft. north and the other at 20 ft. south of the pumping station. The 2 wells were said to be identical in construction and to be 120 and 135 ft. deep. At the top of each well is a reservpir 9 ft. deep and 6 ft. in diameter below a depth of 3 1/2 ft. The upper 3 1/2 ft. is drawn in to about 3 ft. diameter and covered with a lid.

The top of the 8-in. casing in the north well is 8 ft. 3 in. below the cover plate. The north 8-in. well has been out of service about 3 or 4 years.

The south 8-in. well failed Oct. 15, 1948 and was rehabilitated by Lowell French. A 6-in. casing was driven to a depth of 128 ft. 5 in. below the well lid. The bottom 5 ft. of casing was perforated with 3/8-in. holes spaced 1 in. apart. After bailing out about 22 ft. of sand and corroded pieces of 8-in. casing, a production test was made. When pumping at a rate of 120 gpm. the drawdown was 23 ft. from a non-pumping water level of 3 ft. below the top of the lid. The top 5 ft. of casing was subsequently cut off and a tee welded to the cas-

LABORATORY NO. 116,361

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.2		Silica	SiO_2	19.9	
Manganese	Mn	Tr.		Fluoride	F	0.3	
Calcium	Ca	152.6	7.63	Chloride	Cl	20.0	0.56
Magnesium	Mg	57.1	4.70	Nitrate	NO_3	0.3	Tr.
Ammonium	NH_4	1.9	0.11	Sulfate	SO_4	401.1	8.35
Sodium	Na	67.9	2.95	Alkalinity	(as $CaCO_3$)	324.	6.48
Turbidity		16		Hardness	(as $CaCO_3$)	617.	12.33
Color		0		Residue		947.	
Odor		0		Free CO_2 (calc.)		47.	
Temperature 54° F.				pH = 7.25			

LABORATORY NO. 116,353

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Fluoride	F	0.4	
Calcium	Ca	3.8	0.19	Chloride	Cl	23.0	0.65
Magnesium	Mg	6.8	0.55	Sulfate	SO_4	435.5	9.06
Sodium	Na	358.6	15.59	Alkalinity	(as $CaCO_3$)	332.	6.64
Turbidity		4		Hardness	(as $CaCO_3$)	38.	0.76
Color		0		Residue		1036.	
Odor		0		Free CO_2 (calc.)		8.	
Temperature 55° F.				pH = 8.0			

ing to permit a free flow to the storage reservoir at the top of the well.

Because of the urgent demand for water, the south 8-in. well was immediately returned to service. Water is temporarily pumped by suction lift and discharged through a fire hose. It is planned to install a Westco centrifugal pump with 40 ft. of 2-in. suction pipe.

Analysis of a sample (Lab. No. 116,361) collected Nov. 5, 1948 after continuous pumping at an estimated rate of 100 gpm., showed this water to have a hardness of 36.0 gr. per gal., a residue of 947 ppm., and an iron content of 2.2 ppm.

All water is aerated and softened. Analysis of a sample (Lab. No. 116,353) collected Nov. 5, 1948 showed the treated water to have a hardness of 2.2 gr. per gal., a residue of 1036 ppm., and an iron content of 0.2 ppm.

A well was completed at a depth of 129 ft. in Oct. 1948 by Lowell French, and located 8 ft. south and 2 ft. east of the north 6-in. well. The drilling extended to 141 ft. but the bottom, from 129 to 141 ft., was a formation of blue clay. Immediately above the blue clay formation was brown dirty sand from 119 to 122 ft. and gravel from 122 to 129 ft.

The well was cased with 124 ft. of 5-in. pipe and 5 ft. of 5-in. Johnson Everdur screen having No. 40 slot openings.

When completed, a production test was made by the driller. After 3-hr. pumping at an average rate of 112 1/2 gpm., the drawdown was 25 ft. from a non-pumping water level of 2 ft. below the ground surface. All other wells at the site were idle.

Total pumpage is estimated to average 105,500 gpd.

The public water supply was installed by the village of Glasford (782) in 1917.

At that time a well was drilled to a depth of 1669 ft. by R. J. Bauereisen, and located near the center of the village (or approximately 2100 ft. N. and 450 ft. E. of the S. W. corner of Section 22, T. 7 N., R. 6 E.). The elevation of the ground surface is 610± ft.

The well was cased from the surface to a depth of 620 ft. with 10-in. wi. pipe. The diameter of the bore was 10 in. from 620 to 1130 ft. and 8-in. below that depth.

The following pump assembly, installed in 1945 by Mike Ebert, Washington, is in place: 130 ft. of 5-in. id. column pipe; 8-in., 10-stage Poma Electric Unidrive turbine, rated at 175 gpm. against 130 ft. of head; 10 ft. of suction pipe and strainer; 20-hp., 1760 rpm. Westinghouse electric motor. There is no airline.

When the well was completed, the non-pumping water level was 60 ft. below the ground surface. It was reported that, during a test, water was pumped at a rate of 140 gpm. for 5 hr. The driller reported that the well was baled for 1 hr. at a rate of 105 gpm. without lowering the water level.

Analysis of a sample (Lab. No. 109,096), collected Jan. 31, 1947, after 5-min. pumping, showed the water to have a hardness of 13 gr. per gal., a residue of 1866 ppm., and an iron content of 1.0 ppm.

The water is aerated.

Pumpage is estimated to average 65,000 gpd.

Correlated driller's log of well drilled in 1917 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene and Pennsylvanian systems		
Subsoil and sandstone	160	160
Pennsylvanian system		
Sandstone, some water	15	175
Shale, thin limestone bed	125	300
Sandstone, little water	20	320
Shale, thin limestone bed	150	470
Mississippian system		
Keokuk - Burlington formations		
Limestone	180	650
Kinderhook group		
Shale	230	880
Devonian and Silurian systems		
Limestone, little water	250	1130
Ordovician system		
Maquoketa formation		
Shale and slate	220	1350
Galena-Platteville formations		
Limestone	280	1630
St. Peter formation		
Sandstone	55	1685

LABORATORY NO. 109.096

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.0		Silica	SiO_2	14.3	
Manganese	Mn	0.0		Fluoride	F	4.0	
Calcium	Ca	57.5	2.88	Chloride	Cl	450.0	12.69
Magnesium	Mg	18.9	1.55	Nitrate	NO_3	1.1	0.02
Ammonium	NH_4	1.6	0.09	Sulfate	SO_4	564.9	11.75
Sodium	Na	585.6	25.46	Alkalinity	(as $CaCO_3$)	276.	5.52
Color		0		Hardness	(as $CaCO_3$)	222.	4.44
Odor (at well)		H_2S		Residue		1866.	
Turbidity		20					
Temperature 70° F.							

GLEN CARBON
Madison County
Dec. 3, 1948

An attempt was made in 1939 to install a public water supply for the village of Glen Carbon (1091). A dug well, 10 ft. in diameter, and curbed with porous concrete, was constructed in the ball park in the valley of Judy's Branch (or approximately 950 ft. N. and 100 ft. W. of the S. E. corner of Section 33, T. 4 N., R. 8 W.). At a depth of 33 ft. only blue mud had been penetrated and the maximum inflow was 8 ft. of water in 13 hr. A small auger hole was put down to an additional depth of 30 ft. but no important water-bearing formation was penetrated.

The State Water Survey made a production test in each of 2 test pits. One pit had been originally constructed in 1890 as a mine ventilating shaft, but had been abandoned when the shaft became flooded with water at a depth of 40 ft. The shaft was located within the village limits about 100 ft. northerly of the center line of the Litchfield and Madison R. R. tracks. The test made by the State Water Survey on Aug. 31, 1939 indicated a yield of about 11 gpm.

Analysis of a sample (Lab. No. 86250) collected Aug. 31, 1939 showed this water to have a hardness of 43.5 gr. per gal., a residue of 966 ppm., and an iron content of 0.2 ppm.

The second pit had been constructed by the village and located 340 ft. northeasterly from the old ventilating shaft. The inside dimensions of the pit were 5 3/4 x 5 3/4 ft. after being curbed with timber to a depth of 26 ft. An auger hole from 26 to 51 ft. penetrated hard tough shale from 26 to 49 ft. and soft gravelly clay with water from 49 to 51 ft.

The test made by the State Water Survey on Aug. 31, 1939 indicated a yield of less than 49 gpm.

Analysis of a sample (Lab. No. 86252) collected Aug. 3 1, 1939 showed this water to have a hardness of 19.5 gr. per gal., a residue of 400 ppm., and no iron.

Water is obtained from a well drilled in 1940 to a depth of 72 ft. by Harold Watson, East St. Louis, and located in the American Bottoms about 1 1/4 mile southwest of Glen Carbon (or approximately 1800 ft. S. and 4500 ft. E. of the N. W. corner of Section 5, T. 3 N., R. 8 W.). The elevation of the ground surface is 440± ft.

Correlated driller's log of well drilled in 1940 furnished by the State Geological Survey:

Formation	Thickness ft.	Thickness in.	Depth ft.	Depth in.
Pleistocene system				
Clay	30		30	
Sand	4	6	34	6
Clay	2	6	37	
Sand	10	6	47	6
Mud	1		48	6
Sand, grading to gravel	16	6	65	
Gravel	7		72	
Pennsylvanian system				
Rock	at		72	

The well was cased with 6-in. pipe to a depth of 62 ft. and with 10 ft. of Johnson Everdur welded screen, having No. 20 slot openings.

A production test was made by the State Water Survey on Apr. 5, 1940. Before the test, water had been pumped at an unknown rate for 45 1/2 hr. After a 30-minute shut-down the water level was 24 1/2 ft. below ground level and then after 4-hr.

LABORATORY NO. 116,649

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	3.0		Silica	SiO_2	23.8	
Manganese	Mn	0.2		Fluoride	F	0.4	
Calcium	Ca	162.8	8.14	Chloride	Cl	27.0	0.76
Magnesium	Mg	69.1	5.68	Nitrate	NO_3	0.2	Tr.
Ammonium	MH_4	0.2	0.01	Sulfate	SO_4	337.1	7.01
Sodium	Na	22.5	0.98	Alkalinity (as $CaCO_3$)		352.	7.04
Turbidity		30		Hardness (as $CaCO_3$)		691.	13.82
Color		0		Residue		867.	
Odor		0		Temperature 57.5° F.			

pumping at 65 gpm. the drawdown was 12 ft. The pumping rate was then increased and after 1-hr. pumping at 80 gpm. the drawdown was 15 ft. On Dec. 3, 1948 the non-pumping water level was 28 ft. below the pump base.

The pumping equipment consists of 50 ft. of 4-in. column pipe; 6-in., 8-stage Cook turbine pump, No. 4532, rated at 60 gpm. against 75 ft. of head; the overall length of the pump is 37 7/8 in.; 55 ft. of 1/4-in. air line; 10 ft. of 4-in. suction pipe; 2-hp., 1800 rpm. U. S. electric motor No. 241287.

Analysis of a sample (Lab. No. 116,649), collected Dec. 3, 1948 after 10-min. pumping showed this water to have a hardness of 40.4 gr. per gal., a residue of 867 ppm., and an iron content of 3.0 ppm.

The municipality owns a treatment plant which was not in operation when visited.

Pumpage is estimated to average 12,100 gpd.

GLEN ELLYN
Du Page County
June 17, 1947

A public water supply was installed by the village of Glen Ellyn (8055) about the year 1907.

The initial supply was obtained from a well drilled to a depth of 310 ft. and cased with 8-in. pipe to rock at a depth of 115 ft. It was located about 150 ft. north of Pennsylvania Ave. and 300 ft. west of Main St. Water was reported in the limestone formation at depths of 125 and 196 ft., and in a 13-ft. vein at a depth of 266 ft. The lower 31 ft. of the well was dry hard rock.

A production of 500 gpm. was obtained in a test made in 1916. After pumping for 6 to 7 hr. the drawdown was 93 ft. from a non-pumping water level of 42 ft. below the surface.

This well was in use as a source of supply until about 1939. It was then maintained for emergency purposes until 1944, when the air lift equipment was removed and sold. The well has been abandoned.

Well No. 2 was drilled in 1922 to a depth of 352 ft. by W.L. Thorne Co., Des Plaines, and located about 60 ft. north of the older well (approximately 1400 ft. N. and 1200 ft. E. of the S. W. corner of Section 11, T. 39 N., R. 10 E.). The elevation of the top of the concrete pump base is 761.45 ft.

The well is reported cased with 12-in. pipe to a depth of 116 ft. below which the hole was 12-in. diameter to a depth of 235 ft. 10 in. from 235 ft. to the bottom. A 64-ft. liner of 10-in. pipe was placed to case off the shale.

The following pump installation is in service: 159 ft. of 8-in. column pipe; 12-in., 9-stage Layne turbine pump, No. 5594, having a rated capacity of 750 gpm. against 160 ft. of head; the length of the pump is 8 1/2 ft.; 20 ft. of 8-in. suction pipe; 159 ft. of 1/4-in. wi. air line; 50-hp. Westinghouse electric motor.

From May, 1943 to June, 1947, the non-pumping levels fluctuated between the range of 66 to 76 ft. and were observed during idle periods varying from 1 to 7 weeks, and show interference from pump operations at well No. 3 located about 850 ft. northwest. On Oct. 6, 1942 after the pump had been in operation for 8 hr. at a rate of 750 gpm. the water level was 138 1/2 ft. below the pump base, and on July 29, 1943 after 3 1/2-hr. operation, when the pump in Well No. 3 was in continuous operation at a rate of 770 gpm., the water level dropped to 150 1/2 ft. On June 16, 1947 the pumping water level was 144 ft.

Analysis of a sample (Lab. No. 110,684) collected June 16, 1947 after 6 1/2-hr. pumping at 750 gpm. showed this water to have a hardness of 16.9 gr. per gal., a residue of 471 ppm., and an iron content of 0.5 ppm.

Sample-study log of Well No. 3 by State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Clay"	95	95
Gravel	37	132
Silurian system		
Niagaran and Alexandrian dolomite	127	259
Ordovician system		
Maquoketa shale and shaly dolomite	163	422

During 1947 the operation of this well unit was

LABORATORY NO. 110,684

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.5		Silica	SiO_2	17.4	
Manganese	Mn	0.0		Fluoride	F	0.0	
Calcium	Ca	65.3	3.27	Chloride	Cl	8.0	0.23
Magnesium	Mg	30.6	2.52	Nitrate	NO_3	1.0	0.02
Ammonium	NH_4	0.5	0.03	Sulfate	SO_4	121.8	2.53
Sodium	Na	57.0	2.48	Alkalinity (as $CaCO_3$)		276.	5.52
Turbidity		0		Hardness (as $CaCO_3$)		290.	5.79
Color		0		Residue		471.	
Odor		0					
Temperature 51.8° F.							

alternated monthly with Well No. 3.

Well No. 3 was drilled in 1941 to a depth of 422 ft. by Ray Feuerborn, Batavia, and located about 120 ft. south of Cottage Ave. and 110 ft. east of Prairie Ave. (approximately 1970 ft. N. and 550 ft. E. of the S. W. corner of Section 11). The elevation of the top of the concrete pump base is 788.7 ft.

The well is cased with 137 1/2 ft. of 18-in. od. pipe extending 1 1/2 ft. above ground level and the hole was finished 16 in. in diameter at the bottom.

A production test was made on Dec. 3, 1941 by the State Water Survey. Before the test the water level was 94 1/2 ft. below the top of the casing, and after pumping one hr. at 860 gpm. the drawdown was 102 1/2 ft. The pumping rate was reduced to 770 gpm. and after 5-hr. pumping at that rate apparent equilibrium was attained. The drawdown was 82 1/2 ft. The pump in Well No. 2 was operated intermittently during the test. The mutual lowering in pumping water level was about 5 ft.

The existing pump installation, made in July 1943, is: 220 ft. of 8-in. column pipe; 12-in., 3-stage American Well Works turbine pump (Shop No. 67670) having a rated capacity of 750 gpm. against 205 ft. of head; 10 ft. of 8-in. suction pipe; 220 ft. of 1/4-in. gi. air line; 60-hp. U. S. electric motor.

Water levels reported from Sept. 1943 to Aug. 1945 showed wide fluctuations. A level of 95 ft. below the pump base was observed on Dec. 9, 1943 after a 40-day idle period. Other observations made during this period show: non-pumping levels ranging between 93 and 98 1/2 ft. and pumping levels ranging between 155 and 170 ft. below the pump base. Subsequent observations of water levels to June, 1947 show about the same conditions.

Analysis of a sample collected Dec. 3, 1941 showed this water to have a hardness of 18.6 gr. per gal., a mineral content of 435 ppm., and an iron content of 0.7 ppm. The general character was similar to that of the water obtained from the No. 2 well.

The operation of this well in 1947 was alternated monthly with Well No. 2.

The combined total metered pumpage from Aug. 1, 1943 to May 1, 1947 averaged 662,300 gpd. which varied from a winter minimum average of 448,000 to a summer maximum average of 805,000 gpd.

GLENVIEW COUNTRYSIDE
Cook County
June 14, 1946,

Glenview Countryside is a strictly residential development located about 1/4 mi. west of the west village limits of Glenview and lying between Glenview Rd. on the north, Central Rd. on the south, and extending west along Central Rd. to Milwaukee Ave.

The community water supply system was installed in Mar. 1940 and is owned by the Arthur T. Mcintosh Co. It is leased and operated by the Suburban Water Co., and on June 12, 1946, was serving 400 homes.

Water is obtained from 2 wells drilled by Henry Boysen, Jr., Libertyville.

Well No. 1 is located about 100 ft. south of Linneman Rd. and 200 ft. east of Greenwood Rd. (or approximately 1200 ft. N. and 2450 ft. W. of the S. E. corner of Section 33, T. 42 N., R. 12 E.). The elevation of the surface of the ground at the well is 680± ft.

The well was drilled in 1939 to a depth of 572 ft. and was cased with 8-in. pipe from the surface to a depth of 183 ft., and with 6-in. pipe from the surface to a depth of 380 ft. 10 in.

An 8-hr. production test was made after the completion of the well in 1939. When pumping, at a rate of 100 gpm., the drawdown was 12 ft. from a non-pumping water level of 212 ft. below the pump base.

The pump installation, completed in Mar. 1940, is still in service: 260 ft. of 4-in. column pipe; 6-in., 28-stage Cook turbine pump rated at 100 gpm. against 50 psi. discharge pressure; 260 ft. of air line; 10 ft. of 3 1/2-in. suction pipe; 20-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 106,729) collected June 13, 1946 from the pump discharge tap after several hours pumping at 100 gpm., showed the water from this well to have a hardness of 21.8 gr. per gal., a residue of 651 ppm., and an iron content of 0.1 ppm.

Well No. 2 is located about 150 ft. south of Linneman Rd. and 100 ft. west of Revere Rd. (or approximately 1150 ft. N. and 1200 ft. E. of the S. W. corner of Section 33). The elevation of the surface of the ground at the well is 680± ft.

The well was drilled to a depth of 606 ft. and completed in Aug. 1941. It is cased with 10-in. pipe from the surface to a depth of 274 ft. The hole below the casing is 10 in. in diameter.

During an 8-hr. test upon completion of the well, water was pumped at a rate of 200 gpm. The drawdown was 26 ft. from a static water level of 188 ft. below the pump base.

The pump installation was made in 1941 and is still in service: 270. ft. of 5-in. column pipe; 8-in., 15-stage Cook turbine pump rated at 200 gpm. against 50 psi. discharge pressure; the overall length of the pump is 6 ft. 9 5/8 in.; 270 ft. air line; 20 ft. of 5-in. suction pipe with a 1-ft. 1 1/8-in. tapered strainer; 20-hp. U. S. electric motor.

A sample of water was collected June 13, 1946 from a house tap located 100 ft. from the well after the pump had been in operation for several hours. The distribution line was not connected with the supply from Well No. 1. This water was found to have a hardness of 18.8 gr. per gal., a mineral content of 581 ppm., and an iron content of 0.1 ppm. The general character was similar to that of the water obtained from the 572-ft. well, excepting for the temperature which was 54.3° F.

LABORATORY NO. 106,729

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	12.4	
Manganese	Mn	0.0		Fluoride	F	0.6	
Calcium	Ca	92.1	4.61	Chloride	Cl	36.0	1.02
Magnesium	Mg	34.8	2.86	Nitrate	NO_3	1.3	.02
Ammonium	NH_4	0.5	0.03	Sulfate	SO_4	225.4	4.69
Sodium	Na	77.1	3.35	Alkalinity (as $CaCO_3$)		256.	5.12
Color		0		Hardness (as $CaCO_3$)		374.	
Odor		0		Residue		651.	
Turbidity		10-		Temperature 56.5° F.			

Pumpage for the year of 1945 averaged 29,000 gpd. The water is not treated.

Well No. 2 was drilled in 1925 for the village of Glenview and located about 1 mi. east of the Glenview Countryside wells. The elevation of the ground surface is 655± ft.

Sample-study log of Glenview Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay, pebbly	38	38
Gravel	10	48
Clay, pebbly	40	88
Gravel	12	100
Clay, pebbly	20	120
Silurian system		
Niagaran-Alexandrian series		
Dolomite	80	200
Dolomite, shaly and shale	5	205
Dolomite, silty in lower part	125	330
Ordovician system		
Maquoketa shale, some dolomite	158	488
Galena-Platteville dolomites	322	810
Glenwood-St. Peter formations		
Sandstone, partly dolomitic	5	815
Sandstone, incoherent	150	965
Conglomerate of sandstone, shale and chert	10	975
Oneota formation		
Dolomite	50	1025
No record	15	1040
Cambrian system		
Trempealeau dolomite	125	1165
Franconia dolomitic sandstone, thin shale bed	85	1250
Galesville dolomitic sandstone	170	1420
Eau Claire sandstone, shale and dolomite	11 1/2	1431 1/2

GRAND RIDGE
La Salle County
June 19, 1947

The public water, supply was installed by the village of Grand Ridge (385) in 1915.

Water is obtained from 2 sand and gravel wells at the pumping station on a village-owned lot in the east central part of town (or approximately 800 ft. S. and 1015 ft. E. of the N. W. corner of Section 24, T. 32 N., R. 3 E.).

The West Well was drilled in 1915 by the Central Engineering Co. It was reported to be 162 ft. in depth below a ground surface elevation of 652± ft.

Correlated driller's log of the West Well furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay, soil at top	115	115
Sand (dry, no water)	10	125
Sand, some gravel	35	160

The well was reported to be cased with 10-in. pipe to a depth of 150 ft. below which was placed a 10-ft. length of Cook screen. In 1920 the screen became loose and was removed. A 16-ft. length of 8-in. casing, perforated with 3/4-in. holes, and surrounded by copper wire gauze, was attached below the working barrel and sunk 12 ft. into the sand and gravel. The working barrel was reported to be at a depth of 150 ft. and 16 ft. above the bottom of the well.

The well is equipped with a Keystone Driller Co. double-acting deep-well pump with a 5 3/4-in. cylinder attached to 150 ft. of 8-in. drop pipe. The pump operates against a head of 270 ft. and is gear-connected to a 10-hp.,860 rpm. Westinghouse electric motor, No. 1348284.

When the well was completed, the water level was reported to be 37 1/2 ft. below the surface; and after pumping 22 hr. at 70 gpm., there was no indication of exhaustion. The pumping water level could not be measured. In Oct. 1922 the non-pumping water level was 125 ft.; and after pumping 2 1/4 hr. at about 88 gpm., the drawdown was 5 ft.

The well is maintained for emergency use.

Analysis of a sample (Lab. No. 103,251), collected June 17, 1945, showed the water from this well to have a hardness of 4.8 gr. per gal., a mineral content of 356 ppm., and an iron content of 7.2 ppm.

Well No. 2 was drilled in 1926 by John Schomas, Ottawa. It is located 10 ft. east of the older well and is 156 ft. deep. It was cased with 10-in. pipe and an 11-ft. screen was placed in the bottom.

The pumping equipment, installed in 1943, consists of 135 ft. of 4-in. column pipe; 5-in., 22-stage Fairbanks-Morse turbine pump, No. 3 W 30443, rated at 125 gpm.; the pump is 9 ft. long and has a screen attached at the bottom; 135 ft. of 1/4-in. airline; 15-hp., 1755-rpm. Fairbanks-Morse electric motor, No. 479026.

The pump is reported to discharge 125 gpm. against 52-lb. pressure.

In July 1927 the water level was 122.2 ft. from the top of the casing; and after pumping 45 min., the water was lowered 9 ft. 2 in. In the fall of 1943 after the new pump was installed, the water level was 125 ft.; and after pumping a few minutes at 125 gpm., the pump broke suction.

LABORATORY NO. 110,769

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.4		Silica	SiO_2	11.8	
Manganese	Mn	Tr.		Fluoride	F	1.3	
Calcium	Ca	21.4	1.07	Chloride	Cl	8.0	0.23
Magnesium	Mg	11.6	0.95	Nitrate	NO_3	6.0	0.10
Ammonium	NH_4	1.7	0.10	Sulfate	SO_4	0.0	0.00
Sodium	Na	102.4	4.45	Alkalinity (as $CaCO_3$)		312.	6.24
Color		0		Hardness (as $CaCO_3$)		101.	2.02
Odor		M		Residue		358.	
Turbidity		10-		Free CO_2 (calc.)			
Temperature		53° F.		pH =			

When operating at 75 gpm., the water was lowered 9 ft. In Jan. 1945, it was reported that the pump was repaired because water leaked into the shaft tube and up around the line shaft.

Analysis of a sample (Lab. No. 110,769), collected June 19, 1947 after pumping 10-min., showed the water from Well No. 2 to have a hardness of 5.9 gr. per gal., a residue of 358 ppm., and an iron content of 0.4 ppm.

The water is not treated.

Pumpage is estimated at 30,000 gpd.

GRANT PARK
Kankakee County
Jan. 20, 1949

A public water supply was installed by the village of Grant Park (519) in 1887.

Water is obtained from a well drilled in 1904 and located about 100 ft. north of Taylor St. and 50 ft. east of East Main St. (or approximately 1500 ft. N. and 300 ft. E. of the S. W. corner of Section 20, T. 32 N., R. 14 E.). The surface elevation is 700± ft.

The well was originally drilled 8 in. in diameter into limestone at a depth of 147 ft. and was cased to a depth of 75 ft.

The non-pumping water level in 1917 was 30 ft. below the top of the well.

The well was deepened in 1919 to 251 ft., and cased to a depth of 60 ft. The old pump was reinstalled with the cylinder at a depth of 130 ft., and 20 ft. of suction pipe was added. After deepening, the well produced 87 gpm. with no apparent drawdown from a non-pumping water level of 30 ft. below the ground surface. In 1938 the non-pumping water level was reported to be 30 ft.

This well was equipped with the following pumping unit in 1942: a Myers Ejecto pump, No. F-1000 AY, having a rated capacity of 100 gpm. against 55 psi., and 10-hp. General Electric motor. The pump has an all-bronze impeller, 60 ft. of 3-in. discharge pipe and a 1 1/2-in. air pipe, and a foot-valve with a heavy perforated brass screen.

In 1942 the water level was 30 ft. below the pump base after an idle period of 1 week. In June, 1947, the pump was pulled and new discharge and air pipes were installed. At that time the non-pumping water level was 30 ft. below the pump base after an idle period of 2 days.

Analysis of a sample (Lab. No. 112,737), collected Dec. 1, 1947 after pumping 20 min. at 100 gpm., showed the water to have a hardness of 27.4 gr. per gal., a residue of 538 ppm., and an iron content of 3.2 ppm.

A well, located in a brickyard about 500 ft. south of the village well, (or approximately 1000 ft. N. and 400 ft. E. of the S. W. corner of Section 20), was acquired by the village in Mar., 1946 and has been used as an emergency supply. This well is 180 ft. deep, 10 in. in diameter, and is cased to rock.

Well No. 3 was completed to a depth of 330 ft. in Jan. 1949, by Geo. Berns, Chebanse, and located about 600 ft. southwest of Well No. 1 (or approximately 1100 ft. N. and 300 ft. W. of the S.E. corner of Section 19.).

Rock was encountered at 62 ft. and the well was cased with 8-in. pipe from 2 ft. above to 63 ft. below ground level. A production test was made by the State Water Survey on Jan. 20, 1949, using a turbine test pump powered by a farm tractor. The pump was set at 150 ft. Before pumping, the water level was 41 ft. below the top of the casing. Pumping was started at 130 gpm. After 1 hr. pumping at 222 gpm. the drawdown was 36 ft. and after 3 hr. at a final rate of 315 gpm. the drawdown was 75 ft.

Analysis of a sample (Lab. No. 117,118) collected Jan. 20, 1949, after 3-hr. pumping at 315 gpm. showed this water to have a hardness of 28.0 gr. per gal., a residue of 567 ppm. and an iron content of 4.1 ppm.

In Nov. 1947, pumpage was estimated to average 36,000 gpd.

LABORATORY NO. 112,737

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	3.2		Silica	SiO_2	23.8	
Manganese	Mn	Tr.		Fluoride	F	0.1	
Calcium	Ca	112.1	5.61	Chloride	Cl	12.0	0.34
Magnesium	Mg	46.0	3.78	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	0.3	0.02	Sulfate	SO_4	106.8	2.22
Sodium	Na	11.7	0.51	Alkalinity	(as $CaCO_3$)	368.	7.36
Turbidity		40		Hardness	(as $CaCO_3$)	470.	9.39
Color		0		Residue		538.	
Odor		0		Free CO_2 (calc.)		75.	
Temperature		53.5° F.		pH = 7.1			

LABORATORY NO. 117,118

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	4.1		Silica	SiO_2	25.1	
Manganese	Mn	0.1		Fluoride	F	0.1	
Calcium	Ca	116.9	5.85	Chloride	Cl	21.0	0.59
Magnesium	Mg	45.8	3.76	Nitrate	NO_3	0.2	Tr.
Ammonium	NH_4	0.4	0.02	Sulfate	SO_4	97.9	2.04
Sodium	Na	17.5	0.76	Alkalinity	(as $CaCO_3$)	388.	7.76
Turbidity		23		Hardness	(as $CaCO_3$)	481.	9.61
Color		0		Residue		567.	
Odor		0					

The public water supply was installed by the village of Granville (1038) in 1911.

A well was drilled at that time by the J. P. Miller Artesian Well Co., Chicago. It was located on Lot 1, Block 15 at Main and Lake St. (or approximately 730 ft. S. and 2400 ft. W. of the N. E. corner of Section 9, T. 32 N., R 1 W.). The well was drilled to a depth of 1741 ft. 7 in. below a ground surface elevation of 685± ft. MSL. datum. The material penetrated, as reported by the driller, was mostly shale with strata of limestone to a depth of 1389 ft., lime rock from 1389 to 1650 ft., and sandstone from 1650 to 1741 ft. 7 in. The hole and casing record is shown in Table 1.

TABLE 1

Hole Record

4 1/4-in. from 1316 1/2 ft. to 1741 ft. 7 in.

Casing Record

10-in.	from surface to 130 ft.
8-in.	from surface to 345 ft.
6-in.	from 334 to 578 ft.
5-in.	from 572 to 1192 ft.
4 1/4-in.	from 1192 to 1316 1/2 ft.

Packers were placed between the 8-in. and 6-in. casings, between the 6-in. and 5-in. casings, and the 4 1/4-in. casing was belled out against the 5-in. casing.

In 1922 an air lift was installed, replacing the old deep-well cylinder pump. The air lift included 443 ft. of 4-in. discharge pipe and the same length of 1 1/4-in. air pipe.

During drilling, water was at 140 ft. depth when the well was 1700 ft. deep, and 125 ft. when it was 1710 ft. deep. When the drilling was at 1318 ft., a production test was made with a pump cylinder attached to 249 ft. of drop pipe. Depth to water was 115 ft.; and after pumping 3 min. at a rate of 3 gpm., the water was exhausted.

In 1915 and 1918 the non-pumping water level was 125 ft., and in 1938 it was reported that no noticeable recession in water level had taken place. In 1938 the usage was estimated to be 100,000 gpd.

On Jan. 8, 1946, when some repairs were being made on the well, the non-pumping water level was measured and found to be 167 1/2 ft. from the top of the well.

Analysis of a sample (Lab. No. 109,928) collected Apr. 13, 1947, after 7-hr. pumping, showed the water from this well to have a hardness of 14.6 gr. per gal., a residue of 1091 ppm., and an iron content of 0.1 ppm.

Well No. 2 was completed in Nov. 1948 to a depth of 1793 ft. by Neely and Schimelpfenig, Batavia, and located approximately 2225 ft. S. and 400 ft. W. of the N. E. corner of Section 9. The ground elevation at the well-site is 685± ft. The well was cased with 18-in. pipe from the surface to 279 ft. and with 8-in. pipe from 1.5 ft. above to 1297.5 ft. below ground level. The annular space outside the 8-in. casing was cemented.

A production test was made on Dec. 14-15, 1948 by the State Water Survey, using temporary pumping equipment, consisting of 270 ft. of 4-in. column pipe; 12-stage turbine pump and 20 ft. of 5-in. suction pipe. Before the test the water level was 171.5 ft. below the top of the 8-in. casing. For the first 1 1/2 hr. water was pumped at a rate of 96 gpm. and the drawdown was 22.5 ft.; the

LABORATORY NO. 109,928

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	14.0	
Manganese	Mn	Tr.		Fluoride	F	1.1	
Calcium	Ca	61.8	3.09	Chloride	Cl	375.0	10.58
Magnesium	Mg	23.2	1.90	Nitrate	NO_3	4.8	0.08
Ammonium	NH_4	0.4	.02	Sulfate	SO_4	149.7	3.12
Sodium	Na	315.8	13.73	Alkalinity (as $CaCO_3$)		248.	4.96
Color		0		Hardness (as $CaCO_3$)		250.	5.00
Odor		0		Residue		1091.	
Turbidity		0		Temperature 67° F.			

Sample-study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Black soil, yellow and gray clay"	90	90
"Hardpan with gravel"	75	165
Sand and gravel, silty	15	180
Till, gravelly at base	50	230
Sand and gravel	10	240
Pennsylvanian system		
Shale; coal; underclay	30	270
Siltstone	15	285
Shale; coal; underclay	30	315
Limestone, dolomitic	10	325
Siltstone	45	370
Shale; coal; underclay	55	425
Siltstone; limestone	15	440
Shale; limestone; sandstone	140	580
Silurian system		
Niagaran series		
Dolomite, silty, shale streaks	110	690
Shale, dolomitic, silty	15	705
Dolomite, silty, shale streaks	325	1030
Dolomite	22	1052
Alexandrian series		
Kankakee formation		
Dolomite, cherty,	35	1087
Edgewood formation		
Siltstone, glauconitic	16	1103
Ordovician system		
Maquoketa formation		
Shale, dolomitic	62	1165
Dolomite, argillaceous	20	1185
Shale, dolomitic	65	1250
Dolomite, argillaceous	10	1260
Galena formation		
Dolomite	160	1420
Dolomite, cherty, argillaceous	120	1540
Decorah formation		
Dolomite	30	1570
Platteville formation		
Dolomite, cherty at base	65	1635
St. Peter formation		
Sandstone	157	1792
Conglomerate, shale, and chert	1	1793

next 2 1/4 hr. the pumping rate was 150 gpm. and the drawdown 41.0 ft. For the last 7 hr. the rate was gradually increased to 234 gpm. and the final drawdown was 88.5 ft. Ten minutes after stopping the pump the water level was 172.0 ft. Six hr. later the water level was 166.0 ft.

Analysis of a sample (Lab. No. 116,793) collected Dec. 14, 1948 during the production test showed this water to have a hardness of 17.3 gr. per gal., a residue of 994 ppm., and an iron content of 1.7 ppm.

On June 8, 1949 the following pumping equipment was on hand but not yet installed: 300 ft. of 5-in. column pipe; 8-in., 18-stage Aurora Pump

Co. turbine pump, No. 42799 designed for 200 gpm. against 400 ft. of head; 300 ft. of 1/8 -in. gi. air line; 5-in. suction strainer; 30-hp., 1750-rpm. electric motor with type B -30 Johnson right-angle gear-drive head.

Pumpage is estimated at 90,000 gpd., including an average of 11,500 gpd. to the village of Mark, which receives its entire water supply from Granville.

LABORATORY NO. 116,793

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.7		Silica	SiO_2	13.6	
Manganese	Mn	0.0	0.00	Fluoride	F	1.5	
Calcium	Ca	67.9	3.40	Chloride	Cl	305.0	8.60
Magnesium	Mg	30.7	2.52	Nitrate	NO_3	3.9	0.06
Ammonium	NH_4	0.3	0.02	Sulfate	SO_4	164.4	3.42
Sodium	Na	255.3	11.10	Alkalinity	(as $CaCO_3$)	248.	4.96
Turbidity		27		Hardness	(as $CaCO_3$)	296.	5.92
Color		0		Residue		994.	
Odor		Tr.					
Temperature		66.9° F.					

The installation of a public water supply was completed by the village of Grays Lake (1182) in 1915.

Two wells have constituted the source of the entire public supply both of which are located in the pumping station on the north side of Hawley St. near the corner of Whitney St. The floor of the pumping station is at normal ground level which is 785± ft.

The first well was drilled in 1915 by Charles Thorn, DeKalb, and located about 1200 ft. N. and 840 ft. E.of the S. W. corner of Section 26, T. 45 N., R. 10 E. The exact depth of the well is not known. It is about 1039 ft. deep, and is reported cased to rock at a depth of 246 ft. with 12-in. pipe below which the hole tapers to 6 in. in diameter at the bottom.

The well was cleaned out by Henry Boysen, Jr., Libertyville, in 1938. New casing was set inside the old but was removed when it shut off a vein of w ater below 200 ft. The well is now cased as previously reported.

The well is equipped with a Keystone Driller Co. double-acting plunger pump having a cylinder 6 3/4 in. in diameter and an 18-in. stroke. When operated at a rate of 3 1 spm.,its theoretical displacement is 173 gpm. The pump is driven by a 20-hp. General Electric motor.

This well is not in regular service. The pump is operated once a week for maintenance as an emergency supply unit.

The second well was drilled in 1924 to a depth of 1323 ft. by F. M. Gray, Jr., Chicago, and located 20 ft. east of the older well.

A lead seal was placed at the depth of 231 ft. 11 in., and a rubber packer at a depth of 575 ft.

A non-pumping water level of 142 ft. below the pump base was measured on Sept. 11, 1928.

The existing pump installation, made in Feb. 1941, consists of 240 ft. of 5-in. column pipe; 8-in., 17-stage Pomona turbine pump, S. W. 3114, rated at 150 gpm. against 320 ft. of head; 240 ft.

Sample-study log of well drilled in 1924 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil	10	10
Sand and gravel	10	20
Glacial till, silt and sand	50	70
Gravel	10	80
Till	40	120
Gravel	60	180
Till, silt and sand	30	210
"Gravel"	20	230
Silurian system		
Niagaran-Alexandrian dolomites	110	340
Ordovician system		
Maquoketa shale and dolomite	210	550
Galena - Platteville dolomites	290	840
Glenwood sandstone and dolomite	70	910
St. Peter formation		
Sandstone	120	1030
Conglomerate of shale and sandstone	65	1095
Cambrian system		
Franconia sandstone and shale	45	1140
Galesville s andstone		
Sandstone, dolomitic	50	1190
Sandstone, incoherent	120	1310
Eau Claire formation		
"Marl, red"	13	1323

of air line; 20-hp. General Electric motor.

The hole and casing record were reported as shown in Table 1.

TABLE 1

Hole Record

12 1/2-in. from 241 to 575 ft.
10-in. from 575 to 1078 ft.
8-in. from 1078 to 1323 ft.

Casing Record

12 1/2-in. driver pipe from surface to 241 ft.
10-in. liner from 231 ft. 11 in. to 575 ft.
8-in. liner from 995 ft. 5 in. to 1078 ft.

On July 13, 1944, a non-pumping water level of 177 ft. was obtained by use of the air line.

Analysis of a sample (Lab. No. 107,555), collected Sept. 3, 1946 after 15-min. pumping at 150 gpm., showed this water to have a hardness of 14.7 gr. per gal., a residue of 319 ppm., and an. iron content of 0.3 ppm. The temperature and quality indicate that the major proportion of this sample is from the Galesville sandstone.

The average pumpage is estimated to be 100,000 gpd. and varies from a minimum winter average of 75,000 gpd. to a maximum summer average of 150,000 gpd.

All water has been chlorinated since 1939.

LABORATORY NO. 107,555

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.3		Silica	SiO_2	12.4	
Manganese	Mn	0.0		Fluoride	F	0.9	
Calcium	Ca	70.5	3.53	Chloride	Cl	9.0	0.25
Magnesium	Mg	18.6	1.53	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	0.4	0.02	Sulfate	SO_4	37.0	0.77
Sodium	Na	18.9	0.82	Alkalinity	(as $CaCO_3$)	244.	4.88
Turbidity		0		Hardness	(as $CaCO_3$)	253.	5.06
Color		0		Residue		319.	
Odor		0		Free CO_2	(calc.)	38.	
Temperature 59.6° F.				pH = 7.2			

GRAYVILLE
White and
Edwards Counties
May 3, 1948

The city of Grayville (2240) installed a public water supply in 1895. Water was originally obtained from the Wabash River, but since 1928, the supply has been obtained from wells.

Well No. 1 was drilled in 1927 to a depth of 72 1/2 ft. by Thorpe Concrete Well Co., Alton, and is located just over the county line in Wabash County, east of town, and about 300 ft. north of a bend in the Wabash River, (or approximately 834 ft. N. and 2140 ft. E. of the S. W. corner of Section 16, T. 3 S., R. 14 W.). The ground surface elevation is 375.5 ft.

Correlated driller's log of Well No. 1 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and silt	14	14
Sand	55	69
Gravel and sand	3 1/2	72 1/2

The well was cased with 55 ft. of 26-in. id. by 36-in. od. porous concrete pipe set on a cast iron shoe at the bottom, and with 15 ft. of plain concrete pipe at the top.

When tested by the Caldwell Engineering Co. in 1927, the well produced 377 gpm. with a drawdown of 3 ft. 7 1/2 in. from a non-pumping water level of 9 ft. 2 in.

The pump house floor elevation is 389.5 ft. and is about 12 ft. above the top of the casing, which is 2 ft. above the normal ground surface. The pumping equipment consists of 65 1/2 ft. of 8 3/4-in. column pipe; Pomona turbine pump No. SE 377; 10 ft. of suction pipe; 70 ft. of 1/4-in. gi. air line; 25-hp. General Electric motor, No. 4546044.

In 1942, it was reported that the pump had not been operated in over a year, and that the pump broke suction a short time after starting. The porous concrete screen was reported to be badly clogged.

A production test was made by Warren and Van Praag, consulting engineers, on Dec. 12, 1944. It was reported that the well, after 2-hr. pumping, produced 300 gpm. with a drawdown of greater than 46.5 ft. below the non-pumping water level of 31 ft. below the pump house floor. The well was treated with 500 gal. of hydrochloric acid by Dowell Incorporated. Before the treatment, the well was reported to produce about 150 gpm. with a drawdown of 46 ft. Following the treatment, a test showed the well to be producing about 265 gpm. with a drawdown of 3.5 ft.

Analysis of a sample (Lab. No. 62138) collected after 1-hr. pumping on July 12, 1928, showed the water to have a hardness of 17.3 gr. per gal., a residue of 319 ppm., and an iron content of 0.4 ppm.

Well No. 2 was drilled in 1927 by Thorpe Concrete Well Co., and is located 80 ft. east of Well No. 1. The well is 71.8 ft. deep below normal ground level and was cased with 55 ft. of 26-in. id. by 36-in. od. porous concrete pipe set on cast iron shoe at the bottom, and with 15 ft. of plain concrete pipe at the top. The pump house floor is 14 ft. above normal ground level, or elevation 389.5 ft.

A production test was made Oct. 19, 1927 by the Caldwell Engineering Co. The well yielded an average of 502 gpm. for 12 hr. with a drawdown of 5 ft. 7 in. from a non-pumping water level of

LABORATORY NO. 118,846

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.5		Silica	SiO_2	17.7	
Manganese	Mn	.3		Fluoride	F	0.0	
Calcium	Ca	93.1	4.65	Chloride	Cl	10.0	.28
Magnesium	Mg	21.6	1.78	Nitrate	NO_3	.9	.03
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	47.9	1.00
				Alkalinity (as $CaCO_3$)		256.	5.12
Turbidity		5		Hardness (as $CaCO_3$)		322.	6.43
Color		0		Residue		354.	
Odor		0					

9 ft. 4 in. below the ground surface. In Aug. 1942, it was reported that the pump was operated about 2 days per month. A production test was made on Dec. 13, 1944 by Warren and Van Praag. The well produced about 320 gpm. for 1 hr. with a drawdown of 24 ft. from a non-pumping water level of 31 ft. below the pump house floor level.

The pumping equipment installed about Jan. 1948 consists of 60 ft. of 6-in. column pipe; 8-in., 10-stage American Well Works turbine pump, No. 72804 rated at 300 gpm. against 270 ft. of head; overall length of pump about 7 ft.; 10 ft. of 5-in. suction pipe and gi. strainer; 70 ft. of 1/4-in. gi. air line; 30-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 118,846) collected July 15, 1949 showed the water to have a hardness of 18.8 gr. per gal., a residue of 354 ppm., and an iron content of 0.5 ppm.

Well No. 3 was constructed in 1941 by the Thorpe Concrete Well Co., and is located 80 ft. south of Well No. 2. The well is reported to be about 73 ft. in depth below the ground surface, and to have about 55 ft. of 26-in. id. by 36-in. od. porous concrete casing above which is 30 ft. of plain concrete pipe. The top of the concrete casing is about 2 ft. below the pump base. The well is enclosed in concrete to a height of about 15 ft. above the ground surface or elevation 390.5 ft. The pump head and motor are mounted on top of the concrete.

The pumping equipment installed in 1941 consists of 60 ft. of 6-in. od. column pipe; 8-in., 12-stage Pomona turbine pump No. SA 2223, having an overall length of 6 ft. 5 in. and rated at 350 gpm. against 270 ft. of head operating at 1760 rpm.; 10 ft. of 6-in. suction pipe; 70 ft. of 1/4-in. gi. air line; 30-hp. Westinghouse electric motor No. 1078636, operating at 1750 rpm.

In 1942 this well was reported to furnish most of the village supply. A production test was made on Dec. 12, 1944, by Warren and Van Praag. The well produced 125 gpm. for 1 hr. with a drawdown of 2.5 ft. from a non-pumping water level of 31 ft. below the floor level.

Analysis of a sample (Lab. No. 102,160) collected Dec. 22, 1944, showed the water to have a hardness of 17.2 gr. per gal., a residue of 328 ppm., and an iron content of 0.3 ppm. This water is similar in quality to previous analyses.

Pumpage is estimated to average 236,250 gpd.

The village of Greenfield (1006) installed a public water supply in 1936.

In 1935, twelve test wells were drilled by the Thorpe Concrete Well Company, Alton, in the valley of Rubicon Creek, east and southeast of town, and 12 test holes were drilled in the small creek valley from about 1 mile west to 2 miles northwest of town.

A permanent well was constructed 3 ft. east of test hole No. 20 on the west bank of Rubicon Creek in the easterly part of town (or approximately 3250 ft. N. and 50 ft. W. of the S. E. corner of Section 4, T. 10 N., R. 10 W.). The well was finished by Thorpe in Feb. 1936, to a depth of 34 1/2 ft. below the pump base and constructed with 16 ft. of solid concrete casing, 26-in. id. and 36-in. od., below which was placed 16 ft. of porous concrete casing of the same diameter. The elevation of the ground surface is 544± ft.

A production test was made by the State Water Survey on Feb. 17, 1936. Before the test was started, the water level was 9 ft. 10 in. below the top of the casing. After 8-hr. pumping at a final rate of 42 gpm. the drawdown was 11.1 ft. and it appeared that equilibrium was established when pumping at a rate of 43 gpm.

The pump assembly was overhauled in 1947 and now consists of: 30 ft. of 4-in. column pipe; 6-in., 7-stage Fairbanks-Morse turbine pump, No. 29458, rated at 50 gpm. against 55 ft. of head at 1750 rpm.; the overall length of the pump is 4 ft.; a 4-in. by 12-in. strainer placed on the suction end of the pump; 2 hp., U. S. electric motor, No. 436835. The air line was omitted when the pump was reinstalled.

On Nov. 12, 1937, the non-pumping water level was 15 ft. below the pump base.

When the well was new, water was obtained from 2 sand strata, one at a depth of 18 to 24 ft. and the other between 29 and 34 ft. On Feb. 21, 1940, the upper sand stratum was completely dry. An auger hole had been put down to a depth of 24 ft. at a location about 30 ft. north of the well. No water was encountered and the following morning the hole was dry.

Analysis of a sample (Lab. No. 82356) collected Nov. 12, 1937, showed this water to have a hardness of 45.6 gr. per gal., a residue of 1384 ppm., and an iron content of 3.33 ppm.

The North Well was constructed in 1944 to a depth of 32 ft. by Thorpe Concrete Well Co. and located about 90 ft. north of the first well. The well is cased with 16 ft. of 34-in. id. (44-in. od.) solid concrete pipe and with 16 ft. of porous concrete screen of same diameter.

The pumping equipment includes a Myers Ejecto pump, No. F 150 BZ having a 1 1/2-in. pressure and a 2-in. delivery pipe, with the jet set at 4 ft. above the bottom of the well. Power is furnished by a 1 1/2-hp., 3425 rpm. General Electric motor, No. BX 7600.

The pumps in both wells are operated simultaneously.

Analysis of a sample (Lab. No. 116,392) collected Nov. 8, 1948, after 18-hr. pumping, showed the water from the North Well to have a hardness of 27.8 gr. per gal., a residue of 607 ppm., and an iron content of 0.3 ppm.

The municipality has a water softening unit installed but at the time of the field visit, the softener had not been in use for several months because of scarcity of water. All water is chlorinated and treated for iron removal. Analysis of a sample

LABORATORY NO. 116,392

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.3		Silica	SiO_2	19.2	
Manganese	Mn	0.3		Fluoride	F	0.2	
Calcium	Ca	117.7	5.89	Chloride	Cl	18.0	0.51
Magnesium	Mg	44.0	3.62	Nitrate	NO_3	6.8	0.11
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	168.9	3.51
Sodium	Na	19.8	0.86	Alkalinity (as $CaCO_3$)		312.	6.24
Turbidity		2		Hardness (as $CaCO_3$)		476.	9.51
Color		0		Residue		607.	
Odor		Tr.		Temperature 58° F.			

(Lab. No. 116,395) collected Nov. 8, 1948, showed the treated water to have a hardness of 24.8 gr. per gal., a residue of 489 pprn., and an iron content of 0.1 ppm.

Well No. 1-49 was drilled to a depth of 31 ft. in Oct., 1949, by Walter Vette, Beardstown, and located about 1440 ft. north of the North Well, which was constructed in 1944, (or approximately 500 ft. S. and 50 ft. W. of the N. E. corner of Section 4). The hole was drilled 8 in. in diameter to 40 ft., the lower 9 ft. penetrating yellow shale. The hole was then plugged at 31 ft., the bottom of a 9 ft. stratum of sand and gravel. The well was cased with 8-in. id. pipe from the surface to 18 ft. 4 in. and with 6-in. id. pipe from 4 to 22 ft. The bottom of the 6-in. casing is 4 ft. below the bottom of the 8-in. casing. An 8-ft. length of 6-in. Johnson silicon red-brass screen is attached to the bottom of the 6-in. casing. The screen has No. 60 slot openings.

A production test was made on Nov. 1, 1949, using State Water Survey measuring equipment. For test purposes, a portable Jaeger centrifugal pump was used with the bottom of the 2 1/2-in. suction line set at 31 ft. below the top of the casing. Before starting the test, the water level was 7.6 ft. below the top of the casing. After 8-hr. pumping at 27.6 gpm. the drawdown was 19.0 ft. While pumping in Well 1-49 the water level in Well 2-49 was lowered 0.2 ft.

Analysis of a sample (Lab. No. 119,759) collected Nov. 1, 1949, after 8-hr. pumping, showed this water to have a hardness of 3 1.8 gr. per gal., a residue of 736 ppm. and an iron content of 2.5 ppm.

Well No. 2-49 was drilled to a depth of 28 ft. in Oct., 1949, by William Vette, and located about 250 ft. north of Well No. 1-49. The hole was drilled 8-in. in diameter to a depth of 36 ft., the lower 8 ft. penetrating gray mud and shale. The hole was then back-filled with washed gravel to 28 ft., the bottom of a 6 ft. stratum of sand and gravel. The well is cased with 6-in. id, pipe from the surface to 23 ft. and with a 6-in. Johnson silicon red-brass screen, having No. 60 slot openings.

A production test was made on Oct. 31, 1949, using State Water Survey measuring equipment. The pumping equipment was identical with that used in Well No. 1-49, except the bottom of the suction line was set at 27 ft. Before starting the test the water level was 7.4 ft. below the top of the casing. After 8-hr. pumping at 13.0 gpm. the drawdown was 15.8 ft. While pumping in Well 2-49 the water level in Well No. 1-49 was lowered 0.2 ft.

Analysis of a sample (Lab. No. 119,761) collected Oct. 31, 1949, after 5-hr. pumping showed this water to have a hardness of 27.7 gr. per gal., a residue of 504 ppm. and an iron content of 1.7 ppm.

Pumpage is estimated to average 25,000 gpd.

LABORATORY NO. 119,759

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.5		Silica	SiO_2	19.0	
Manganese	Mn	0.2		Fluoride	F	0.3	
Calcium	Ca	130.2	6.91	Chloride	Cl	53.0	1.49
Magnesium	Mg	49.0	4.03	Nitrate	NO_3	00.0	0.00
Ammonium	NH_4	0.7	0.04	Sulfate	SO_4	184.9	3.84
Sodium	Na	50.4	2.19	Alkalinity	(as $CaCO_3$)	392.	7.84
Turbidity		20		Hardness	(as $CaCO_3$)	547.	10.94
Color		0		Residue		736.	
Odor		0					

The village of Greenup (1410) installed a public water supply in 1897.

Water was obtained from the Embarrass River until 1924.

In 1924 an infiltration well was constructed on the northwest bank of the Embarrass River, about 800 ft. north of State Highway No. 121. The ground surface elevation at the site is 520± ft.

The well is 10 ft. in diameter and 14 ft. deep. The masonry walls were extended above the ground surface to prevent flooding during times of high water. The lower 6 ft. of the well was reported to penetrate gravel, with the bottom on shale.

Water flowed by means of a gravity pipe line to a collecting reservoir at the pumping station on the opposite side of the river. When completed, the well was reported to have yielded 186,000 gpd.

In 1925, the water level was reported to be 8-8 1/2 ft. below the ground surface. In 1935, this well furnished most of the village supply.

Analysis of a sample (Lab. No. 55030) collected Sept. 10, 1925, showed the water to have a hardness of 16.2 gr. per gal., a residue of 354 ppm., and an iron content of 1.4 ppm.

A second reservoir, 16 ft. in diameter was constructed in 1925 on the east side of the river 800 ft. northeast of the bridge on Route 121, and about 30 ft. north of the pumping station, and close to the old intake and suction well to which it was connected with a pipe line and transformed into a storage reservoir.

The infiltration well, reservoirs and pumping station on the Embarrass River were abandoned shortly after Well No. 1 was placed in service.

An electrical earth resistivity survey was made by the State Geological Survey in 1935. The area surveyed included the Embarrass River valley, in Greenup, and about 1 mile north.

Well No. 1 was completed in 1938 at a depth of 28 ft. by Joseph Heth, Jewett, and located about 900 ft. northwest of the Embarrass River and 800 ft. northeast of Route No. 121 (or approximately 1500 ft. S. and 20 ft. E. of the N. W. corner of Section 2, T. 9 N., R. 9 E.). The well was located at the site of a test hole which had been drilled to a depth of 46 ft. below a ground surface elevation of 520± ft.

Correlated driller's log of test hole and well furnished by the State Geological Survey:

Formation	Thickness ft.	Thickness in.	Depth ft.	Depth in.
Pleistocene system				
Clay loam	19		19	
Gravel	7		26	
Quicksand	2		28	
Gravel, cemented	4		32	
Sand, yellow, no water	4		36	
Shale		6	36	6
Sand, porous, water rises 17 feet in hole, not strong	5	6	42	
Quicksand	3	4	45	4
Shale		8	46	

The well is of the gravel-wall type and is cased with 16-in. inner casing and 36-in. outer casing. The annular space between casings is filled with limestone. An 8 ft. length of 15-in. Cook, Type W W, red brass screen, having No. 80 slot openings, is installed between the depths of 17 1/2 and 25 1/2 ft., with 2 1/2 ft. of blank pipe below the screen.

A production test was made by the State Water Survey on July 25, 1939. The well produced 155 gpm. for 10 hr. with a drawdown of 11.4 ft. from a non-pumping water level of 12 ft. below the ground surface.

The pump was removed in Dec. 1946 and the casing covered by a welded cap.

Analysis of a sample (Lab. No. 86073) collected July 25, 1939, showed the water to have a hardness of 14.1 gr. per gal., a residue of 293 ppm., and an iron content of 0.1 ppm.

Well No. 2 was drilled in 1940 to a depth of 43 ft. by Hosey Burson, Casey, and is located about 50 ft. north and 50 ft. east of Well No. 1. The well was cased with 12-in. pipe, and the lower 26ft. of the casing has 18-in. slots staggered and spaced 4 in. apart.

The pumping equipment consists of 31 ft. of 5-in. column pipe; 8-in. 15-stage Cook turbine pump, No. 4470 having 9 ft. overall length and rated at 250 gpm. against a head of 100 psi.; 5 ft. of 5-in. suction pipe; 1/4-in. brass pipe air line extending to 40 ft. below ground surface; 25-hp. U. S. electric motor, No. 212450, operating at 1800 rpm.

A production test was made by the State Water Survey on Nov. 11, 1940. The well produced 170 gpm. with a drawdown of 9.5 ft., and 205 gpm. with a drawdown of 18.5 ft. from a non-pumping water level of 13.5 ft. below the ground surface.

Well No. 2 is maintained for service as an auxiliary supply unit.

Analysis of a sample (Lab. No. 89283) collected Nov. 11, 1940 showed the water to have a hardness of 18.4 ppm., a residue of 381 ppm., and an iron content of 0.7 ppm.

Well No. 3 was drilled in Nov. 1946 to a depth of 43 ft. by E. C. Baker, Sigel, and is located 35 ft. north of Well No. 2. The well was cased with 10-in. pipe to a depth of 23 ft. and with a slotted screen from 23 to 43 ft.

It is reported that, in a production test on completion of the well, after pumping at 300 gpm. for 5 hr. the drawdown was 8 ft. from a non-pumping water level of 15 ft. below the pump base. The pump base is 2 ft. above the top of the casing.

Well No. 3 is the sole source of supply and the pumping equipment consists of: 30 ft. of 5-in. column pipe; 8-in., 15-stage Cook turbine pump, No. 3397, having an overall length of 9 ft. and a rated capacity of 250 gpm. against 200 ft. of head; 40 ft. of 1/4-in. copper tubing air line; 3 ft. of 5-in. suction pipe; 25-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 114,927), collected June 3, 1948 after 1 1/2-hr. pumping at 200 gpm., showed this water to have a hardness of 18.1 gr. per gal., a residue of 362 ppm. and an iron content of 0.3 ppm.

Pumpage is estimated to average 50,000 gpd.

LABORATORY NO. 114,927

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.3		Silica	SiO_2	21.1	
Manganese	Mn	0.2		Fluoride	F	0.1	
Calcium	Ca	75.1	3.76	Chloride	Cl	5.0	0.14
Magnesium	Mg	29.6	2.43	Nitrate	NO_3	6.8	0.11
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	60.7	1.26
Sodium	Na	2.8	0.12	Alkalinity	(as $CaCO_3$)	240.	4.80
Turbidity		Tr.		Hardness	(as $CaCO_3$)	310.	6.19
Color		0		Residue		362.	
Odor		0		Free CO_2 (calc.)		20.	
Temperature 54.2° F.				pH = 7.5			

GREEN VALLEY
Tazewell County
October 28, 1948

A public water supply was installed for the village of Green Valley (516) in 1948.

Well No. 1 was completed to a depth of 115 ft. by Chris Ebert., Washington, and located in the north central part of town (or approximately 120 ft. N. and 310 ft. E. of the S. W. corner of Section 26, T. 23 N., R. 5 W.). The ground elevation at the well is 538± ft. The driller reported that from 41 to 117 ft. fine sand and gravel were penetrated. The hole was actually drilled to 117 ft. but the lower 2 ft. was in fine sand and was backfilled. The 8-in. casing was pulled back and a 9-ft. overall length of 8-in. Johnson wire-wound brass screen was set with 8 ft. exposed to the aquifer with the bottom of the screen set at 115 ft. The screen had No. 20 slot openings. Nearly 1 cu. yd. of fine sand was removed from the well during development.

A production test was made by the State Water Survey on Oct. 27, 1948, using an electrically-driven turbine pump with the bottom of the suction set at 63 ft. below the top of the casing, or 62 ft. 4 in. below ground level. Before any pumping, the water level was 33.5 ft. below the top of the casing. After 5-hr. pumping at a final rate of 149 gpm. the drawdown was 13 ft. After stopping the pump, the water level recovered to 13 ft. in 2 min.

Analysis of a sample (Lab. No. 116,249) collected Oct. 28, 1949, after 4-hr. pumping at 150 gpm. showed this water to have a hardness of 20.6 gr. per gal., a residue of 387 ppm. and an iron content of 2.0 ppm.

LABORATORY NO. 116,249

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.0		Silica	SiO_2	20.4	
Manganese	Mn	0.1		Fluoride	F	0.1	
Calcium	Ca	84.9	4.25	Chloride	Cl	11.0	0.31
Magnesium	Mg	34.1	2.80	Nitrate	NO_3	0.3	0.01
Ammonium	NH_4	0.2	Tr.	Sulfate	SO_4	75.7	1.58
Sodium	Na	1.2	0.05	Alkalinity	(as $CaCO_3$)	260.	5.20
Turbidity		10		Hardness	(as $CaCO_3$)	353.	7.05
Color		0		Residue		387.	
Odor		0		Free CO_2 (calc.)		35.	
Temperature 54° F.				pH = 7.3			

GREENVIEW
Menard County
Feb. 18, 1948

A public water supply was installed by the village of Greenview (749) about 1893.

Water was obtained originally from a well located at the southwest corner of the public square (or approximately 270 ft. S.and 1420 ft. E. of the N. W. corner of Section 23, T. 19 N., R. 6 W.). The ground surface elevation at the well site is 537± ft. The well was dug 10 ft. in diameter to a depth of 20 ft., 7-ft. diameter to 30 ft. and 4-ft. diameter to 34 1/2 ft. The well was lined with a water-tight iron shell. In 1913, a hole was bored in the bottom of the dug well to a total depth of 80 ft. below the surface.

Correlated driller's. log of well drilled about 1893 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Surface soil	30	30
Hardpan	4	34
Sand and gravel	6	40
No record	40	80

Later it was reported that three 4-in. perforated pipe, each 10 ft. in length, were driven below the dug portion of the well.

In 1913, it was reported that the non-pumping water level was 12 ft. below the top of the well, and that the pump broke suction with the water level at 28 ft. after 1/2 hr. or 1 hr. of pumping.

In 1919 it was reported that the triplex pump was still in use, and that a Hill single-acting deep-well pump, geared to a 7 1/2-hp. electric motor, had been added. The non-pumping water level in 1919 was reported to be 12 ft., and after 2-hr. pumping the water level, was lowered to 35 ft. below the pump house floor. The pumping equipment, installed in 1947, consists of a Jacuzzi jet pump Unit No. 138724, rated at 200 gpm. against 50 psi. pressure, attached to 33 ft. of 3-in. eductor pipe and 2 1/2-in. air pipe; 15-hp. U.S. electric motor, No. 538589, operated at 1800 rpm.

This well was reported to have been abandoned between 1925 and 1938, but again furnished the entire village supply from 1938 to 1947. It is now maintained for emergency use. The water level is about 12 ft. below the top of the casing.

Analysis of a sample (Lab. No. 51797) collected July 10, 1924, showed the water to have a hardness of 36.7 gr. per gal., a residue of 763 ppm., and an iron content of 0.6 ppm.

Eight test wells were drilled in 1924. Test Well No. 8 was finished as a permanent well, and was located near the northwest corner of Adams and Gay St. (or approximately 2160 ft. N. and 2280 ft. E. of the S. W. corner of Section 23). The surface elevation at the well site is 543 ft. The well was reported to have been 10 in. in diameter and 153 ft. deep, penetrating sand and gravel to shale at 148 ft.

Sometime prior to 1938, an attempt was made to rehabilitate the well by removing the screen. Subsequent heaving of sand filled the well and necessitated its abandonment. No further attempts have been made to rehabilitate the well.

In 1947, Hayes & Sims, Champaign, drilled a well, called New No. 8 to a depth of 149 ft. and located 6 ft. west of the abandoned Test Well No. 8. This well is cased with 8-in. pipe from 14 in. above to 139 ft. below ground level and an 8-in.

LABORATORY NO. 113,543

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	25.5		Silica	SiO_2	24.2	
Manganese	Mn	0.2		Fluoride	F	0.3	
Calcium	Ca	292.7	14.64	Chloride	Cl	53.0	1.49
Magnesium	Mg	130.1	10.70	Nitrate	NO_3	1.3	0.02
Ammonium	NH_4	9.9	0.55	Sulfate	SO_4	892.7	18.57
Sodium	Na	208.6	9.07	Alkalinity	(as $CaCO_3$)	744.	14.88
Turbidity		242.		Hardness	(as $CaCO_3$)	1267.	25.34
Color		0.		Residue		2148.	
Odor		0.					
Temperature 56° F.							

Johnson screen, 10 ft. 10 in. in length, from 139 ft. to the bottom of the well. A lead packer is wedged between the screen and bottom of the casing.

A production test was made on June 26, 1947, by the State Water Survey. For test purposes a 5 3/4-in. cylinder pump, set at a depth of 75 ft., and operated by the drill rig was installed. After 6-hr. pumping at a rate of 96 gpm.,the drawdown was 15.5 ft. from a non-pumping water level of 42 ft. When the test was ended, complete recovery of the water level occurred within 1/2-hr. On Feb. 5, 1948, after 1-hr. pumping at 90 gpm. the drawdown was 13 ft. from a non-pumping water level of 42 ft. below the top of the well.

The pumping equipment consists of: a Jacuzzi jet pump, Unit No. 180911, rated at 110 gpm. against 68 psi. pressure, attached to 80 ft. of 3-in. eductor pipe and 2 1/2-in. air pipe; 15-hp. General Electric motor, No. DJ6756918, operated at 1755 rpm.

Analysis of a sample (Lab. No. 113,543) collected Feb. 18, 1948 after 1-hr. pumping at 90 gpm. showed the water to have a hardness of 74.0 gr. per gal., a residue of 2148 ppm., and an iron content of 25.5 ppm. The quality is similar to that noted when the well was first drilled.

Pumpage is estimated to average 17,500 gpd.

A public water supply was installed by the city of Greenville (3391) in 1884.

Water was originally obtained from wells 45 to 60 ft. deep, penetrating sand and gravel, and located at the pumping station in the southern part of town, north of the railroad depot between Second and Third St. The elevation of the ground surface at that site is 565t ft.

Eight wells were in use at that location in 1923. The yield of the 8 wells on May 18, 1923 was estimated to be 195 gpm. The maximum pumpage was 100,000 gpd. All of the wells have been abandoned.

Seven wells were drilled to average depths of 62 ft. in 1927 and located just north of the stock yards. Six of the wells were 8 in. in diameter and the seventh well was 36 in. in diameter, and located on the east side of the lot. The gravel stratum was thickest at that location. The 8-in. wells yielded 25 gpm. each and the 36-in. well 150 gpm. All of the wells have been abandoned.

A test-well was drilled to a depth of 158 ft. in Apr. 1926 by Benjamin Bates, East St. Louis, and located about one mile southwest of town, and about 30 ft. from Lindly No. 1 gas well (or approximately 2600 ft. S. and 1000 ft. W. of the N. E. corner of Section 22, T. 5 N., R. 3 W.). The test-well was cased with 8-in. pipe to 120 ft. and 8-in. Cook screen, having No. 24 slot openings. When the well was completed the static water level was about 58 ft. below the ground elevation of 528± ft. It was reported that water was pumped for 2 da. at a rate of 30 gpm.

Correlated driller's log of 8-in. test-well furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil, yellow and blue clay	40	40
Soft sandy mud	10	50
Gravelly and sandy clay	78	128
Clean sand	3	131
Blue clay	14	145
Brown sand and gravel	11	156
Pennsylvanian system		
Limestone	2	158

Two wells were drilled in 1932 and located 1/4 mile southwest of the pumping station (or approximately 1000 ft. S. and 2500 ft. W. of the N. E. corner of Section 15, T. 5 N., R. 3 W.). The wells were 60 ft. apart and gravel-packed.

The East Well was 68 ft. deep and cased with 36-in. steel pipe to 51 ft. and an 18-in. strainer, 17 ft. long, was placed with a 9-in. gravel envelope surrounding the strainer.

The West Well was 65 ft. deep and cased with 36-in. steel pipe to 55 ft. and a 24-in. strainer, 10 ft. long, was placed with a 6-in. gravel envelope surrounding it.

Sample-study log of West Well furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Silt, sandy and clayey	8	8
Sand and granule gravel	27	35
Granule gravel, clean	20	55
Gravel, clean	10	65

Water-bearing gravel was found at 42 ft. in each well and when the wells were completed, the static water level was 42 ft. below the top of the wells.

Each well is equipped with 50 ft. of 5-in. column pipe; 8-in., 3-stage Sterling turbine pump, having an overall length of 28 in.; 14 ft. of suction pipe.

In 1932, when pumping at 250 gpm. for 1 hr., the drawdown was 1 ft. It was not reported as to whether one well was interfered with, in the operation of the other well.

In Nov. 1948, the West Well was being rehabilitated. The strainer and casing were being replaced. The well is maintained for emergency use.

Analysis of a sample (Lab. No. 71806) collected Oct. 7, 1932 showed the water from the East and West Wells to have a hardness of 27.9 gr.per gal., a residue of 703 ppm., and no iron.

The North Well was drilled in 1939 or 1940 to a depth of 69 ft. by John Hampton, Greenville, and located 50 ft. north of the East Well. The well was drilled 36 in. in diameter but, because of the inability to get delivery of pipe of that size, a 21-in. casing and strainer was installed. The annular space outside of the strainer was packed with gravel. The static water level at the time was 51 ft. below a ground level elevation of 550i ft.

The pumping equipment corresponds to that in the other wells and consists of 50 ft. of 5-in. column pipe; 8-in., 3-stage Sterling turbine pump, No. S 4033, having an overall length of 28 in.; 14 ft. of suction pipe; 7 1/2-hp., 1750 rpm., General Electric motor, No. 5530302.

The pumps in the East and North Wells are operated simultaneously by automatic control.

Water is now obtained principally from the East and North Wells.

Analysis of a sample (Lab. No. 116,363) collected Nov. 4, 1948 showed the water in the North Well to have a hardness of 31.9 gr. per gal., a residue of 776 ppm., and an iron content of 0.1 ppm.

All water is chlorinated.

Pumpage is estimated to average 325,000 gpd.

LABORATORY NO. 116,363

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	26.6	
Manganese	Mn	Tr.		Fluoride	F	0.1	
Calcium	Ca	139.9	7.00	Chloride	Cl	42.0	1.18
Magnesium	Mg	47.9	3.94	Nitrate	NO_3	4.5	0.07
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	201.0	4.18
Sodium	Na	44.4	1.93	Alkalinity	(as $CaCO_3$)	372.	7.44
Turbidity		3		Hardness	(as $CaCO_3$)	547.	10.94
Color		0		Residue		776.	
Odor		0		Temperature 58° F.			

The village of Gridley (745) installed a public water supply in 1923.

Well No. 1 was drilled in Dec. 1922 by John Bolliger, Fairbury, and is located about 65 ft. north of the Toledo, Peoria, & Western R. R. main tracks between Woodford and Center St. (or approximately 820 ft. N. and 2480 ft. E. of the S. W. corner of Section 4, T. 26 N., R. 3 E.). The well is 290 ft. deep below a surface elevation of 750± ft. An 8-in. casing extends to a depth of 270 ft. and a 20-ft. length of Johnson screen extends to the bottom of the well. The screen has No. 30 slot openings.

For test purposes, the completed well was equipped with a 5 3/4-in. single-acting cylinder pump with the bottom of the suction pipe set at a depth of 122 ft. A production test was made Jan. 23, 1923. The non-pumping water level was reported to be 54 ft. below the ground surface. After 53-hr. pumping at a rate of 50 gpm., the drawdown was 6 ft. After 1 1/2-hr. pumping at an increased rate of 70 gpm., the drawdown was 10 ft., and after 1/2-hr. pumping at 77 gpm., the drawdown was 11 ft.

In 1924, it was reported that, after 2-hr. pumping at an average rate of 82 gpm., the water level was 59 ft. below the floor level. In the spring of 1945, the pump rods were pulled. At that time the non-pumping water level was 59 ft. below the pump base. In June 1945, it was reported that the pump was operated at an estimated rate of 75 gpm.

The pumping equipment consists of 80 ft. of 6-in. column pipe; 5 3/4-in. by 18-in. A. D. Cook double-acting cylinder pump, No. 1396, with overall length of 8 to 9 ft., rated at 90 gpm. when operating at 25 strokes per minute; 20 ft. of suction pipe; 15-hp., 400 rpm. Fairbanks-Morse oil engine.

The pump has not been operated since June 1948. The following pump and assembly is on order: 150 ft. of 5-in. column pipe; American Well Works turbine pump, having a rated capacity of 100 gpm. against 280 ft. of head at 1750 rpm.; 10 ft. of 5-in. suction pipe; 150 ft. of 1/4-in. gi. air line; 15-hp. electric motor and a Johnson right angle gear drive with stub shaft and pulley for belt drive.

Analysis of a sample (Lab. No. 83963) collected June 27, 1938, showed the water to have a hardness of 9.4 gr. per gal., a residue of 646 ppm., and an iron content of 0.2 ppm.

Well No. 2 was drilled in 1945 by John Bolliger & Sons, and is located 30 ft. west of Well No. 1. This well was drilled to a depth of 291 ft.

Sample-study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and till	70	70
Gravel, very silty	15	85
Till	45	130
Soil	5	135
Till	145	280
Granule gravel, sandy, slightly silty at top	10	290

The well is cased with 283 ft. of 8-in. pipe from 18 in. above the ground surface, and a 15-ft. 10-in. length of 7 1/2-in. od. Johnson screen was

LABORATORY NO. 115,992

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.5		Silica	SiO_2	18.3	
Manganese	Mn	0.1		Fluoride	F	0.2	
Calcium	Ca	36.2	1.81	Chloride	Cl	17.0	0.48
Magnesium	Mg	17.8	1.46	Nitrate	NO_3	0.2	Tr.
Ammonium	NH_4	4.0	0.22	Sulfate	SO_4	142.8	2.97
Sodium	Na	183.2	7.96	Alkalinity (as $CaCO_3$)		400.	8.00
Turbidity		0		Hardness (as $CaCO_3$)		164.	3.27
Color		30		Residue		648.	
Odor		0		Free CO_2 (calc.)		14.	
Temperature 55° F.				pH = 7.85			

installed with 9 1/2 ft. of effective length below the casing. The screen has No. 30 slot openings.

For testpurposes, a tractor-driven deep-well turbine pump with the top of the bowls at 185 ft. was installed. A production test was made June 19, 1945 by the driller, engineer, and the State Water Survey. When pumping at 110± gpm.» the drawdown was 32 ft. below a non-pumping water level of 65 ft.

The permanent pump assembly consists of 150 ft. of 5-in. column pipe; 7-in., 12-stage American Well Works turbine pump, No. 71520 rated at 100 gpm. when operating at 1760 rpm. against 277 ft. of head; 150 ft. of air line; 10 ft. of 5-in. suction pipe; 15-hp. U. S. electric motor.

On Oct. 2, 1948 the non-pumping water level was 63 ft. below the pump base (1/2 ft. above ground level). After 22-minutes pumping at 160 gpm. the drawdown was 17 ft.

Analysis of a sample (Lab. No. 115,992) collected Oct. 2, 1948 after 22-minutes pumping at 160 gpm., showed the water to have a hardness of 9.6 gr. per gal., a residue of 648 ppm., and an iron content of 0.5 ppm.

From Jan. 1 to Oct. 1, 1948 metered pumpage averaged 47,410 gpd. of which 9000 gpd. was used by commercial consumers.

GRIGGSVILLE
Pike County
May 26, 1948

The city of Griggsville (1266) installed a public water supply in 1935.

Water is obtained from 3 wells constructed in 1935 by the Thorpe Concrete Well Co., Alton, and located about 3 mile north of the city.

Well No. 1 is located about 600 ft. N. and 300 ft. W. of the S. E. corner of Section 34, T. 3 S., R. 3 W. The well is 43 ft. deep below a ground surface elevation of 480± ft.

Correlated driller's log of Well No. 1 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay	10	10
Sand and gravel, dirty	20	30
Clay, yellow	4	34
Sand and gravel, dirty	6	40
Hardpan and clay	4	44

The well is cased with 26-in. id. by 36-in. od. solid concrete pipe from the surface to 25 ft. and with 26-in. id. by 36-in. od. porous concrete pipe from 25 to 43 ft.

A production test was made by the State Water Survey on Mar. 11-12, 1935. The well produced 58 gpm. for 5 1/2 hr., with a drawdown of 34 1/2 ft. from a non-pumping water level of 1 ft. below the ground surface.

The pumping equipment consists of: 40 ft. of 3-in. column pipe; 8-in., single-stage Westco turbine pump, No. 4DT7-1-71836 AB, having 14-in. overall length and rated at 30 gpm.; 1 1/2-hp. U. S. electric motor No. 126,648, operating at 1800 rpm. The base of the pump is 7 1/2 ft. above ground level. There is no suction pipe nor air line.

On May 12, 1948 the non-pumping water level was 10 to 12 ft. below ground level.

Analysis of a sample (Lab. No. 114,728) collected May 12, 1948, showed the water to have a hardness of 21.0 gr. per gal., a residue of 369 ppm., and no iron.

Well No. 2 is located about 200 ft. north and 250 ft. east of Well No. 1. The well is 60 ft. deep below ground level, and is cased from 10 1/2 ft. above to 16 ft. below ground level with 26-in. id. by 36 in. od. solid concrete pipe and with 26-in. id. by 36-in. od. porous concrete screen from 16 to 60 ft. A gravel envelope, 6 1/2 in. in thickness was placed around the screen, and a concrete plug was placed in the bottom of the screen.

This well is equipped as follows: 30 ft. of 3-in. column pipe; 8-in. single-stage Westco turbine pump No. 4DT-7-171838AB having 14-in. overall length and rated at 30 gpm.; 1 1/2-hp. U.S. electric motor No. 126645, operating at 1800 rpm.

The pump base is 10 1/2 ft. above ground level. There is no suction pipe nor air line.

When pumping at a rate of 50 gpm. in Well No. 3 the drawdown was 3 ft. in Well No. 2. The well is in service, but for short periods only.

Well No. 3 is located about 250 ft. east of Well No. 1. This well is 41 1/2 ft. deep and is cased with 26-in. id. by 36-in. od. solid concrete pipe

LABORATORY NO. 114,728

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.0		Silica	SiO_2	20.4	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	92.7	4.64	Chloride	Cl	6.0	0.17
Magnesium	Mg	31.3	2.58	Nitrate	NO_3	11.9	0.19
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	26.3	0.55
Sodium	Na	0.2	0.01	Alkalinity	(as $CaCO_3$)	316.	6.32
Turbidity		Tr.		Hardness	(as $CaCO_3$)	361.	7.22
Color		0		Residue		369.	
Odor		0					
Temperature 53° F.							

to a depth of 13 1/2 ft. and with 26-in. id. by 36-in. od. porous concrete screen between the depths of 13 1/2 ft. and 41 1/2 ft.

A production test was made by the State Water Survey on May 10, 1935. After 13 1/2-hr. pumping at an average rate of 50 gpm.,the drawdown was 26 1/2 ft. from a non-pumping water level of 1 ft. below the ground surface.

The pumping equipment consists of: 40 ft. of 3-in. column pipe; 8-in., single-stage Westco turbine pump, No. 4DT-7-1-71837AB having 14-in. overall length, and rated at 30 gpm.; 1 1/2-hp. U.S. electric motor No. 128655, operating at 1800 rpm.

All water is chlorinated. Pumpage is estimated to average 70,000 gpd.

HAMMOND
Piatt County
Sept. 10, 1948

A public water supply for the village of Hammond (384) was installed in 1935.

Two test wells were drilled during 1934 by L. R. Burt, Decatur. Test Well No. 1 was located in the northwest corner of the City Park, at the west end of Seventh St. (or approximately 850 ft. N. and 80 ft. E. of the S. W. corner of Section 36, T. 16 N., R. 5 E.). The ground elevation is 674t ft.

Sample-study log of Test Well No. 1 furnished by the State Geological Survey:

Formation	Thickness ft.	Thickness in.	Depth ft.	Depth in.
Pleistocene system				
Soil and till	38		38	
Sand, slightly dirty	4		42	
Till	23		65	
Sand and gravel, clean	10	6	75	6
Till	53	6	129	
Gravel, clean	7		136	
Sand, clean	7		143	
Pennsylvanian system				
Shale	9		152	

A production test showed that not more than 25 to 30 gpm. could be withdrawn. The thin layer of sand at approximately 75-ft. depth was not tested for production.

Well No. 1 was finished to a depth of 87 ft. at the site of Test Well No. 2 and located just east of the Wabash R. R. at the west end of Second St. (or approximately 2265 ft. N. and 580 ft. E. of the S. E. corner of Section 36). This location is 1415 ft. north and 500 ft. east of Test Well No. 1. The ground elevation is 13 ft. higher than at Test Well No. 1.

The well was of the gravel-wall type with a 26-in. steel casing extending from the surface to 70 1/2 ft. and a 12-in. casing from the surface to 71 1/2 ft. with 15 1/2 ft. of 12-in. Cook screen swedged to the bottom of the 12-in. casing. The screen had 3/16-in. slot openings. The annular space between the casings and outside the screen was filled with selected gravel.

A production test was made by the State Water Survey on Nov. 26, 1934. The static water level was 11 ft. below the ground surface and when pumping at 175 gpm. the drawdown was 8 ft. When pumping at rates of 210 and 278 gpm. the drawdowns were 11.0 and 17.2 respectively. Hydrogen-sulfide was reported to be present.

The pumping equipment consists of: 76 ft. of 6-in.id. column pipe; 7-in., 10-stage Fairbanks-Morse turbine pump, No. 26314, rated at 150 gpm. and 6 ft. 2 in. long; 80 ft. of air line; 1 1/2 ft. of strainer; 15-hp., 1740 rpm. Fairbanks-Morse electric motor.

On Sept. 10, 1948 the pump discharge rate to aerator was 268 gpm. The non-pumping water level was 15 1/2 ft. below the pump base and after 18-minutes pumping at 268 gpm. the drawdown was 12 ft.

Analysis of a sample (Lab. No. 115,790) collected Sept. 9, 1948 after 15-minutes pumping showed this water to have a hardness of 15.9 gr. per gal., a residue of 502 ppm., and an iron content of 5.3 ppm.

The water is aerated, filtered and softened. Analysis of a sample (Lab. No. 115,786) collected Sept. 9, 1948 showed the treated water to have a hardness of 8.3 gr. per gal., a mineral content of 505 ppm., and an iron content of 0.49 ppm.

Pumpage is estimated to average 14,420 gpd.

LABORATORY NO. 115,790

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	5.3		Silica	SiO_2	25.1	
Manganese	Mn	0.1		Fluoride	F	0.1	
Calcium	Ca	88.6	4.43	Chloride	Cl	26.0	0.73
Magnesium	Mg	12.1	1.00	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	10.3	0.58	Sulfate	SO_4	3.1	0.06
Sodium	Na	97.1	4.22	Alkalinity (as $CaCO_3$)		472.	9.44
Turbidity		100		Hardness (as $CaCO_3$)		272.	5.43
Color		15		Residue		502.	
Odor		Tr.		Temperature 56° F.			

LABORATORY NO. 115,786

	ppm.	epm.			ppm.	epm.
Iron (total) Fe	0.49		Fluoride	F	0.2	
			Chloride	Cl	31.0	0.87
Turbidity	0		Alkalinity	(as $CaCO_3$)	432.	8.64
Color	25		Hardness	(as $CaCO_3$)	142.	2.84
Odor	0		Total Mineral Content		505.	
Temperature 64° F.						

A public water supply was installed by the village of Hampshire (757) in 1902.

Water was first obtained from a 6-in. well drilled to a depth of 72 ft. and penetrating a stratum of water-bearing sand and gravel. It is located about 60 ft. south of Main St. and 60 ft. west of Jefferson St. (or approximately 650 ft. N. and 100 ft. W.of the S. E. corner of Section 21, T. 42 N., R. 6 E.). The elevation of the ground surface is 900t ft.

Short production tests made in Apr., 1922 and June, 1923 indicated about 23 gpm. In Apr., 1922 the non-pumping water level was 35 ft. below the pump base. This well was the source of the entire public supply until another well was drilled in **1924.**

The pump installation, made in 1941, consists of a jet pump and a 3-hp. Century electric motor and is operated to deliver about 40 gpm. which is the present capacity of the well.

The well is used for emergency purposes.

Well No. 2 was drilled in 1924 to a depth of 1178 ft. by P. E. Millis, Byron, and located about 18 ft. southwest of the older well. It was reported to be cased with 10-in. pipe to rock at a depth of 178 ft. below which the hole is 8-in. diameter to the bottom. Upon completion of the well the non-pumping water level was 42 ft. below the ground surface. The production was 120 gpm. during a 6-hr. pumping period.

This well was later plugged at a depth of 400 ft. and "shot" at a depth of about 300 ft.

The existing pump installation, made in 1944, is: 100 ft. of 6-in. od. column pipe; 8-in., 9-stage American Well Works turbine pump, No. 59046,

Log of the J. B. Interrieden Co. Well, Hampshire, furnished by the State Geological Survey from the description of sample cuttings:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
No sample	5	5
Gravel, sandy, silty at base	20	25
Glacial till, gravel, sand and silt	55	80
Sand, coarse	5	85
Soil	5	90
Sand and gravel	20	110
Glacial till, sand and silt	80	190
Granular gravel	10	200
Ordovician system		
Maquoketa shale, some dolomite	100	300
Galena dolomite	55	355

LABORATORY NO. 111,401

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.4		Silica	SiO_2	21.8	
Manganese	Mn	0.0		Fluoride	F	0.2	
Calcium	Ca	54.3	2.72	Chloride	Cl	3.0	0.08
Magnesium	Mg	9.7	0.80	Nitrate	NO_3	1.0	0.02
Ammonium	NH_4	1.0	0.06	Sulfate	SO_4	5.1	0.11
Sodium	Na	47.6	2.07	Alkalinity (as	$CaCO_3$	272.	5.44
Turbidity		0		Hardness (as	$CaCO_3$	176.	3.52
Color		0		Residue		302.	
Odor		Tr.		Free CO_2 (calc.)		11.	
Temperature 52.5° F.				pH = 7.8			

having a rated capacity of 125 gpm. against 190 ft. of head; the overall length of the pump is 5 ft. 5 3/4 in.; 10 ft. of 5-in. suction pipe; 110 ft. of 1/4-in. gi. air line; 10-hp. U. S. electric motor.

On May 18, 1938 the non-pumping water level was 25 ft. below the pump base. On Aug. 6, 1947 the water level was 45 1/2 ft. below the pump base after a 15-min. idle period, and after 15-min. pumping at 125 gpm. the water level was 50 ft.

Analysis of a sample (Lab. No. 111,401) collected from a tap on the pressure tank after 15-min. pumping at 125 gpm. showed this water to have a hardness of 10.3 gr. per gal., a residue of 302ppm., and an iron content of0.4ppm. Methane gas has also been found to be present in the water in a concentration of 3.3 cu. ft. per 1000 gal.

Metered pumpage from Apr. 1 to July 1, 1947 averaged 65,940 gpd.

Pumpage from industrial wells in the vicinity averages 150,000 gpd.

HANOVER
Jo Daviess County
Jan. 11, 1947

A public water supply was placed in service by the village of Hanover (899) in 1923.

Water is obtained from a well drilled by the Ohio Drilling Co., Massillon,.Ohio, and completed Jan. 10, 1922. The well isin the pumping station located at the end of Jackson St. about 110 ft. north of North Monroe St. (or approximately 1150 ft.N. and 2100 ft. W. of the S. E. corner of Section 9, T. 26 N., R. 2 E.). The well was drilled to a depth of 1090 ft. below a ground surface elevation of 638± ft.

The well casing record is: 30 ft. of 12-in. casing; 500 ft. of 8-in. casing; and 100 ft. of 6.-in. casing. The top of the 12-in. casing was evidently in a pit several feet below ground level, and the casing extended to the top of the rock. The 8-in. casing from the surface to a depth of 500 ft., and the 6-in. pipe probably serves as a liner through some shale formation.

During drilling operations, water was encountered at a depth of 372 ft., in 59 ft. of water-bearing sandstone formation; but the main supply was at a depth of 972 ft., in 100 ft. of water-bearing sandstone. The artesian flow of the well was estimated in Feb. 1922 to be 300 gpm. At that time when pumping at a rate of 600 gpm. during the driller's test, the water level was lowered to a depth of 13 1/2 ft. below the top of the casing. The pressure at that time, with no pumping, was 20 lb. In 1937 there was artesian flow, but the static pressure had reduced to 16 lb. The free flow on the outside of the 12-in. casing, is wasted into the Apple River. No water can escape from between the 8 and 12-in. casings because the annular space between the casings is capped.

On Dec. 7, 1946 the pumping water level was 26 ft. below the pump base, and after 15 min. of shut-down, the water flowed to waste. The amount of this free flow was very small.

Mr. Lee Harkness, Water Superintendent, advises that on Mar. 1, 1948 the following pumping equipment was installed: 60 ft. of 6-in. brass column pipe; 6-in., 9-stage Aurora turbine pump, water lubricated and with bronze impellers; 60 ft. of air line; 10 ft. of 6-in. suction pipe; 30-hp. U. S. electric motor. It was also reported in Jan. 1949. When pumping the water level is 60 ft. Twenty minutes after stopping the pump, the water flows over the top of the well.

Analysis of a sample (Lab. No. 108,631) collected Dec. 7, 1946 after 1-hr. pumping at 300 gpm., showed the water from this well to have a hardness of 14.8 gr. per gal., a residue of 263 ppm., and an iron content of 0.8 ppm.

The average pumpage is estimated to be 80,000 gpd., and the maximum summer pumpage is 120,000 gpd.

Sample-study log of well drilled in 1922 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay, pebbly and sandy	32	32
Ordovician system		
Galena-Platteville dolomites	301	333
Glenwood shale	7	340
St. Peter sandstone	340	680
Oneota dolomite	30	710
Cambrian system		
Jordan dolomitic sandstone	50	760
Trempealeau dolomite	120	880
Franconia formation		
Sandstone, some dolomite and shale	40	920
"Sandy shale with blue clay seams"	30	950
Galesville formation		
"White sand, water-bearing"	137	1087
Eau Claire formation		
"Shale"	3	1090

LABORATORY NO. 108,631

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.8		Silica	SiO_2	16.1	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	47.4	2.37	Chloride	Cl	2.0	.06
Magnesium	Mg	32.9	2.70	Nitrate	NO_3	1.0	.02
Ammonium	NH_4	0.1	.01	Sulfate	SO_4	22.4	.47
Sodium	Na	0.7	.03	Alkalinity	(as CaC O_3)	228.	4.56
Color		0		Hardness	(as $CaCO_3$)	254.	5.08
Odor		0		Residue		263.	
Turbidity		Tr.		Free CO_2 (calc.)		18.	
Temperature 58.6° F.				pH = 7.5			

HARDIN
Calhoun County
Sept. 23, 1948

A public water supply was installed for the village of Hardin (838) in 1934, provided for by a Public Works Administration loan and grant.

Water is obtained from a well drilled to a depth of 70 ft. by E. C. Kuhse, Grafton, and located at the town hall on Main St. west of Water St. (or approximately 2450 ft. S. and 390 ft. W. of the N. E. corner of Section 27, T. 10 S., R. 2 W.). The elevatio.n of the top of the well is 440.6 ft.

The well was cased with 55 ft. of 8 1/4-in. pipe and 15 ft. of 7 1/2-in. Cook Everdur screen, with No. 20 slot openings. The pumping assembly consists of 48 ft. of 5-in. column pipe; 7 1/2-in. od., 9-stage Peerless turbine pump, rated at 125 gpm. against 75 psi. pressure at 1760 rpm.; overall length of pump is 52 in.; 10 ft. of 5-in. suction pipe with strainer; 15-hp. U. S. electric motor.

On Dec. 7, 1934, the non-pumping water level was 24 ft. below the top of the well and after 3-hr. pumping at 205 gpm. the drawdown was 4 ft.

Correlated driller's log of well drilled in 1934 furnished by the State Geological Survey:

Formation	Thickness ft.	in.	Depth ft.	in.
Pleistocene system				
Soil, clay, and silt	35		35	
Gravel	5		40	
Sand	5		45	
Sand, silt and gravel	10		55	
Sand	12	6	67	6
Devonian or Silurian system				
Rock	2	6	70	

Analysis of a sample (Lab. No. 115,899) collected Sept. 23, 1948 after 20-minutes pumping, showed this water to have a hardness of 28.6 gr. per gal., a residue of 568 ppm., and an iron content of 0.1 ppm.

Pumpage is estimated to average 100,000 gpd.

LABORATORY NO. 115,899

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	28.	
Manganese	Mn	0.1		Fluoride	F	0.1	
Calcium	Ca	126.5	6.33	Chloride	Cl	23.0	0.65
Magnesium	Mg	42.0	3.46	Nitrate	NO_3	15.3	0.25
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	69.7	1.45
Sodium	Na	20.2	0.88	Alkalinity (as $CaCO_3$)		416.	8.32
Turbidity		0		Hardness (as $CaCO_3$)		490.	9.79
Color		0		Residue		568.	
Odor		0		Temperature 57° F.			

The village of Harmon (201) installed a public water supply in 1909.

Water was first obtained from a well drilled in 1909 to a depth of 532 ft. by Jonah Stultz, Dixon, and located on the south side of North Ave. and on the west side of First St. (or approximately 2000 ft. N. and 50 ft. W. of the S. E. corner of Section 14, T. 20 N., R. 8 E.). The surface elevation is 700± ft.

Correlated driller's log of well drilled in 1909 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay	165	165
Ordovician system		
Maquoketa and Galena-Platteville formations		
Rock	135	300
Rock, solid	232	532

The well was 5 in. in diameter and equipped with a Gould's cylinder pump set at a depth of 90 ft. Power was furnished by a 14-hp. Root and Vandervoort gasoline engine operating at 250 rpm.

The non-pumping water level in Dec. 1916 was 7 ft. below the ground surface; and when pumping at 30 gpm., the drawdown was about 60 to 65 ft.

In 1938 the well was reported to have been abandoned since about 1923. It had been allowed to freeze, the cylinder lost in the well, and the pump rod was broken. This well is no longer in service.

Analysis of a sample (Lab. No. 36191) collected Dec. 27, 1916 showed this water to have a hardness of 17.4 gr. per gal., a residue of 348 ppm., and an iron content of 0.6 ppm.

The village now obtains water from 8 driven wells arranged in 2 east-west rows, the north row about 8 ft. south of the old well. The rows are 4 ft. apart, and the wells are spaced 4 ft. The wells are about 32 ft. deep. The drive pipes are 1 1/4 in. in diameter with a 2 1/2-ft. length of well-point installed at the bottom of each drive pipe. All the wells are connected to a 5-in. by 5-in. F. E. Myers Bros. suction pump operating at about 35 rpm. The 8 wells, pump, and old well are in a pit 4 ft. deep. The pump is driven by a 3-hp. General Electric motor, operating at 1790 rpm.

Analysis of a sample (Lab. No. 112,899) collected Dec. 12, 1947 after 2-hr. pumping, showed the water to have a hardness of 30.9 gr.per gal., a residue of 682 ppm., and an iron content of 2.5 ppm.

Pumpage is estimated to average 16,000 gpd.

[A]
LABORATORY NO. 112,899

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.5		Silica	SiO_2	19.6	
Manganese	Mn	0.1		Fluoride	F	0.1	
Calcium	Ca	120.2	6.01	Chloride	Cl	36.0	1.02
Magnesium	Mg	55.8	4.59	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	0.3	0.02	Sulfate	SO_4	218.0	4.54
Sodium	Na	16.1	0.70	Alkalinity (as $CaCO_3$)		288.	5.76
Turbidity		30		Hardness (as $CaCO_3$)		530.	10.60
Color		0		Residue		682.	
Odor		Tr.		Temperature 53° F.			

HARTFORD
Madison County
Dec. 7, 1948

A public water supply was installed in 1926 by the village of Hartford (1842).

At that time two wells were drilled, 100 ft. apart, by Thorpe Concrete Well Co., Alton, and located west of St. Louis Road, between First and Second St. extended (or approximately 1190 ft. S. and 910 ft. W. of the N. E. corner of Section 4, T.4 N., R. 9 W.). The wells were drilled to depths of 67 ft. below a ground surface elevation of 430± ft., and cased with 16-in. id. concrete pipe with the lower 45 ft. porous concrete strainers.

Each well was equipped with a Chippewa Model E - 24 pump, with 8 3/4-in. cylinder and 24-in. stroke operated at 23 to 24 spm. When completed the pumps were operated for 16 hr. at a rate of more than 300 gpm. and the water level was lowered 7 to 8 ft. When pumping from both wells the drawdown was reported to be about 0.15 ft. greater than when pumping from one well only. On Dec. 1, 1926, the non-pumping water level in the north well was 22 ft. below ground level and after 11-minutes pumping the drawdown was 7 to 8 ft.

Analysis of a sample (Lab. No. 70013) collected Dec. 7, 1931 showed this water to have a hardness of 22.3 gr. per gal., a residue of 448 ppm., and an iron content of 16.0 ppm.

The two wells were not used after 1934.

Well No. 1 which was number three in the order of wells was drilled in 1934 to a depth of 115 ft. by Thorpe Concrete Well Co. and located 18 ft. west of the old south well. The well was cased with 26-in. id. concrete pipe. The length of the porous concrete strainer was not reported.

The pumping equipment in Well No. 1 includes a 4 1/2-in. column pipe; Pomona turbine pump, No. M 3176, rated at 200 gpm.; 9 ft. of 4 1/2-in. suction pipe; 7 1/2-hp., 1745 rpm. General Electric motor. The bottom of the suction pipe is 93 ft. below the pump base.

Analysis of a sample (Lab. No. 98900) collected Jan. 1944, showed this water to have a hardness of 24.5 gr. per gal., a mineral content of 460 ppm., and an iron content of 9.6 ppm.

Well No. 2 was drilled by Thorpe in 1946 to a depth of 106 ft. and located 50 ft. west and a few feet north of Well No. 1. The well was cased with 28-in. id. concrete pipe with a porous concrete pipe screen of unknown length. The pumping equipment includes a 4-in. column pipe; 2-stage Byron Jackson No. 1 BM bronze turbine, rated at 200 gpm. against 90 ft. of head; the shafting is chrome steel; 7 1/2-hp., 1750 rpm. Byron Jackson submersible-type motor with the bottom of the motor set at 103 ft.

The pump discharges at a rate of 180 gpm.

Analysis of a sample (Lab. No. 116,680) collected Dec. 7, 1948 shows the water from Well No. 2 to have a hardness of 27.0 gr. per gal., a residue of 566 ppm., and an iron content of 10.3 ppm.

The water is aerated, softened and chlorinated.

Analysis of a sample (Lab. No. 116,681) collected Dec. 7, 1948 showed the treated water to have a hardness of 11.9 gr. per gal., a mineral content of 255 ppm., and an iron content of 0.08 ppm.

The pump in Well No. 1 was not in service in Dec. 1948 but under normal operations, the pump in No. 1 is operated in the morning and the pump in Well No. 2 is operated in the afternoon of each day.

Pumpage is estimated to average 85,000 gpd.

LABORATORY NO. 116,680

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	10.3		Silica	SiO_2	36.4	
Manganese	Mn	0.6		Fluoride	F	0.2	
Calcium	Ca	131.6	6.58	Chloride	Cl	13.0	0.37
Magnesium	Mg	32.9	2.70	Nitrate	NO_3	0.5	0.01
Ammonium	NH_4	0.3	0.02	Sulfate	SO_4	114.8	2.39
Sodium	Na	11.7	0.51	Alkalinity (as $CaCO_3$)		352.	7.04
Turbidity		94		Hardness (as $CaCO_3$)		464.	9.28
Color		0		Residue		566.	
Odor		0		Temperature 57° F.			

LABORATORY NO. 116,681

	ppm.	epm.			ppm.	epm.
Iron (total) Fe	0.1		Fluoride	F	0.4	
			Chloride	Cl	15.0	0.42
Turbidity	0		Alkalinity (as $CaCO_3$)		88.0	1.76
Color	0		Hardness (as $CaCO_3$)		204.	4.08
Odor	Tr.		Total Mineral Content		255.	

Until 1948, the village of Hartsburg (269) had no public water supply.

A well for public supply was completed to a depth of 96 ft. in Apr. 1948 by Bruner Machine and Supply Co., Hartsburg, and located about 20 ft. east of Second St. between Front and Logan St. (or approximately 250 ft. N. and 2390 ft. W. of the S. E. corner of Section 21, T. 21 N., R. 3 W.). The elevation of the ground surface is 600± ft.

Sample-study log of well drilled in 1948 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Loess and till	81	81
Sand and some gravel, slightly silty	9	90
Gravel, silty surfaces	7	97

The well is cased with 8-in. pipe from 1 1/2 ft. above to 84 ft. below ground level and with 12 ft., exposed length, of 8-in. Johnson screen, having equal sections of No. 20, 40, 60 and 80 slot openings. The bottom of the well was choked with a 14-in. oak plug.

A production test was made by the State Water Survey on May5, 1948, using a 5-in. turbine test-pump, belt-driven from a farm tractor. The top of the bowls was 82.4 ft. below the top of the casing. Before the test was started, the water level was 49.2 ft. below the top of the casing. After 1/2-hr. pumping at 23 gpm. the drawdown was 5 ft. The pumping rate was increased and after an additional 1 1/4-hr. pumping at 57 gpm., the drawdown was 13 1/2 ft. The pumping rate was then increased to 70 gpm. and after 3/4 hr. the drawdown was 27 ft.

A production rate of 25 gpm. was needed by the village.

Analysis of a sample (Lab. No. 118,251) collected May 18, 1948 after 5-min. pumping at 45 gpm. showed this water to have a hardness of 31.8 gr. per gal., a residue of 694 ppm., and an iron content of 0.1 ppm.

The water is softened. Analysis of a sample (Lab. No. 118,391) collected May 18, 1949 showed the treated water to have a hardness of 3.4 gr. per gal., a mineral content of 640 ppm., and a trace of iron content.

The well-pumping equipment includes 80 ft. of 3-in. column pipe; Pomona turbine pump, No. SJ 231 having an overall length of 6 ft. 10 in.; 10 ft. of 3-in. suction pipe; 5-hp. General Electric motor.

On Sept. 16, 1948, the depth to water was 50 ft. below the top of the casing.

LABORATORY NO. 118,251

		ppm.	epm.			ppm.	epm.
Iron	Fe	.1		Silica	SiO_2	31.8	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	126.2	6.31	Chloride	Cl	32.0	.90
Magnesium	Mg	55.8	4.59	Nitrate	NO_3	123.	1.98
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	131.	2.72
Sodium	Na	21.6	.94	Alkalinity	(as $CaCO_3$)	312.	6.24
Turbidity		Tr.		Hardness		545.	10.90
Color		0		Residue		694.	
Odor		0					
Temperature 58°							

LABORATORY NO. 118.391

	ppm.	epm.			ppm.	epm.
Iron (total) Fe	Tr.		Fluoride	F	.2	
			Chloride	Cl	33.0	.93
Turbidity	Tr.		Nitrate	NO_3	75.8	1.22
Color	0		Alkalinity (as	$CaCO_3$)	320.	6.40
Odor	0		Hardness (as	$CaCO_3$)	58.0	1.16
			Total Mineral Content		640.	

A public water supply was installed by the city of Harvard (3121) in 1892.

The initial supply was obtained from a well drilled to a depth of 1600 ft. and located about 80 ft. southerly of Gertrude St. and 150 ft. westerly of Ayer St. (approximately 650 ft. N. and 2200 ft. E. of the S. W. corner of Section 35, T. 46 N., R. 5 E.). The ground surface elevation is 925t ft.

The well was reported originally to be cased with 10-in. pipe to a depth of 150 ft., below which the hole was 8 in. in diameter from 150 to 300 ft. and 6 in. in diameter for the balance of the depth. On July 8, 1914 the non-pumping water level was reported to be about 20 ft. below the ground surface and when pumping with a cylinder setting of 115 ft. the plunger pump frequently broke suction.

In Aug. 1922 an air lift was installed. A 2-in. air pipe extended to a depth of 551 ft. and the eduction pipe was 170 ft. of 5-in. and 442 ft. of 5 5/8-in. During a test made on Aug. 18, 1922 the production was 315 gpm. The starting and operating pressures were 202 and 148 lb. respectively. The "shut-in" pressure was 133 psi., or 306.5 ft., the drawdown was 210 ft. from a non-pumping water level of 33 ft. below the floor surface. By Nov. 8, 1922 the air-pipe was lowered 36 ft. to a depth of 587 ft. to increase the. submergence. At that time the production was 286 gpm. as calculated fromreservoir measurements.

On May 19, 1938 a new 2-in. air-pipe was reported to be 600 ft. long. A production of 250 gpm. was reported when the air lift was operated 5 hr.a day. In May 1944 the production was 276 gpm. as measured in the surface storage reservoir.

Since Mar. 1947 the well has been used as a stand-by unit. It is maintained for service and operated every two weeks.

Well No. 2 was drilled to a depth of 742 ft. by C. D. Acley, Walworth, Wisc., in 1913 and located about 53 ft. southerly of Metzen St. and 150 ft. westerly of Ayer St., or about 27 ft. northerly of Well No. 1. The well is reported 8-in. in diameter from the surface to a depth of 156 ft. and 6-in. at the bottom.

When completed the production was reported to be 150 gpm. and the pumping water level was 176 ft. below the surface. The water level was lowered when pumping from Well No. 1. On Nov. 11, 1922 during a 4-hr. period of continuous pumping at 290 gpm. in Well No. 1, the water level in Well No. 2 was lowered from a depth of approximately 45 ft. to a depth of 109 ft.

Well No. 2 was continued in service until 1929 when it was abandoned. The pump pipe was pulled and the casing cut off beneath the ground surface and plugged with concrete in Jan. 1944.

Well No. 3 was constructed to a depth of 71 ft. by Fairbanks-Morse & Co. in 1929 and located about 75 ft. southwest of Well No. 1. It was dug and lined with a 48-in. steel tube to a depth of 30 ft., with a 45-in. steel tube between depths of 30 and 43 ft., and 42-in. steel tube between 43 ft. and rock at 71 ft. A 16-in. porcelain enameled cast-iron screen 15 ft; long was installed and seated on the rock, above which was set a 14-in. casing extending to the ground surface. The annular space between the bottom and a depth of 32 ft. was filled with washed selected pea gravel and the 42-in. steel tubing withdrawn. A 32-in. steel tube was installed from the surface to a depth of 32 ft. and its annular space was filled with concrete. The space between the 14-in. casing and the 32-in. tube was filled with gravel. Water-bearing gravel was encountered between the depths of 43 and 71 ft. and when the well was completed, the non-pumping water level was 15 ft. below the ground surface. In a production test, made upon the completion of the well, the production rate was 550 gpm. which slowly increased to 600 gpm. after the well was placed in service.

The production rate fell off in 1938 and on May 19, 1938 after pumping at 600 gpm. for less than 15 min., the water was drawn down to the bottom of the suction pipe at a depth of 68 ft. A new turbine pump was installed in 1940 but no improvement in production was shown. The non-pumping water level at that time was 16 to 18 ft. below the surface. In May 1944 the production was 260 gpm. or about 50 per cent of its original capacity.

The capacity continued to drop off and on Aug. 13, 1946 the well was acidized. After acidization, a production in excess of 500 gpm. was obtained.

The existing pump installation, made in 1940, is: 60 ft. of 8-in. column pipe; 8-in., 3-stage Fairbanks-Morse turbine pump; 24-in. length of cone shaped strainer; 15-hp. Fairbanks-Morse electric motor.

This unit was reported delivering 600 gpm. to the ground storage reservoir at the site on

July 14, 1947, and since Mar. 1947 this well has furnished the entire public water demand averaging 180,000 gpd.

Analysis of a sample (Lab. No. 111,090) collected July 14, 1947 after 1-hr. pumping at about 600 gpm. showed this water to have a hardness of 29.9 gr. per gal., a residue of 589 ppm., and an iron content of 0.1 ppm.

Well No. 4 was constructed in 1946 by Layne-Western Co., Chicago, as a gravel packed well to a depth of 69 ft. and located in the south end of Ayer St. about 100 ft. north of the south city limits (approximately 100 ft. N. and 2100 ft. E. of the S. W. corner of Section 35). The ground surface elevation is 920± ft.

The following information relative to its construction was furnished by the Wells Engineering Co.:

The formation penetrated consisted of sand and clay from the surface to a depth of 49 ft. which was followed by gravel to the bottom. A concrete plug was placed at the 69 ft. level.

Casing Record of Well No. 4

60-in. from surface to 20 ft. - removed upon completion
38-in. from surface to 49 ft.
26-in. from surface to 49 ft.
26-in. screen from 49 to 69 ft.
The annular space outside the casing and screen was filled with selected gravel.

On Mar. 26, 1946, pumping was started at a rate of 200 gpm. and increased to 385 gpm. After 4 1/2 hr., the drawdown was 29 ft. from a non-pumping water level of 17 ft. below the surface.

After the well was placed in service its rate of production dropped to 275 gpm. The well was acidized on Nov. 23, 1946 and after acidization a production of 375 gpm. was reported.

On July 14, 1947, the following pumping equipment was on hand but not installed: 40 ft. of 6-in. column pipe; 12-in., 3-stage American Well Works turbine pump Shop No. 72530 having an overall length of 44 in. and a rated capacity of 425 gpm. against 65 ft. of head at 1160 rpm.; 2 ft. of 8-in. suction pipe; 2 ft. of 8-in. strainer. A 10-hp. General Electric motor was on order.

Bowman Dairy Co. has 3 wells located at the plant on the east side of Jefferson St., just south of the Chicago and Northwestern Railway (approximately 500 ft. N. and 500 ft. W. of the S. E. corner of Section 35). Well No. 2 was drilled to a depth of 804 ft. in 1920 by W. L. Thorne Co., Des Plaines.

Correlated driller's log of Bowman Dairy Co. Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay	5	5
Gravel	3	8
Clay and gravel	37	45
Sand and fine gravel	30	75
Hardpan	53	128
Silurian system		
Alexandrian series		
Lime rock, white	42	170
Ordovician system		
Maquoketa formation		
Shale, blue	81	251
Rock, brown	12	263
Shale, blue	77	340
Galena-Platteville formations		
Lime rock, white	185	525
Lime rock, gray	120	645
St. Peter formation		
Sand rock, white	159	804

LABORATORY NO. 111,090

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	20.4	
Manganese	Mn	Tr.		Fluoride	F	0.0	
Calcium	Ca	119.0	5.95	Chloride	Cl	38.0	1.07
Magnesium	Mg	52.3	4.30	Nitrate	NO_3	10.6	0.17
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	141.5	2.94
Sodium	Na	3.9	0.17	Alkalinity (as $CaCO_3$)		312.	6.24
Turbidity		0		Hardness (as $CaCO_3$)		513.	10.25
Color		0		Residue		589.	
Odor		0		Free CO_2 (calc.)		52.	
Temperature 51.3° F.				pH = 7.2			

HAVANA
Mason County
Feb. 16, 1948

A public water supply was installed by the city of Havana (3999) about 1889.

Water was originally obtained from 10 wells located at the water works pumping station located two blocks east of the Court House Square on the north side of Main St. (or approximately 1500 ft. S. and 850 ft. W. of the N. E. corner of Section 1, T. 21 N., R. 9 W.).

Two of the wells were located within the pump station and spaced 12 ft. apart. The other eight were in two pits just outside the station, and the wells in each group were in a square with 10 ft. spacing between wells. All of the wells were within a radius of 30 ft. The pits were 15 ft. deep below a ground surface elevation of 470± ft., and 16 ft. in diameter. The pit was floored with concrete. Each well was 72 ft. deep and cased to a depth of 52 ft. with 6-in. pipe, below which a 20-ft. Cook strainer was placed.

Water was pumped by two Deane, tandem-compound, double-acting duplex plunger pumps set in the pits and with 10-in. suctions connected to 6-in. suction pipes set in the well casings. The suction lift averaged about 15 ft.

In Nov. 1914 the non-pumping water level was 30 ft. below ground surface.

In 1938 all water for the public supply was obtained from a well constructed in 1930 by Thorpe Concrete Well Co., Alton, and located a few feet from the old wells, some of which had been plugged.

The Thorpe well is 85 ft. below the ground surface and has 65 ft. of 26-in. id. blank concrete casing and 20 ft. of 26-in. id. porous concrete screen.

Water is pumped by two 3-in. Fairbanks-Morse centrifugal pumps, No. 186804 and 186805, each rated at 500 gpm. Power is furnished by a 25-hp. Fairbanks-Morse electric motor.

In Apr. 1938, the non-pumping water level was reported to be 33 ft. below ground surface.

A well was completed in 1942 to a depth of 85 ft. by C. B. Layman, Havana, and located 30 ft. south and 20 ft. east of the Thorpe Well.

The well was drilled originally to a depth of 90 ft. but the casing was pulled back about five feet. It was cased with 70 ft. of 12-in. steel pipe and with 15 ft. of Cook screen. The pumping equipment consists of 70 ft. of 8-in. column pipe; single-stage Fairbanks-Morse turbine pump, No. 189919, rated at 950 gpm.; 10 ft. of 8-in. suction pipe; 70 ft. of air line; 50-hp. Fairbanks-Morse electric motor, No. 432791, operated at 1760 rpm.

In Feb. 1948, the non-pumping water level was reported to be 22 ft. below the pump base which was approximate ground level, and when pumping at 950 gpm. the drawdown was seven feet. No readings could be made because either the air line was defective or the gauge was out of order. This well is the principal source of supply, but when this supply is insufficient, either one or both of the centrifugal pumps operate automatically.

Analysis of a sample (Lab. No. 113,476) collected after 15-min. pumping showed this water to have a hardness of 10.9 gr. per gal., a residue of 232 ppm., and an iron content of 0.2 ppm.

Pumpage is estimated to average 290,000 gpd.

LABORATORY NO.-113,476

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	16.9	
Manganese	Mn	0.1		Fluoride	F	0.1	
Calcium	Ca	48.5	2.43	Chloride	Cl	6.0	0.16
Magnesium	Mg	15.6	1.28	Nitrate	NO_3	7.5	0.12
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	39.3	0.82
Sodium	Na	2.5	0.11	Alkalinity (as $CaCO_3$)		136.	2.72
Turbidity		Tr.		Hardness (as $CaCO_3$)		186.	3.71
Color		0		Residue		232.	
Odor		0		Temperature 56.5° F.			

HEBRON
McHenry County
July 30, 1947

A public water supply was installed by the village of Hebron (627) in 1904 - 1905.

Water is furnished by a well drilled to a depth of 269 ft. 5 in. and located about 12 ft. south of North Western Ave. and 280 ft. west of North Main St. (approximately 300 ft. N. and 280 ft. W. of the S. E. corner of Section 8, T. 46 N., R. 7 E.). The elevation at the ground surface is 930± ft.

The well was drilled by J. W. Miller, Genoa, Wis., who reported that the well passed through "clay, then putty sand for many feet and ends in water-bearing gravel". The well was reported to be cased with 8-in. pipe from the surface to a depth of 173 ft. 3 in., and 6-in. pipe from 155 1/2 ft. to 258 ft. 5 in. Below the bottom of the 6-in. casing a 16-ft. slotted brass screen was driven 11 ft., lapping the 6-in. casing 5 ft. When the well was completed the water level was reported to be 61 ft. below the ground surface.

The following pump installation, made in 1932, was pulled for inspection in 1945 and re-installed: 130 ft. of 5-in. od. column pipe; 7-in., 8-stage Fairbanks-Morse turbine pump, Factory No. 21999, rated at a capacity of 210 gpm. against 130 ft. of head; the overall length of the pump is 4 ft. 10 in.; 10 ft. of 5-in. od. suction pipe; 15-hp. Fairbanks-Morse electric motor. An unrecorded length of air line is in place.

Analysis of a sample (Lab. No. 110,980) collected July 9, 1947 after 25-min. pumping at a rate of about 200 gpm. showed this water to have a hardness of 14.9 gr. per gal., a residue of 288 ppm., and an iron content of 0.8 ppm.

In June, 1947, the estimated average pumpage was about 120,000 gpd. The largest industrial consumers were the Borden Milk Co., Wilbrandt Packing Co., and Lossee Products Co.

LABORATORY NO. 110,980

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.8		Silica	SiO_2	17.9	
Calcium	Ca	51.5	2.58	Fluoride	F	0.2	
Magnesium	Mg	30.8	2.53	Chloride	Cl	3.0	0.08
Ammonium	NH_4	1.0	0.06	Nitrate	NO_3	1.7	0.03
Sodium	Na	22.1	0.96	Sulfate	SO_4	1.0	0.02
				Alkalinity	(as $CaCO_3$)	300.	6.00
Turbidity		10		Hardness	(as $CaCO_3$)	256.	5.11
Color		0		Residue		288.	
Odor		0		Free CO_2 (calc.)		10.	
Temperature		51.2° F.		pH = 7.9			

The public water supply for the village of Hennepin (396) is obtained from a well which was drilled in 1875 and located near the center of the public square (or approximately 1350 ft. N. and 1600 ft. W. of the S. E. corner of Section 9, T. 32 N., R. 2 W.).

The well was drilled at a diameter of 4 in. to a depth of 800 ft.

Correlated driller's log of well drilled in 1875 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil	3	3
Gravel	62	65
Conglomerate	8	73
Sand, gravel at base	39	112
Clay	63	175
Sand and gravel	25	200
Clay	30	230
Pennsylvanian system		
Shale	130	360
Sand	40	400
Silurian system		
Niagaran series		
Limestone and sandstone (probably all limestone)	100	500
Limestone	350	850

The elevation of the ground surface is 503± ft. The well was originally cased with 4-in. pipe to a depth of 400 ft.; but in 1910, on account of decreased pressure, Mr. Winfield Hall cleaned the well, drilled it a few feet deeper, and installed 480 ft. of 4-in. casing.

In 1875, the artesian flow rose to 65 ft. above the top of the well and was estimated at 80 gpm. In 1910 the pressure had decreased to 18 psi., which was sufficient to flow directly into the distribution system but insufficient to supply the 50-ft. elevated storage tank. After the repair of the well by Mr. Hall in 1910, the pressure was still insufficient to supply the tank. In 1926 the pressure was reported to be 10 psi., sufficient to distribute water for normal use.

There were a number of private wells about 100 ft. in depth. In 1926 the water level in these wells was reported to be 70 ft. below the ground surface.

In 1938 the well was connected directly to the distribution system, but the pump was not available. Some drinking fountains and watering troughs had been abandoned in order to increase the pressure in the system.

In 1939 the well was cleaned and recased by Chris Ebert, Washington, after which the artesian flow was 20 gpm., and the pressure was 17 psi.

A summary of the flows and pressure is:

Year	Pressure (psi.)
1875 Artesian flow 80 gpm.	32
1910	18
1926	10
1939 (After cleaning) 20 gpm.	17

Analysis of a sample (Lab. No. 109,926) collected Apr. 13, 1947, showed the water to have a hardness of 3.7 gr. per gal., a residue of 2865 ppm., and an iron content of 2.0 ppm.

In 1941, Schwiderski & Son drilled a 4-in. well in the east part of Hennepin. This well is 100 ft. deep and cased with 4 in. pipe to a depth of 95 ft.

LABORATORY NO. 109,926

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.0		Silica	SiO_2	11.6	
Manganese	Mn	0.0		Fluoride	F	3.5	
Calcium	Ca	15.8	0.79	Chloride	Cl	1180.0	33.28
Magnesium	Mg	5.6	0.46	Nitrate	NO_3	0.3	Tr.
Ammonium	NH_4	1.1	.06	Sulfate	SO_4	190.7	3.97
Sodium	Na	1104.5	48.02	Alkalinity	(as $CaCO_3$)	604.	12.08
Color		0		Hardness	(as $CaCO_3$)	63.	1.26
Odor		0		Residue		2865.	
Turbidity		10-					

and a 5-ft. section of Clayton screen with No. 60 slot openings. There is 80 ft. of drop pipe, a 2 1/2-in. cylinder, and 4 ft. of suction pipe.

At present the well is seldom used. When the well was completed, the non-pumping water level was 78 ft. below the ground surface. Water was pumped 2 hr. at 25 gpm. when the well was completed.

Pumpage is estimated at 3700 gpd.

A public water supply was installed by the city of Henry (1877) in 1902.

Water was obtained from 2 tubular wells, 8 ft. apart, in sand and gravel, and located at the pumping station on rising ground about 200 ft. from the river bank. Each well was 8 in. in diameter and 40 ft. deep, with a Johnson strainer, 8 ft. in length. Due to an insufficient supply of water, a third well was dug in 1903 to a diameter of 8 ft. and to a depth of 40 ft. It was located about 10 ft. distant from the tubular wells. The walls of the dug well were lined with brick, laid in cement mortar to a depth of 10 ft. from the top and with open joints below that depth-. A Roots rotary pump with 6-in. suction and 4-in. discharge pipe was connected directly to the casing of each tubular well and also could draw water from the dug well. Each pump was rated at 500,000 gpd.

Subsequently the tubular wells were abandoned and filled, and in July 1938 the dug well was reported to be only 22 ft. deep and could be pumped dry in summer time.

The dug well was abandoned in 1945 after a new well was placed in operation.

In 1930 Fred Bickorman, Henry, drilled a well, now called Well No. 1, 20 ft. southeast of the south corner of the pumping station which faces northwester approximately 1590 ft. N. and 1150 ft. W. of the S.E. corner of Section 16, T. 13 N., R. 10 E.). The well is 8 in. in diameter and 62 ft. deep below a ground surface elevation of 480± ft. A No. 30 slot screen, 14 ft. long, is installed in the bottom.

The well is equipped with 40 ft. of 6-in. column pipe; 7 5/8-in., 9-stage American Well Works turbine pump, No. 58653, rated at 300 gpm. against a head of 200 ft;; the overall length of the pump is 5 ft. 19/16 in.; 10 ft. of 5-in. suction pipe; 25-hp. U. S. electric motor, No. 114757.

In July 1938 the non-pumping water level was reported to be 18 ft. below the ground surface.

Analysis of a sample (Lab. No. 108,854), collected Jan. 8, 1947, showed the water from Well No. 1 to have a hardness of 20.6 gr. per gal., a residue of 436 ppm., and a trace of iron.

In 1936 Mike Schwiderski, Henry, drilled Well N6. 2, at a location 30 ft. northeast of the northeast side of the pumping station (or approximately 1620 ft. N. and 1080 ft. W. of the S. E. corner of Section 16). The well is 12 in. in diameter and 62 ft. deep with a No. 30 slot screen, 14 ft. long, installed in the bottom. The well is equipped with 40 ft. of 6-in. column pipe; 12-in., 4-stage American Well Works turbine pump, No. 60199, rated at 500 gpm. against a head of 220 ft.; the overall length of the pump is 4 ft. 5 15/16 in.; 10 ft. of 8-in. suction pipe; 40-hp. U. S. electric motor, No. 136323.

In July 1938 the non-pumping water level was reported to be 18 ft.below the ground surface, and the drawdown was 24 ft. when pumping at 550 gpm.

In 1944, a well, No. 3, was drilled by H. W. Packard, Washburn, and located 20 ft. northwest of the west corner of the pumping station. The well is 74.1/2 ft. deep and cased with 12-in. pipe with 14 ft. of No. 30 slot screen installed in the bottom.

The pump assembly consists of 50 ft. of 6-in. column pipe; 9 5/8-in., 5-stage American Well Works turbine pump, No. 17264, rated at 500 gpm. with an overall length of 4 ft. 7 in.; 10 ft. of 6-in.

LABORATORY NO. 108,854

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	Tr.		Silica	SiO_2	21.8	
Manganese	Mn	0.0		Fluoride	F	0.2	
Calcium	Ca	82.3	4.12	Chloride	Cl	16.0	.45
Magnesium	Mg	35.6	2.93	Nitrate	NO_3	36.2	.58
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	58.0	1.21
Sodium	Na	12.7	.55	Alkalinity	(as $CaCO_3$)	268.	5.36
Color		0		Hardness	(as $CaCO_3$)	353.	7.06
Odor		0		Residue		436.	
Turbidity		Tr.					
Temperature		55° F.					

suction pipe with 6-in. suction strainer; 50 ft. of air line;40-hp. U. S. electric motor, No. 448315. The pump is also equipped with a Johnson Combination geared head, so that, in case of emergency, it can be connected to a Wisconsin gasoline engine.

Water is pumped from the wells into 2 horizontal cylindrical pressure tanks, each tank being 8 ft. in diameter and 36 ft. in length, with a combined capacity of 27,000 gal. The tanks were installed new in 1937 replacing tanks of the same dimensions, which had been set at the time of the original water works installation in 1902. The pumps start automatically when the pressure drops to 50 psi., and at such times there is usually 3 1/2 ft. depth of water in the tanks. When the pressure increases to 70 lb., the pumps stop automatically, and the water in the tanks is about4.69 ft. deep. The major portion of the town is at an elevation of 30 ft. above the pumping station, and the pressure ranges from 37 to 62 lb. In an emergency, such as fire, the pressure tanks are cut off, and direct pumping pressure of 100 lb. or more is maintained.

All 3 wells are used to supply water to the city. Pumpage is estimated at 200,000 gpd.

The village of Herscher (416) installed a public water supply about 1895.

Water was first obtained from a well located about 190 ft. south of Kankakee Ave. and 100 ft. E. of Oak St. (or approximately 2175 ft. N. and 1100 ft. W. of the S. E. corner of Section 29, T. 30 N., R. 10 E.). This well was 5 in. in diameter and about 165 ft. deep and was equipped with a windmill-driven pump. The well is now sealed at a point 3 ft. below the ground surface.

Water was then obtained from a well called Well No. 1, reported to have been drilled about 1895, and located about 30 ft. north of the old well. This well was 5 in. in diameter and was drilled to a depth of 165 ft. below a surface elevation of 665± ft. The casing extended a short distance into rock at a depth of 48 ft.

Water was originally pumped from this well by means of a pump jack, driven by a gasoline motor. In 1925 the well was equipped as follows: 120 ft. of 4-in. drop pipe; 3 3/4-in. by 16-in. Fairbanks-Morse cylinder pump rated at 20 gpm. and operating at 28 rpm.; 8 ft. of 2-in. suction pipe; 5-hp. Fairbanks-Morse electric motor, No. 136565, operating at 1150 rpm.

In 1938 the non-pumping water level was 40 ft. below the ground surface. In 1941, it was reported that the well was filled to about 90 ft. and was producing very little water.

Analysis of a sample (Lab. No. 89978), collected Mar. 4, 1941, showed the water to have a hardness of 15.6 gr. per gal., a residue of 375 ppm., and no iron content.

This well has been abandoned, and in 1946 plans were being made for sealing the well. It is capped about 3 ft. below the pump base.

Well No. 2 was drilled in 1941 by George J. Berns, Chebanse, and is located at the southwest corner of the intersection of Kankakee Ave. and Maple St. (or approximately 2850 ft. S. and 430 ft. W. of the N. E. corner of Section 29.). The surface elevation is 665± ft. On July 1, 1941, when drilling had reached a depth of 70 ft., no water was found.

Another hole was drilled to a depth of 52 ft. about 40 ft. south of Well No. 2, but no water was encountered.

Well No. 3 was drilled in 1941 by George Berns, and was located about 95 ft. southwest of Well No. 1. When drilling was between 66 and 201 ft., the water level was 48 ft., but at 201 ft., a crevice was encountered into which all the water escaped. The well was then abandoned and plugged and the casing removed. It is reported that the production of Well No. 1 decreased after this hole was drilled.

Well No. 4 was drilled in 1944 by Ray Feuerborn, Batavia, and is located about 55 ft. south of Well No. 1, 105 ft. east of Oak St. and 225 ft. south of Kankakee Ave. (or approximately 2150 ft. N. and 1100 ft. W. of the S. E. corner of Section 29). The well is 725 ft. deep.

The well was cased with 8-in. drive pipe from the surface to 51 ft. 10 in. and with 6-in. pipe from the surface to 244 ft. From 244 to 725 ft., the hole was 6 in. in diameter. The casing was cemented in.

Before a production test, made in July 1944, the water level was 185 ft. When pumping at 125 gpm., the drawdown was 8 ft.

LABORATORY NO. 112,753

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	11.1	
Manganese	Mn	0.1		Fluoride	F	2.5	
Calcium	Ca	70.9	3.55	Chloride	Cl	330.0	9.31
Magnesium	Mg	35.8	2.94	Nitrate	NO_3	0.2	Tr.
Ammonium	NH_4	1.2	0.07	Sulfate	SO_4	348.4	7.25
Sodium	Na	344.1	14.96	Alkalinity (as $CaCO_3$)		248.	4.96
Turbidity		5-		Hardness (as $CaCO_3$)		325.	6.49
Color		0		Residue		1298.	
Odor (at well)		H_2S		Free CO_2 (calc.)		20.	
Temperature 56° F.				pH = 7.5			

Sample-study log of Well No. 4 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Glacial till	47	47
Ordovician system		
Maquoketa shale, some limestone and dolomite	103	150
Galena-Platteville dolomite and limestone	388	538
St. Peter sandstone	187	725

The well is equipped as follows: 240 ft. of 4-in. column pipe; 6-in., 27-stage Pomona turbine pump, No. SE 2447, rated at 160 gpm., against 292 ft. of head; 220 ft. of (defective) 1/4-in. steel air line; 20-hp. Westinghouse electric motor. When the pump was installed in the fall of 1944 the distance'to water measured 176 ft. below the pump base. In April 1945 the non-pumping water level was 178 1/2 ft. The pump was operated about 1 hr. per day.

Analysis of a sample (Lab. No. 112,753), collected Dec. 2, 1947 after 40-min. pumping at 160 gpm. showed this water to have a hardness of 19.0 gr. per gal., a residue of 1298 ppm., and an iron content of 0.2 ppm.

Pumpage is estimated to be 15,000 gpd.

The village of Heyworth (996) installed a public water supply in 1936.

The State Geological Survey made an electrical earth resistivity surveyin and west of Heyworth in 1935.

Test wells were drilled at several locations in and near the village in an attempt to locate a suitable source of water for the public supply.

Test Well No. 1 was located approximately 400 ft. N. and 100 ft. E. of the S. W. corner of Section 34, T. 22 N. R. 2 E. and was finished at a depth of 96 ft. The ground elevation at the site is 750± ft.

Sample-study log of Test Well No. 1 furnished by the State Geological Survey:

Formation	Thickness ft.	Thickness in.	Depth ft.	Depth in.
Pleistocene system				
Soil and till	39		39	
Granule gravel, sandy	2		41	
Silt	7		48	
Granule gravel, sandy	2	6	50	6
Till	13	6	64	
Gravel, sandy	2		66	
Till	19		85	
Sand	4		89	
Gravel	7		96	
Till	26		122	
Sand and granule gravel, silty	2		124	
Till	41		165	
Sand, very silty	21		186	
Sand and gravel	4		190	
Till and silt	124		314	
Pennsylvanian system				
Shale	14		328	

A production test was made on Dec. 13, 1934. After 2 1/2-hr. pumping at an average rate of 50 gpm., the drawdown was 55.2 ft. below a non-pumping water level of 21 ft. and was still increasing.

Analysis of a sample (Lab. No. 75475) collected Dec. 14, 1934, showed the water to have a hardness of 24.3 gr. per gal., a residue of 475 ppm., and an iron content of 3.0 ppm.

Test Well No. 6 was located about 100 ft. E. of Test Well No. I and was reported to be 90 1/2 ft. deep. During a production test made June 7, 1935, the yield was 22 gpm. with a drawdown of 59 1/2 ft. below a non-pumping water level of 13 ft.

Test Well No. 7 was located 1 1/2 miles west of town (or approximately 50 ft. N. and 250 ft. E. of the S. W. corner of Section 32). The well was 6 in. in diameter and 107 ft. deep. A production test was made June 25, 1935. The non-pumping water level was 13 ft. below the ground surface. After 1-hr. pumping at 40 gpm., the water level was drawnbelow the bottom of the suction pipe at a depth of 87 ft. The pump was stopped for 1 hr. and then started at a rate of 30 gpm. The pump again broke suction after 45 minutes.

Analysis of a sample (Lab. No. 76223) showed the water to have a hardness of 13.9 gr.per gal., a residue of 349 ppm., and an iron content of 1.6 ppm.

Test Well No. 8 was located in the valley of Kickapoo Creek in the S. W. 1/4, S. W. 1/4 of Section 32. The well is 6 in. in diameter, 66 ft. deep, and penetrated clean, coarse sand and gravel between the depths of 7 and 66 ft.

A 6-hr. production test was made July 8, 1935. During the last 5 hr. of the test, the well produced 250 gpm. with a drawdown of 8 ft. below a non-pumping water level of 6 ft. 9 in.

The Heyworth village well was drilled by Luther R. Burt, Decatur and is located about 150 ft. south and 100 ft. west of Test Well No. 8, about 150 ft. south of State Highway No. 119 and 1.7 miles west of U.S. Highway No. 51, in Heyworth, (in N. W. 1/4 N. W. 1/4 of Section 5, T. 21 N., R. 2 E.). The well is 61 ft. 8 in. deep, and is cased with 12-in. pipe with 20 ft. of 12-in., Johnson well screen, having No. 100 slot openings.

A production test was made by the State Water Survey Sept. 23, 1935. The well produced 275 gpm. with a drawdown of 3.2 ft., and 380 gpm. with a drawdown of 4.2 ft. below a non-pumping water level of 18 ft. below the ground surface.

A production test was made Oct. 5, 1936. For 2 hr. the production rate was 160 gpm. with a drawdown of 2 ft. below a non-pumping water level of 19 1/2 ft. below the pump base.

The pump installation consists of 40 ft. of 5-in. column pipe; 7-in. od., 12-stage Fairbanks-Morse deep-well turbine pump, No. 29783 having 6 ft. 10 in. overall length and rated at 250 gpm.; 20-hp. Fairbanks-Morse induction motor operating at 1750 rpm. An identical replacement of the pump

assembly was made in Apr. 1948.

A 24-hr. production test was made Oct. 12-13, 1936. The well produced 155 gpm. with a drawdown of 1.5 ft. and 325 gpm. with a drawdown of 3.2 ft. below a non-pumping water level of 20 ft. below the pump base plate.

Analysis of a sample (Lab. No. 115,894) collected Sept. 23, 1948 after 3-hr. pumping at 100 gpm., showed the water to have a hardness of 17.5 gr. per gal., a residue of 590 ppm., and an iron content of 3.3 ppm.

All water is aerated and filtered. Analysis of a sample (Lab. No. 116,040) collected Sept. 23, 1948 showed the treated water to have a hardness of 19.2 gr. per gal., a mineral content of 338 ppm., and an iron content of 0.14 ppm.

From Sept. 1, 1947 to Sept. 1, 1948, pumpage averaged 38,770 gpd.

LABORATORY NO. 115,894

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	3.3		Silica	SiO_2	21.1	
Manganese	Mn	0.0		Fluoride	F	0.3	
Calcium	Ca	71.6	3.58	Chloride	Cl	96.0	2.70
Magnesium	Mg	29.3	2.41	Nitrate	NO_3	0.4	0.01
Ammonium	NH_4	5.2	0.29	Sulfate	SO_4	3.3	0.07
Sodium	Na	107.2	4.66	Alkalinity (as $CaCO_3$)		408.	8.16
Turbidity		20		Hardness (as $CaCO_3$)		300.	5.99
Color		20		Residue		590.	
Odor		Tr.		Free CO_2 (calc.)		42.	
Temperature 53.5° F.				pH = 7.4			

A public water supply system was installed by the village of Hillside (1080) about 1927. Water was first obtained from a well located about 100 ft. west of Wolf Road and 100 ft. south of the Illinois Central right-of-way (or approximately 2900 ft. N. and 100 ft. W. of the S. E. corner of Section 18, T. 39 N., R. 12 E.). The well was originally drilled to a depth of 591 ft. by W. H. Cater. The elevation of the pump base is 668.97 ft. Original production and water levels are not known but the yield was reported to be less than 100 gpm. in Jan. 1937.

In a sample collected Nov. 30, 1937 the water was shown by analysis to have a hardness of 24.7 gr. per gal., a total mineral content of 558 ppm., and an iron content of 0.4 ppm.

This well was deepened by the J. P. Miller Artesian Well Co. in 1940 to a depth of 1970 ft.

TABLE 1

Hole Record

12-in. hole to a depth of 467 ft.
10-in. hole from 467 to 1288 ft.
8-in. hole from 1288 to 1675 ft.
6-in. hole from 1675 to 1970 ft.

12-in. drive pipe from surface to limestone at 22 ft.
10-in. from surface to 467 ft.
8-in. liner from 1199 to 1288 ft.
6-in. liner from 1447 to 1675 ft.

Sample-study and driller's log of well drilled about 1927 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Glacial drift"	22	22
Silurian system		
Niagaran-Alexandrian series		
"Limestone"	218	240
Ordovician system		
Maquoketa formation		
"Shale"	218	458
Galena-Platteville dolomite		
"Limestone"	132	590
Dolomite	194	784
Glenwood-St. Peter formations		
Sandstone, partly dolomitic	76	860
Sandstone, incoherent	30	890
Conglomerate of sandstone, chert and shale	13	903
Oneota dolomite, thin shale and sandstone beds	147	1050
Cambrian system		
Trempealeau dolomite	154	1204
Franconia sandstone, some dolomite, thin shale beds	101	1305
Galesville sandstone		
Sandstone, partly dolomitic	110	1415
Sandstone, incoherent	49	1464
Eau Claire formation		
Shale, dolomite, some sandstone	291	1755
Sandstone, incoherent	50	1805
Sandstone, dolomitic, and shale	15	1820
Sandstone, incoherent	50	1870
Mt. Simon sandstone	100	1970

The driller's hole and casing record is shown in Table 1.

A 24-hr. production test was conducted by the driller on June 8-9, 1940. The non-pumping water level was reported 259 ft. below the pump base and the drawdown was 66 ft. when pumping at a rate of 300 gpm. A decided lowering of both the pumping and non-pumping water levels occurred after May 15, 1944. The temperature of the water at the pump discharge was 52.5° F. on June 13, 1944 after 7 hr. of pumping. On July 3, 1944, the pumping level was below the bottom of the 360 ft. air line. The pump was then shut down because the yield had decreased from 140 to 50 gpm. and considerable entrained air was being discharged.

Air line measurements on July 24, 1944, after a rest period of 3 weeks, indicated a non-pumping water level of 268 ft. On Sept. 18, 1944, after the pump was pulled and the well had been idle since July 3, 1944, the non-pumping water level was measured at 77.5 ft.

The following pump assembly, installed on Oct. 5, 1944, is now in service: 462 ft. of 6-in. column pipe (an addition of 10 new 10-ft. sections); new 8-in., 21-stage Peerless turbine pump having an overall length of 12 ft. 5 in.; 22 ft. 7 in. of 5-in. suction pipe; 497 ft. of air line; old 40-hp. Westinghouse electric motor.

An 8-hr. production test was conducted on Oct. 9,1944. The rate of production was reported to be 223 gpm. against a discharge pressure of 52 to 53 lb. The pumping water level was 428 ft. below the pump base at the end of 8 hr. Equilibrium conditions were not approached and practically all of the water was pumped from the upper limestone, entering the well from behind the 10-in. casing. The maximum temperature observed during this test was 52.5° F., and the analyses of 8 samples collected, during the 8 hr. of pumping, showed the water to have a hardness of about 28.5 gr. per gal. A high iron content of 2-8 ppm. was also noted.

A sample collected Oct. 10 after pumping approximately 100,000 gpd. was submitted with a reported temperature of 54° F. Analysis showed the iron content to be low (0.2 ppm.) and the hardness to be 25.2 gr. per gal.

On Apr. 26, 1946 a sample of water collected from the distribution system was shown by analysis (Lab. No. 106,442) to have a hardness of 30.2 gr. per gal., and a total mineral content of 604 ppm., this being typical in character as were all other samples from this well of upper limestone water in this vicinity.

The water receives Calgon treatment and is chlorinated.

A Simplex Meter was installed on the pump discharge line on May 26, 1945. An average pumpage of 106,350 gpd. during the month of July 1945 was recorded.

During 1937 the village made arrangements for the use of the 180-ft. well at the Mater Dolorosa Seminary on Butterfield Road about 1500 ft. west of Wolf Road (or approximately 100 ft. S. and 3400 ft. E. of the N. W. corner of Section 18). This well was drilled by C. E. Pigg who furnished the following information: The top of the casing is about 3 ft. below the ground surface. The well is cased to 65 ft. with 8-in. pipe, and an 8-in. hole extends to 140 ft. with a 6-in. perforated liner between depths of 80 and 140 ft. The hole is 6 in. in diameter below a depth of 140 ft. After completion of the well, water was pumped for 8 hr. at a rate of 40 gpm. The drawdown was 25 ft. below a non-pumping water level of 35 ft.

The well is equipped with an American Well

LABORATORY NO. 106,442

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.4					
Calcium	Ca	109.1	5.45	Chloride	Cl	9.0	.25
Magnesium	Mg	59.2	4.84				
				Sulfate	SO_4	196.2	4.08
Sodium	Na	23.9	.10	Alkalinity (as $CaCO_3$)		352.	7.04
Color		0		Hardness (as $CaCO_3$)		520.	10.4
Odor		0		Total Mineral Content		604.	
Turbidity		10-		Free CO_2 (calc.)		83.	
Temperature 52.5° F.				pH = 7.05			

Works turbine rated at 100 gpm. capacity and set at a depth of 160 ft. Until Oct. 1944 the well was operated by the village as an auxiliary and emergency water supply unit.

Analysis of a sample (Lab. No. 82463), collected Sept. 26, 1937, showed this water to have a hardness of 25.2 gr. per gal., and a total mineral content of 569 ppm. A strong odor of hydrogen sulfide was noticed at the time of collection of the sample, and the iron content was found to be 1.1 ppm.

Since Oct. 5, 1944, its limited yield has been insufficient to meet the demands of the village in cases of emergency. The Seminary obtains its water from the village supply.

LABORATORY NO. 82463

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.12		Silica	SiO_2	14.0	
Manganese	Mn	0.0					
Calcium	Ca	86.5	4.32	Chloride	Cl	3.0	0.08
Magnesium	Mg	53.2	4.37	Nitrate	NO_3	1.4	0.02
Ammonium	NH_4	0.5	0.03	Sulfate	SO_4	165.5	3.46
Sodium	Na	41.5	1.80	Alkalinity	(as $CaCO_3$)	348.0	6.96
Color		0		Hardness	(as $CaCO_3$)	434.5	8.69
Odor		0		Residue		569.0	
Turbidity		2					

HINCKLEY
De Kalb County
Oct. 1, 1947

The village of Hinckley originally installed a public water supply about the year 1893 primarily for fire protection purposes.

Water was obtained from a well 350 ft. deep and was pumped by air lift to a collecting reservoir from which it was pumped to the mains and elevated tank. Some years later this equipment was discarded and a deep well pump and pneumatic tank were installed. This second system was operated until about 1905 when a contract was made with a local tile company to install a well and furnish the public supply.

The expenses and operation were considered too great by the village officials and another well was drilled in 1913. This well is the present source of the public water supply and is located about 60 ft. north of the center line of the Chicago, Burlington, and Quincy R. R. and 50 ft. west of Garfield St. (approximately 2000 ft. N. and 750 ft. W. of the S. E. corner of Section 15, T. 38 N., R. 5 E.). The elevation of the ground surface is 740± ft. The well was drilled by William Cater, Chicago, to a depth of 708 ft. and is reported to be cased with 12-in. pipe to rock at a depth of 120 ft.

Driller's log of well drilled in 1913 correlated by State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Glacial drift	120	120
Ordovician system		
Galena-Platteville dolomites	280	400
St. Peter sandstone	308	708

When the well was completed in 1913, the standing water level was 4 ft. below the ground and was drawn down 24 ft. after pumping 1 hr. at a rate of 250 gpm.

A concrete pit 16 ft. deep was constructed around the well and 2 centrifugal pumps, each of 200 gpm. capacity, were installed with the pump centers about 11 ft. below the ground surface.

On Mar. 7, 1922, the non-pumping water level after 3 hr. of idle period was 16 1/2 ft. below the ground surface and the pumping level when 1 pump was pperated was 25 ft. A slight odor of hydrogen sulfide was reported at this time. Both pumps, with a combined capacity of 400 gpm., could be operated simultaneously for a period of 40 min.

About 1935, a new American-Marsh centrifugal pump of 225 gpm. capacity and a 15-hp. Howell electric motor were installed. This unit is in daily operation.

During the summer of 1947, the vacuum gauge on the suction line showed a pumping water level of about 24 ft. in the pit, or 35 ft. below the ground. On Sept. 30, 1947, the gauge showed a pumping water level of 21 1/2 ft., or 33 1/2 ft. below ground level.

An old American Well Works centrifugal pump of 200 gpm. rated capacity and a 15-hp. Century electric motor are maintained for service as an emergency pumping unit.

Analysis of a sample (Lab. No. 112,097) collected Sept. 30, 1947 after 1/2-hr. pumping at 200 gpm. showed this water to have a hardness of 16.8 gr. per gal., a residue of 325 ppm., and an

LABORATORY NO. 112,097

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.0		Silica	SiO_2	25.3	
Manganese	Mn	0.0		Fluoride	F	0.3	
Calcium	Ca	55.8	2.79	Chloride	Cl	3.0	0.08
Magnesium	Mg	36.0	2.96	Nitrate	NO_3	3.3	0.05
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	6.0	0.12
Sodium	Na	13.3	0.58	Alkalinity (as $CaCO_3$)		304.	6.08
Turbidity		10		Hardness (as $CaCO_3$)		288.	5.75
Color		0		Residue		325.	
Odor		0		Free CO_2 (calc.)		16.	
Temperature 51.5° F.				pH = 7.7			

iron contemt of 1.0 ppm. The low temperature and appreciable iron content indicates the presence of a considerable proportion of water from a source other than the bottom of the well.

Pumpage is estimated to average 80,000 gpd. The largest consumer is the Pure Milk Association.

HINSDALE
Du Page County
June 28, 1947

A public water supply was installed by the village of Hinsdale (7336) in 1890.

The initial supply was obtained from a well drilled to a depth of 864 ft. by the J. P. Miller Artesian Well Co., Brookfield. The well was reported cased with 8-in. pipe to limestone at a depth of 42 ft. and to have penetrated limestone between depths of 42 and 353 ft., in shale between depths of 353 and 496 ft., and in limestone below a depth of 496 ft. This well was the source of the entire public water supply until 1900 when a second well was drilled. It was located in the basement of the generating station about 60 ft. west of Well No. 1.

The use of the well was discontinued in 1901 and has been abandoned and filled with concrete.

A well, now called Well No. 1, was drilled to a depth of 209 ft. 3 in. and located in the power house about 210 ft. west of Park Ave. and 95 ft. north of the Chicago, Burlington & Quincy Railroad right-of-way (approximately 50 ft. N. and 2150 ft. W. of the S. E. corner of Section 1, T. 38 N., R. 11 E.). The well was cased to rock with 12-in. pipe and was finished 8-in. diameter to the bottom.

The top of the well is in a pit, the floor of which is 18 1/2 ft. below the floor of the station which has an elevation of 685t ft. Water was originally pumped by suction lift ranging from 16 to 20 ft. below the floor of the pit. At the start of pumping a discharge of about 650 gpm. was obtained which dropped to about 600 gpm. after several hr. of pumping.

On Feb. 15, 1924 the water level was 16 1/2 ft. below the floor of the pit after a 3-hr. rest period, and after 4-hr. pumping at 540 to 500 gpm. the drawdown was 3 ft.

This well continued to supply all the water for the village until the latter part of 1924, when Well No. 2 was placed in service. Since then Well No. 1 has been used principally as an emergency supply unit.

The existing pump installation, made in Nov., 1932, is: 76 ft. 3 in. of 7-in. column pipe; 10-in., 5-stage Layne turbine pump, No. 6524, having a rated capacity of 700 gpm. against 118 ft. of head; the overall length of the pump is 4 ft. 7 in.; 10 ft. of 6-in. suction pipe; 90 ft. 10 in. of air line. Power is furnished by a Murray Iron Works steam turbine.

The well was used extensively from May 1, 1945 to Aug. 11, 1945. During this period a rate of production of 833 gpm. was obtained.

Well No. 2 was drilled in 1924 to a depth of 271 ft. below the ground surface by M. T. Peterson, Madison, Wis., and located about 35 ft. east of Park Ave. and 45 ft. north of the Chicago, Burlington & Quincy Railroad right-of-way (approximately 150 ft. N. and 1950 ft. W. of the S.E. corner of Section 1).

The top of the existing casing is in a pit and has an elevation of 674.8 ft.

The elevation of the upper concrete floor of the pump house is 686.1 ft.

The well was reported cased from the ground surface to a depth of 56 1/2 ft. with 20-in. genuine wi. casing, penetration 42 ft. of drift and 14 1/2 ft. of limestone. Below the casing the hole was 19-in. diameter in limestone to the bottom. A crevice was encountered at a depth of 116 ft.

In Aug. 1924 a 50-hr. pumping test was reported. Before the test the water level was 36 1/2 ft. below the ground surface and, during the test, while pumping at 1100 gpm. the drawdown was steady at 23 1/2 ft.

During 1925 the pumping rate was reported to be 1600 gpm. Wide fluctuations in discharge occurred about 1928 at which time the pump bowls were lowered 10 ft. without any apparent effect on the discharge. After Well No. 3 was placed in service in 1928, the Well No. 2 was used infrequently over a period of about 10 yr. because of its smaller output. On June 19, 1934, a test run was attempted. The pump would operate about 20 min. when it broke suction. The pump was pulled in July, 1934 and found in operating condition. A bailer was lowered into the well but very little mud was found. At that time, the standing water level was 50.8 ft. below the upper floor of the pump house or about 49 ft. below the ground surface. The flanges were all removed from the 12-in. column pipe and replaced with screwed couplings, nearly doubling the free annular space between the pump column and the well casing. After this work was completed the discharge rate averaged 1040 gpm. with greatly reduced fluctuations. In May, 1939, the well was again reported in regular service and operated 8 hr. daily at a rate of 1167 gpm. with a drawdown of 30 ft.

On May 25, 1942, the production was tested

by pumping to free discharge and produced an average of 1080 gpm. with a drawdown of 32 ft. However, the flow from the well was not steady and the pump pulsated considerably, discharging quantities of air with the water. The pump was pulled on May 27, 1942, and the well acidized with 3000 gal. of 15% hydrochloric acid. There was no pressure of any consequence built up in. the well. The acid was left in the well overnight, and the following morning about 100 cu. ft. of gray mud was reported removed by the bailer. After cleaning the well the water level was 48.1 ft. below the upper floor of the pump house on May 29, 1942. The same pump was re-installed, and the well was tested again by pumping to free discharge. A production of 1460 gpm. with a drawdown of 14 ft. was reported.

Following the acidizing job the pump was operated from 7 to 8 hr. daily at a production rate of 1100 gpm. for a period of 2 yr.

Weekly observations of water levels from June, 1943 to July, 1944 show a recession in the non-pumping level from 47 1/2 ft. to 50 1/2 ft. and in the pumping level from 63 ft. to 71 ft.

During the latter part of July, 1944, the non-pumping level dropped to 51 1/2 ft. and the pumping level to 92 1/2 ft. On May 1, 1945, the non-pumping water level was 56 ft. and when pumping at 900 gpm. the pumping water level was 106 ft.

The pump was pulled about May 1, 1945 and found in operating condition, but showed evidences of wear and corrosion. A bailer was lowered in the well and stopped at a depth of 264.6 ft. below the upper floor of the pump house. Gray mud was removed and the well was cleaned out to its original depth of 272 ft. 9 in. The distance to water was 53 ft. after the cleanout.

The existing pump installation, made on Aug. 10, 1945, is: 125 ft. 5 in. (40 ft. new) of 12-in. column pipe; a new 15-in., 4-stage Layne turbine pump, having a rated capacity of 1000 gpm. against 144 ft. of head; the overall length of the pump is 4 1/2 ft.; 35 ft. of 10-in. suction pipe; 160 ft. of 1/4-in. copper tubing air line; 60-hp. Westinghouse electric motor. While pumping with this unit on Aug. 11, 1945, for 5 hr. at 1006 gpm. the drawdown was 70 ft. from a non-pumping water level of 53 ft. below the upper floor of the pump house. On May 31, 1947, the water level was 58 ft. after a 15-hr. idle period. On June 2, 1947 the pumping water level was 134 ft.

Analysis of a sample (Lab. No. 110,514) collected June 2, 1947 after 3 1/2-hr. pumping at 970 gpm., showed this water to have a hardness of 29.4 gr. per gal., a residue of 631 ppm., and an iron content of 1.6 ppm.

Well No. 3 was drilled in 1928 to a depth of 210 ft. by the Gray Drilling Co., Milwaukee, Wis., and located about 35 ft. west of Elm St. and 40 ft. north of the Chicago, Burlington & Quincy Railroad right-of-way (approximately 250 *ii.* N. and 1400 ft. W. of the S. E. corner of Section 1),

The top of the existing casing is in a pit and has an elevation of 678.0 ft. The elevation of the upper concrete floor of the pump house is 686.7 ft. Upon completion of the well the production was 1120 gpm. with a drawdown of 5 ft. from a non-pumping water level of 45 ft. below the ground surface.

This well was the source of practically the entire public supply for a period of about 10 yr. after it was placed in service. At the end of this period fluctuations in its yield rate were reported similar to Well No. 2. The well was cleaned in 1938, and

LABORATORY NO. 110,514

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.6		Silica	SiO_2	24.4	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	136.9	6.85	Chloride	Cl	6.0	0.17
Magnesium	Mg	39.7	3.27	Nitrate	NO_3	3.3	0.05
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	181.2	3.77
Sodium	Na	20.7	0.90	Alkalinity	(as $CaCO_3$)	352.	7.04
Turbidity		10-		Hardness	(as $CaCO_3$)	506.	10.12
Color		0		Residue		631.	
Odor		0		Free CO_2 (calc.)		69.	
				pH = 7.1			

the pump bowls were lowered 10 ft.

By 1939 both Wells No. 2 and No. 3 were in use to supply the public demands.

This well was acidized, and it was reported on Mar. 30, 1943 that, after acidizing, the production increased from 1050 gpm. with a 52-ft. drawdown to 1400 gpm. with a 11-ft. drawdown. From June, 1943 to May, 1945 the non-pumping level dropped 6 ft. and the pumping water level dropped 10 ft. During this period the well was in daily service at a pumping rate of 1000 to 1100 gpm.

The existing pump installation, made in Apr. 1946, is: 160 ft. of 12-in. column pipe; 15-in., 4-stage Layne turbine pump having a rated capacity of 1000 gpm. against 144 ft. of head; the overall length of the pump is 4 1/2 ft.; 35 ft. of 10-in. suction pipe; 175 ft. of 1/2-in. copper tubing air line; 60-hp. Westinghouse electric motor.

On May 31, 1947 the water level was 61 ft. below the upper floor of the pump house after an idle period of 15 hr. and after 5-hr. pumping at 700 gpm., the water level was 141 ft.

Analysis of a sample (Lab. No. 110,515) collected June 2, 1947, after 5-hr. pumping at 700 gpm. showed this water to have a hardness of 30.6 gr. per gal., a residue of 678 ppm., and a trace of iron.

The water is softened by lime and soda ash. Analysis of a sample (Lab. No. 110,885) collected June 2, 1947 showed the treated water to have a hardness of 6.2 gr.per gal., a total mineral content of 293 ppm., and an iron content of 0.1 ppm.

From Aug. 1, 1943 to Aug. 1, 1945 the metered pumpage averaged 917,135 gpd. which varied from a winter minimum average of 735,365 to a summer maximum average of 1,113,400 gpd.

LABORATORY NO. 110,515

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	Tr.		Silica	SiO_2	25.6	
Manganese	Mn	0.0		Fluoride	F	0.2	
Calcium	Ca	141.4	7.07	Chloride	Cl	8.0	0.23
Magnesium	Mg	41.9	3.45	Nitrate	NO_3	13.5	0.22
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	194.0	4.04
Sodium	Na	25.1	1.09	Alkalinity	(as $CaCO_3$)	356.	7.12
Turbidity		0		Hardness	(as $CaCO_3$)	526.	10.52
Color		0		Residue		678.	
Odor		0					
Temperature		52.1° F.					

HOMER
Champaign County
Dec. 13, 1948

A public water supply was installed in 1939 by the village of Homer (983).

Water is obtained from a well drilled in 1939 to a depth of 72 ft. by Layne-Western Co., Chicago, and located at the southwest corporate limits about 50 ft. north of Crittenden St. (or approximately 2300 ft. N. and 1500 ft. W. of the S. E. corner of Section 8, T. 18 N., R. 14 W.). The ground elevation at the well-site is 670± ft.

The well is of the gravel-wall filter type, having an outer casing of 16-in. pipe extending from the ground surface to 40 ft. and an inner casing of 8-in. pipe extending from the surface to 49 ft. 7 in. below which was an 8-in. screen extending to 72 ft. The top 10 ft. and the bottom 5 ft. of-the screen has slot openings, and the intermediate 7 1/2 ft. is blank pipe. Gravel was packed in the annular space between the casings and outside the screen.

The pump assembly consists of 50 ft. of 4-in. column pipe; 8-in., 3-stage Layne turbine pump, No. 9700, having an overall length of 2 ft. 11 in.; 63 ft. of air line; 10 ft. of 4-in. suction pipe; 5-hp. U. S. electric motor. The pump base is approximately 3 ft. above the ground surface.

On July 7-8, 1939, a production test was made by the State Water Survey. Static water level was 11 ft. below ground level and after 22-hr. pumping at 80 gpm. the drawdown was 28 ft. On Dec. 19, 1939, after 2-hr. pumping with the permanent installation, the drawdown was 28 ft. from a non-pumping water level of 16 ft. below the pump base. On Dec. 9, 1948, after a 14-hr. non-pumping period, the water level was 33 1/2 ft. and, after 3-hr. pumping at an estimated rate of 50 gpm., the drawdown was 12 ft.

This well is the present source of the public supply.

Analysis of a sample (Lab. No. 116,703) collected Dec. 9, 1948 after 2-hr. pumping at 50 gpm., showed this water to have a hardness of 15.3 gr. per gal., a residue of 437 ppm., and an iron content of 1.5 ppm.

The water is aerated and filtered. Analysis of a sample (Lab. No. 116,711) showed the treated water to have a hardness of 15.6 gr. per gal., a mineral content of 399 ppm., and an iron content of 0.1 ppm.

A well was drilled for the village in Nov. 1947 to a depth of 68 ft. 4 in. by Hayes and Sims, Champaign, and located about 300 ft. south of the first well. The well was cased with 12-in. pipe with a screen set in a vein of water-bearing coarse sand having some gravel. It was reported that, when completed, the static water level was 20 ft. and when bailing at a rate of about 35 gpm., the drawdown was 10 ft.

The well is not equipped for pumping, but there is, at the site, a Burks ejector pump rated at 100 gpm. against 60 ft. of head and 3-hp., Wagner electric motor. It is planned to install about 60 ft. of 2-in. pressure pipe and 3-in. eductor pipe.

Pumpage for the village is estimated to average 30,000 gpd.

LABORATORY NO. 116,703

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.5		Silica	SiO_2	24.6	
Manganese	Mn	Tr.		Fluoride	F	0.5	
Calcium	Ca	64.3	3.22	Chloride	Cl	17.0	0.48
Magnesium	Mg	24.7	2.03	Nitrate	NO_3	9.1	0.15
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	19.5	0.41
Sodium	Na	65.1	2.83	Alkalinity	(as $CaCO_3$)	352.	7.04
Turbidity		97		Hardness	(as $CaCO_3$)	263.	5.25
Color		0		Residue		437.	
Odor		0		Free CO_2	(calc.)	57.	
Temperature 54° F.				pH = 7.2			

HOMEWOOD
Cook County
July 22, 1946

A public water supply was installed by the village of Homewood (4078) in 1911. Water was first obtained from a well located about 90 ft. north of Chestnut Road and 100 ft. west of the Dixie Highway (or approximately 2100 ft. N. and 2450 ft. E. of the S. W. corner of Section 31, T. 36 N., R. 14 E.).

Well No. 1, which was drilled in 1911 to a depth of 252 ft., was cased with 12-in. id. pipe to rock at a depth of 70 ft. below which the hole was finished 10 in. in diameter. The elevation of the ground surface is 652± ft.

The first authentic record of yield of the well was made in 1923 when, during a test run of 1 hr., a production of 170 gpm. was reported with a drawdown of 22 ft. from a non-pumping water level of 26 ft. below the pump base.

This well was acidized by Dowell, Inc. on Apr. 23, 1945 with 2000 gal. of 15% HCL, and the initial specific capacity was about 1.8 gpm. per ft. of drawdown while pumping at a rate of 245 gpm. with a drawdown of 134 ft. from a non-pumping water level of 34 ft. The well continued to improve after the acidizing treatment. On June 11, 1945 it was reported that the production was 345 gpm. with a drawdown of about 120 ft. or a specific capacity of about 2.9 gpm. per ft. of drawdown. On Nov. 18, 1945 the production rate was 356 gpm. for several hr. after the well had been at rest for a period of 6 hr.

The following pump installation is in service: 110 ft. of 6-in. column pipe; 8-in., 7-stage Pomona turbine pump rated at 300 gpm. against 110 ft. of head; the overall length of the pump is 8 ft.; 10 ft. of 6-in. suction pipe; 15-hp. electric motor.

Analysis of a sample (Lab. No. 107,163) collected July 19, 1946 after three days of continuous pumping at 285 gpm., showed this water to have a hardness of 33.2 gr. per gal., a residue of 755 ppm., and an iron content of 0.4 ppm.

Water levels have been reported as follows:

Date	Water level (ft. below pump base)
1914	16
1921	22
1923	26
1932	27
Apr. 23, 1945	34
May 6, 1945	20 1/2
Nov. 18, 1945	26

This well furnished the entire supply until 1924 when Well No. 2 was drilled. Well No. 1 is still the principal source of supply.

Well No. 2, located 40 ft. north and 75 ft. west of No. 1, was drilled in 1924 by Robert H. Kersey, South Bend, Indiana. Originally the well was 360 ft. deep and cased with 80 ft. of 15-in. id. pipe. Below the casing the hole diameter was 15 in. to a depth of 160 ft. and 10 in. from 160 to 360 ft.

The maximum capacity of the well was reported to be 200 gpm.

The public demand for water increased, and a guaranteed contract for a well to yield 500 gpm. was let to S. B. Geiger & Co., Chicago, who proposed to rehabilitate or deepen the well. Work was started in Jan. 1932 and completed in Aug. 1933. At that time the well was reported to be 1350 ft. deep and producing 508 gpm. with a drawdown of 45 ft. The non-pumping water level was 240 ft.

LABORATORY NO. 107,163

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.4		Silica	SiO_2	22.6	
Manganese	Mn	0.0		Fluoride	F	0.5	
Calcium	Ca	127.6	6.38	Chloride	Cl	12.0	0.34
Magnesium	Mg	61.1	5.02	Nitrate	NO_3	1.4	0.02
Ammonium	NH_4	0.7	0.04	Sulfate	SO_4	268.6	5.59
Sodium	Na	45.0	1.87	Alkalinity	(as $CaCO_3$)	368.	7.36
Turbidity		Tr.		Hardness	(as $CaCO_3$)	570.	11.40
Color		0		Residue		755.	
Odor		Tr.		Free CO_2	(calc.)	107.2	
Temperature 52° F.				pH = 6.95			

below the pump house floor elevation of 652.5 ft.

It was reported in 1945 that W. L. Thorne Co., Des Plaines, extended this well from its depth of 1350 ft. in an effort to improve the quality of the water. No record is available of what was actually done.

A geophysical log of the well was made in May 1945 by the Halliburton Oil Well Cementing Co. in cooperation with the State Water Survey and the State Geological Survey. On May 25, 1945 the measured depth of the well was 1690 ft.; the water level was 318 ft. below the top of the casing.

The report of the Survey described the conditions in the well as follows:

"a) A string of 9-in. casing extends from the ground surface to a depth of 696 ft. Corrosion has badly affected this casing opposite the Maquoketa shale, between the depths of 476 and 568 ft. and, to a lesser extent, between the depths of 568 and 696 ft. An 8-in. liner is in place between the depths of 914 and 1363 ft. The upper portion of this liner, between depths of 914 and 1094 ft. opposite the St. Peter sandstone is in poor condition. This liner is seated in the basal Trempealeau dolomite, probably on a packer. There is an enlargement of the hole immediately below the liner.

b) Below a depth of 1363 ft. the well bore is uncased. The lower 40 ft. of Trempealeau formation, the complete Franconia formation and all but a few feet of the Galesville formation are open to the well.

c) The Galesville sandstone had been shot with nitroglycerine which caused hole enlargements between depths of 1624 and 1634 ft. and between 1646 and 1664 ft. The most permeable section of the Galesville appears to be, for the most part, below the bottom "shot" hole or between depths of 1660 and 1690 ft."

As a result of the geophysical survey report, gun-perforated work was performed in the well to test the possibility of exposing suspected crevices in the Trempealeau dolomite that had been shut out of the well by the 8-in. liner. A number of bullets of 9/16-in. diameters were shot through the liner at the following depths in feet below the top of the casing: 1238 to 1242, 1275 to 1294, 1298 to 1312, 1315 to 1320, and 1335 to 1341. Lastly, a number of holes were put into the liner opposite the St. Peter sandstone between the depths of 1040 and 1050 ft. to allow any available water from that source to enter the well.

The short production test of several hr. was made on Nov. 18, 1945. A production of 246 gpm.

Sample-study and driller's log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Surface"	70	70
Silurian system		
Niagaran-Alexandrian series		
"Limestone"	360	430
Ordovician system		
Maquoketa formation		
"Shale and limestone"	165	595
Galena-Platteville dolomites	335	930
Glenwood sandstone	10	940
St. Peter formation		
Sandstone, incoherent	125	1065
Shale	5	1070
Oneota dolomite, some chert, thin sandstone beds at base	135	1205
Cambrian system		
Trempealeau dolomite	145	1350
Trempealeau, Franconia and Galesville formations		
No record	341	1691

was reported but no water levels were recorded.

The following pump installation is in service: 390 ft. of 7-in. column pipe; 15-stage Pomona turbine pump rated at 225 gpm. against 430 ft. of head; the overall length of the pump is 8 ft. 1 in.; 10 ft. of 7-in. suction pipe; 50-hp. Westinghouse electric motor.

A quality-source test (Analyses Nos. 106,176-106,183) of about 6-hr. duration was made on Apr. 12, 1946. The well produced at a rate of 285 gpm., and the mineral qualities of the water are given by analysis Laboratory Nos. 106,176 - 106,183.

These analyses show that the first water obtained while pumping was from the Galena-Platteville formation. The second sample collected after 4 min. of pumping contained a much higher hardness and sulfate concentration but still had a low chloride concentration indicating that this sample was originally primarily from the Niagaran limestone. Subsequent samples showed the presence of lesser Niagaran water and the return of water from the Galena-Platteville formation. This was followed at 8:24 A.M. by a decrease in the amount of water from the Galena formation and an increasing proportion of water from the Galesville sandstone.

The proportion of limestone water entering the well is, of course, very small and limited by the size of holes permitting this water to enter through the casing and "float" on the surface of the water above the bowls and above the Galena-Platteville water.

Water was pumped from Wells No. 1 and 2 alternately every day except during peak summer demand when they were operated together.

When Well No. 2 was down for repairs in May and June, 1943, some water was obtained from the Ravisloe Country Club well which is 1090 ft. deep and located 1500 ft. N. and 650 ft. E. of the S. W. corner of Section 31).

A third well was drilled by the Layne Western Co., Chicago, in Mar. and Apr. 1945 in the southwest part of the village near Harwood Ave. and 183rd St. (or approximately 550 ft. S. and 1050 ft. E. of the N. W. corner of Section 6, T. 35 N., R. 14 E.). The elevation of the ground surface at the well is 660± ft.

The well was drilled to a depth of 436 ft., and the thickness of the material penetrated was reported as follows: 66 ft. of clay at the top; 119 ft. of broken lime and shale; 245 ft. of limestone and ended in 6 ft. of shale at a depth of 436 ft.

It was cased from the surface to a depth of 66 ft. with 30-in. pipe and with 22-in. od. pipe from the surface to a depth of 186 ft. The annular space outside the 22-in. casing was cement grouted from the top to the bottom of the 22-in. pipe. The driller reported the hole below the 22-in. casing was 21 1/2 in. in diameter. This well failed to produce an adequate supply of water when tested on Apr. 20, 1945 and was not equipped for service.

Another well, known as the Dixmoor well, was put into service in 1929-1930. It was purchased by the village from the Dixmoor Country Club about Jan. 1946. It is located about 100 ft. S. and 1900 ft. E. of the N. W. corner of Section 31. The elevation of the concrete floor at the west side of the well is 638.1 ft. The well was drilled in 1922 to a depth of 210 ft. by W. L. Thorne Co. and cased to a depth of 64 ft. with 10-in. id. pipe.

This well, formerly used as a water supply for the Dixmoor Country Club, served as a source of part of the village water supply until the central water treatment plant was built in 1935.

Analyses Nos. 106,176 - 106,183

Time	Temp. °F.	Fe ppm.	Cl ppm.	SO_4 ppm.	Alk. ppm.	Hd. ppm.	Res. ppm.
7:45 AM.	pump started						
7:46	52.5	0.7	15	293.3	276	139	748
7:49	53.0	0.3	12	395.4	280	433	808
7:54	54.0	0.2	15	355.4	276	388	788
8:04	56.2	0.3	23	360.4	276	320	798
8:24	58.5	0.4	61	376.2	296	346	915
8:44	59.1	0.3	170	415.1	288	442	1145
8:14	60.0	0.3	290	469.0	468	537	1402
3:19 PM.	61.0	0.5	310	498.0	240	598	1477

A geophysical log of this well was made by the State Geological Survey on July 18, 1945. The major findings were reported as follows: (a) 10-in. id. casing to a depth of 64 ft.; (b) probable water-bearing zone between the depths of 92 and 104 ft.; (c) a crevice zone that would take water between depths of 195 and 201 ft.; and (d) maximum depth of well reached with logging equipment was 204 ft.

The well was cleaned out by Kramer Brothers, Harvey, to a depth of 213 ft. and 2 1/2 ft. of 10-in. pipe was welded to the top of the casing. A 24-hr. production test was made on Jan. 18 and 19, 1946. After 18 1/2 hr., the pumping rate was 240 gpm and continued at this rate to the end of the 24-hr. period. The drawdown was 73 ft. from a non-pumping water level of 17 ft. below the top of the extended casing (elevation of 639.2 ft.). The appearance of sand in the water pumped during the test and the characteristics of the drawdown-yield curve indicated that most of the water entered the well above 90 ft. and was coming from behind the casing and under the casing seat.

On Jan. 22 to 24, 1946, a plastic plugging job was performed in the well between the depths of 64 and 73 1/2 ft., below the top of the extended casing, in order to close off the infiltration of sand at the bottom of the casing and the small crevices in the top of the limestone. The plug was tested on Jan. 24, 1946 with 350 lb. of water pressure and held satisfactorily. No leaks were found in the 10-in. drive pipe. The core of the plastic plug was drilled out to a 10-in. diameter on Jan. 26, 1946, and after several days of observation, the cored area of plastic plug showed no signs of leakage. The well was drilled and cleaned out in the limestone to a total depth of 226 ft., the last 2 ft. of which was drilled with an 8-in. bit. The well was acidized on Jan. 28 and Feb. 26, 1946.

During an 8-hr. production test, made on Mar. 2, 1946, the production was 205 gpm. with a drawdown of 124 ft. from a non-pumping water level of 20 ft. below the top of the casing.

Seven samples collected April 27, 1947 during a 23-hr. pumping period showed the water to have a turbidity of 0-5 ppm., an iron content of 0.1-0.4 ppm.,a hardness of 31.2 to 35.8 gr.per gal. The first sample after 5-min. pumping was noted to have a turbidity of 31 ppm. and an iron content of 0.7 ppm.

A water level recorder was installed in the well on Mar. 14, 1946 by the State Water Survey. On that date the water level was 15 1/2 ft. below the top of the casing. Subsequent recorder readings indicate that water levels in the well are influenced by the pumping of the Calumet Country Club well located about 2100 ft. northwest and also by Homewood village Well No. 1.

A 6-in. test well was drilled for the village by Kramer Brothers at a location 200 ft. S. and 1000 ft. W.of the N. E. corner of Section 36, T. 36 N., R. 13 E. The well was completed on Mar. 7, 1946 to a depth of 455 ft. and is cased with 81 ft. of 6-in. id. pipe from 2 ft. above ground surface. The elevation of the top of the casing is 655.11 ft.

On Mar. 16, 1946, during an 8-hr. test by the driller, the production was 210 gpm. with a drawdown of 59 ft. from a non-pumping water level of 29 ft. below the top of the casing. A sample of water collected after 10-hr. pumping on Mar. 16, 1947 showed this water to have a hardness of 34.2 gr. per gal., a mineral content of 785 ppm., an iron content of 8.7 ppm. with a turbidity of 200 gpm. When pumping at 100 gpm. the water was clear with 1.6 ppm. iron content.

The driller reported that the first water was encountered at a depth of 88 ft. or near the lowest pumping level observed during the pumping test.

The treatment plant built in 1935 south of

LABORATORY NO. 107,221

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Chloride	Cl	54.0	
Calcium	Ca	11.0	0.55	Sulfate	SO_4	304.8	6.35
Magnesium	Mg	3.5	0.29	Alkalinity	(as $CaCO_3$)	352.	
Turbidity		0		Hardness	(as $CaCO_3$)	42.	0.84
Color		0		Total Mineral Content		884.	
Odor		0		Free CO_2 (calc.)		50.	
Temperature 54.8° F.				pH = 7.25			

Well No. 2 is still in service. It consists of a coke-tray aerator, 3 pressure filters, and 2 softeners and was converted to automatic operation on July 14, 1946.

A sample of treated water collected July 19, 1946 showed the hardness to be reduced to 2.5 gr. per gal.

The combined metered pumpage of Wells No. 1 and 2 from Jan. 1, 193 7 to Jan. 1, 1943 averaged 304,540 gpd. There was an increase from an average of 260,000 gpd. in 1937 and 1938 to 341,400 gpd. in 1941 and 1942.

A public water supply was installed in 1888 by the city of Hoopeston (5381).

A prospect well, which had been drilled in 1886 to a depth of 2100 ft., was plugged at a depth of 360 ft. and used to furnish water, when the water works was installed. The well was cased with 8-in. pipe and located at the pumping station at the southeast corner of Main and Fourth Ave., (or approximately 2350 ft. S. and 1535 ft. W. of the N. E. corner of Section 11, T. 23 N., R. 12 W.).

In Sept. 1919, the yield was 100 gpm. but at that rate of pumping for 10 minutes, water would be drawn down to the bottom of the suction pipe, at a depth of about 65 ft. The well was maintained in service until about 1927, when it was capped, and is now covered by the concrete floor of the pumping station.

Analysis of a sample (Lab. No. 23,286) showed this water to have a hardness of 14.7gr.per gal., a mineral content of 327 ppm., and an iron content of 1.6 ppm.

At the time of installing the water works a second well was drilled at the plant to a depth of 360 ft. and cased with 8-in. pipe. The casing became badly corroded and was replaced by 6-in. casing. The well was abandoned about 1933 and is now covered by the pumping station floor.

Well No. 1 was drilled in 1906 to a depth of 110 ft. by O. A. Musson, Hoopeston. The well was located in the boiler room of the plant, about 10 ft. south and 10 ft. west of the 8-in. well, and was cased with 10-in. pipe to a depth of 96 ft. and with 14 ft. of 10-in. Cook screen. The ground elevation at the plant is 710± ft.

In June 1932, the well was reported to be equipped with 80 ft. of 8-in. drop pipe and a plunger pump with 36-in. stroke and operated 16-18 spm. At that time when pumping at an estimated rate of 300 gpm., the drawdown was very little from a non-pumping water level of 32 to 35 ft.

Well No. 1 was sealed and abandoned in 1938. A cross in the concrete floor of the pumping station marks the spot.

Well No. 2 was drilled in 1914 to a depth of 110 ft. by O. A. Musson and located 15 ft. north and 15 ft. west of Well No. 1. The well was cased with 96 ft. of 10-in. pipe and 14 ft. of 10-in. Cook screen.

Well No. 2 is equipped with an Erb steam pump-head with a 5 3/4-in. Erb double-acting cylinder, having a 36-in. stroke and set at 91 ft. The well is maintained as an emergency supply unit. The pump is operated about once a month at a speed of about 12 upstrokes per minute.

Well No. 3 was drilled in 1914 to a depth of 110 ft. by O. A. Musson, and located 25 ft. south and 50 ft. west of Well No. 1. The well was cased with 96 ft. of 10-in. pipe and 14 ft. of Cook screen.

The pumping equipment includes 50 ft. of 8-in. column pipe; 10-in., 2-stage Pomona turbine pump, No. H 85, which discharges at an estimated rate of 650 gpm.; 10 ft. of 7-in. suction pipe; 15-hp. Westinghouse electric motor.

The pump shaft was repaired in 1942.

Well No. 3 is maintained as an auxiliary supply and is used principally during peak summer demands.

Table 1 shows the readings observed on Dec. 4, 1948 on the altitude gauge. Length of air line was not known.

TABLE 1

Depth of water in air line ft.	Conditions
18.0	No pumping in Well No. 3 and after 3-hr. pumping at 750 gpm. in Well No. 4.
21.0	No pumping in Well No. 3 and after 70-min. non-pumping in Well No. 4.
17.0	After 7-min. pumping in Well No. 3 at 650 gpm. No pumping in Well No. 4.

Well No. 4 was drilled in 1927 to a depth of 110 ft. by A. L. Winks, Lafayette, Ind., and located 75 ft. south and 50 ft. west of Well No. 1. The well was cased to a depth of 96 ft. with 12-in. pipe and with 14 ft. of screen.

The pumping equipment, installed about 1935, consists of 60 ft. of 8-in. column pipe; 10-in., 3-stage Pomona turbine pump, No'. K275, estimated to discharge 750 gpm. to the aerator; 10 ft. of 8-in. suction pipe; 20-hp. Westinghouse electric motor. The driller reported the air line length to be 67 ft.

On Dec. 4, 1948, with no pumping in Well No. 3 and, after three-hours pumping at 750 gpm. in

Well No. 4, the water level in Well No. 4 was 63 1/4 ft. below the top of the pump base. After a 70-minute shut down of both pumps the water level in Well No. 4 was 36 ft.

Analysis of a sample (Lab. No. 116,551) collected Nov. 26, 1948 after 4-hr. pumping showed the water from Well No. 4 to have a hardness of 18.1 gr. per gal., a residue of 361 ppm., and an iron content of 2.1 ppm.

All water is aerated.

Pumpage is estimated to average 637,420 gpd.

Water for the swimming pool, drinking, sanitation and concessions in McFerren Park, owned by the city, is largely furnished by a well drilled to a depth of 176 1/2 ft. by O. A. Musson. The well is located east of the State Highway No. 1, about the extension of Lincoln St. (or approximately 1700 ft. N. and 700 ft. E. of the S. W. corner of Section 11). The well is cased with 8-in. pipe with 8 ft. of screen in the gravel formation at the bottom. The screen has No. 60 slot openings.

The pumping equipment includes a Deming plunger pump, discharging at an estimated rate of 150 gpm. and a 7 1/2-hp. General Electric motor.

The supply from the well is inadequate to meet all of the demands of the park facilities and additional water is furnished from the other municipal wells.

LABORATORY NO. 116,551

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.1		Silica	SiO_2	19.0	
Manganese	Mn	0.0		Fluoride	F	0.3	
Calcium	Ca	66.5	3.33	Chloride	Cl	2.0	0.06
Magnesium	Mg	34.9	2.87	Nitrate	NO_3	0.5	0.01
Ammonium	NH_4	1.8	0.10	Sulfate	SO_4	6.2	0.13
Sodium	Na	23.5	1.02	Alkalinity (as $CaCO_3$)		356.	7.12
Turbidity		9		Hardness (as $CaCO_3$)		310.	6.20
Color		0		Residue		361.	
Odor		0		Free CO_2 (calc.)		29.	
Temperature 54.5° F.				pH = 7.5			

HOPEDALE
Tazewell County
Feb. 7, 1947

A public water supply was installed by the village of Hopedale (545) about 1892.

Water was obtained from a well 4 in. in diameter and 180 ft. in depth and located less than a block distant from the center of the business district. The well became clogged with sand and was abandoned.

In 1900, Well No. 2, or North Well, was drilled near the old well (or approximately 1340 ft. S. and 1170 ft. E. of the N. W. corner of Section 26, T. 23 N., R. 3 W.). The well was drilled to a depth of 180 ft. and is 6 in. in diameter.

At present this well is used for emergency only. It is equipped with a Gould piston pump, belt-driven by a 10-hp. Wagner electric motor.

In 1922 Mr. Cochran, a local driller, furnished some general information in regard to various strata penetrated by the village wells. A buried drift of rotten wood and leaves and 8 to 12 ft. in thickness was encountered at 50 ft., with blue clay below the buried drift to a depth of 80 ft. A stratum of cemented sand and gravel containing gas was encountered at 80 ft., and below the gas vein, a stratum of blue clay, about 50 ft. in thickness, was encountered. Sand was penetrated at the bottom of the well.

In 1921 Mr. Cochran drilled Well No. 3, or South Well, about 15 ft. south of Well No. 2. Well No. 3 is 180 ft. deep and is cased with 160 ft. of 8-in. pipe, and a Cook screen 16 ft. in length, is placed below the casing. The slot openings in the screen were in 3 sets of sizes and reported to be No. 20, 14, and 12 slot. The lower 15 or 16 ft. of the well was reported by the driller to be in gravel, overlain with 45 ft. of sand.

In 1922 the non-pumping water level was estimated to be at a depth of 120 ft. below the ground surface elevation of 635± ft. Power was furnished by a 20-hp. Westinghouse electric motor.

The pump assembly, installed in 1943 by Mike Ebert, Washington, consists of: 165 ft. of 4 1/2-in. od. column pipe; 13-stage American Well Works turbine pump rated at 125 gpm. against a head of 245 ft. at 1745 rpm.; the overall length of the pump is 6 ft. 8 in.; there is a strainer below the bowl but no suction pipe; 165 ft. of airline; 15-hp. U. S. electric motor.

The non-pumping water level is about 112 ft. below the base of the pump; and when pumping, the drawdown is 22 to 25 ft.

Analysis of a sample (Lab. No. 109,153), collected Feb. 7, 1947 after 2-hr. pumping, showed the water from Well No. 3 to have a hardness of 18.0 gr. per gal., a residue of 371 ppm., and an iron content of 3.1 ppm.

The pump is operated 4 to 5 hr. per day. Consumption is about 35,000 gpd.

LABORATORY NO. 109,153

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	3.1		Silica	SiO_2	23.0	
Manganese	Mn	0.8		Fluoride	F	0.2	
Calcium	Ca	72.3	3.62	Chloride	Cl	3.0	0.08
Magnesium	Mg	30.8	2.53	Nitrate	NO_3	1.3	0.02
Ammonium	NH_4	1.9	0.11	Sulfate	SO_4	0.8	0.02
Sodium	Na	20.7	0.90	Alkalinity	(as $CaCO_3$)	352.	7.04
Color		0		Hardness	(as $CaCO_3$)	308.	6.16
Odor		0		Residue		371.	
Turbidity		0					
Temperature		54.5° F.					

The village of Hull (572) installed a public water supply in 1903.

Water was obtained originally from a shallow well, but no information is available on this source of supply.

The present source of supply is from a well drilled in 1936 by E. W. Franke, Batchtown, and located near the southwest corner of the intersection of Walnut and Railroad St. (or approximately 2300 ft. N. and 1450 ft. W. of the S. E. corner of Section 21, T. 4 S., R. 7 W.). This well was drilled to a depth of 51 ft. 3 in. below a ground surface elevation of 473± ft.

Correlated driller's log of well drilled in 1936 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Gumbo and clay	20	20
Sand	30	50

The well is cased to a depth of 41 ft. with 8-in. pipe and with 10 ft. of 8-in. Cook wire-wound screen, having No. 20 slot openings. The top of the casing is 3 ft. above the ground surface.

The pumping equipment consists of: 40 ft. of 4 1/2-in. od. column pipe; 6-in., 6-stage, A. D. Cook turbine pump, No. 1977, having 33 1/2-in. overall length, and rated at 100 gpm. against 60 ft. of head, operating at 1800 rpm.; 7 ft. of 4-in. od. suction pipe; 3-hp. U. S. electric motor, No. 114389, operating at 1800 rpm.

A production test was made by the State Water Survey on Mar. 24, 1936. The well produced 150 gpm. for 8 hr. with a drawdown of 5 ft. 9 in. from a non-pumping water level of 12.9 ft. belowthe top of the casing. Another production test was made by the State Water Survey, June 17-18, 1936. The well produced 142 gpm. for 24 hr. with a drawdown of 5.9 ft. from a non-pumping water level of 15.9 ft. below the top of the casing.

In 1945, it was reported that the well was producing about 20 gpm.

Analysis of a sample (Lab. No. 114,127) collected Apr. 7, 1948after 15-min. pumping showed the water to have a hardness of 14.4 gr.per gal., a residue of 358 ppm., and an iron content of 5.5 ppm.

The water is aerated and filtered for iron removal. Analysis of a sample collected Apr. 7, 1948 showedthe treated water to have a hardness of 14.6 gr. per gal., a residue of 359 ppm., and 0.03 ppm. iron.

Pumpage is estimated to average 9,000 gpd.

LABORATORY NO. 114,127

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	5.5		Silica	SiO_2	41.2	
Manganese	Mn	2.7		Fluoride	F	0.8	
Calcium	Ca	69.7	3.49	Chloride	Cl	24.0	0.68
Magnesium	Mg	17.6	1.45	Nitrate	NO_3	0.2	Tr.
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	82.5	1.72
Sodium	Na	20.5	0.89	Alkalinity	(as $CaCO_3$)	172.	3.44
Turbidity		50+		Hardness	(as $CaCO_3$)	247.	4.94
Color		0		Residue		358.	
Odor		0					
Temperature 56° F.							

HUNTLEY
McHenry County
July 30, 1947

A public water supply was installed by the village of Huntley (674) in 1905.

Water has been obtained from 3 sand and gravel wells located about 300 ft. southeast of Main St. and 180 to ZOO ft. west of Railroad St. (approximately 300 ft. S. and 1800 ft. E. of the N. W. corner of Section 33, T. 43 N. R. 7 E.). The elevation of the ground surface is 889t ft.

Two of the wells, spaced 6 ft. apart, are 6-in. in diameter and 74 ft. deep. The other well located 25 ft. east is 10-in. in diameter and 69 ft. deep. Water from all 3 wells was originally pumped by suction. The combined production on Nov. 13, 1924 was 120 gpm.

The screens were reported cleaned and put back in 1934.

On July 17, 1947 the old Goulds 7 x 8-in. single-acting triplex pump powered by a 10-hp. Century electric motor was still connected to the north 74-ft. well. The south 74-ft. well was capped. The pump was operated only twice a week and was estimated to discharge 60 gpm. At that time the pump installation in the 69-ft. well consisted of 50 ft. of 4-in. column pipe; 6-in., 11-stage Aurora Pump Co. turbine pump No. 11687 having a rated capacity of 100 gpm. against 140 ft. of head; overall length of 5 ft. 4 in.; 10 ft. of 4-in, suction pipe; 50 ft. of 1/4-in. gi. air line; 5-hp. U. S. electric motor.

In May 1947 the pump was pulled, overhauled, and re-installed. The sand screen had become clogged with sand, and the well was cleaned out and drilled about 5 ft. deeper to provide space for accumulation of sand. This work was done by Wm. R. Boetsch and Son.

On July 17, 1947 after 6-hr. pumping at 100 gpm. the drawdown was 3 ft. from a non-pumping water level of 23 ft. below the pump base (1.7 ft. above ground level).

Analysis of a sample (Lab. No. 111,119) collected July 17, 1947 from the 69-ft. well after 6-hr. pumping at a rate of about 100 gpm. showed this water to have a hardness of 23.0 gr. per gal., a residue of 447 ppm., and an iron content of 1.3 ppm.

The largest consumers are the Wm. M. Fencil Co. and the M. C. Catty Corp. The average pumpage is estimated as 48,000 gpd.

LABORATORY NO. 111,119

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.3		Silica	SiO_2	24.2	
Manganese	Mn	Tr.		Fluoride	F	0.1	
Calcium	Ca	86.8	4.34	Chloride	Cl	12.0	0.34
Magnesium	Mg	43.2	3.56	Nitrate	NO_3	1.9	0.03
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	67.5	1.40
Sodium	Na	6.0	0.26	Alkalinity	(as $CaCO_3$)	320.	6.40
Turbidity		Tr.		Hardness	(as $CaCO_3$)	395.	7.90
Color		0		Residue		447.	
Odor (at well)		H_2S		Free CO_2 (calc.)		34.	
				pH = 7.4			

HUTSONVILLE
Crawford County
May 12, 1948

The village of Hutsonville (714) installed a public water supply in 1936.

The North Well was drilled to a depth of 35 ft. in 1936 by C. A. Chambers, Hutsonville, and is located about 15ft. south of Dower St., and 30 ft. west of the Wabash River (or approximately 600 ft. S. and 3280 ft. E. of the N. W. corner of Section 29, T. 8 N., R. 11 W.). The ground surface elevation at the well site is 435± ft.

It was reported by the driller that below 5 ft., the formation varied from gravel to coarse sand, then to fine sand. A 10-in. casing extends from 2 ft. above to 21 ft. 10 1/4 in. below the ground surface. A Cook screen, having No. 125 slot openings, was installed between the depths of 22 ft. 5 3/8 in. and 29 ft. 5 3/8 in., and a short length of casing was placed below the screen to a depth of 32 ft. 7 1/2 in.

A production test was made by the State Water Survey on Mar. 31, 1936. When pumping at 153-158 gpm. the drawdown was 9.8 ft. from a non-pumping water level of 11.5 ft. below the top of the casing.

The pumping equipment consists of: 30 ft. of 5-in. column pipe; 7-in. 8-stage Fairbanks-Morse turbine pump, No. 30043; 1 1/2 ft. of 4-in. suction pipe; 15-hp. Fairbanks-Morse electric motor operating at 1740 rpm.

The screen is reported to have been pulled and cleaned in 1940. After the screen was pulled, part of the formation caved in. The original 11-stage pump and assembly could not be re-installed. It was necessary to reduce the pump to 8 stages.

Analysis of a sample (Lab. No. 82498) collected Dec. 1, 1937, showed the water to have a hardness of 20.8 gr. per gal., a residue of 459 ppm., and an iron content of 0.2 ppm.

Considerable pump difficulty has been caused by sand and gravel entering the pump and damaging the impeller blades. The North Well has been maintained as a stand-by unit since Apr. 1946.

The capacity has been reduced 50%.

The South Well was drilled in Apr. 1946 to a depth of 36 1/2 ft. by Harry Knox, Graysville, Ind., and is located 25 ft. south of the North Well. The well was cased with 10-in. pipe, the bottom section being perforated.

The existing pump assembly is said to be identical with the one originally installed in the North Well, and includes Fairbanks-Morse turbine pump No. SW 38325 and a 15-hp. Fairbanks-Morse electric motor.

Non-pumping water levels vary with the Wabash River stages. On Apr. 28, 1948 the water level was 20 ft. below the pump base.

Analysis of a sample (Lab. No. 114,507) collected Apr. 28, 1948 after 10-minutes pumping at 150 gpm. showed this water to have a hardness of 19.4 gr. per gal., a residue of 394 ppm. and an iron content of 0.1 ppm.

All water is chlorinated.

The South Well is the source of the entire public supply.

Pumpage is estimated to average 30,000 gpd.

LABORATORY NO 114,507

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	18.5	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	100.6	5.03	Chloride	Cl	10.0	0.28
Magnesium	Mg	19.4	1.60	Nitrate	NO_3	33.6	0.54
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	62.7	1.30
Sodium	Na	10.4	0.45	Alkalinity	(as $CaCO_3$)	248.	4.96
Turbidity		0		Hardness	(as $CaCO_3$)	332.	6.63
Color		0		Residue		394.	
Odor		0		Free CO_2	(calc.)	21.	
Temperature		51.5° F.		pH = 7.5			

ILLINOIS SOLDIERS AND SAILORS CHILDRENS HOME
McLean County
Oct. 27, 1948

The Illinois Soldiers' and Sailors' Childrens' Home obtains water from 2 wells.

The East Well was drilled by Ed. Johnson, Bloomington, about 1920, and is located approximately 1360 ft. N. and 2965 ft. W. of the S. E. corner of Section 22, T. 24 N., R. 2 E. The well was reported to be about 114 ft. deep below a surface elevation of 830± ft., and to be cased with 8-in. pipe with a 10-ft. section of screen attached.

This well was originally equipped with a Keystone Driller double-acting deep-well pump. About 1940, the following equipment was installed: 90 ft. of 4 1/2-in. column pipe; 7-in., 8-stage American Well Works water-lubricated, turbine pump, No. 62886, rated at 175 gpm. against 150 ft. of head and having an overall length of 62 1/2 in.; 5 ft. of 5-in. suction pipe; 90 ft. of air line; 10-hp. General Electric motor, operating at 1750 rpm.

This well was given an acid treatment by Dowell, Inc. on Jan. 25, 1945. Prior to the treatment the well produced 77 gpm. with a drawdown of 35.5 ft. from a non-pumping water level of 43.5 ft. Immediately after the treatment, production was 174 gpm. with a drawdown of 42.5 ft. below a non-pumping water level of 43.5 ft.

The production of the well was reported to have dropped to 150 gpm. in Apr. 1945, and to 61.5 gpm. on May 29, 1946. The non-pumping water level on May 29, 1946 was 39.4 ft. below the pump base.

The pump has been removed and the well abandoned.

Analysis of a sample (Lab. No. 102,960) collected Apr. 4, 1945, showed the water to have a hardness of 16.3 gr. per gal., a residue of 345 ppm., and an iron content of 1.7 ppm. Methane gas was found to be present in a concentration of 5.4 cu. ft. per 1000 gal.

West Well, now called Well No. 2, located about 20 ft. west of the East Well, is equipped with a Keystone Driller double-acting deep-well pump, No. 32, and a 15-hp. General Electric motor.

During June and July 1947 the yield was 40 gpm. Because of the small yield, it is planned to abandon the well and fill it with clay.

Well No. 3 was completed Aug. 15, 1947 to a depth of 106 ft. by Layne-Western Co., Chicago, and located 5 ft. from Test Well No. 2 or 25 ft.

Sample-study log of Test Hole No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Wisconsin drift		
Soil, leached, yellow, oxidized	5	5
Till, very silty, leached, yellow, oxidized	5	10
Till, grayish-yellow, partly oxidized, calcareous	5	15
Till, gray, calcareous	40	55
Sangamon soil		
Soil, leached, dark brown	1	56
Illinoian drift		
Till, buffish-gray, calcareous	34	90
Sand and granule gravel, very silty and clayey	5	95
Sand and granule gravel, slightly silty, gray	10	105
Till, very sandy and gravelly, grayish-yellow, oxidized, calcareous	10	115 T.D.

south and 75 ft. east of Well No. 1.

Well No. 3 is cased with 8-in. pipe from the ground surface to 95 ft. with 11 ft. of 6-in. Layne screen, exposed, with the bottom set at 106 ft. The screen extends upward into the 8-in. casing a length of 9 ft. and is wrapped with Keystone bronze wire over a standard 6-in. pipe.

The pump installation includes 90 ft. of 4 1/2-in. column pipe; 7-in. od., 8-stage American Well Work s turbine pump having bronze bowls and rated at 175 gpm. against 140 ft. of head; 81 ft. 10 in. of air line; 10-hp. U. S. electric motor. The pump base is 3 ft. above ground level.

On Aug. 15, 1947, when pumping for 2 hr. at a rate of 165 gpm., the drawdown was 26 ft. from a non-pumping water level of 44 ft. below the pump base. On Oct. 11, 1948, the water level was 39 1/2 ft. below the pump base after a 2 1/2-hr. non-pumping period and after 1 3/4-hr. pumping at an average rate of 160 gpm. the water level was 76 ft.

Well No. 3 is the source of the entire public supply.

Analysis of a sample (Lab. No. 116,116) collected Oct. 11, 1948 after 1 3/4-hr. pumping at 160 gpm. showed the water to have a hardness of 16.9 gr. per gal., a residue of 335 ppm., and an iron content of 0.9 ppm.

Well NO. 4 was drilled in Sept. 1948 to a depth of 106 ft. by Hayes and Sims, Champaign, and located 131 ft. north of Well No. 3. The well is cased with 8-in. pipe from a 3 ft. above to 94 ft. below ground level, and 12 ft. of exposed 8-in. Johnson screen having No. 40 slot openings.

On Sept. 27, 1948 a production test was made by the State Water Survey. For test purposes, a Pomona turbine pump was used at a setting of 80 ft. Water had been pumped from the well for 2 days prior to the test. After 3 1/2-hr. pumping at 180 gpm. (pump in Well No. 3 idle) the drawdown in Well No. 4 was 13 ft. from a non-pumping water level of 46 ft. The pump in Well No. 3 was started and after 2-hr. pumping in Well No. 4 at a final rate of 248 gpm., when the pump in Well No. 3 broke suction, the drawdown in Well No. 4 was 23 ft. After an additional 1-hr. pumping in Well No. 4 (pump in Well No. 3 idle) at 342 gpm. the drawdown in Well No. 4 was 32 ft. One hr. after stopping the pump, the water level in Well No. 4 was 48 ft.

Permanent pumping equipment was not in place.

Analysis of a sample (Lab. No. 115,996) collected Sept. 27, 1948, after 6-hr. pumping at 342 gpm. showed the water to have a hardness of 17.1 gr. per gal., a mineral content of 354 ppm., and an iron content of 1.2 ppm.

From Oct. 1, 1947 to Oct. 1, 1948 total metered pumpage averaged 86,280 gpd.

LABORATORY NO. 116,116

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.9		Silica	SiO_2	22.8	
Manganese	Mn	Tr.		Fluoride	F	0.4	
Calcium	Ca	64.2	3.21	Chloride	Cl	1.0	0.03
Magnesium	Mg	31.5	2.59	Nitrate	NO_3	0.5	0.01
Ammonium	NH_4	1.8	0.10	Sulfate	SO_4	7.2	0.15
Sodium	Na	25.1	1.09	Alkalinity (as $CaCO_3$)		340.	6.80
Turbidity		20		Hardness (as $CaCO_3$)		290.	5.80
Color		0		Residue		335.	
Odor		0		Free CO_2 (calc.)		28.	
Temperature 53° F.				pH = 7.5			

ILLINOIS STATE
PENITENTIARY
JOLIET BRANCH
Will County
April 20, 1949

The water supply from Wells No. 1 and 2 for the Illinois State Penitentiary - Joliet Branch or Old Prison - is described on pages 55 and 56 of Bulletin No. 34, published in 1941.

In Apr. 1945, the pump in Well No. 1 was removed for the third time since 1937,because of a badly corroded condition. The bowls were not cleaned, however, because of being so weakened by rust that it was feared they would be broken. The pump was re-set at 40 ft. lower or 420 ft. below the surface. On May 16, 1945, the pump discharge was estimated to be 275 gpm. On July 13, 1948 the pump was removed, because of a broken shaft and badly broken bowls. The pump was reassembled with substitute bowls and other used parts, and re-set at 450 ft. On Aug. 6, 1948, when running a production test in Well No. 3 (new) the pump in Well No. 1 broke suction. The water level in Well No. 1 was 538 ft. Four hours after stopping the test, the water returned into Well No. 1 and the pump resumed production at its normal rate.

Sometime prior to Oct. 1944 a turbine pump had been installed in Well No. 2 and set at 400 ft. The air line was 408 ft. in length. The non-pumping water level was 342 ft. and, when pumping at a rate of 270 gpm., the drawdown was 11 ft. On Aug. 20, 1948, after repairs, the pump was re-set at an additional depth of 40 ft. The pumping assembly now consists of 440 ft. of column pipe, (210 ft. of 6-in. threaded pipe and 230 ft. of 8-in. flanged pipe); 18-stage Cook pump, Serial No. 186 and overall length of 10 1/2" ft.; 440 ft. of air line; 20 ft. of 5-in. suction pipe; 60-hp., 1800 rpm. U. S. electric motor.

On Aug. 20, 1948 the non-pumping water level was 417 ft. and after 15-min. pumping at 212 gpm. the drawdown was 5 ft.

On Apr. 19, 1949 a new pump was being installed and the assembly now includes 520 ft. of 6-in. column pipe; 17-stage Peerless turbine pump with bronze bowls; 520 ft. of 1/4-in. copper air line; 20 ft. of suction pipe with strainer; 125-hp. electric motor. On the same date the depth to water was 405 ft., with the pump in Well No. 1 in operation.

Well No. 3 was completed in July 1948 to a depth of 1600 ft. by J. P. Miller Artesian Well Co., Brookfield and located inside the northeast corner of the main wall of the Diagnostic Depot (or approximately 2400 ft. S. and 2300 ft. W.of the N. E. corner of Section 3, T. 35 N., R. 10 E.). The ground surface elevation at the well site is 555± ft. The hole and casing diameter record is shown in Table 1.

TABLE 1

Hole Record

24-in. from 0 to 453 ft.
15-in. from 453 to 953 ft.
12-in. from 953 to 1600 ft.

Casing Record

23-in. od. from +0.5 to 60.5 ft.
16-in. od. from +2.5 to 449 ft.
12-in. od. liner from 848 to 953 ft.

The 16-in. casing was cemented in.

A production test was made on Aug. 3-4, 1948 under the supervision of the State Water Survey. For test purposes a 7-stage, engine-driven turbune pump was attached to 5.50 ft. of 8-in. column pipe and with 21.7 ft. of 6-in. suction pipe. Before the test the water level was 420 ft. below the top of the 16-in. casing and after 24-hr. pumping at variable rates of 500 to 642 gpm. the drawdown varied from 75 1/2 to 114 1/2 ft. Water levels did not become stabilized at any time during the test. Pumping was stopped when the pump in Well No. 1 broke suction. One hr. after stopping the test the water level in Well No. 2 was 482 ft.

The well was "shot" on Sept. 8 and 15, and on Oct. 26, 1948 with 3 charges of nitrogen gel of 300, 350 and 200 lb. at depths of 1517, 1508 and 1471 ft. respectively. The loose sand was removed and the hole cleaned out to 1600 ft.

A production test was made on Dec. 7, 1948 under the supervision of the State Water Survey, using the same temporary pumping equipment as in the test in Aug. Before the test was started the water level was 424 ft. and after 15-hr. pumping at a rate of 645-654 gpm. during the final 8 hr.,the drawdown was 55 ft. Forty minutes after shutdown the water level was 443 ft.

In Apr. 1949, a new pump had not been installed in Well No. 3.

Analysis of a sample (Lab. No. 115,477) collected Aug. 4, 1948 after 24-hr. pumping at 642 ppm. showed this water to have a hardness of

14.0 gr. per gal., a residue of 520 ppm., and an iron content of 1.8 ppm.

Metered pumpage in 1947 for the Joliet Branch, averaged 349,000 gpd.

LABORATORY NO. 115,477

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.8		Silica	SiO_2	11.7	
Manganese	Mn	0.1		Fluoride	F	1.4	
Calcium	Ca	61.3	3.07	Chloride	Cl	52.0	1.47
Magnesium	Mg	20.7	1.71	Nitrate	NO_3	0.2	Tr.
Ammonium	NH_4	0.9	0.05	Sulfate	SO_4	100.4	2.09
Sodium	Na	97.8	4.25	Alkalinity	(as $CaCO_3$)	276.	5.52
Turbidity		5		Hardness	(as $CaCO_3$)	239.	4.78
Color		0		Residue		520.	
Odor		Ch		Free CO_2	(calc.)	43.	
Temperature		59.6° F.		pH = 7.2			

ILLINOIS STATE
PENITENTIARY
STATEVILLE BRANCH
Will County
March 11, 1949

The water supply from Wells No. 1-4, inclusive for the Illinois State Penitentiary - Stateville Branch, is described on pages 57-63 of Bulletin No. 34, published in 1941.

Well No. 1, (Center well) was in regular service in Mar. 1949. The pump was removed in the spring of 1946 and was replaced at the same depth of setting. The non-pumping water level in Jan. 1947 was 404.0 ft. and in May 1948 was 451.0 ft. The air line has been in bad order.

Well No. 2 (South Well) was "shot" with 200 lb. of nitrogen gel between depths of 1528 and 1548 ft. in May 1947. The water level lowered considerably for 2 or 3 days after the shooting, thenrose to 164 ft. below the surface. On May 15, 1947 the water level was 80 ft. The well was "shot" again in June 1947 with 250 lb. of gel. between depths of 1506 and 1526 ft. An estimated amount of 18-20 truck loads of sand was removed. A new 10-in. casing was installed from the ground level to 415 ft. 11 in. and was cemented-in from top to bottom. The 70 ft. of 16-in. casing and the 8-in. liner were not moved during the shooting, and are now in the well. Three weeks after the second "shot" the water level was 433 to 436 ft. The well was reported to be 1553 ft. deep. The rehabilitation of the well was done by J. P. Miller Artesian Well Co. The old pump assembly, in service for 9 mo., was in poor condition, the column pipe was badly corroded, the shaft tubing leaked and the shaft could not be rotated. The pump assembly now consists of 521 ft. of 6-in. column pipe; 8 5/8-in., 12-stage Worthington turbine pump, Serial No. 5832, having an overall length of 8 ft. 7 in.; 481 ft. of air line; 10 ft. of suction pipe; 60-hp. U. S. electric motor.

On Sept. 18, 1947 when pumping at 260 gpm., the drawdown was 30 ft. from a non-pumping water level of 445 ft. In Mar. 1949, the non-pumping water level was 454 to 456 ft.

Well No. 3 (North Well) was rehabilitated by J. P. Miller Artesian Well Co. in Mar. 1942. The well was "shot" with three 150-lb. charges at depths of 1515, 1497 and 1475 ft. An aggregate of slightly less than 5 cu. yd. of sand was removed, the greatest amount of which was loosened after the first shot,'at 1515 ft.

A production test was made on Apr. 7, 1942 under the supervision of the State Water Survey. Before the test was started the water level was 328 ft. below the top of the casing which was 1.0 ft. above ground level, and after 8-hr. pumping at a rate of 300 gpm., the drawdown was 64 ft., a specific capacity of 4.7 gpm. per ft. of drawdown as against a specific capacity of 3.0 prior to the rehabilitation work. Well No. 1 was in service during the test, and the pumping water level in Well No. 1 was observed to recede approximately 5 ft. during the test.

New pumping equipment was installed after the rehabilitation work in April 1942 and in 1944, after casing repairs, the pump was lowered 40 ft. and the air line 50 ft. The pumping equipment now consists of 439 ft. 3 in. of column pipe; 10-in., 10-stage Peerless turbine pump rated at 400 gpm.; 448 ft. 3 in. of 1/8-in. copper air line; 50-hp. electric motor.

In Apr. 1942 the new casing intalled consisted of 312 ft. of 14-in. and 11-in. pipe and at the same time 411 ft. of 10-in. liner, butthe location of the liner installation was not reported. On Apr. 20, 1944 the water level after 3 days non-pumping was 367 ft. below the surface. On Mar. 11, 1949 the non-pumping water level was 439 ft.

Well No. 4 was rehabilitated by J. P. Miller Artesian WellCo., during the period between Dec. 1947 and Mar. 1948. Three shots were set off in the well at depths of 1565, 1548 and 1518 ft. There was very little sand from the first two shots but several truck loads from the third shot. The well was cleaned out to 2005 ft. and then back-filled with gravel up to 1566 ft. The old casing was removed except the 10-in. below 1566 ft. depth. The casing record is now:

Casing Record

20-in. from the surface to 20 ft.
16-in. from the surface to 443 ft. 5 in.
12-in. from the surface to 96 ft.

The 16-in. casing was cemented in for the entire length. The top 3 ft. of the 12-in. casing was cemented in.

Temporary pumping equipment was installed in June 1948, delivering at a rate of 225 gpm. on a 24-hr. daily schedule until removed in Nov. 1948. A new installation was made at that time and now consists of 580 ft. of 6-in. id. column pipe; 11 1/2-in. od., 9-stage Peerless turbine pump, Serial No. 46549, having an overall length of 6 ft. 4 in.; 580 ft. of air line; 125-hp., 1800 rpm. U. S. electric motor.

Since installation, this pump has been delivering at a rate of about 625 gpm. for 21-hr. daily. Analysis of a sample (Lab. No. 117,549) collected Mar. 11, 1949 after 12-hr. pumping showed this water to have a hardness of 14.5 gr. per gal., a residue of 477 ppm., and an iron content of 0.2 ppm.

Total pumpage from all Stateville wells is estimated to average 933,000 gpd.

LABORATORY NO. 117,549

		ppm.	epm.			ppm.	epm.
Iron	Fe	0.2		Chloride	Cl	50.	1.41
				Sulfate	SO_4	76.1	1.58
				Alkalinity	(as $CaCO_3$)	288.	5.76
Temperature		62.2° F.		Hardness	(as $CaCO_3$)	248.	4.96
				Residue		477.	

ILLIOPOLIS
Sangamon County
Aug. 21, 1948

The village of Illiopolis (714) installed a public water supply in 1936.

In Jan., 1935, Test Hole No. 1 was drilled near the center and Test Hole No. 2 and 3 in the northern part of the village. Test Hole No. 3 was 132 ft. deep and was reported to have produced 55 gpm.

An electrical earth resistivity survey was made by the State Geological Survey in Feb., 1935.

Test Hole No. 4, 5 and 7 were then drilled in the southwest part of the village, and Test Hole No. 6, 8 and 9 in the northern part.

Test Hole No. 6 was drilled in 1935 and is located about 100 ft. north and 125 ft. west of the inter section of Fifth and Elizabeth St., (or approximately 1425 ft. S. and 1800 ft. W. of the N. E. corner of Section 7, T. 16 N., R. 1 W.). The ground surface elevation is 610t ft.

The hole was cased with 6-in. pipe to a depth of 34 ft. 2 in., and a 10-ft. section of Cook screen was attached to the bottom of the casing. Half of the screen had No. 100 slot openings and half had No. 80 slots.

A production test was made by the State Water Survey on June 11, 1935. The well produced 62 gpm. with a drawdown of 21 ft. from a non-pumping water level of 6 ft. 2 in. below ground surface.

Test Well No. 9 was located 10 ft. west of Test **Well No. 6.**

The well was drilled to a depth of 51 ft. and completed at 40 ft. Water-bearing sand was reported to have been penetrated between the depths of 33 and 40 ft., and fine, dirty sand between 40 and 51 ft. A 6-in. casing extended to a depth of 33 ft. and a 4 1/2-in. Cook screen was installed **between** 33 and **40** ft. The screen had No. 50 slot **openings.**

A short production test was made on July 30, 1935 by the State Water Survey. After 2 1/2-hr. pumping at a rate of 54 gpm. the drawdown was 11.5 ft. from a non-pumping water level of 6 1/2 ft. below the ground level. Another production test was made by the State Water Survey on Aug. 8, 1935. The well produced 67 gpm. with a drawdown of 23 1/2 ft. below a non-pumping water level of 6 1/2 ft. below the ground surface.

Analysis of a sample (Lab. No. 76419) showed the water to have a hardness of 24.2 gr.per gal., a residue of 496 ppm., and a high iron content.

The finished municipal well was drilled in 1935 and was located between Test Well No. 6 and 9. This well was 45 ft. deep and of the gravel-walled type, 12-in. by 26-in. in diameter. The 26-in. outer casing was set to a depth of 33 ft., and the 12-in. inner casing to a depth of 35 ft. below the ground surface. A 12-in., Cook wire-wound screen having No. 187 slot openings was placed between 35 and 40 ft.

A production test was made by the State Water Survey on Nov. 29, 1935. The well produced 78 gpm. for 8 hr. with a drawdown of 17 1/2 ft. from a non-pumping water level of 12 ft. below the ground surface. Another production test was made by the State Water Survey on Dec. 15-16, 1936. The well produced 67 gpm. with a drawdown of 22.8 ft. from a non-pumping water level of 13 ft. below the ground surface. After pumping had been stopped for 20 minutes, the water level was 18 ft. below the non-pumping level.

Pumping equipment was installed as follows: 35 ft. of 4-in. column pipe; 6-in., 12-stage, Fairbanks-Morse deep-well turbine; 5-hp. Fairbanks-Morse induction motor, operating at 1735 rpm. In 1941, the non-pumping water level was reported to be about 19 ft. and the pumping level about 33 ft. below the ground surface.

Analysis of a sample (Lab. No. 79239) collected Dec. 16, 1936 after 25-hr. pumping, showed the water to have a hardness of 24.8 gr. per gal., a residue of 497 ppm., and an iron content of 6.0 ppm.

The village well failed in Aug. 1942, following a period of continuous pumping, when supplying water for construction at the Sangamon Ordinance Plant. Since about 1943, a treated water supply has been obtained from the wells of the Ordinance Plant.

Analysis of a sample (Lab. No. 115,606) of water from the Sangamon Ordinance Plant Wells No. 4 and 5 collected at the treatment plant 3 1/2 mile from the wells, shows this water to have a hardness of 23.6 gr. per gal., a residue of 480 ppm. and an iron content of 5.1 -ppm.

The water is aerated, softened, and chlorinated.

Analysis of a sample (Lab. No. 115,783) collected Aug. 17, 1948 shows the treated water to

have a hardness of 7.2 gr. per gal., a mineral content of 161 ppm., and an iron content of 0.08 ppm.

The village has recently purchased Ordinance Plant Well No. 1 and 2. These wells are not in use.

From Apr. 14, 1948 to Aug. 14, 1948 the metered water purchased by the village averaged 47,980 gpd. Of this, the Wabash R. R. used an average of 3720 gpd.

LABORATORY NO. 79239

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	6.0		Silica	SiO_2	14.0	
Manganese	Mn	0.0		Chloride	Cl	13.0	.37
Calcium	Ca	103.2	5.16	Nitrate	NO_3	1.1	.02
Magnesium	Mg	40.9	3.37	Sulfate	SO_4	5.0	.10
Ammonium	NH_4	2.2	.12	Alkalinity	(as $CaCO_3$)	464.0	9.28
Sodium	Na	25.8	1.12	Hardness	(as $CaCO_3$)	426.5	8.53
Turbidity		1.0		Residue		497.0	
Color		1.0		Temperature 55° F.			

LABORATORY NO. 115,606

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	5.1		Silica	SiO_2	21.8	
Manganese	Mn	0.3		Fluoride	F	0.3	
Calcium	Ca	98.5	4.93	Chloride	Cl	11.	0.31
Magnesium	Mg	38.4	3.16	Nitrate	NO_3	0.3	Tr.
Ammonium	NH_4	0.2	0.01	Sulfate	SO_4	94.0	1.96
Sodium	Na	5.8	0.25	Alkalinity	(as $CaCO_3$)	304.	6.08
				Hardness	(as $CaCO_3$)	400.	8.09
Turbidity		50		Residue		480.	
Color		0		Free CO_2 (calc.)		73.	
Odor		0		pH = 7.0			

LABORATORY NO. 115,783

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Fluoride	F	0.1	
				Chloride	Cl	8.0	0.23
Turbidity		0		Alkalinity	(as $CaCO_3$)	24.	0.48
Color		0		Hardness	(as $CaCO_3$)	123.	2.46
Odor		0		Total Mineral Content		161.	
Temperature 64.5° F.				pH = 9.6			

IPAVA
Fulton County
Feb. 2, 1948

A public water supply was installed by the village of Ipava (629) about 1890.

Water was obtained from a well located north of West Main St. at Grove Alley (or approximately 1170 ft. N. and 1400 ft. E. of the S. W. corner of Section 6, T. 4 N., R. 2 E.).

The well was cased with 500 ft. of 6-in. pipe. Below the casing, the hole was 6 in. in diameter. In 1914, the water level was 50 ft. below a ground surface elevation of 640t ft. The well was abandoned about 1915.

The public water supply is now obtained from a well drilled in 1915 to a depth of 1324 ft. by M. T. Smith, Bushnell, and located east of the old well at the water works plant.

The well was cased as follows: 54 ft. 4-in. of 12 1/2-in.pipe; 195 ft. 2 in. of 10-in. pipe; 481 ft. 2 in. of 8 1/4-in. pipe; and 429 ft. of 6 5/8-in. pipe.

A vein of black water was encountered at a depth of 525 ft. When the well was completed, the water level was 84 ft. below the surface; and after stopping the pump following 24 hr. operation, the water level raised immediately to 86 ft. The driller reported a production rate of 240 gpm. In 1923, the water level was 83 ft. below the ground surface, and the pump was operated about 6 hr. daily at ah average rate of 30 gpm. On Feb. 2, 1948, the non-pumping water level was esti-. mated at 120 ft.

The pump assembly consists of: 180 ft. of 4-in. column pipe; 15-stage Pomona turbine pump; 10 ft. of 4-in. suction pipe with strainer; 10-hp., 1755 rpm. Westinghouse electric motor, No. 1078607.

Analysis of a sample (Lab. No. 113,373), collected Feb. 2, 1948, showed this water to have a hardness of 37.7 gr. per gal., a residue of 2953 ppm., and an iron content of 0.3 ppm.

Pumpage is estimated at 60,000 gpd.

Correlated driller's log of well drilled in 1915 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil, loess, and soapstone	50	50
Sand and gravel	15	65
Pennsylvanian system		
Shale, some limestone and coal	115	180
Sandstone	15	195
Mississippian system		
St. Louis formation		
Limestone	50	245
Warsaw formation		
Shale	75	320
Keokuk - Burlington formations		
Limestone	205	525
Kinderhook formation		
Slate and shale	230	755
Silurian system		
Niagaran - Alexandrian series		
Limestone	80	835
Ordovician system		
Maquoketa formation		
Slate and shale	76	911
Limestone and slate	114	1025
Galena - Platteville formations		
Limestone	279	1304
St. Peter formation		
Sandstone	20	1324

LABORATORY NO. 113,373

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.3		Silica	SiO_2	13.2	
Manganese	Mn	0.0		Fluoride	F	4.0	
Calcium	Ca	158.4	7.92	Chloride	Cl	780.0	22.00
Magnesium	Mg	60.8	5.00	Nitrate	NO_3	Tr.	Tr.
Ammonium	NH_4	1.9	0.11	Sulfate	SO_4	967.8	20.14
Sodium	Na	770.7	33.51	Alkalinity	(as $CaCO_3$)	220.	4.40
Turbidity		5		Hardness	(as $CaCO_3$)	646.	12.92
Color		0		Residue		2953.	
Odor (at well)		H_2S					
Temperature 69.5° F.							

Island Lake Estates, unincorporated, is a subdivision of W. 1/2 W. 1/2 of Section 21, T. 44 N., R. 9 E. in Lake County and the E. 1/2 E. 1/2 of Section 20, T. 44 N., R. 9 E. in McHenry County.

A community of 400 residences of which 50% are permanently occupied is supplied with water by the Island Lake Water Co. now owned and operated by Frank P. Lichtfield, Wauconda. Water is obtained from wells drilled by Henry Boysen, Jr., Libertyville.

The following information has been furnished by the owner and the driller: Well Lot. 19, Block U:- This well, known as 19-U, is located about 240 ft. south of Fairfield Drive and 160 ft. east of Midway Drive (or approximately 1130 ft. N. and 190 ft. E. of the S. W. corner of Section 21). The elevation of the ground surface is 770± ft. It was drilled in July 1940 to a depth of 116 ft. and is cased to a depth of 92 ft. with 10-in. pipe and 24 ft. of 9 5/8-in. diameter Cook strainer. The well strainer is made up of 5 ft. of No. 60 slot opening at the top, followed by 10 ft. of No. 14 slot openings, 8 ft. of No. 40 slot opening, and 1 ft. of blank section at the bottom.

No water-bearing veins were cased out, and the well was finished in gravel and sand. After completion, when pumping at 503 gpm. for 8 hr., the drawdown was 11 ft. below a water level of 29 ft. below the ground surface.

The following pump installation is in place: 80 ft. of 5-in. column pipe; 6-in., 5-stage Cook turbine pump, No. 4367, rated at 425 gpm.; no suction pipe; 15-hp. U. S. electric motor.

This well was originally the main source of the water supply and was extensively used to maintain the artificial lake level during the development of the project. It is now used during the summer period to meet the increased residential demand when all homes are occupied.

No changes have been reported in the water levels. On Aug. 1, 1946, after 2 months of continuous operation, both pumping and non-pumping water levels were the same as reported in 1940.

Well Block K. Lot 9, known as K-9: - The well is located about 50 ft. north of Forest Drive and 10 ft. west of Eastway Drive (or approximately 1385 ft. S. and 1255 ft. E. of the N. W. corner of Section 21, T. 44 N., R. 9 E.). The elevation of the ground surface is 770t ft.

This well was drilled to a depth of 87 ft. in 1943 and is cased with 8-in. pipe from the surface to a depth of 77 ft. below which is 10 ft. of 7-in. diameter Cook screen.

A log of the formations penetrated shows gravel from the surface to a depth of 36 ft., sand between the depths of 36 and 84 ft., and gravel between the depths of 84 and 87 ft.

Water was pumped for 2 days following completion of the well. When pumping at 280 gpm., the drawdown was 16 ft. below a water level of 9 ft. below the surface of the ground.

The following pump installation is in service: a 6-in., 5-stage Cook turbine pump rated at a capacity of 50 gpm. against a total head of 150 ft.; 5-hp.U. S. electric motor. This well is used for the public supply throughout the year.

A number of other wells were drilled for test purposes which were not developed for a water supply. One of the test holes was drilled on Lot 1 Block 11 and located at the north intersection of Highland Drive and Hillside Drive (approximately 1835 ft. S. and 685 ft. W. of the N. E. corner of Section 20), at a ground elevation of 760t ft.

This well was drilled in Jan. 1941 to a depth of 190 ft. and was cased from the surface to a depth of 170 ft. with 4 1/2-in. diameter pipe.

Correlated driller's log of well drilled in 1941 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Yellow stony gravel	20	20
Stony gravel and sand	67	87
Stone, gravel and sand	68	155
Red clay	15	170
Silurian system		
Niagaran series		
Rock	20	190

After pumping for 8 hr.at 10 gpm., the drawdown was 40 ft. below a water level of 70 ft. below the surface.

A public water supply was installed by the village of Itasca (787) in June 1926.

The original supply was obtained from a well drilled to a depth of 800 ft. by W. L. Thorne Co., Des Plaines, and located about 70 ft. south of Center St. and 40 ft. east of Willow St. (approxi - mately 1940 ft. S. and 75 ft. E. of the N. W. corner of Section 8, T. 40 N., R. 11 E.). The elevation of the ground surface is 700t ft.

The well was reported to be cased with 10-in. pipe from the surface to a depth of 86 ft. and 8-in. casing from 86 to 430 ft. below which the hole was 6-in. diameter to the bottom. The driller's log reported a sand rock formation at a depth of 770 ft., which was hard and tight and containing very little water. A production of only 45 gpm. was obtained. It is reported that the well was "shot" in the Niagaran limestone without increasing its yield.

This well was the source of the public supply until 1936 when it was plugged at a depth of 200 ft. The rate of production had dropped to 25 gpm. and the plunger pump frequently broke suction. The pump was removed and the well abandoned after Well No. 2 was placed in service.

Well No. 2, located 10 ft. east of the original well, was drilled in 1936 to a depth of 184 ft. by Wayman & Wayman, Arlington Heights. The elevation of the ground surface is 700± ft.

The well was reported cased with 8-in. pipe from the surface to rock at a depth of 85 ft. below which the hole was 8-in. diameter to the bottom.

The driller reported penetrating subsurface soil and clay to a depth of 83 ft., at which point limestone was encountered, the top of which was very limey and of medium hardness to a depth of about 130 ft., where a very shattered and broken rock of different colors was encountered. The water level was 16 ft. below the surface until drilling reached a depth of 130 ft. when the water level dropped to 60 ft. After completion the well was tested by pumping for short periods but the pump broke suction at a rate of 200 gpm.

The existing pump installation, made in 1937, is: 170 ft. of 5-in. column pipe; 8-in., 13-stage Pomona turbine pump, No. N2658, having a rated capacity of 100 gpm. against a head of 290 ft.; the overall length of the pump is 81 in.; 170 ft. of air line; 15-hp. Westinghouse electric motor.

On June 12, 1939 the non-pumping water level was 62 ft. below the pump base and after pumping for several minutes at 80 gpm. the water level dropped to the bottom of the 170-ft. air line.

Analysis of a sample (Lab. No. 110,329) collected May 16, 1947 after 2-hr. pumping at 50 gpm. showed this water to have a hardness of 19.4 gr. per gal., a residue of 593 ppm., and an iron content of 0.2 ppm.

Well No. 3 was drilled in 1939 by Wayman & Wayman and is located at the east end of the business district about 25 ft. south of Orchard St. and 130 ft. east of Walnut St. (approximately 2300 ft. S. and 1400 ft. E. of the N. W. corner of Section 8). The elevation of the ground surface is 690t ft.

This well was drilled to a depth of 200 ft. and cased with 12-in. pipe to limestone at a depth of 80 ft.

The existing pump installation, made in 1940, is: 70 ft. of 6-in. column pipe; 10-in., 5-stage American Well Works turbine pump, Shop No. 63209, rated at a capacity of 350 gpm. against 230 ft. of head; 10 ft. of 6-in. suction pipe; 70 ft. of 1/4-in. gi. air line; 30-hp. General Electric motor.

When pumping at 500 gpm. to free discharge, the drawdown was 15 ft. from a non-pumping water level of 2 ft. below the pump base.

On May 6, 1947 the water level was 12 ft. and after 10-min. pumping at 350 gpm. the drawdown was 20 ft.

This well is used only as an auxiliary supply unit.

Analysis of a sample (Lab. No. 110,328) collected May 16, 1947 after 10-min. pumping at 350 gpm. showed this water to have a hardness of 21.6 gr. per gal., a residue of 527 ppm., and an iron content of 0.6 ppm.

The average estimated pumpage is 45,000 gpd.

LABORATORY NO. 110,329

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	21.8	
Manganese	Mn	0.0		Fluoride	F	0.4	
Calcium	Ca	69.3	3.47	Chloride	Cl	3.0	0.08
Magnesium	Mg	38.7	3.18	Nitrate	NO_3	0.7	0.01
Ammonium	NH_4	0.6	0.03	Sulfate	SO_4	189.7	3.95
Sodium	Na	31.3	1.36	Alkalinity (as $CaCO_3$)		200.	4.00
Turbidity		0		Hardness (as $CaCO_3$)		333.	6.65
Color		0		Residue		593.	
Odor		0		Free CO_2 (calc.)		33.	
Temperature 52.2° F.				pH = 7.2			

LABORATORY NO. 110,328

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.6		Silica	SiO_2	21.4	
Manganese	Mn	0.0		Fluoride	F	0.4	
Calcium	Ca	79.9	4.00	Chloride	Cl	2.0	0.06
Magnesium	Mg	41.2	3.39	Nitrate	NO_3	0.8	0.01
Ammonium	NH_4	0.6	0.03	Sulfate	SO_4	211.3	4.40
Sodium	Na	27.8	1.21	Alkalinity (as $CaCO_3$)		208.	4.16
Turbidity		Tr.		Hardness (as $CaCO_3$)		370.	7.39
Color		0		Residue		527.	
Odor		0		Free CO_2 (calc.)		43.	
Temperature 52° F.				pH = 7.1			

JERSEYVILLE
Jersey County
Sept. 24, 1948

A public water supply was installed by the city of Jerseyville (4809) in 1886.

Water was obtained from a well drilled to a depth of 2003 ft. by J. P. Miller Artesian Well Co., Chicago, and located on a city-owned lot in the south part of town. This well furnished water for 8 years, when the yield decreased to 100 gpm. After plugging back to 834-ft. depth, with no improvement in the yield, the well was abandoned. In Jan., 1925, the depth of the well was 40 ft.

In 1895 a well was drilled to a depth of 1468 ft. and deepened in 1896 to 1542 ft. by J. A. and Chas. Johnson. The well was located on the same lot at the 2003-ft. well, (or approximately 500 ft. S. and 500 ft. E. of the N. W. corner of Section 28, T. 8 N., R. 11 W.). The ground elevation is 646± ft.

The well was cased with 10-in. pipe from the surface to 896 ft. and with 8-in. pipe from 896 to 1367 ft., below which the hole was 8-in. diameter. The water level was 25 ft. below the surface until drilling reached 896 ft. The hole was practically dry from 896 to 1040 ft. when salt water was encountered. A small, but inadequate, flow was found at 1492 ft. At 1492-ft. depth, with 896 ft. of casing, the well produced 90 gpm., with the water drawn down to the pump cylinder at 220 ft. from a static water level of 117 ft. The well was finished at 1542 ft. and the 8-in. casing then installed to 1367 ft.

In 1912, the yield was 100,000 gpd. and, after recasing the well, the yield was 220,000 gpd., or 150 gpm. In 1921, when equipped with an air lift pump, with 600 ft. of 2-in. air pipe in good condition, the yield rate was about 178 gpm. Later, the air pipe was in poor condition, and on pumping 20 to 22 hr. per day, the production was estimated to be 150,000 gpd.

Analysis of a sample (Lab. No. 46513) collected Nov. 3, 1921, showed this water to have a hardness of 27.5 gr. per gal., a mineral content of 3012 ppm., and an iron content of 0.1 ppm.

The well was abandoned May 6, 1924 and in Jan., 1925, was reported to have filled in to 350-

Correlated driller's log of well drilled in 1895 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil, clay and gravel	26	26
Pennsylvanian system		
Shale	74	100
Mississippian system		
Salem formation		
Limestone	16	116
Warsaw formation		
Shale, some limestone	105	221
Keokuk-Burlington and Fern Glen formations		
Limestone	259	480
Kinderhook group		
Limestone and shale	170	650
Devonian and Silurian systems		
Limestone	160	810
Ordovician system		
Maquoketa formation		
Shale, some limestone	165	975
Galena-Plattin and Joachim formations		
Limestone	340	1315
Limestone with mud seams	35	1350
Limestone, with sandstone	12	1362
St. Peter formation		
Sandstone	180	1542

ft. depth. At that time the water level was 121 ft. below the surface.

In 1923, the city developed a water supply from 3 springs located on the north bluff of Otter Creek, about 2 1/2 miles south and 5 1/2 miles west of Jerseyville (or approximately 1900 ft. N. and 1000 ft. W. of the S. E. corner of Section 4, T. 7 N., R. 12 W.).

Water is collected in a reservoir surrounding Spring No. 1 and pumped through a 10-in. pipe line to the city's distribution system, by a Worthington 9 by 10-in. single-acting triplex pump, connected to a 50-hp. Fairbanks-Morse Diesel. In July, 1921 the springs were estimated to yield the amounts given in Table 1.

TABLE 1

Spring No. 1 - Stamp Springs - 110,000 gpd.
Spring No. 2 - Humiston Springs - 180,000 gpd.
Spring No. 3 - 180,000 gpd.

It is reported that Spring No. 3 was never developed and the supply is from Springs No. 1 and 2.

In the summer of 1941, the flow of the springs was 125,000 gpd. In Apr., 1943, the flow was about 175,000 gpd. and supplied the demand. All industrial wells were abandoned and industrial users were supplied water by the city.

Analysis of a sample (Lab. No. 115,900) collected Sept. 24, 1948, showed the water from the reservoir to have a hardness of 18.1 gr. per gal., a residue of 339 ppm., and an iron content of 0.3 ppm.

Pumpage is estimatedto average 225,000 gpd.

In 1943, two test holes and a well were drilled in the valley floor about 1000 ft. south of the springs. All three holes were drilled to rock at about 34 ft. below a surface elevation of 492t ft. The well was cased with 25 ft. 2 in. of 10-in. pipe and 8 ft. 10 in. of Cook strainer. In a production test by the driller, water was pumped for 24 hr. at 75 gpm. with a drawdown of 16 ft. from a static level of 12 ft.

This well was used for a short time only.

There are several springs in the vicinity of the two springs which furnish the present supply. The city may attempt to supplement the supply by developing some of those nearby springs.

LABORATORY NO. 115,900

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.3		Silica	SiO_2	14.8	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	91.8	4.59	Chloride	Cl	6.0	0.17
Magnesium	Mg	19.4	1.60	Nitrate	NO_3	11.0	0.18
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	20.2	0.42
Sodium	Na	0.5	0.02	Alkalinity (as $CaCO_3$)		272.	5.44
Turbidity		5		Hardness (as $CaCO_3$)		310.	6.19
Color		0		Residue		339.	
Odor		Tr.		Temperature 55° F.			

The water works in the city of Joliet (42,365) were installed under private owner ship in 1884 and were purchased by the city in 1888.

The original supply was obtained from a group of drift wells about 40 ft. deep and 6 in. in diameter located in the eastern part of the city in the valley of Hickory Creek north of Washington St. and west of the Elgin, Joliet, & Eastern R. R. at what is known as the Washington St. or Main Station of the Joliet Water Works. There were 20 wells in this group and were estimated to have had a combined yield of 1.25 mgd. This source of supply met the requirements of the city for only a few years, and a supplementary supply was obtained by drilling a number of sandstone wells 1200 to 1700 ft. in depth in the vicinity of the Washington St. Station. This group comprised 6 wells having diameters of 4 to 8 in. A test of their capacities was made on Apr. 26 and 27, 1900. With all 6 wells producing the maximum combined discharge rate was 979 gpm.; and the average pumping water level was 81 1/2 ft. below a ground surface having an elevation of 563t ft. The non-pumping water levels at this time were reported to be about 40 ft. below the ground surface.

Until 1907, the city supply was from drift and sandstone wells, which had a combined yield of about 2.65 mgd. and were supplemented at times by water taken from Hickory Creek and neighboring stone quarries. The emergency supply available from the quarries and Hickory Creek was estimated to be about 1.0 mgd.

In the fall of 1910, the city began hypochlorite treatment of the water at the Washington St. Station when any part of the supply was obtained from quarries or Hickory Creek.

A series of isolated deep wells was begun by the city in 1907. The first of these wells was drilled on Ottawa St. just north of the principal mercantile center. In 1911, a similar well was sunk on Canal St. on the opposite side of the river from the Ottawa St. well. The yield of each of these wells was approximately 1.0 mgd.

In 1912, a deep well was drilled south of the mercantile district known as the Spruce Slip well. In 1913, a well was drilled in Van Buren St. to the eastward of the mercantile district and another on Des Plaines St. to the southwest of the mercantile district. The combined yield of the last 3 wells at that time was estimated as 1.877 mgd.

With the addition of these 5 deep rock wells to the public water supply, the approximate quantities of total water available from the various well supplies in Oct., 1913 was 6.527 mgd., with an emergency supply of 1.0 mgd. from Hickory Creek and the stone quarries.

In 1915, another deep rock well, known as the Ruby St. well, was completed. It is located near the west bank of the Des Plaines River and was reported to have a yield of 1.5 mgd. at the time of completion.

In Jan. 1922, a general recession of the water levels in the deep rock wells and a decline in their production was quite evident. These wells were still equipped with air lifts, and the air lines had been extended. Tests of their yields and observations of water levels had just been completed.

The combined yield of the Ottawa St., Canal St., Spruce Slip, Van Buren St., and Des Plaines St. wells was reported to be 1812 gpm., or 2.609 mgd., as compared to an original production of 3.877 mgd. whenthese wells were completed. The water levels varied greatly, depending upon the extent of pumping influence of other wells, but none showed a recession of less than 100 ft. from the original levels.

The yield of the Ruby St. well was reported to be 532 gpm., or a loss of 50% from its original production. The Washington St. deep rock wells were not tested but only 4 of the original 6 wells were still in service, and their combined yield was estimated as 400,000 gpd. The drift wells at the Washington St. Station were still connected but not in service.

Two more deep rock wells were completed in 1924. The Williamson Ave. well located in the northeast part of the city near the intersection of Charlesworth Ave., and the Jasper St. well, located in the southwest part of the city on the west bank of the Des Plaines River at the intersection of Center St. In Mar. 1927, the Williamson Ave. well was reported to be producing 1.1 mgd., and the Jasper St. well 1.8 mgd.

In Oct. 1929, another production check-up of the deep rock wells was made. The rates of discharge were measured, and water levels observed. A continued decline in production and recession of water levels was noted. The yield of the group of 5 deep rock wells known as the Ottawa St., Canal St., Spruce Slip, Van Buren St., and Des Plaines St. wells was 805 gpm. or 1.16 mgd. At the Washington St. Station only wells numbered 4, 5,

and 6 were in service, and turbine pumps had been substituted in Wells No. 4 and 5. Production rates of 78 gpm. for No. 4 and 800 gpm. for No. 5 were reported. The Williamson Ave. well was "shot" and reconditioned.

A report on the status of the deep rock wells, dated Nov. 1, 1933, noted the following changes: The Canal St. and Spruce Slip wells were shut down, and the Van Buren St. and Des Plaines St. wells were used infrequently; the Ruby St. well was repaired in 1931 and was reported producing 360,000 gpd.; the Jasper St. well was "shot" in 1933; the Williamson Ave. well turbine pump had been repaired and was pumping 1.32 mgd.; the Ottawa St. well, which was rehabilitated by shooting in 1932, was producing 740,000 gpd. In Oct. 1933, none of the wells at the Washington St. Station were in use.

A new well was drilled at the Washington St. Station by C. W. Varner, Dubuque, Iowa, in 1937; and in 1938, this well, which is now known as No. 1, produced at a rate of 1050 gpm. with a drawdown of 125 ft. from a non-pumping water level of 270 ft. below the top of casing. In 1937, Well No. 5 of the Washington St. Station group of deep rock wells was "shot" and cleaned out. This well was then designated as No. 2. A test of its production was reported to be 450 gpm. with a drawdown of 114 ft. from a non-pumping water level of 242 ft. below the top of casing.

Following the completion of Well No. 1 and the reconditioning of Well No. 2 at the Washington St. Station, the other 5 deep rock wells at this station were abandoned, and the equipment was removed. During 1937 and 1938, the wells at Canal St., Des Plaines St., Van Buren St., and Spruce Slip were also abandoned; and by July 1941 all equipment had been removed, and the pump houses were dismantled. A description of these abandoned wells with production records, water levels, and some logs of the formations penetrated may be found in Bulletin No. 34.

A report on the status of the deep rock wells on July 25, 1941 is as follows: the wells in service were Washington St. Station No. 1, Ruby St., and Ottawa St. Auxiliary wells used on occasions were Washington St. Station No. 2, Williamson Ave., and Jasper St.

Average pumpage for the period from Jan. 1, 1941 to Jan. 1, 1946 was 2.913 mgd. with only a 4% variation in the yearly records. However, subsequent reports show a definite increase in pumpage. For the 6-month period from Jan. 1, 1946 to July 1, 1946, the average pumpage was 3.5 mgd. During the month of Sept. 1946, an average pumpage of 4.3 mgd. is shown in Table 1.

TABLE 1

	Mg.	% of total
Washington St. Station		
Well No. 1	**43.4**	**33.7**
Ottawa St.	**33.4**	**25.9**
Williamson Ave.	**29.6**	**22.8**
Ruby St.	**20.1**	**15.8**
Jasper St.	**2.4**	**1.8**
Total for Sept. 1946	**128.9**	**100.0**

The status of the wells by the end of Oct. 1946 was as follows: the original group of 20 drift wells at the Washington St. Station are still connected and can be used under extreme emergency conditions. However, they have not been in service since 1944, and the extent of their usefulness is limited by the amount of recharge from surface infiltration.

Well No. 2 at the Washington St. Station has not been in service since 1940. It is still equipped with 400 ft. of 7-in. column pipe; 10-in., 11-stage Peerless turbine pump having an overall length of 10 ft.; 20 ft. of 7-in. suction pipe. A recession of the water level below the turbine setting, and the influence created by the pumping in Well No. 1 has put this well out of service. It is planned to remove the equipment and abandon the well as a source of supply.

Well No. 1 is the only well remaining in service at the Washington St. Station. When production in this well dropped off in 1944, the pump was pulled; and the hole was found bridged at a depth of 1192 ft., and the hole was filled with sand to the 1484 ft. level. The sand was bailed out to a depth of 1595 ft., and a complete string of tools left in the hole in previous years was removed, and the hole cleared to its original bottom. This work was completed by Oct. 30, 1944, and the overhauled turbine was set at 460-ft. On Jan. 2, 1945, pumping was continuous at a rate of 975 gpm. The depth of the well was measured on Apr. 10, 1946 and found to be 1677 ft.

The following pump installation, made on May 8, 1946, is in service: 500 ft. of 10-in. column pipe; 12-in., 9-stage Peerless turbine pump having a rated capacity of 1200 gpm. against 482 ft. of head; the length of the pump is 8 ft.; 518 ft. of air line; 20 ft. of 8-in. suction pipe; 200-hp. U. S. electric motor.

After pumping at 1200 gpm. from May 9 to 14, 1946, the water level was 483 ft. below the pump base (elevation 563.70 ft.). On Oct. 4, 1946 a water level of 409 ft., after a 45-min. idle period, and a water level of 505 ft., after continuous pumping, were reported. During the month of Oct. 1946, the pump was operated on an average of nearly 23 hr. daily.

Analysis of a sample (Lab. No. 108,173), collected Oct. 30, 1946 from the pump discharge after continuous pumping at 1120 gpm., showed the water in this well-to have a hardness of 17.9 gr. per gal., a residue of 505 ppm., and an iron content of 0.2 ppm.

The Ottawa St. well is in continuous service; This well was rehabilitated by the J. P. Miller Artesian Well Co., Brookfield, in the spring of 1944. It was reamed from a 10-in. diameter to 15 1/4-in. diameter between the depths of 200 and 615 ft.

The hole and casing record were reported as shown in Table 2.

TABLE 2

Hole Record

20-in. from 0 to 200 ft.
15 1/4-in. from 200 to 615 ft.
10-in. from 615 to 1209 ft.
8-in. from 1209 to 1525 ft.

Casing Record

16-in. od. from 0 to 200 ft.
8-in. id. liner from 1088 to 1209 ft.

The top of a 5-in. perforated liner was found in bad condition at a depth of 1525 ft. but was not removed. The original depth of the well was reported as 1621 ft.

After completion of the repairs, the well was tested for production on Mar. 9, 1945. When pumping at 1000 gpm. against 10-lb. pressure, the drawdown was 92 ft. The water level was 338 ft. below the pump base before the test. The pump base has an elevation of 535.7 ft. above sea level.

The following pump installation is in service: 500 ft. of 8-in. column pipe; 12-in., 9-stage all-bronze Peerless turbine pump rated at a capacity of 1000 gpm. against 450 ft. of head; the overall length of the pump is 8 3/4 ft.; 520 ft. of air line; 10 ft. of 8-in. suction pipe; 150-hp. U. S. electric motor.

On Oct. 4, 1946, the water level, after a 45-min. idle period, was 381 ft. below the pump base, and the water level was 459 ft. after continuous pumping. During the month of Oct. 1946, the pump was operated 24 hr. daily at 865 gpm.

Analysis of a sample (Lab. No. 108,172), collected Oct. 30, 1946 from the cooling line after continuous pumping at 865 gpm., showed the water to have a hardness of 17.6 gr. per gal., a residue of 534 ppm., and an iron content of 0.2 ppm.

The Williamson Ave. well is in continuous service. It was rehabilitated by the J. P. Miller Artesian Well Co. during the period from Apr. 24, to Nov. 29, 1945. The well was "shot" in the Galesville sandstone at depths of 1525, 1515, 1500, 1489, and 1458 ft.

The hole diameter and casing record is shown in Table 3.

TABLE 3

Hole Record

19 1/4-in. from 0 to 386 ft.
15 1/4-in. from 386 to 1170 ft.
12-in. from 1414 ft. 9 in. to 1610 ft.

Casing Record

20-in. od. from 0 to 20 ft.
16-in. od. from 0 to 386 ft.
13-in. od. liner from 1108 1/2 to 1170 ft.
10-in. id. liner from 1170 to 1414 ft. 9 in.

The hole was drilled and bailed out to a depth of 1610 ft. when the work was completed.

The following pump installation, made on Feb. 15, 1946, is in service: 500 ft. of 10-in. column pipe; 12-in., 10-stage all-bronze, Peerless turbine pump, No. 31940, rated at a capacity of 1000 gpm. against 463 ft. of head; the length of the pump is 9 1/3 ft.; 500 ft. of air line; 21 ft. of 8-in. suction pipe and strainer; 150-hp. U. S. electric motor.

A 10-hr. test was made with this equipment on Feb. 15, 1946. A production of 980 gpm. against 6-lb. pressure was obtained with a pumping water level of 453 ft. below the pump base. The eleva-

tion of the pump base is 557.8 ft. A water temperature of 53.1° F. was observed near the end of the test. Samples collected during the test were found to have a hardness of 43 gr.per gal. After 14 hr. of shutdown, the water level was 348 ft. The quality and temperature of this water indicated the original source to be from the limestone. Continuous pumping reduced the percentage of limestone water and produced an increasing percentage of water from the sandstone.

A sample collected July 8 after one month of continuous pumping showed the water to have a hardness of 39.2 gr. per gal., and a temperature of 54.3° F.

On Oct. 4, 1946, after pumping since June at 865 gpm.,the water level was 490 ft. and the water level, after 36 min. of idle period, was 410 ft.

Analysis of a sample (Lab. No. 108,171), collected Oct. 30, 1946 from a tap on the discharge line about 10 ft. from the pump after continuous pumping at a rate of 865 gpm., showed the water in this well to have a hardness of 33.1 gr. per gal., a residue of 735 ppm., and an iron content of 0.1 ppm.

On Dec. 10, the water was, found to have a hardness of 29.4 gr. per gal. and a temperature of 57.4° F.

The Ruby St. well is in service but is not operated continuously. During the month of Oct. 1946, water was pumped for an average period of 15 hr. daily at 600 gpm. Forty-two samples collected from this well from 1943-1947 showed the water to have a hardness of 13-17 gr. per gal., a mineral content of 460-500 ppm., and iron content of 0.1-0.6 ppm., and a temperature of 60.4 to 62.6° F.

TABLE 4

Hole Record

18-in. from 0 to 440 ft.
12-in. from 440 to 1237 ft.
10-in. from 1237 to 1544 ft.

Casing Record

14-in. from 0 to 440 ft.
12-in. standard pipe from 0 to 437 ft.
10-in. from 437 to 1237 ft.
8-in. perforated liner from 1237 to 1438 ft.

A check-up of this well was made by the J. P. Miller Artesian Well Co. on Jan. 4, 1940. The well was sounded and found to have a depth of 1544 ft., and the water level was 228 ft. below the pump base. The hole and casing diameters were reported as given in Table 4.

The pump and motor were overhauled in Nov. 1944. The well was tested on Feb. 19, 1945 and produced 680 gpm. The non-pumping water level was 348 ft. below the pump base and the pumping water level was below the 458-ft. air line at the time. The elevation of the pump base is 546.2 ft.

The existing pump installation in service consists of 525 ft. of 8-in. column pipe; 10-in., 15-stage, all-bronze Peerless turbine rated at a capacity of 900 gpm. against 480 ft. of head; the overall length of the pump is 10 ft. 10 in.; 458 ft. of air line; 10 ft. of 7-in. suction pipe and strainer; 150-hp. U. S. electric motor.

On Oct. 4, 1946, the water level, after continuous pumping at 600 gpm., was below the 458-ft. air line; and, after a 45-min. idle period, the water level was 398 ft.

Analysis of a sample (Lab. No. 108,174), collected Oct. 31, 1946 from a tap at the pump discharge after 20-min. pumping at 600 gpm. against 52-lb. pressure, showed the water in this well to have a hardness of 263, a residue of 475, and a content of iron of 0.5 ppm.

The Jasper St. well serves as a standby unit and was used extensively during the summer of 1946 pumping at a rate of 675 gpm. No work has been done in the well since it was cleaned out in 1937. The well is reported to have a 21-in. diameter hole and 17-in. diameter casing from the surface to a depth of 303 ft., below which the hole is 15 in. in diameter to the bottom which was originally 1565 ft.

The pumping installation made in 1937 is still in place: 450 ft. of 10-in. column pipe; 14-in., 13-stage Cook turbine pump rated at 1000 gpm. against 450 ft. of head; the overall length of the pump is 12 ft.; 450 ft. of air line (now defective); 40 ft. of 8-in. suction pipe; 150-hp. General Electric motor.

The pump discharges to the suction side of an Economy centrifugal pump which is connected to the mains and is powered by a 60-hp. electric motor. The elevation of the pump base plate, flush with the floor level, is 536.67 ft.

On Sept. 8, 1938, the water level was 427 ft. below the pump base when pumping at 940 gpm. A non-pumping water level of 261 ft. was reported on July 25, 1941. Subsequent water levels have not been observed due to a defective air line.

A detailed record of the original construction of these wells together with locations, early production and water levels is shown in Bulletin No. 34. Many of the industrial wells in the Joliet area are also reported in that bulletin.

The recession in water levels in some of the Joliet city wells is shown in Table 5, with water level elevations shown in ft. above mean sea level:'

The possibility of developing a public water supply from the glacial drift deposits of sand and gravel in the Hickory Creek and Spring Creek valleys lying east of Joliet was investigated by the city of Joliet in 1945 and 1946. Nine test wells were drilled in these valleys located in Sections 1 and 14 of Township 35 North, Range 10 East; Sections 5, 6, 7, and 8 of Township 35 North, Range 11 East; and Section 32 of Township 36 North, Range 11 East. These wells were all drilled 6 in. in diameter and varied in depths from 36 ft. to 160 ft. Most of the wells penetrated the underlying limestone formation, and some were "swabbed" and acidized. Production tests were made from both the limestone and drift formations encountered. The limestone formation was tested first by casing out the overlying deposits. The well was then plugged in the limestone, the casing was raised, and a screen installed below the casing. All tests for production were conducted independently, using 6-in. pumps as the wells were completed.

The results of these tests indicated yields which varied from 37 to 345 gpm. Two wells were not tested because their yields by bailer tests did not warrant the installation of test pumps. The influence and effect of sustained pumping of these water-bearing glacial deposits has not been determined.

LABORATORY NO. 108,173

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	11.9	
Manganese	Mn	0.0		Fluoride	F	1.0	
Calcium	Ca	81.5	4.08	Chloride	Cl	30.0	0.85
Magnesium	Mg	24.9	2.05	Nitrate	NO_3	0.9	0.01
Ammonium	NH_4	0.7	0.04	Sulfate	SO_4	122.5	2.56
Sodium	Na	58.2	2.53	Alkalinity	(as $CaCO_3$)	264.	5.28
Color		0		Hardness	(as $CaCO_3$)	307.	6.14
Odor		Tr.		Residue		505.	
Turbidity		0		Free CO_2	(calc.)	50.	
Temperature 61° F.				pH = 7.1			

LABORATORY NO. 108,172

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	11.7	
Manganese	Mn	Tr.		Fluoride	F	1.1	
Calcium	Ca	79.6	3.98	Chloride	Cl	42.0	1.18
Magnesium	Mg	25.1	2.07	Nitrate	NO_3	0.4	0.01
Ammonium	NH_4	0.9	0.05	Sulfate	SO_4	135.8	2.82
Sodium	Na	78.9	3.43	Alkalinity	(as $CaCO_3$)	276.	5.52
Color		0		Hardness	(as $CaCO_3$)	303.	6.06
Odor		0		Residue		534.	
Turbidity		0		Free CO_2	(calc.)	42.	
Temperature 61° F.				pH = 7.2			

LABORATORY NO. 108,171

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	12.4	
Manganese	Mn	Tr.		Fluoride	F	0.6	
Calcium	Ca	130.4	6.52	Chloride	Cl	3.0	0.08
Magnesium	Mg	59.0	4.85	Nitrate	NO_3	0.9	0.01
Ammonium	NH_4	0.3	0.02	Sulfate	SO_4	289.4	6.02
Sodium	Na	29.4	1.28	Alkalinity	(as $CaCO_3$)	328.	6.56
Color		0		Hardness	(as $CaCO_3$)	569.	11.38
Odor		0		Residue		735.	
Turbidity		0		Free CO_2 (calc.)		64.	
Temperature 57° F.				pH = 7.1			

LABORATORY NO. 108,174

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.5		Silica	SiO_2	12.0	
Manganese	Mn	Tr.		Fluoride	F	1.1	
Calcium	Ca	69.8	3.49	Chloride	Cl	31.0	0.87
Magnesium	Mg	21.5	1.77	Nitrate	NO_3	0.3	Tr.
Ammonium	NH_4	0.9	0.05	Sulfate	SO_4	105.3	2.19
Sodium	Na	67.9	2.95	Alkalinity	(as $CaCO_3$)	260.	5.20
Color		0		Hardness	(as $CaCO_3$)	263.	5.26
Odor		0		Residue		475.	
Turbidity		10-		Free CO_2 (calc.)		48.	
Temperature 62.2° F.				pH = 7.1			

TABLE 5

Year	Washington St.	Ottawa St.	Spruce St.	Des Plaines St.	Jasper St.	Ruby St.
1895	570					
1900	480					
1907		525				
1913	480		490	445		
1921				340		
1923	350				323	350
1924			380			
1929	320					
1930				308		
1931						232
1933		290				325
1934	345	270				
1936		295				
1937	320					
1938	235					
1941				310		
1942		300	310			
1944						221
1945	202	173	225	215		
July 1947	167	151	215	204	227	150

Average recession from 1895 to 1929 = 7.3 ft. per year
Average recession from 1913 to 1947 = 8.1 ft. per year
Average recession from 1933 to 1947 =13.1 ft. per year

The city of Jonesboro (1521) installed a public water supply system in 1924.

Water was first obtained from a well, which was drilled in 1901 for the Jonesboro Light Co., and which was sold to the city in 1921. This well was located at the southeast corner of Union and Pecon St. (or approximately 640 ft. S. and 740 ft. E. of the N. W. corner of Section 30, T. 12 S., R. 1 W.). The well depth is 267 ft. below a surface elevation of 515t ft.

This well, now called Well No. 1, is located at the site of the original town spring and when the spring went dry the Jonesboro LightCo. first dug a 4-ft. diameter hole to limestone at 28 ft. and later drilled the well into limestone. At a depth of 233 ft. the drill bit dropped 34 ft. and drilling was discontinued. An 8-in. casing extended from the ground surface to an unknown depth.

The original pumping equipment in 1924 consisted of an A. D. Cook single-action deep-well plunger pump set at a depth of 100 ft. and driven by a 5-hp. electric motor. It was reported that the average pumpage was 30 gpm. and that the non-pumping water level was 10 ft. In 1925 the pump setting was lowered to a depth of 140 ft. and in 1926 the non-pumping water level was 13. 1/2 ft. and that pumpage was at a rate of 30 gpm. It was reported that in the winter of 1926 the pump was operated for 2 or 3 hr. every other day.

A production test was made by the State Water Survey on Sept. 6, 1935. When pumping at 53 gpm., the calculated drawdown was 57 ft. below a non-pumping water level of 25 ft. 8 in. below the top of the casing.

In 1936 it was reported that the well produced 50 gpm. after 4-hr. continuous pumping.

Measurements made in 1937 recorded the depth of the well below the surface as 203 ft. and the distance to water as 16 ft. In the summer of 1942 the depth of the well was found to be 200 ft. and the water level was 25 1/2 ft. below the pump base which is 1 ft. 1 in. above the pump house floor.

Due to a cracked hole several pump installations have been made. The following pump installation, made in the summer of 1942, is in service: 135 ft. 7 in. of 5-in. column pipe; 6-in., 11-stage Fairbanks-Morse turbine pump, No. 16683, having an ove rall length of 6 1/2 ft. and a rated capacity of 150 gpm. against 130 ft. of head; 19 ft. of 5-in. suction pipe and 1-ft. 4-in. tapered strainer; 7 1/2-hp. General Electric motor. There is no available record of the length of the air line but Mr. Everett Smith who installed the pump advises that he started the 1/4-in. gi. air line at the bottom of the bowl assembly which would make the length about 142 ft. below the pump base.

The production of the well has fluctuated widely during the past 5 years of operation and now varies from 35 gpm. after long periods of operation to 100 gpm. for short periods of operation. It is estimated to average 65 gpm. over an operating period of 10 hour based on the amount of water pumped to the treatment plant.

Considerable trouble has been experienced by pumping mud from this well. Numerous caveins have been reported in the area adjacent to the well site, and it is presumed that mud has settled into the vertical cracks and crevices of the upper limestone formation.

The pump is in service and has a normal pumping period of lu hr. daily,! discharging an estimated 39,000 gpd. over the aerator at the well site.

On Feb. 7 and 8, 1948 a series of water level readings in Well No. 1 were recorded in ft. below the pump base and are shown in Table 1.

The accuracy of the water level readings were questionable because of a leaky air line, when released from pressure.

Analysis of a sample (Lab. No. 113,347) collected Jan. 29, 1948 after 1-hr. pumping at 70 gpm., showed the water to have a hardness of 19.4 gr. per gal., a residue of 431 ppm., and an iron content of 0.1 ppm.

Sample-study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil	10	10
Mississippian system		
Osage group		
Keokuk-Burlington limestones, shaly at base	292	302

Well No. 2 was drilled to a depth of 302 ft. in 193 7 by A. C. Wise, St. Louis Mo., and located about 275 ft. north of the depot and 30 ft. east of the Mobile and Ohio R. R. right-of-way, 850 ft. southwest of Well No. 1 (approximately 1440 ft. S. and 440 ft. E. of the N. W. corner of Section 30).

The'ground elevation at the well is 490± ft.

The hole and casing record is shown in Table 2.

TABLE 2

Hole Record

22-in. from surface to 11 ft.
20-in. from 11 to 30 ft.
15-in. from 30 to 78 ft.
10-in. from 78 to 302 ft.

Casing Record

22-in. from surface to 11 ft.
10-in. from surface to 78 ft.

Concrete seal between casings from surface to 20 ft.

The following pump installation made in 1938 is still in service: 150 ft. of 5-in. od. column pipe; 6-in., 18-stage Fairbanks-Morse turbine pump, No. 1402, having a rated capacity of 50 gpm. against 204 ft. of head; 5-hp. Fairbanks-Morse electric motor. An air line was installed the length of which is in doubt but is reported to be 140 ft.

A production test was made by the State Water Survey on Apr. 22-23, 1937. The non-pumping water level was 7 1/2 ft., and the following pumping rate and drawdowns were reported.

Rate gpm.	Time hr.	Drawdown ft.
40	5	50.8
36	7	53.1
45	5	69.4
52	6	92.4

On Feb. 7 and 8, 1948 a series of water level readings in Well No. 2 were recorded in ft.below the pump base and are shown in Table 3.

These readings may also be questioned because of a defective air line.

The pump in Well No. 2 is operated simultaneously with Well No. 1 and the normal pumping period is 10 hr. daily, discharging an estimated 30,000 gpd. over the aerator at the plant site near Well No. 1.

Analysis of a sample (Lab. No. 113,348) collected Jan. 29, 1948 after 8-hr. pumping at an estimated rate of 50 gpm., showed this water to have a hardness of 19.0 gr. per gal., a residue of 432 ppm., and an iron content of 0.6 ppm.

All water for the public supply is aerated, filtered, softened and chlorinated. The treatment plant was not operating on Feb. 8, 1948.

Total metered pumpage for Aug. 1947 averaged 68,880 gpd.

TABLE 1

Water Levels

Date	Time	Pumping ft.	Non-Pumping ft.	Remarks
Feb. 7	5:30 A.M.			Start pumping in Wells No. 1 and 2.
Feb. 7	8:30 A.M.	45		
Feb. 7	10:30 A.M.	53		
Feb. 7	11:00 A.M.	55		Stop pumping in Wells No. 1 and 2.
Feb. 7	11:40 A.M.		45	
Feb. 7	1:00 P.M.		40	
Feb. 8	5:30 A.M.		22	

TABLE 3
Water Level

Date	Time	Pumping ft.	Non-Pumping ft.	Remarks
Feb. 7	7:10 A.M.			Pumping in both wells
Feb. 7	11:10 A.M.	103		Stop pumping
Feb. 7	1:30 P.M.		84	
Feb. 8	6:00 A.M.		80	

LABORATORY NO. 113,347

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	25.1	
Manganese	Mn	Tr.		Fluoride	F	0.1	
Calcium	Ca	113.7	5.69	Chloride	Cl	29.0	0.82
Magnesium	Mg	12.4	1.02	Nitrate	NO_3	31.7	0.51
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	32.2	0.67
Sodium	Na	9.4	0.41	Alkalinity (as $CaCO_3$)		256.	5.12
Turbidity		Tr.		Hardness (as $CaCO_3$)		336.	6.71
Color		0		Residue		431.	
Odor		0		Free CO_2 (calc.)		100.	
Temperature 57.4° F.				pH = 6.8			

LABORATORY NO. 113,348

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.6		Silica	SiO_2	25.1	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	98.3	4.92	Chloride	Cl	67.0	1.89
Magnesium	Mg	19.4	1.60	Nitrate	NO_3	11.2	0.18
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	17.9	0.37
Sodium	Na	27.6	1.20	Alkalinity (as $CaCO_3$)		264.	5.28
Turbidity		Tr.		Hardness (as $CaCO_3$)		326.	6.52
Color		0		Residue		432.	
Odor		0		Free CO_2 (calc.)		205.	
Temperature 58° F.				pH = 6.5			

The public water supply for the village of Joy (470) was installed in 1923.

Water is obtained from a well drilled by Ray Robinson, Joy, in 1914. The well is located about 100 ft. south of Main St. and 250 ft. east of Federal St. (or approximately 3400 ft. N. and 1400 ft. W. of the S. E. corner of Section 19, T. 14 N., R. 4 W.).

The well is 322 ft. deep below a ground surface elevation of 687± ft., and is cased with 8-in. pipe to rock at a depth of 80 ft. The well is equipped with an A. D. Cook double-acting deep well pump, No. 1338, with a 5 3/4-in. cylinder attachedto 256ft. of 6-in. drop pipe. The pump operates at 15 spm. Power is furnished by a 15-hp. Fairbanks-Morse induction motor. In 1940 the cylinder was lowered from 225 ft. to the present setting, and the speed of the pump was reduced from 25 spm. to the present rate.

A production test of the well was made in 1914 by the driller. The non-pumping water level was 125 ft. below the ground surface, and the water was lowered to 140 ft. after pumping several hours at 60 gpm. Continued pumping did not lower the water level further.

In 1940 an air-compressor, belt-driven from a 15-hp. pump motor, was installed to discharge air into the discharge line between the air chamber and gate valve. This was used in lieu of an aerator and was reported to reduce the amount of hydrogen-sulphide at domestic taps and the staining of fixtures.

Analysis of a sample (Lab. No. 108,246), collected Nov. 7, 1946, showed the water to have a hardness of 10 gr. per gal., a residue of 593 ppm., and an iron content of 0.2 ppm.

Pumpage is estimated at 28,000 gpd.

LABORATORY NO. 108,246

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	12.6	
Manganese	Mn	0.0		Fluoride	F	0.6	
Calcium	Ca	42.5	2.13	Chloride	Cl	38.0	1.07
Magnesium	Mg	15.6	1.28	Nitrate	NO_3	0.9	0.01
Ammonium	NH_4	1.6	0.09	Sulfate	SO_4	80.4	1.67
Sodium	Na	166.8	7.25	Alkalinity	(as $CaCO_3$)	400.	8.00
Color		0		Hardness	(as $CaCO_3$)	171.	3.42
Odor (at well)		H_2S		Residue		593.	
Turbidity		10					
Temperature		55.2° F.					

KANSAS
Edgar County
June 16, 1948

The village of Kansas (875) installed a public water supply in 1915.

Well No. 1 was drilled in 1915 and is located on Cherry Ave., 330 ft. east of Front St. (or approximately 2400 ft. S. and 1560 ft. E. of the N. W. corner of Section 26, T. 13 N., R. 14 W.). The ground surface elevation is 700± ft.

The well, was 80 ft. deep, and was cased with 10-in. wi. pipe and a section of sand screen.

Correlated driller's log of Well No. 1 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Loam and clay	12	12
Sand	5	17
Clay	15	32
Sand and gravel	50	82

The well was equipped as follows: 64 ft. of column pipe; 5 3/4-in.by 12-in. Luitweiler deep-well pump; 12 ft. of strainer; 7 1/2-hp. Lincoln Electric motor.

It was reported that when completed, the well produced-55 gpm. for 48hr. In 1918, the well was reported to produce 47 gpm., and the non-pumping water level was 14 ft. below the pump house floor. Well No. 1 was abandoned after Well No. 2 was placed in Service in 1925. The pumping equipment has been removed and the well capped and sealed.

Analysis of a sample (Lab. No. 38810) collected Jan. 8, 1918, showed the water to have a hardness of 19.8 gr. per gal., a residue of 413 ppm., and an iron content of 3.0 ppm.

Well No. 2 was drilled to a depth of 76 ft. in 1925 by Kortey and is located about 20 ft. west of Well No. 1. The well was cased with 8-in. pipe to a reported depth of 67 ft. and with a Cook screen installed between the depths of 67 and 76 ft. The screen had No. 60 slot openings.

The pumping equipment consists of 52 ft. of drop pipe; 5 3/4-in. by 18-in. Cook 2-stroke pump No. 1241, over all length 81 1/2 in.; 15 ft. of 4-in. suction pipe; 10-hp. Wagner electric motor No. 335430, operating at 30 rpm. The pump is estimated to discharge 80 gpm.

In 1927, the non-pumping water level was reported to be 13 ft. and the same water level was reported in 1945, when the pump was out for repairs.

In June 1948 the pump was operated 3 hr. daily.

Analysis of a sample (Lab. No. 115, 045) collected after one-hour, pumping on June 16, 1948 showed the water to have a hardness of 22.0 gr. per gal., a residue of 423 ppm., and an iron content of 3.1 ppm. Methane gas is present in a concentration of 5.8 cu. ft. per 1000 gal.

All water is aerated, filtered, and softened. The treatment plant was not in service on June 16, 1948.

Well No. 3 was drilled in 1932 to a depth of 85 ft. by E. W. Johnson, Bloomington, and is located about 12 ft. south of Well No. 2.

LABORATORY NO. 115,045

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	3.1		Silica	SiO_2	28.0	
Manganese	Mn	Tr.		Fluoride	F	0.1	
Calcium	Ca	93.1	4.66	Chloride	Cl	6.0	0.17
Magnesium	Mg	34.9	2.87	Nitrate	NO_3	Tr.	Tr.
Ammonium	NH_4	8.1	0.45	Sulfate	SO_4	8.6	0.18
Sodium	Na	21.4	0.93	Alkalinity (as $CaCO_3$)		428.	8.56
Turbidity		40		Hardness (as $CaCO_3$)		377.	7.53
Color		0		Residue		423.	
Odor		0		Free CO_2 (calc.)		68.	
Temperature 55° F.				pH = 7.2			

The well was cased with 10-in. pipe and with a 12-ft. length of 10-in. Johnson screen, The aquifer is reported to be very fine sand. The pumping equipment includes a Sterling turbine pump No. S 936, rated at 100 gpm. at 3600 rpm; 10-hp. U.S. Electric motor No. 105994, operating at 3600 rpm. The pump is estimated to discharge 80 gpm. Methane gas is present in the water from this well.

In June 1948 this pump was operated about 3 hr. daily.

From June 7, 1947to June 5, 1948 the metered pumpage averaged 24,000 gpd.

KEITHSBURG
Mercer County
Nov. 6, 1946

The public water supply was installed by the city of Keithsburg (1130) in 1893.

Water was obtained from a number of wells located along the river bank at the foot of Washington St. The first wells were drilled in 1893, and by the latter part of 1913, eight wells had been drilled.

In 1918 a new pumping station was constructed by the city on Second St. near Washington St. (or approximately 50 ft. N. and 575 ft. W. of the S. E. corner of Section 22, T. 13 N., R. 5 W.).

Water is now supplied from 7 wells, the deepest of which is 32 ft. Each well is cased with 6-in. pipe beneath which is a 5-in. Cook screen the bottom 6 ft. of which was slotted. Water is pumped from all wells by a Platt Iron Works suction pump located in a pit about 8 ft. deep. The pump has three 9-in. by 12-in. vertical pistons and is belt-connected to a 25-hp. Allis Chalmers motor.

No log is available, but a note from the city record is as follows: "From the surface of the ground, Wells No. 4 and 5, to the bottom of the screen is about 29 ft., and the bottom of the screen rests on a vein of very hard blue clay."

Analysis of a sample (Lab. No. 108,245), collected Nov. 6, 1946 after 45-min. pumping, showed this water to have a hardness of 26.0 gr. per gal., a residue of 658 ppm., and an iron content of 0.1 ppm.

The water is not treated.

The pump is operated about 2 hr. daily at a rate of 450 gpm. Water pumped during September 1946 averaged 53,250 gpd. and for October 1946, the average was 50,000 gpd.

LABORATORY NO. 108,245

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	31.3	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	128.4	6.42	Chloride	Cl	35.0	0.99
Magnesium	Mg	30.4	2.50	Nitrate	NO_3	44.0	0.71
Ammonium	NH_4	0.5	0.03	Sulfate	SO_4	164.6	3.42
Sodium	Na	40.7	1.77	Alkalinity	(as $CaCO_3$)	280.	5.60
Color		0		Hardness	(as $CaCO_3$)	446.	8.92
Odor		0		Residue		658.	
Turbidity		10					
Temperature		56.6° F.					

A public water supply was installed in 1894 by the village of Kempton (259).

At that time a well was drilled to a depth of 404 ft. at the northeast corner of First and Kemp St. In 1909, a well, now called No. 1, was drilled at the new pumping station on First St., 2 blocks north of the old well, (or approximately 75 ft. S. and 2120 ft. E. of the N. W. corner of Section 6, T. 28 N., R. 9 E.).

The well was cased with 6-in. pipe to rock at about 285 ft. and was equipped with a cylinder pump attached to 220 ft. of 3-in. drop pipe. In 1916 the non-pumping water level was 80 ft. below the ground surface elevation of 73 7± ft. The production at that time was about 8 gpm. In 1923 a production test was made by the State Water Survey. At the start, the pumping rate was 5 gpm. but gradually decreased to 2 1/2 gpm. and the water was drawn down to the pump cylinder. It was necessary to pump continuously 10 to 12 hr. daily to supply the demand.

The pumping equipment includes a Myers plunger pump with 2 1/2-in. cylinder and 12-in. stroke. In 1938, this well was being used for the entire supply in preference to Well No. 2, because of the softer quality of the water. Well No. 1 has been out of service since Apr. 1947 when the Myers pump failed.

Analysis of a sample (Lab. No. 72733) collected Apr. 4, 1933 showed this water to have a hardness of 0.5 gr. per gal., a residue of 801 ppm., alkalinity of 640 ppm., and no iron.

In Jan. 1931, Well No. 2 was completed to a depth of 238 ft. by E. W. Johnson, Bloomington, and located 20 ft. west of Well No. 1. The well was cased with 220 ft. of 8-in. wrought steel pipe and 10 ft. of 8-in. Johnson welded screen, the top 7 ft. having No. 20 slot openings and the lower 3 ft. having No. 30 slots. It was reported that, during drilling operations, the drift did not cave and 170 ft. of hole was drilled without casing.

When the well was completed the driller reported a static water level at. 80 ft. and after 4-days pumping at 110 gpm., the drawdown was 100 ft.

The pumping assembly consists of 210 ft. of 4 1/2-in. column pipe; 6-in., 8-stage Sterling turbine pump, No. S 496; the overall length of the pump is 45 in.; 20 ft. of 4 1/2-in. suction pipe; 15-hp., 3600 rpm. U.S. electric motor, No. 92095.

Correlated driller's log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and clay	188	188
Streak of sand, some water, 5 to 10 gal. per min.	at	188
Clay	35	223
Streak of sand, some water about 2 gal. per minute	at	223
Clay	5	228
Sand	7	235
Sand, some gravel	3	238
Clay	2	240

The pump was pulled several years ago for inspection. No repairs were necessary. At that time the pump discharge rate was 110 gpm.

Analysis of a sample (Lab. No. 116,251) collected Oct. 26, 1948 after 30-minutes pumping at 100 gpm., showed this water to have a hardness of 42.7 gr. per gal., a residue of 1688 ppm., and an iron content of 2.1 ppm.

Well No. 2 has been the sole source of supply since Apr. 1947.

Well No. 3 was completed in Jan. 1949 to a depth of 386 ft. by Lowell French, Ashkum, and located 12 ft. south of Well No. 2. The hole was cased with 8-in. pipe from 2 ft. above to 276 ft. 9 in. below the ground surface. Below the casing the hole was finished 8 in. in diameter.

A production test was made on Jan. 24, 1949 using State Water Survey calibrated measuring equipment. A temporary plunger pump, operated from the drill-rig, was set at a depth of 310 ft. Before the test, the water level was 100 ft. below the top of the casing. After 1-hr. pumping at 12.2 gpm. the drawdown was 130 ft. One hour after stopping the test the water level was 169 ft.

Analysis of a sample (Lab. No. 117,231) collected Feb. 5, 1949, showed this water to have a hardness of 8.3 gr. per gal., a mineral content of 998 ppm. and an iron content of 2.4 ppm.

Pumpage for the village is estimated to average 18,000 gpd.

LABORATORY NO. 116.251

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.1		Silica	SiO_2	12.4	
Manganese	Mn	0.1		Fluoride	F	0.9	
Calcium	Ca	162.4	8.12	Chloride	Cl	21.0	0.59
Magnesium	Mg	79.6	6.55	Nitrate	NO_3	0.5	0.01
Ammonium	NH_4	1.6	0.09	Sulfate	SO_4	1049.2	21.83
Sodium	Na	240.8	10.47	Alkalinity (as $CaCO_3$)		140.	2.80
Turbidity		20		Hardness (as $CaCO_3$)		734.	14.67
Color		0		Residue		1688.	
Odor		Tr.		Free CO_2 (calc.)		9.	
Temperature 54.6° F.				pH = 7.6			

LABORATORY NO. 117,231

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.4		Fluoride	F	3.5	
				Chloride	Cl	45.0	1.27
Turbidity		25		Sulfate	SO_4	166.4	3.46
Color		0		Alkalinity (as $CaCO_3$)		652.	13.04
Odor		0		Hardness (as $CaCO_3$)		141.	2.82
				Total Mineral Content		998.	

A water supply was installed by the city of Kewanee (16,901) in 1883 or 1884.

At the time, water was taken from a shallow well obtaining its flow from gravel beds around Crystal Lake. In 1887 and 1888, 3 deep wells were drilled, each to a depth of 1460 ft. Several deep-well type pumping installations were made, but these proved unsatisfactory, and in 1904 air lift equipment was installed. In 1905 Wells No. 2 and 3 were being cleaned, but some tools were lost in Well No. 3, and it was abandoned. An additional well, No. 4, was drilled, and an addition to the pumping station was constructed.

The wells and pumping station were located on a tract of 9 acres owned by the city on the west side of Madison Ave. in the north part of the city. Water was pumped from the 3 deep wells into a collecting well and then into the distribution system. The shallow well water was used for sprinkling purposes only. Wells No. 1, 2 and 3 were drilled to the same depth, and Wells No. 1 and 3 were drilled to the same diameters and were cased alike: 10-in. pipe from the surface to 300 ft.; 6-in. pipe from the surface to 700 ft.; no casing from 700 to 1460 ft.

Analysis of a sample (Lab. No. 24348) collected Nov. 18, 1912, showed the water from Well No. 1 to have a hardness of 15.0 gr. per gal., a residue of 1292 ppm., and an iron content of 0.2 ppm.

Well No. 2 was cased with 4-in. pipe from the surface to 700 ft. and no casing from 700 to 1460 ft. The ground surface elevation at the 3 well sites was 825t ft.

Well No. 4 was drilled by J. P. Miller Artesian Well Co. at a point 315 ft. east of No. 3 to a depth of 1426 ft. 6 in. It was cased as follows: 16-in. pipe from surface to 118 ft.; 12-in. pipe from 118 ft. to 300 ft. 2 in.; 10-in. pipe from surface to 500 ft. 7 in.; 8-in. pipe from 500 to 1002 ft. 11 in.; no casing from 1002 ft. 11 in. to 1426 ft. 6 in.

In 1906 the non-pumping water level in Well No. 4 was 246 ft. below the ground surface, and the drawdown was 248 ft. when pumping at 150 gpm. during a 30-hr. test. When the pumps in Wells No. 1 and 2 were being operated, Well No. 4 produced 142 gpm. The drawdown was 42 ft.

In 1908 a new pumping station site was selected near the center of the city, and 2 wells were drilled, in addition to a new pumping station building, on the east side of Tremont St. north of and adjoining the Chicago, Burlington & Quincy R. R. right-of-way (or approximately 650 ft. S. and 2300 ft. E. of the N. W. corner of Section 33, T. 15 N., R. 5 E.).

The date of change from the old water works to the new location is not definite, but it occurred about 1913, and Wells No. 5 and 6, drilled in 1908, were placed in service. The wells at the old station were abandoned at the same time.

Wells No. 5 and 6 are about 30 ft. apart, and the elevation of the ground surface is 853± ft.

Well No. 5 was drilled to a depth of 1464 ft. 3 in. and was cased as follows: 15-in. pipe from surface to 35 ft. 2 in.; 12-in. pipe from surface to 294 ft. 7 in.; 10-in. pipe from 294 ft. 7 in. to 392 ft. 9 in.; 6-in. pipe from 392 ft. 9 in. to 976 ft. 8 in.; no casing from 976 ft. 8 in. to 1464 ft. 3 in.

Well No. 6 was drilled to a depth of 1464 ft. 10 in. and was cased as follows: 15-in. pipe from surface to 35 ft. 9 in.; 12-in. pipe from surface to 274 ft. 2 in.; 10-in. pipe from 274 ft. 2 in. to 392 ft.; 6-in. pipe from 392 ft. to 1001 ft.; no casing from 1001 ft. to 1464 ft. 10 in.

The non-pumping water level in both wells in July 1921 was 270 ft. below the surface. Both wells were equipped with air lift, and the production rate was about 210 gpm. from both wells, with a drawdown of 130 ft.

In 1919, Whitney Well Drilling Co., Chicago, completed a new well, now called No. 1, at a point 40 ft. south and 25 ft. west of Wells No. 5 and 6. The wells at the old station in the north part of town had been abandoned, and Wells No. 5 and 6 were abandoned in 1925, except that the west well was maintained for boiler water until 1931.

Well No. 1 was drilled to a depth of 2497 ft.

The well is cased with 16-in. pipe to a depth of 500 ft. and attached to it by a swedge nipple is 503 ft. 6in. of 14-in. pipe. Below this, the bore hole is 12 in. in diameter and not cased. The well was originally equipped with an air lift with 600 ft. of 3-in. air pipe. In 1919 the non-pumping water level was 260 ft., and the drawdown was 21 ft. while pumping at 834 gpm.

On Nov. 19, 1925 the non-pumping water level was 282 1/2 ft., and the drawdown was 39 ft. while pumping. In July 1926 during a test, **the**

production was 640 gpm.

The well is equipped with 390 ft. of 8-in. drop pipe and 19-stage Cook turbine pump, No. 1103. Power is furnished by a 100-hp. U. S. electric motor, No. 113148.

Analysis of a sample (Lab. No. 45785) collected July 26, 1921, showed this water to have a hardness of 15.3 gr. per gal., a mineral content of 1325 ppm., and an iron content of 0.2 ppm.

In 1927 Thorpe Brothers, Des Moines, Iowa, completed Well No. 2 for the city. It is located north of Fifth St. and east of Tremont St., about 450 ft. north of Well No. 1 (or approximately 200 ft. S. and 2350 ft. E. of the N. W. corner of Section 33).

The well was drilled to a depth of 2438 ft. below a ground surface elevation of 848t ft.

The hole and casing diameter record is shown in Table 1.

TABLE 1

Hole Record

27-in. from 0 to 250 ft.
25-in. from 250 to 439 ft.
19-in. from 439 to 1388 ft.
17-in. from 1388 to 1488 ft.
12-in. from 1488 to 2438 ft.

Casing Record

28-in. od. steel drive pipe from 0 to 41 ft.
20-in. od. wrought iron casing from 0 to 439 ft.
14-in. od. wrought iron casing from 439 to 1498 ft.

The well is equipped with: 320 ft. of 10-in. column pipe; 11-stage Cook deep well turbine rated at 900 gpm.; 150-hp. electric motor.

Well No. 2 was tested at a depth of 1480 ft. on May 12, 1927 before the 14-in. casing was installed. The non-pumping water level was 300 ft. below the top of the casing, and the drawdown was 1'50 ft. while pumping at 178 gpm. On July 21, 1927 the 14-in. casing had been installed, and a test was made. The non-pumping water level was 278 ft., and the water was drawn down 108 ft. after 6-hr. pumping at 968 gpm. On July 19, 1945 the non-pumping water level was 304.9.

Analysis of a sample (Lab. No. 108,625) collected on July 28, 1938 after 15-min. pumping, showed the water from Well No. 2 to have a hardness of 22.6 gr.per gal., a residue of 1700 ppm., and an iron content of 0.3 ppm.

Well No. 3 was drilled by Milaeger and Smyth, Chicago, in 1939. It is located on the west side of Madison Ave. near the old pumping station site (or approximately 1940 ft. N. and 1500 ft. E. of the S. W. corner of Section 28).

It was originally intended to obtain water from the St. Peter sandstone if an adequate supply could be produced therefrom. When the drilling had reached 1442 ft., the sandstone was "shot" with a total of 2000 lb. of dynamite; and on May 29, 193 9 a short production test was made by the State Water Survey. The well had been cased with 450 ft. of 16-in. pipe and with 12-in. pipe between depths of 450 and 1000 ft. The non-pumping water level was 272 ft. below the surface, and the water was drawn down 103 ft. while pumping at a rate of 125 gpm.

Due to the low capacity of the well, as indicated by the test, drilling was continued to a final

LABORATORY NO. 108,625

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.3		Silica	SiO_2	13.9	
Manganese	Mn	0.0		Fluoride	F	0.8	
Calcium	Ca	96.9	4.85	Chloride	Cl	640.0	18.05
Magnesium	Mg	35.5	2.92	Nitrate	NO_3	0.9	.01
Ammonium	NH_4	2.1	.12	Sulfate	SO_4	278.3	5.79
Sodium	Na	474.0	20.60	Alkalinity (as $CaCO_3$)		232.	4.64
Color		0		Hardness (as $CaCO_3$)		389.	7.78
Odor		0		Residue		1700.	
Turbidity		0		Temperature 70° F.			

depth of 2484 ft. below a ground surface elevation of 825± ft.

As completed, the well is cased with 16-in. pipe to a depth of 469 ft.; 12-in. pipe from 445 to 1014 ft.; and a 10-in. liner was set between depths of 133 7 and 1525 ft. and perforated betweendepths of 1355 and 1430 ft. to permit entrance of water from the sandstone.

A production test was made by the State Water Survey on Aug. 30-31, 1939. After pumping 24 hr. at 655 gpm., the drawdown was 92.2 ft. from a non-pumping water level of 273.8 ft. In May 1944 the non-pumping water level in Well No. 3 was 273 ft. The well is equipped with 400 ft. of 8-in. column pipe; 19-stage Cook deep-well turbine; 12 ft. of 8-in. suction pipe; 100-hp. electric motor.

Analysis of a sample (Lab. No. 86245) collected Aug. 30, 1939 after 9 1/2-hr. pumping at 675 gpm., showed the water from Well No. 3 to have a hardness of 20.0 gr. per gal., a residue of 1600 ppm., and an iron content of 0.4 ppm.

Pumpageis estimated to average 750,000 gpd.

Sample-study log of Well No. 3 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Silt and glacial till	10	10
Gravel, sandy	50	60
Glacial till	60	120
Pennsylvanian system		
Shale, some siltstone and coal	245	365
Devonian system		
Cedar Valley dolomite and limestone	40	405
Wapsipinicon limestone, some dolomite	60	465
Silurian system		
Niagaran-Alexandrian dolomites	345	810
Ordovician system		
Maquoketa shale, some dolomite	188	998
Galena-Platteville dolomites	357	1355
Glenwood formation		
Sandstone	75	1430
Shale and dolomite	10	1440
St. Peter formation		
Sandstone	60	1500
Shale, sandstone, chert, and dolomite	55	1555
Shakopee dolomite, some sandstone	145	1700
New Richmond sandstone, some dolomite and shale	65	1765
Oneota formation		
Dolomite	267	2032
Sandstone	18	2050
Cambrian system		
Trempealeau dolomite	208	2258
Franconia sandstone and dolomite, some shale	157	2415
Galesville sandstone	69	2484

The village of Kinderhook (336) installed a public water supply in 1940.

An electrical earth resistivity survey was made in Dec. 1939 by the State Geological Survey, in and south of Kinderhook.

A test well was drilled in 1939 and was located in the south part of the village (or approximately 500 ft. N. and 1400 ft. W. of the S. E. corner of Section 24, T. 4 S., R. 7 W.). The ground surface elevation at the site is 475± ft. The test well consisted of a 2-in. well point, 3 ft. long, set in the bottom of a 30-ft. auger hole. The non-pumping water level was about 25 ft. below the ground surface, and the well produced about 20 gpm.

The permanent well was drilled in 1940 to a depth of 40 ft. by E. W. Franke, Batchtown, and is located near the testhole (or approximately 450 ft. N. and 1400 ft. W. of the S. E. corner of Section 24). A 6-in. casing extends from 6 ft. above to 30 ft. below the ground surface, and a 10-ft. length of 6-in. Johnson Everdur screen is installed at the bottom of the well. The screen has No. 34 slot openings.

Pumping equipment, in place, consists of 30 ft. of 4-in. column pipe; 6-in., 3-stage American Well works turbine pump, No. 63477, about 1 1/2 ft. in overall length and rated at 75 gpm. against 190 ft. of head at 3450 rpm.; 10 ft. of 4-in. suction pipe; 7 1/2-hp. U. S. electric motor, No. 179564, operating at 3600 rpm. There is no air line.

Correlated driller's log of well drilled in 1940 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
No record	30	30
Sand	10	40

A production test was made by the driller on Mar. 22, 1940. The well was reported to have produced 125 gpm. with a drawdown of 5 ft. from a non-pumping water level of 21 ft. below the ground surface.

Analysis of a sample (Lab. No. 114,128), collected Apr. 8, 1948 after 1 1/2-hr. pumping showed the water to have a hardness of 17.4 gr. per gal., a residue of 380 ppm., and a trace of iron.

All water is chlorinated.

The pump is operated every other day for about 5 hr. Pumpage is estimated to average 11,500 gpd.

LABORATORY NO. 114,128

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	Tr.		Silica	SiO_2	24.9	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	81.2	4.06	Chloride	Cl	17.0	0.48
Magnesium	Mg	23.4	1.92	Nitrate	NO_3	33.1	0.53
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	65.4	1.36
Sodium	Na	15.4	0.67	Alkalinity	(as $CaCO_3$)	214.	4.28
Turbidity		0		Hardness	(as $CaCO_3$)	299.	5.98
Color		0		Residue		380.	
Odor		0					
Temperature		55.5° F.					

KINGSTON
DeKalb County
Oct. 19, 1947

A public water supply was installed by the village of Kingston (259) in 1911.

Water is obtained from a well drilled to a depth of 202 1/2 ft. and is located approximately 110 ft. N. and 1100 ft. E. of the S. W. corner of Section 22, T. 42 N., R. 4 E. The elevation of the ground surface is 825t ft.

The well is reported cased with 10-in. pipe at the top, below which the hole is 10 in. in diameter.

A previous attempt to drill a 10-in. well on the site about 10 ft. from the existing well ended in a crooked hole which was abandoned. In Sept. 1928 the distance to water in the crooked hole was 36 1/2 ft. below the top of casing or 35 ft. below the ground surface, after the pump in the existing well had been idle 1 hr. After pumping 1 1/2 hr. at a rate of about 30 gpm. the water was lowered about 20 ft. A weight was lowered to a depth of 68 ft. in the crooked hole.

The existing pump installation consists of 160 ft. of 5-in. drop pipe; American Well Works double-acting plunger pump, Shop No. J3147, having an 18-in. stroke and a theoretical displacement of 68.16 gpm. when operated at a speed of 30 gpm.; 10-hp. General Electric motor.

Analysis of a sample (Lab. No. 112,251) collected Oct. 19, 1947 after 18-min. pumping at 60 gpm. showed this water to have a hardness of 23.0 gr. per gal., a residue of 417 ppm., and an iron content of 0.4 ppm.

A new well was drilled in Sept., 1947 to a depth of 311 ft. by Morris Kennedy, DeKalb, and located about 10 ft. south and 15 ft. west of the old well. The ground surface elevation is the same as at the old well.

Correlated driller's log of well drilled in 1947 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay	22	22
Coarse gravel	5	27
Clay	6	33
Medium gravel	7	40
Clay	13	53
Water sand	7	60
Clay	19	79
Ordovician system		
Maquoketa formation		
Gray and fine rock	46	125
Galena formation		
Yellow, gray and white lime	160	285
White limestone, creviced	26	311

The well is reported to be cased with 8-in. pipe from the surface to a depth of 80 ft. where it was seated in 14 in. of limestone. Below the casing the hole diameter was 8 in. to the bottom.

When drilling was completed, the water level was 35 ft. below the surface. A bailer test was run at a rate of 27 gpm., and the plunger pump in the old well was operated at the same time. It is reported that under these conditions, there was no appreciable drawdown.

The wellhas been equipped with a Fairbanks-Morse jet pump, No. B D 50 V having 84 ft. of 2-in. discharge pipe and 1 1/2-in. jet pressure pipe; 5-hp. General Electric motor.

Pumpage is estimated to average 15,000 gpd.

LABORATORY NO. 112,251

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.4		Silica	SiO_2	24.4	
Manganese	Mn	Tr.		Fluoride	F	0.2	
Calcium	Ca	83.6	4.18	Chloride	Cl	10.0	0.28
Magnesium	Mg	45.0	3.70	Nitrate	NO_3	1.3	0.02
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	64.8	1.35
Sodium	Na	0.2	0.01	Alkalinity (as $CaCO_3$)		312.	6.24
Turbidity		20		Hardness (as $CaCO_3$)		394.	7.88
Color		Ch		Residue		417.	
Odor		0		Free CO_2 (calc.)		33.	
Temperature 50.5° F.				pH = 7.4			

KINSMAN
Grundy County
Dec. 13, 1947

The village of Kinsman (164) installed a public water supply in 1895.

The original supply was obtained from a well drilled to a depth of 710 ft. by Mr. Johnson, Seneca. It was cased with 8-in. pipe at the top and is reported to have penetrated sandstone. This well was in service until 1936 when a collapsed casing caused the well to fill. The well produced practically no water in 1936 and was abandoned.

A new well was then drilled to a depth of 700 ft. by J. Otis Heflin, Joliet, and located about 10 ft. north and 40 ft. east of the old well, on the west side of Sundown St. between Main and Emmet St. (or approximately 2240 ft. S. and 1150 ft. W. of the N. E. corner of Section 6, T. 31 N., R. 6 E.). The driller reported 143 ft. of drift formation below the surface followed by broken shale between depths of 143 and 335 ft. and broken limestone of unknown thickness above the sandstone. The well was cased with 8-in. pipe from the surface to 143 ft. and 6-in. pipe between depths of 137 and 335 ft. below which the hole was 6 in. in diameter to the bottom.

The existing pump installation, made in 1945, is: 250 ft. of 4-in. column pipe; 6-in., 12-stage Peerless turbine pump, No. 6586, having an overall length of 6 ft. and a rated capacity of 50 gpm. against 210 ft. of head; 30 ft. of 3-in. suction pipe; 7 1/2-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 112,586) collected Nov. 13, 1947 from a tap at the pressure tank showed the water to have a hardness of 15.8 gr. per gal., a residue of 854 ppm., and an iron content of 0.7 ppm.

The water is aerated. The average pumpage is approximately 5000 gpd.

LABORATORY NO. 112,586

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.7		Silica	SiO_2	20.1	
Manganese	Mn	0.1		Fluoride	F	0.6	
Calcium	Ca	55.3	2.77	Chloride	Cl	184.0	5.19
Magnesium	Mg	32.1	2.64	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	0.9	0.05	Sulfate	SO_4	161.7	3.36
Sodium	Na	214.6	9.33	Alkalinity (as $CaCO_3$)		312.	6.24
Turbidity		10-		Hardness (as $CaCO_3$)		271.	5.41
Color		0		Residue		854.	
Odor (at well)		H_2S		Temperature 53° F.			

A public water supply system was installed by the village of Kirkland (570) in 1928.

Water is obtained from a well owned and operated by the Chicago, Milwaukee, St. Paul and Pacific Railroad Co. The well is located 35 ft. south of the center line of the main track and about 140 ft. west of Fourth St. (approximately 650 ft. S. and 1850 ft. W. of the N. E. corner of Section 26, T. 42 N., R. 3 E.). The elevation of the ground surface is 775± ft.

This well was reported drilled to a depth of 737 ft. in 1896 and cased with 7-in. pipe to a depth of 88 ft.

A non-pumping water level of 6 ft. below the ground surface was reported in 1934 and a drawdown of 14 ft. when pumping at a rate of 200 gpm.

The existing pump installation was made about Mar. 1, 1946: 20 ft. of column pipe; 6-in. Deming-Mueller turbine pump, No. T. 6687, having a rated capacity of 200 gpm. against 160 ft. of head; 15-hp. U. S. electric motor. The distance to water was 6 ft. below the pump base when the pump was installed.

Analysis of a sample (Lab. No. 112,033) collected Sept. 24, 1947 from a tap on the pump discharge after 1-hr. pumping at 215 gpm., showed this water to have a hardness of 21.7 gr. per gal., a residue of 381 ppm., and an iron content of 0.6 ppm.

From July 1 to Sept. 1, 1947, the average metered pumpage was 102,480 gpd. During this period the average village consumption was 20,000 gpd.

Oil Test Well. No. 1 was drilled in 1934 for Barton et al - J. McQueen and located 1/2 mile west of Kirkland (approximately 1120 ft. S. and 1120 ft. W. of the N. E. corner of Section 27). The ground elevation is 770t ft.

Sample-study log of Oil Test Well No. 1 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
No record	55	55
Ordovician system		
Galena-Platteville dolomites	265	320
Glenwood dolomite, sandstone and shale	45	365
St. Peter formation		
Sandstone	185	550
Conglomerate of sandstone, chert and shale	55	605
Cambrian system		
Trempealeau dolomite	115	720
Franconia sandstone, some shale and dolomite	105	825
Galesville sandstone, containing thin dolomite beds	150	975
Eau Claire sandstone, some shale and dolomite	406	1381
Cambrian and Pre-Cambrian systems		
Mt. Simon and Fond du Lac sandstones, thin shale beds	1584	2965

LABORATORY NO. 112,033

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.6		Silica	SiO_2	21.3	
Manganese	Mn	0.0		Fluoride	F	0.2	
Calcium	Ca	84.3	4.22	Chloride	Cl	3.0	0.08
Magnesium	Mg	39.0	3.21	Nitrate	NO_3	1.8	0.03
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	13.4	0.28
Sodium	Na	1.6	0.07	Alkalinity (as $CaCO_3$)		356.	7.12
Turbidity		10-		Hardness (as $CaCO_3$)		372.	7.43
Color		5		Residue		381.	
Odor		0		Free CO_2 (calc.)		74.	
Temperature 51.1° F.				pH = 7.1			

KIRKWOOD
Warren County
Nov. 5, 1946

A public water supply was installed for the village of Kirkwood (746) in 1894.

At that time a well was drilled to a depth of 216 ft. at a point about 1 block from the business center. Rock was encountered at 75 ft., and a 6-in. casing was set on the rock. The well produced an insufficient amount of water and it was necessary to drill another well in 1907 in the western part of the village. It was located approximately 300 ft. N. and 3300 ft.E. of the S. W. corner of Section 8, T. 10 N., R. 3 W.

The new well, later known as No. 1, was 127 ft. deep, and was cased to gravel with 6-in. pipe, but no information is available as to the size of the screen. At the time of installation, the well produced 30 to 54 gpm.

Analysis of a sample (Lab. No. 37606), collected July 17, 1917, showed this water to have a hardness of 24.5 gr. per gal., a mineral content of 531 ppm., and an iron content of 1.4 ppm.

In May 1921 itwas reported that not more than 50 ft. of water could be maintained in the sandpipe. The water was pumped about 5 hr. a day, and the pumping level was reported to be near the bottom of the well. Well No. 1 has been abandoned.

Some time between 1921 and 1931, Well No. 2 was drilled to a depth of 140 - 145 ft. and located at the extreme north end of the principal north and south street. It was equipped with a plunger pump. The well has been abandoned.

Well No. 3 was drilled in 1931 by E. W. Johnson, Bloomington, at a location 100 ft. S. and 3800 ft. E. of the N. W. corner of Section 17). It is 145 ft. deep with 8-in. casing to rock.

Correlated driller's log of Well No. 3 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and clay	35	35
Clay, sand and gravel	80	115
Mississippian system		
Limestone	20	135

Water was pumped at a rate of 50 gpm. for 24 hr. with a drawdown of 50 ft. from a non-pumping level of 30 ft. In 1944 the following pump equipment was installed and is now in service: Red Jacket centri-jet pump, Serial No. W 257, with the, jet placed at 120 ft.; 5-hp., 3450 rpm. General Electric motor.

Analysis of a sample (Lab. No. 108,091), collected Oct. 25, 1946 after 15-min. pumping, showed this water to have a hardness of 25.3 gr.per gal., a residue of 503 ppm., and an iron content of 1.7 ppm.

Pumpageis estimated at 12,000 to 15,000 gpd.

A treatment plant is under construction.

LABORATORY NO. 108,091

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.7		Silica	SiO_2	20.1	
Manganese	Mn	0.1		Fluoride	F	0.2	
Calcium	Ca	99.9	5.0	Chloride	Cl	Tr.	Tr.
Magnesium	Mg	44.7	3.67	Nitrate	NO_3	0.5	.01
Ammonium	NH_4	1.0	.06	Sulfate	SO_4	21.6	.45
Sodium	Na	26.9	1.17	Alkalinity	(as $CaCO_3$)	472.	9.44
Color		0		Hardness	(as $CaCO_3$)	434.	8.68
Odor		0		Residue		503.	
Turbidity		20					
Temperature 54° F.							

KNOXVILLE
Knox County
Mar. 31, 1947

A public water supply was installed by the city of Knoxville (2241) in 1896.

Water was obtained from a well drilled by S. Swanson, Minneapolis, Minn., on a city-owned lot at the southwest corner of Ann and Line St. (or approximately 2500 ft. N. and 2600 ft. E. of the S. W. corner of Section 28, T. 11 N., R. 2 E.). The elevation of the pump house floor is 777.8 ft.

The well was drilled originally to a depth of 1350 ft. and was cased to 1056 ft., with 468 ft. of 8-in. wi. pipe and 588 ft. of 6-in. pipe. In 1935, C. W. Varner, Dubuque, Iowa, removed the 6-in. casing and deepened the well to 1375 ft. A 40-lb. shot was set off in the St. Peter sandstone at 1340 ft. and a 60-lb. shot was set off at 1280 ft. After cleaning the well, a 6-in. wi. casing weighing 19 lb. per ft. was placed with the top 3 ft. above floor level, and the bottom at 1056 ft. below floor level. The 8-in. casing was not removed, and no cement grout was used. Water was pumped by air lift, using the 6-in. casing as the eductor pipe.

The water levels are given in Table 1.

On Feb. 8, 1944 the water level was reported to drop 6 ft. after pumping 35 min. in Well No. 2; and, 5 min. after the pump in No. 2 was shut down, a recovery of 3 ft. in the water level of No. 1 was reported.

The air lift and compressor were removed from Well No. 1 (East well) in Nov. 1946. The pump assembly consists of 288 ft. of 4-in. column pipe; 4-in., 20-stage Peerless turbine pump, No. 33234, rated at 1259 gpm.; overall length of pump, 12 ft.; 288 ft. of air line; 20 ft. of 4-in. suction pipe; 15-hp., 1800-rpm. U. S. electric motor.

This pump is kept for emergency use and is operated 2 or 3 times weekly to keep in operating condition.

Analysis of a sample (Lab. No. 45,204), collected May 14, 1921, showed the water to have a hardness of 16.5 gr. per gal., a residue of 1114 ppm., and an iron content of 0.4 ppm.

In 1934 C. W. Varner drilled Well No. 2 to a depth of 2495 ft. and located 89 ft. west of Well No. 1.

The elevation of the pump base is 777.8 ft. The hole, casing, and liner diameter record is shown in Table 2.

TABLE 2

Hole Record

15-in.	from	0 to	480 ft.
10-in.	from	480 to	900 ft.
8-in.	from	900 to	1485 ft.
6-in.	from	1485 to	2495 ft.

Casing Record

16-in.	from	0 to	90 ft.
10-in.	from	0 to	480 ft.
8-in.	from	459 to	900 ft.
6 1/4-in. liner	from	1383 to	1485 ft.

The pumping installation consists of 300 ft. of 6-in. column pipe; 10-in., 8-stage Cook deep-well turbine pump, Serial No. 1482, rated at 200 gpm. against 300 ft. of head; the overall length of the pump is 8 ft.; 300 ft. of air pipe; 30 ft. of 6-in. suction pipe; 30-hp. 1760 rpm. electric motor. The original pump was repaired by A. D. Cook in 1943, and some sections of the column pipe were replaced.

A production test was made by the State Water Survey when the drilling reached 1376 ft. Before the test, the water level was 224 ft. below the ground surface; and when pumping at 92 gpm., the drawdown was 76 ft. After the well was completed, the non-pumping water level was 214 ft., and the drawdown was 16 1/2 ft. while pumping at 232 gpm., and a drawdown of 24 ft. while pumping at 300 gpm. On Feb. 8, 1944 the non-pumping water level was 25 7 1/2 ft. After pumping 30 min. at 240 gpm., the drawdown was 18 1/2 ft. or about 25 ft. above the top of the pump. Fifteen min. after the pump was shut down, the water level raised 16 1/2 ft.

Well No. 2 furnishes most of the public supply.

Analysis of a sample (Lab. No. 109,760), collected Mar. 31, 1947 after 15-min. pumping, showed the water in Well No. 2 to have a hardness of 12.7 gr. per gal., a residue of 1101 ppm., and an iron content of 0.7 ppm.

Pumpage is estimated at 65,000 gpd.

TABLE 1

Water Levels

Year	Non-Pumping ft.	Pumping gpm.	Pumping Period	Drawdown ft.
1896	140	150	32 hr.	70±
Nov. 1920	187			48±
Sept. 1934	200	160		100±
1935	deepened to 1375 ft.			
1935	202	237.8		

Sample-study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Glacial till	20	20
Pennsylvanian system		
Shale, some sandstone, limestone and coal	240	260
Mississippian system		
Kinderhook shale	200	460
Devonian system		
Cedar Valley shaly limestone	70	530
Wapsipinicon limestone	20	550
Silurian system		
Niagaran - Alexandrian series		
Dolomite, shale at base	15	565
Dolomite	115	680
Dolomite and shale	25	705
Ordovician system		
Maquoketa shale and dolomite	180	885
Galena - Platteville dolomites	315	1200
Glenwood formation		
Sandstone and dolomite	20	1220
Sandstone	80	1300
Shale and dolomite	5	1305
St. Peter formation		
Sandstone	85	1390
Sandstone, shale, and chert fragments	10	1400
Shakopee dolomite, thin beds of sandstone and shale	225	1625
New Richmond dolomite and sandstone, thin shales	75	1700
Oneota dolomite	240	1940
Cambrian system		
Trempealeau dolomite	290	2230
Franconia sandstone and dolomite, some shale	170	2400
Galesville sandstone, part dolomitic	95	2495

LABORATORY NO. 109,760

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.7		Silica	SiO_2	14.1	
Manganese	Mn	0.0		Fluoride	F	2.6	
Calcium	Ca	49.0	2.45	Chloride	Cl	190.0	5.36
Magnesium	Mg	23.0	1.89	Nitrate	NO_3	0.9	.01
Ammonium	NH_4	1.2	.07	Sulfate	SO_4	375.4	7.81
Sodium	Na	306.6	13.33	Alkalinity	(as $CaCO_3$)	228.	4.56
Color		0		Hardness	(as $CaCO_3$)	217.	4.34
Odor		0		Residue		1101.	
Turbidity		Tr.					
Temperature		68.5° F.					

LACON
Marshall County
Jan. 15, 1947

The water works for the city of Lacon (1627) was installed in 1893.

At that time the city purchased the site of an old well, dug about 1854, and located about 200 ft. from the river during normal stage (or approximately 1000 ft. N. and 300 ft. W. of the S. E. corner of Section 26, T. 30 N., R. 3 W.). The well was 8 ft. in diameter and 40 ft. in depth and had been used as a source of water by an old sugar mill and distillery. When the water works system was installed, a tubular well was drilled through the bottom of the dug well to an additional depth of 20 ft., and another tubular well was drilled 6 ft. distant. Both wells are inside the pumping station, the floor of which is about 12 ft. below the surrounding ground surface which is 463t ft. Both wells have 8-in. casings and are 60 ft. deep. The material penetrated is coarse sand and gravel.

One well is equipped with a 2-stage American Well Works centrifugal pump with 2 1/2-in. discharge pipe and with a 4-in. suction pipe extending in the casing to a depth of 30 ft. The pump was designed to deliver 250 gpm. against 72 lb. discharge pressure and 15-ft. suction lift. The other well is equipped with an American-Marsh centrifugal pump rated at 400 gpm. against a head of 125 ft. It is powered by a 20-hp. Continental electric motor.

The pumps are provided with an automatic switch to start pumping when the water pressure falls to 60 lb. and to stop pumping at a pressure of 65 lb. Each pump, with its motor, is set on a concrete pier built about 3 ft. above floor level to avoid flood water.

In Jan. 1923 a production test was made by the State Water Survey. The non-pumping water level, in the north well, was 10.6 ft. from the top of the casing, and the water was drawn down 2.4 ft. after pumping 5 min.\ at 211 gpm. with 1 pump drawing water from both wells. About 3 min. after pumping was stopped, the water level returned to 10.6 ft., and 45 min. later the water level was still at 10.6 ft.

In 1931 a new well was drilled by Mike Ebert, Washington, and located about 12 ft. south of the old wells with the base of the pump at elevation 463± ft., which is the ground surface elevation. The well is 10 in. in diameter and 39 ft. in depth with a Cook screen, 12 ft. in length, at the bottom.

The well is equipped with: 20 ft. of 6-in. column pipe; 7 5/8-in., 12-stage Worthington turbine pump, No. 290143, rated at 500 gpm. against a head of 180 ft.; the overall length of the pump is 10 ft. 5 1/2 in.; no suction pipe is attached; 40-hp. General Electric motor.

Analysis of a sample (Lab. No. 108,928), collected Jan. 15, 1947 from the well drilled in 1931, showed the water to have a hardness of 21.4 gr. per gal., a mineral content of 437.4 ppm., and an iron content of 0.1 ppm.

Pumpage is estimated to average 200,000 gpd.

LABORATORY NO. 108,928

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	24.4	
Manganese	Mn.	0.0		Fluoride	F	0.2	
Calcium	Ca	86.7	4.34	Chloride	Cl	21.0	0.59
Magnesium	Mg	36.4	2.99	Nitrate	NO_3	24.8	0.40
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	51.4	1.07
Sodium	Na	15.0	0.65	Alkalinity	(as $CaCO_3$)	296.	5.92
Color		0		Hardness	(as $CaCO_3$)	367.	7.34
Odor		0		Residue		457.	
Turbidity		0					
Temperature		55.7° F.					

A public water supply was installed by the village of Ladd (1156) in 1893.

Water was pumped from the shaft of a coal mine.

In 1907, a well was drilled in the northeastern part of town, about 200 ft. north of the intersection of Chicago Ave. and Walnut St. (approximately 2100 ft. N. and 1050 ft. W.of the S. E. corner of Section 9, T. 16 N., R. 11 E.).

The well was 187 ft. deep and cased with 6-in. pipe, the top of which extended 4 ft. above the ground surface elevation of 660t ft. When the well was constructed; the top 22 ft. was dug to a dimension of 9 by 12 ft., and from 22 to 42 ft. depth the dug portion was 6ft. square. The dug portion was lined with wood curbing and used as a reservoir. Water was pumped by air lift.

Non-pumping water level in 1913 was reported to be 40 ft. below the surface.

In 1919, the well became clogged and water was again purchased from the Illinois Third Vein Coal Co.

The mine was 468 ft. deep, penetrating quicksand and gravel at a depth of 180 ft. The pump shaft extended to a depth of 280 ft. In pumping at a rate of 300 gpm.,the drawdown was reported to be 100 ft.

Within 6 months, a water main leading from the mine well was broken, due to settlement of a waste pile which was over the water main, and a new well was drilled for the village by A. B. Bell and Son, St. Charles, in 1919. This well was 300 ft. deep and located close to the well drilled in 1907. Very little production was obtained.

In 1920 the old dug well was cleaned out for use by the village. The water level was 32 ft. below the top of the curb, and the inflow rate was calculated to be 16 gpm.

Analysis of a sample (Lab. No. 39454) collected in July 1918 from well tap showed this water to have a hardness of 19.8 gr. per gal., a mineral content of 471.1 ppm.,and an iron content of 1.3 ppm.

In 1922, the village water supply was discontinued from all these sources. A new well was drilled in 1922 by J. P. Miller Artesian Well Co., Brookfield, and located in the southeastern part of the village about 200 ft. south of Cleveland St. on a line with Hennepin St. (or approximately 300 ft. S. and 1400 ft. E. of the N. W. corner of Section 15). It was drilled to a depth of 1665 ft. 8 in. below a ground surface elevation of 650t ft.

Sample-study log of well drilled in 1922 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Silt and till, soil at bottom	30	30
Till	134	164
Pennsylvanian system		
"Shale, limestone and thin coal beds"	315	479
Silurian system		
Niagaran-Alexandrian series		
"Limestone"	486	965
Ordovician system		
Maquoketa formation		
"Broken shale"	200	1165
Galena-Platteville formations		
"Limestone"	365	1530
St. Peter formation		
"Sandstone"	136	1666

The hole and casing record is shown in Table 1.

TABLE 1

Hole Record

8-in. from surface to 960 ft.
6-in. from 960 to 1665 2/3 ft.

Casing Record

12-in. from surface to 165 ft.
10-in. from 158 1/2 to 524 ft.
8-in. from 498 to 840 ft.
6-in. liner from 960 to 1200 ft.

The joints between the 12 and 10-in. casings and between the 10 and 8-in. casings were sealed with lead.

On May 2, 1922, a production test was made by the driller. The non-pumping water level was 26 ft. below the pump base, and after 11-hr. pumping at 183 gpm., the drawdown was 62 ft.

The non-pumping water level was 38 ft. below the pump base and when pumping at 62 gpm., the

dravdown was 63 ft. When pumping at a rate of 72 gpm., the back pressure was 68 psi. and the water was drawn down below the air line.

In Dec. 1940 the pumping equipment was altered and now consists of 240 ft. of 5-in. column pipe; 8-in., 13-stage Aurora turbine pump, No. 10673, rated at 200 gpm. against 300 ft. of head at 1750 rpm.; the length of the pump is 7 1/2 ft.; 267 1/2 ft. of 1/4-in. galvanized air line; 30 ft. of 5-in. suction pipe; 20-hp. General Electric motor.

On Jan. 9, 1940, a production test was made by the State Water Survey. The non-pumping water level was 30 1/2 ft. below the pump base. After pumping 2 1/2 hr. at 165 gpm., the drawdown was. 128 ft., and the back pressure 82 psi. Considerable solid material had been pumped from the well between Nov. 1939 and Jan. 1940, which had an apparently beneficial effect.

On Aug. 15, 1947, the non-pumping water level was 32 ft. below the pump base, and after pumping 5 1/2 hr. at an estimated rate of 200 gpm. the drawdown was 85 ft.

Analysis of a sample (Lab. No. 111,559) collected Aug. 15, 1947, after 5 1/2-hr. pumping, showed the water from this well to have a hardness of 18.1 gr. per gal., a residue of 375 ppm., and an iron content of 1.9 ppm. Methane gas has been found in the water from this well. The general character of the water indicates it to be almost entirely of drift origin.

The water is not treated.

Well No. 1 was rehabilitated in Sept. 1949, by C. W. Varner, Dubuque, Iowa. The work was reported to consist of removing the old 10-in. casing and replacing it with 8-in. casing from the surface to the top of the old 8-in. casing at about 498 ft.; "shooting" the well at 1600 ft. with 300 lb. of blasting gelatin; deepening the well to 1859.5 ft. The 6-in. liner was left in the hole. It was reported that the old 10-in. casing was badly pitted and the metal eaten away by corrosion near the bottom of the casing. Before rehabilitation, the non-pumping water level was reported to be 38 to 42 below the ground surface. After the new casing was installed, the water level was 126 ft. and after "shooting" and cleaning the well the water level was 98 ft. In a production test on Oct. 10, 1949, after 3 1/2 hr. pumping at 205 gpm. the drawdown was 127 ft., and after an additional 1/2-hr. pumping at 235 gpm. the drawdown was 148 ft.

Analysis of a sample (Lab. No. 119570), collected Oct. 10, 1949, after 3 1/2 hr. pumping showed this water to have a hardness of 18.2 gr. per gal., a total mineral content of 507 ppm. and an iron content of 9.3 ppm. The temperature of the water was 63° F.

In Sept. 1948, a 6-in. test well was drilled to a depth of 155 ft. by Neely and Schimmelphenig, Batavia, and located 20 ft. south of Well No. 1. Sharp, coarse sand was reported to be found between depths of 135 and 155 ft. A 5-in. screen having No. 60 slot openings was set between depths of 150 and 155 ft. The driller reported that, in a production test, when pumping at 32 gpm. the drawdown was 70 ft. from a static water level of 35 ft. below the top of the 6-in. casing.

Well No. 2 was then drilled to a depth of 163 ft. in Dec. 1948, and located about 50 ft. west of the 6-in. test well. Well No. 2 was cased with 137 ft. of 10-in. pipe and 26 ft. of 8-in. Johnson Everdur screen, having slot openings of No. 60, 80, and 60, but the length of each size slot opening was not reported. The top 4 ft. of the 8-in. screen was fitted with 8-in." blank pipe with a swedge nipple on the top end.

A production test was made by the State Water Survey on Dec. 22 and 23, 1948, using a test pump and including 90 ft. of 4-in. column pipe Before the test and when the pump in Well No. 1 had been shut down for 12 hr. the water level in Well No. 2 was 34.3 ft. below the top of the casing. After 2 hr. pumping at 76 gpm. the drawdown was 3.7 ft. The pump in Well No. 1 was then started and after 1-hr. pumping in Well No. 2 at 76 gpm. the drawdown was 5.2 ft. For the next 2-hr. pumping in Well No. '2 at 154 gpm. (No. 1 still operating) the drawdown was 9.4 ft. For the next 4 1/2 hr. with pumping in both wells, No. 2 at 450 gpm., the drawdown in Well No. 2 was 28.0 ft. Well No. 1 pump was then stopped and for the next 11 hr. pumping in Well No. 2 was maintained at 444 gpm. The final drawdown, after a total of 24-hr. pumping, was 30.4'ft. Thirty min. after stopping the No. 2 pump and with No. 1 pump still shut down, the water level was 43.8 ft. or 9.5 ft. below the level before the test was started.

The pumping equipment, now installed in the well, consists of 90 ft. of 6-in. column pipe; 8-in. 7-stage Aurora Pump Co. water lubricated turbine pump, No. 42912, rated at 450 gpm. against 95 ft. of head at 1750 rpm.; 90 ft. of air line; 4-in. suction strainer; 20 ft., 1750 rpm. electric motor. The pump is designed for 300 gpm. against 170 ft. of head.

Analysis of a sample (Lab. No. 120,221) collected Dec. 12, 1949, showed this water to have a hardness of 18.0 gr. per gal., a residue of 357 ppm., and an iron content of 2.7 ppm.

In 1947, the pumpage was estimated to average 150,000 gpd.

LABORATORY NO. 111,559

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.9		Silica	SiO_2	22.4	
Manganese	Mn	0.0		Fluoride	F	0.4	
Calcium	Ca	68.8	3.44	Chloride	Cl	10.0	0.28
Magnesium	Mg	33.3	2.74	Nitrate	NO_3	5.1	0.08
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	3.3	0.07
Sodium	Na	27.9	0.88	Alkalinity	(as $CaCO_3$)	332.	6.64
Color		10.		Hardness	(as $CaCO_3$)	309.	6.18
Odor		0.		Residue		375.	
Turbidity		10.		Temperature 53° F.			

LABORATORY NO. 120,221

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.7		Silica	SiO_2	29.5	
Manganese	Mn	0.0		Fluoride	F	0.4	
Calcium	Ca	73.9	3.70	Chloride	Cl	4.0	0.11
Magnesium	Mg	30.1	2.48	Nitrate	NO_3	5.7	0.09
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	1.2	0.03
Sodium	Na	12.2	0.53	Alkalinity	(as $CaCO_3$)	324.	6.48
Turbidity		4		Hardness	(as $CaCO_3$)	309.	6.18
Color		0		Residue		357.	
Odor		0					

Water works have been installed in La Grange (10,479) since 1889. The first plant was built by a private company, and, after several transfers of ownership, the village purchased the water works from the Public Service Co. of Northern Illinois on Oct. 6, 1938.

The group of 3 wells, located on the village property lying north of Elm St. between Brainard and Stone *Ave.,* constituted the source of the public water supply until 1928 when a fourth well was completed at a site at the northeast corner of Cossitt and Tilden St.

Well No. 1 is located at the southwest corner of the treating plant about 140 ft. east of the center of Brainard Ave. and north of Elm St. (or approximately 2175 ft. N. and 140 ft. E. of the S. W. corner of Section 4, T. 38 N., R. 12 E.).

The well is reported to have been drilled originally in 1889 to a depth of 1962 ft. It was rehabilitated by F. M. Gray, Jr., Chicago, in 1926, and the hole and pipe diameter record (Table 1) was reported by the driller after rehabilitation of the well.

TABLE 1

Hole Record

15-in.	from	surface	to	300 ft.
13-in.	from	300	to	500 ft.
12-in.	from	500	to	1000 ft.
8 5/8-in.	from	1000	to	1430 ft.
7-in.	from	1430	to	2005 ft.

Liner Record

10-in. wrought iron	from	300	to	500 ft.
10-in. wrought iron	from	895	to	1000 ft.
6-in. wrought iron	from	1151	to	1359 ft.

A light reflected into the well on May 22, 1944 after the pump was pulled showed about 10 ft. of casing below the pump base.

Subsequent to 1926 the following obstructions have been reported found in the well but not removed: plugged at a depth of 1225 ft. in 1928; obstruction at a depth of 1135 ft. in 1933; and obstruction at a depth of 1109 ft. in 1935.

On May 22, 1944, after the well had been idle one week and the pump in Well No. 3 was in operation, the water level was 175 1/2 ft. On June 3, 1944, the J. P. Miller Artesian Well Co., Brookfield, reported the well bridged at a depth of 1160 ft. After the pumping equipment was reinstalled on June 27, 1944, water was pumped for a period of 9 days, at a rate of 650 gpm. After 6 days, the drawdown was 47 1/2 ft.; and after 9 days, the drawdown was 59 ft. No other pump was in operation. The water level readings are shown in Table 2.

In 1942 a sample collected from this well was reported to have a temperature of 51.8° F. The hardness was found to be 55 gr. per gal. A sample (Lab. No. 106,486) collected May 14, 1946, was found to have a hardness of 49.5 gr. per gal., a total mineral content of 955 ppm., and an iron content of 1.8 ppm. The temperature and general character of this sample is typical for water from the Silurian dolomite in this vicinity.

After Well No. 1 was rehabilitated by S. B. Geiger Co., Chicago, in July 1947, the hole and casing record is shown in Table 3.

TABLE 3

Hole Record

15 1/4-in.	from	0	to	349 ft.
12-in.	from	500	to	862 ft.
10-in.	from	1014	to	1085 ft.
6-in.	from	1085	to	1225 ft.

Liner Record

16-in. od. short section at top
12-in. id. liner from 349 to 500 ft.
10-in. id. liner from 862 to 1014 ft.

After the rehabilitation work, the pump base was raised 4 1/2 ft. and the elevation of the pump base is now 647.33 ft.

The pumping equipment, installed Aug. 2, 1947, consists of 300 ft. of 10-in. column pipe; 12-in., 7-stage American Well Works turbine pump, No. 71337, rated at 1000 gpm. against 325 ft. of head; an overall length of the pump is 7 1/2 ft.; 300 ft. of air line; 29 ft. 3 in. of 10-in. suction pipe; 125-hp. General Electric motor.

On Aug. 11, 1947 the static level was **reported** to be 180 ft. below the pump base and after 7-hr. pumping at 1200 gpm., the drawdown was 22 ft. On Aug. 18, 1947 the non-pumping level was 242 ft. and after 6-da. pumping at 1000 gpm., the pumping level was 277 ft.

The well was not in service in **Aug. 1948.**

Well No. 2 is located about 40 ft. south and 10 ft. east of Well No. 1. This well was drilled by the J. P. Miller Artesian Well Co. in 1890 to a reported depth of 2014 ft. The elevation of the top of the pump base is 642.44 ft. The ground surface elevation is 648± ft.

The well was abandoned a number of years ago, and the airlift pump was removed. In 1944, the well top was uncovered for water level observations. The water level lowered 30 ft. to elevation 462 ft. after the pump in Well No. 3 (150 ft. southwest) had been operating 21 1/2 hr. at 500 gpm. Well No. 1 was idle at the time. A rise of 14.2 ft. in 1 min. was noted after the pump in No. 3 was shut down, and a drop of 7 1/2 ft. 1 min. later after the pump in No. 1 was started.

On July 3, 1944, after the pump in No. 1 had been operated for 9 days at 650 gpm., and the pump in No. 3 had been idle for the same period, the following water level elevations were reported.

Water Level Elevations

Well No. 1	Well No. 2	Well No. 3
408.0	452.0	479.0

Well No. 3 is located about 150 ft. southwest of Well No. 1 and about 50 ft. east of the center of Brainard Ave. The elevation of the top of the pump base is 645.95 ft. It was reported to have been drilled in 1908 to a depth of 1956 ft. with 20 ft. of 16-in. surface pipe. The well was cleaned in 1931 to'a depth of 1917 ft., and a 6-in. wrought iron liner was installed between the depths of 903 and 1174 ft.

The following hole diameters were reported: 16 in. from the surface to 297 1/2 ft.; 10 in. from 297 1/2 to 1026 ft.; 8 in. from 1026 to 1497 ft.; and 6 in. from 1497 to 1917 ft.

In 1936 an obstruction was reported at a depth of 1760 ft. but was not removed. On Mar. 23, 1945 the pump was removed, and the following measurements made: distance to water below the pump base was 154 ft. when the pump in Well No. 1 was operating. A bridge was found in the hole at a depth of 427 ft. which was not removed.

The following pump installation was made at that time: 268 ft. of 8-in. column lipe (20 ft. new); a new 8-in., 13-stage American Well Works turbine pump having an overall length of 12 ft.; 10 ft. of 8-in. suction pipe; 2-ft. tapered strainer; 290 ft. of air line; 100-hp. General Electric motor.

On Apr. 9, 1946 when Well No. 1 was idle, after 25-min. pumping at 700 gpm. in Well No. 3, the drawdown was 138 ft. from a water level of 135 ft. below the pump base. No additional drawdown occurred after 8-hr. 40-min. pumping at the same rate.

Old records show water levels in ft. below pump base as follows.

Water Levels

Year	Non-Pumping ft.	Pumping ft.	Pumping Rate gpm.
1909	53		
1924	112	186	966
1926	123	233	945

Analysis of a sample (Lab. No. 106,408) collected May 6, 1946 from the end of the cooling coil after pumping 8 1/2-hr.at 740 gpm., showed this water to have a hardness of 50 gr. per gal., a residue of 1038 ppm., and an iron content of 2.0 ppm. This quality is similar to that obtained from Well No. 1.

Well No. 4, located approximately 2700 ft. S. and 1200 ft. W. of the N. E. corner of Section 4, was drilled by W. H. Cater, Chicago, in 1928. The elevation at the top of the casing is 631 1/2 ft. The elevation of the ground surface is 629 1/4 ft.

The driller's record (Table 4) gives the hole, casing, and liner diameters:

TABLE 4

Hole Record

19 1/4-in. from surface to 507 ft. 9 in.
15 1/4-in. from 507 ft. 9 in. to 1269 ft. 11 in.
12 1/4-in. from 1269 ft. 11 in. to 1417 ft. 11 in.
10-in. from 1417 ft. 11 in. to 2008 ft.

Casing and Liner Record

20-in. from surface to 23 ft.
18-in. liner from 378 ft. 7 in. to 507 ft. 9 in.
12 1/2-in. liner from 1102 ft. 9 in. to 1269 ft. 11 in.

The well was rehabilitated in 1945 by cleaning

out to a depth of 2005 ft. and by installing a 10-in. liner between depths of 1095 and 1320 ft. and 41 ft. of 18-in. liner with bottom set about 410 ft. below the surface. See log on fourth page.

The permanent pump, installed in 1930, had a rated capacity of 700 gpm. A pumping water level of 405 ft. below the pump base was reported. A water sample (Lab. No. 68994), submitted in 1931, indicated that the water was obtained from both the top dolomite and the lower. sandstones in the well.

In 1932, the pump was overhauled. The well was found to be bridged at a depth of 1106 ft. The bridge was broken, and the total depth of the well was then found to be 1971 ft. After re-installation, the pump yielded 700 gpm. with a 432-ft. pumping water level.

On May 16, 1938, a non-pumping water level of 56 ft. and a pumping level of 439 ft. were reported, but the rate of production was not known. In Aug. 1944 a water temperature of 5.1.9° F. to 52.2° F. was reported at the plant. When the pump was subsequently removed, the well was found to be filled to 1092 ft.

The following pumping equipment was reinstalled: 400 ft. of 8-in. column pipe; 16-in., 17-stage Aurora turbine pump, 16.1 ft. long; 25 ft. of 10-in. suction pipe; 400 ft. of airline; 200-hp. Westing house electric motor.

A production test was run with this equipment on Nov. 12, 13, and 14, 1945. After 24-hr. pumping at 260 gpm., the drawdown was 324 ft. from a water level of 55 ft. below the pump base. A sample of water was collected after 21 hr. of pumping. During the production test run on Nov. 14, 1945, the drawdown was 338 ft. from a water level of 55 ft. when pumping at 320 gpm.

During the 3-day period, the temperature of the water increased from 54.7° F. to 58.8° F. The iron content decreased from 18.8 ppm. to 6.0 ppm., and the hardness from 1099 ppm. to 853 ppm. The data indicated that the water of high hardness which had accumulated in the lower formation during the long idle period prior to the test had not been completely removed.

A water treatment plant was constructed by the village in 1938. The treatment consisted of softening, iron removal, and chlorination.

A sample of treated water was collected from a tap in the treating plant on May 6, 1946 at 2:45 p.m. The pH was 9.1, the hardness was 5.1 gr. per gal., and the temperature was 56.3 F-. The chlorine residual was 0.1 ppm., and the raw water was collected from Well No. 3.

Well No. 5 was drilled in July 1947 to a depth of 358 ft. by the J. P. Miller Artesian Well Co., and located south of the Chicago, Burlington and Quincy R. R., east of Gilbert St. and north of CossittSt. (or approximately 2580 ft. N. and 2740 ft. E. of the S. W. corner of Section 5).

The well was cased with 22-in. id. pipe from the surface to 38 ft. and with 20-in. od. pipe from the surface to 58 ft. 4 in. The latter casing was cemented in. The hole diameter at the bottom is 19 in.

On July 22, 1947, the static water level was 48 ft. A 12-hr. production test was made by the driller on July 22, 1947 and a second 12-hr. test was made on July 23, with a 12-hr. non-pumping period intervening. The yield was 1400 gpm. at the beginning and 900 gpm. during the last 4 hr. of the test, with a drawdown of 143 ft. When the discharge was increased to 1000 gpm. the water level dropped more than 13 ft.

In Sept. 1948, the non-pumping water level was reported to be 80 ft. and when pumping at 600 gpm. the drawdown was 170 ft.

The combined metered pumpage for the years 1943, 1944, and 1945 averaged 763,440 gpd., varying from an average winter pumpage of 712,820 gpd. to an average summer pumpage of 940,560 gpd. The water supply during this 3-year period was pumped from Wells No. 1 and 3, and all analyses indicate that the water is obtained from the upper limestones.

LABORATORY NO. 106,441

	ppm.		ppm.
Iron (total) Fe	Tr.	Chloride Cl	18.0
Turbidity	0	Alkalinity (as $CaCO_3$)	64.
Color	0	Hardness (as $CaCO_3$)	87.
Odor	0	Total Mineral Content	734.
Temperature 56.5° F.			

LABORATORY NO. 106,486

	ppm.		ppm.
Iron (total) Fe	1.8	Chloride Cl	21.0
Turbidity	30	Alkalinity (as $CaCO_3$)	404.
Color	0	Hardness (as $CaCO_3$)	849.
Odor	0	Total Mineral Content	955.
Temperature 52.4° F.			

LABORATORY NO. 106,408

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.0		Silica	SiO_2	18.0	
Manganese	Mn	0.1		Fluoride	F	0.2	
Calcium	Ca	206.2	10.31	Chloride	Cl	16.0	0.45
Magnesium	Mg	83.9	6.90	Nitrate	NO_3	Tr.	Tr.
Ammonium	NH_4	0.3	.02	Sulfate	SO_4	457.5	9.52
Sodium	Na	9.7	0.42	Alkalinity (as $CaCO_3$)		384.	7.68
Color		0		Hardness (as $CaCO_3$)		861.	17.22
Odor		0		Residue		1038.	
Turbidity		10		Free CO_2 (calc.)		173.7	
Temperature 56.3° F.				pH = 6.75			

Sample-study log of Well No. 4 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay, pebbly	20	20
Silurian system		
Niagaran-Alexandrian dolomites		
Dolomite	280	300
Dolomite, shaly	65	365
Ordovician system		
Maquoketa shale, some dolomite	100	465
Galena-Platteville dolomite, some limestone	320	785
Glenwood dolomitic sandstone	10	795
St. Peter formation		
Sandstone, incoherent	355	1150
Conglomerate of shale, chert and sandstone	123	1273
Cambrian system		
Franconia sandstone, some shale and dolomite	82	1355
Galesville partly dolomitic sandstone, little clay	180	1535
Eau Claire dolomite, sandstone and shale	305	1840
Eau Claire and Mt. Simon sandstones	168	2008

TABLE 2

Date	Water Levels: Non-Pumping ft.	Water Levels: Pumping ft.	Pumping Rate gpm.	Remarks
1909	56			
1924	137	145	752	
1926	Well rehabilitated			
1926	131	160	1190	
1936			1375	
May 30, 1946	224			8-hr. idle period
June 9, 1946	240			3-hr. idle period
June 15, 1946		261	1050	After 14-hr. pumping

The system of water works at Lake Bluff (1729) is owned by the village and was first established in 1896.

Water was first obtained from a well variously reported as 1600, 1900, 2000 ft. in depth and 4 in. in diameter. It was purchased by the village in 1896 from the Lake Bluff Camp Meeting Association and was probably drilled between 1880 and 1890. This well furnished the entire public water supply until 1908 and a considerable part of the supply until 1913. It is reported that the original static level was 45 ft. above the ground, or at an altitude of approximately 725± ft., but that in 1919 the non-pumping water level was 45 ft. below the ground surface and the yield 75 gpm. In Jan. 1921, the pump would deliver 25 to 30 gpm. for one hour's operation. The well was sounded at this time with a weight that could not be lowered below a depth of 450 ft. It was again sounded in 1924 and found to have a depth of 250. ft. The well was then completely filled and abandoned.

A second well, 300 ft. in depth, was drilled in 1908. It was reported to be 6 in. in diameter and the bottom 100 ft. penetrated rock. The water from this well was reported of better quality than the water from the deeper sandstone well, but its available supply was limited. In 1911, water was pumped for a period of 16 hr. a day. It was abandoned about 1914.

A third well was drilled for the village by Wm. Cater, Chicago, in 1913. Itis located at the southeast corner of Center Ave. and Park Drive (or approximately 1700 ft. S. and 500 ft. E. of the N. W. corner of Section 21, T. 44 N., R. 12 E.). The elevation of the ground surface is 680± ft. The well is reported to be 498 ft. deep, and to be cased from the surface to a depth of 197 ft. with 10-in. pipe below which the hole is 10 in. in diameter to a depth of 350 ft. and 8-in. diameter to the bottom.

The well was first equipped with a single-acting plunger pump with a 6-in. by 24-in. cylinder set at a depth of 135 ft. This unit was estimated to deliver 44 gpm. in 1921 and was frequently operated 24hr.a day during the summer. A 10-in., 10-stage turbine pump, rated at 200 gpm. against 150 ft. of head, was installed in June 1924. The turbine was reported set at a depth of 125 ft. with 10 ft. of suction pipe attached. The non-pumping water level at that time was. 55 ft. below the pump base. When first installed, the pump delivered air within one minute.

Additional column pipe was added. On May 27, 1927, the pump discharge was checked, and it delivered at the rate of 97 gpm. for the first hour and 90.9 gpm. for the next 45 minutes. At that time, the pump was operated about 2 hours daily.

A sample collected Apr. 3, 1929 showed this water to have a hardness of 5.3 gr. per gal., a mineral content of 295 ppm., and no iron.

Water was pumped for 22 hr. on Nov. 25 to 26,- 1932 at an average rate of 69 gpm. to the reservoir. The operation was continued and, during a pumping period of 21 1/4 hr. on Nov. 28 to 29, 1932, the discharge averaged 57 gpm. The yield of this well steadily decreased, when pumping continuously over a long period. On Jan. 1, 1933, a more exact test was conducted for 3 hr. during which time the rates of pumpage were 94 1/2 gpm. for the first hr., 86.8 gpm. for the second hr., and 70.2 gpm. the third hr. The non-pumping water level was reported to be 87 ft. below the pump base. When the pump was operated, the water level dropped below the top of the pump bowls at 143 ft.

The well has not been used since Nov. 1932 except for a period of one hour every 3 months.

During June and July 1946, the well was used for a total period of six hours as an auxiliary supply.

A fourth well, 1804 ft. in depth, was drilled by Wm. Cater in 1920 or 1921. It is located on the municipal site at the southeast corner of Center Ave. and Park Drive. The elevation of the pump house floor is 680.4 ft.

The well is reported to be 12-in. diameter to a depth of 670 ft.; 8-in. diameter between depths of 670 and 1256 ft.; and 6 1/4-in. below a depth of 1256 ft. The casing record is not available.

This well was tested on Jan. 21, 1921. Before pumping, the water level was 58 ft. below the top of casing. After pumping at 134 gpm. for one hr., the drawdown was 18 ft. and, after 3-hr. pumping atthe same rate, there was no additional drawdown. The water was reported to have a temperature of 63.5° F.

Pumping equipment was not installed in this well until the early part of 1925 when a 10-in., 13-stage turbine pump rated at 400 gpm. against 170 ft. of head was set at a depth of 170 ft. to the bottom of the bowls, with 20 ft. of suction pipe attached. In a test made on May 27, 1927, this

pump produced 461 gpm. to the reservoir during a period of one hour. The pump installation was pulled for repairs on Nov. 1932; and when re-installed, a 1/4-in. air line 'was placed in the well to a depth of 198 ft. 4 in. On Dec. 1, 1932, the non-pumping water level was 99 ft. below the pump base. On Jan. 1, 1933, after pumping for, one hr. at an average rate of 455 gpm., the water level was 136 ft.

In 1936, a new pump installation was made consisting of 200 ft. of 6-in. column pipe; 10-in., 6-stage Fairbanks-Morse turbine pump (No. 29448) rated at 500 gpm. against 180 ft. of head; 200 ft. of air line; 20 ft. of 6-in. suction pipe; 30-hp. Fairbanks-Morse electric motor. On July 14, 1936, the non-pumping level was 93.73 ft. and the pumping level was 172.28 ft. after 30-min. operation.

During the latter part of Apr. 1944, the pump was pulled and overhauled and 200 ft. of new 6-in. column pipe and air line was installed. The well was in service July 25, 1944.

Pumping water levels in June and July 1946, when the pump was operated 14 hr. daily at a rate of 500 gpm., were constant at a depth of 179 ft. On Aug. 21, 1946, a non-pumping water level of 131 ft. below the pump base was observed after the pump had been idle for a period of 3 hr.

Analysis of a sample (Lab. No. 107,458), collected Aug. 21, 1946 after 40-min. pumping at 500 gpm., showed the water from this well to have a hardness of 21.8 gr. per gal., a residue of 512 ppm., and an iron content of 0.5 ppm. This is similar to that of a sample collected in 1938 and the temperature indicates that the major portion of the water is obtained from the sandstone at the bottom of the well.

The water is not treated.

Pumpage is estimated to average 160,000 gpd.

Provisions have been made for emergency supply by a connection with the Lake Forest distribution system.

Correlated driller's log of the fourth well furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Clay"	55	55
"Quicksand"	7	62
"Gravel"	5	67
"Clay"	45	112
"Gravel"	4	116
"Clay"	65	181
"Gravel"	3	184
Silurian system		
Niagaran - Alexandrian dolomites	308	492
Ordovician system		
Maquoketa shale, some dolomite	138	630
Galena - Platteville formations		
"Rock"	304	934
Glenwood - St. Peter formations		
"Sand rock"	212	1146
Cambrian system		
Franconia and Galesville formations		
"Shale, blue"	54	1200
"Sand"	204	1404
Eau Claire and Mt. Simon formations		
"Pencil rock"		1404
"Lime, shale and sand"	261	1665
"Sand"	139	1804

LABORATORY NO. 107,458

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.5		Silica	SiO_2	12.7	
Manganese	Mn	Tr.		Fluoride	F	1.1	
Calcium	Ca	117.0	5.85	Chloride	Cl	13.0	0.37
Magnesium	Mg	20.0	1.64	Nitrate	NO_3	0.0	0.00
Ammonium	NH_4	0.3	0.02	Sulfate	SO_4	169.5	3.53
Sodium	Na	27.4	1.19	Alkalinity (as $CaCO_3$)		240.	4.80
Turbidity		Tr.		Hardness (as $CaCO_3$)		374.	7.49
Color		0		Residue		512.	
Odor		0		Free CO_2 (calc.)		56.	
Temperature		62.5° F.		pH = 7.			

A public water supply was installed by the village of Lake Villa (438) in 1938.

The water supply is obtained from a well located about 150 ft. N. and 225 ft. E. of the S. W. corner of Section, 33, T. 46 N., R. 10 E. The ground surface elevation is 798± ft.

Before constructing the village well, a test well was drilled by Charles Madsen, Lake Villa, and located about 30 ft. southeast of the village hall and about 15 ft. from the present well. The test well was drilled to a depth of 148 ft. and cased with 3-in. pipe. A screen consisting of a 3 1/2-ft. section of 1 1/2-in. well point covered with 60 gauze well screen was placed at the bottom.

A production test of almost 6-hr. duration was conducted on Mar. 8, 1937. Water was pumped at a rate of 25 to 28 gpm. with a plunger pump operated by the drilling rig. Since the well casing served as the eductor pipe, it was not possible to obtain the pumping water level. The distance to water before pumping was 55 ft. below the ground surface.

The village well was drilled in 1937 by R. E. Mileager, Milwaukee, Wis., to an original depth of 294 ft., penetrating 16 ft. of bedrock, but was finished in sand at a depth of 167 ft. It was cased from the surface to a depth of 131 ft. with 12-in. diameter pipe, and from 131 to 141 ft. with 10-in. pipe. A lead seal was placed between the 12-in. and 10-in. pipes. A 26-ft. length of Cook brass strainer over 8-in. diameter perforated pipe was placed in the well with the bottom set at a depth of 166 ft. 5 in. on a 5-ft. section of 8-in. casing filled with concrete. The screen was made up as follows: upper 11 ft., No. 20-slot opening; next 2 ft. blank; next 11 ft., No. 20-slot opening; and lower 2 ft. blank.

A 24-hr. test was conducted on Mar. 8 and 9, 1938. After 5 hr. of pumping at 154 gpm., the drawdown was 4 1/2 ft. from a non-pumping water level of 55 1/2 ft. below the pump base. This rate was continued for the balance of the test with no additional drawdown. A large amount of sand was pumped during the first part of the test, and, after 24 hr., a small amount of sand was still being pumped.

During the test, the permanent pump was used, which consisted of 120 ft. of 5-in. column pipe; 8-in., 10-stage American Well Works turbine pump rated at 150 gpm. against 237 ft. of head; the overall length of the pump is 5 ft. 6 in.; 10 ft. of 5-in. suction pipe; 15-hp. U. S. electric motor.

It is reported that the pump was pulled for repairs after the test due to the cutting of the impellers by the large amount of sand pumped. When re-installed, 10 ft. of additional 5-in. column pipe and 10 ft. of 5-in. suction were added. An air line terminating at a depth of 140 ft. below the pump base was also installed.

Due to. the fact that considerable sand was pumped from the well, a repair program was carried out by R. E. Mileager in 1939. A 20-ft. length of 4-in. No. 40 slot Johnson screen was inserted in the 8-in. screen. The top of the 4-in. screen was set at a depth of 137 1/2 ft. below the pump base with the bottom sealed. The annular space between the 2 screens was filled with very small gravel particles.

On Oct. 11 and 13, 1939, tests were made to determine the effectiveness of the repairs in ex-

LABORATORY NO. 107,531

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.4		Silica	SiO_2	21.1	
Manganese	Mn	0.0		Fluoride	F	1.0	
Calcium	Ca	29.5	1.48	Chloride	Cl	5.0	0.14
Magnesium	Mg	21.9	1.80	Nitrate	NO_3	0.0	0.0
Ammonium	NH_4	0.1	Tr.	Sulfate	SO_4	91.3	1.90
Sodium	Na	50.6	2.20	Alkalinity	(as $CaCO_3$)	172.	3.44
Turbidity		0		Hardness	(as $CaCO_3$)	164.	3.28
Color		0		Residue		324.	
Odor		0		Free CO_2 (calc.)		28.	
Temperature 51.5° F.				pH = 7.4			

cluding the sand. Water was pumped at a rate of 85 gpm. for periods of 3 to 4 hr. with stop intervals of about one hr. The pump discharged into a steel tank from which the sand was collected during the stops. The amount of sand was dried and weighed. The results of these tests did not indicate a sufficient amount of sand pumped to be objectionable. The non-pumping water level before the test was 45 ft. below the pump base and during the tests, the pumping water levels were 78 to 79 ft. below the pump base.

Analysis of sample (Lab. No. 107,531), collected Aug. 29, 1946 after 10-min. pumping at 80 gpm., showed this water to have a hardness of 9.6 gr. per gal., a residue of 324 ppm., and an iron content of 0.4 ppm.

Anumber of residences still obtain water from private wells. There were 65 service connections in 1946 which demanded an average pumpage of 12,000 gpd. varying from a winter minimum of 9600 gpd. to a summer maximum average of 24,000 gpd.

A public water supply was installed by the village of Lake Zurich (421) in 1912. Two wells have constituted the source of the public supply both of which are located on the village lot on Main St. near the intersection of Lake View Ave. (or approximately 650 ft. S. and 1950 ft. E. of the N. W. corner of Section 20, T. 43 N., R. 10 E.). The elevation of the ground surface of these wells is 855± ft.

The older well which was drilled in 1912 is reported to have a depth of 218 ft. and to be entirely cased with 6-in. pipe. No accurate log of the well is available, but the formations below a depth of 100 ft. are reported to be sand and gravel.

On June 3, 1915, a non-pumping water level of 100 ft. below the pump base was reported. The well was equipped with a Keystone Driller Co. double-acting plunger pump with 4 1/4-in. diameter cylinder and 18-in. stroke. Power was furnished by a 10-hp. electric motor. The production was 35 gpm.

The entire public water supply was furnished by this well until 1921 when another well and pumping equipment were added to the original waterworks. Since then the older well has served as an auxiliary supply unit. The equipment was overhauled in Jan. 1942 and 150 ft. of new 4-in. drop pipe was installed. The pump was pulled in July 1948 and found to be in good condition. It was operated 8 hr. daily in the summer of 1948 during peak periods.

The second well was drilled by Rieke Brothers, Barrington, to a depth of 214 ft. It is located about 40 ft. south of the old well, and is cased with 10-in. pipe to the bottom. The well terminates in drift. There is no record of a screen.

Upon completion of the well, water was pumped for 12 hr. at a rate of 100 gpm. The drawdown was 20 ft. from a non-pumping water level of 95 ft. below the pump base. The well was equipped with a Keystone Driller Co. double-acting plunger pump having a 5 3/4-in. by 18-in. cylinder set at a depth of 150 ft. belt-connected to a 15-hp. Westinghouse electric motor. When the pump was installed, it was operated at a rate of 35 rpm., a displacement of 140 gpm. After 3-hr. operation at this rate, the water level was drawn down to the pump cylinder, and the pump drew air. The speed was reduced to 24 rpm., a displacement of 97 gpm. After 3-hr. pumping at this rate on Nov. 11, 1922, the water level in the older well, 40 ft. west, was lowered to a depth of 99 1/2 ft. below the ground surface. After the pump was shut down, a recovery of 2 ft. within an hour was reported, but no additional recovery was observed 10 hr. later.

On Sept. 10, 1928, the pump was reported operating at a rate of 18 rpm.

The pumping equipment was overhauled in Jan. 1942 and 150 ft. of new 6-in. drop pipe was installed. It is operated at a speed of 17 rpm., or a displacement of 69 gpm.

This wellhas been the main source of the pub-* lic water supply since it was put in service in 1921. During the summer of 1946, water was pumped 9 hr. daily except on Saturdays and Sundays when peak demands required 18-hr. operation. During July and Aug. 1948, the pump was operated 24 hr. daily.

Analysis of a sample (Lab. No. 107,476) collected Aug. 23, 1946 after 8-hr. pumping at 69 gpm., showed this water to have a hardness of 54.0 gr. per gal., a residue of 1599 ppm., and an iron content of 0.3 ppm. This quality is similar to analyses of previous samples collected from this well and the old well.

The water is not treated.

The average pumpage is estimated at 35,000 gpd. and varies from a winter minimum average of 25,000 gpd. to a summer maximum average of 55,000 gpd.

Well No. 3 was completed to a depth of 443 ft. in Mar. 1949 by Henry Boy sen, Jr., Libertyville, and located 50 ft. west of Paine St. and 50 ft. north of the south corporation limits (or approximately 2570 ft. S. and 1250 ft. W. of the N. E. corner of Section 20). The elevation of the ground surface is 885± ft.

The well was cased with 6-in. pipe from one ft. above to 300 ft. below ground level. Below the casing the hole was finished 6-in. in diameter. A production test was made on Mar. 11, 1949, using temporary pumping equipment consisting of 240 ft. of column pipe and an engine-driven turbine pump. The pump base is 2 ft. above the ground surface. Calibrated measuring equipment was furnished by the State Water Survey. Before the test the water level was 135.5 ft. below the top of the pump base and after 15-hr. pumping at a final rate of 209 gpm. the drawdown was 29.0 ft. Ten minutes after stopping the test the water level was 138.0 ft.

Analysis of a sample (Lab. No. 117,575) collected Mar. 11, 1949 after 10-hr. pumping at 166 gpm. showed this water to have a hardness of 57.0 gr. per gal., a residue of 1624 ppm., and an iron content of 2.5 ppm.

LABORATORY NO. 107,476

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.3		Silica	SiO_2	23.8	
Manganese	Mn	0.0		Fluoride	F	0.8	
Calcium	Ca	183.3	9.17	Chloride	Cl	9.0	0.25
Magnesium	Mg	109.9	9.03	Nitrate	NO_3	2.2	0.04
Ammonium	NH_4	0.8	0.04	Sulfate	SO_4	1071.3	22.29
Sodium	Na	131.1	5.70	Alkalinity (as $CaCO_3$)		68.	1.36
Turbidity		10		Hardness (as $CaCO_3$)		910.	18.20
Color		0		Residue		1599.	
Odor		Tr.		Free CO_2 (calc.)		7.	
Temperature 52° F.				pH = 7.4			

Sample-study log of Well No. 3 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Silt, calcareous, grayish brown	5	5
Till, grayish brown to gray	210	215
Gravel, gray, fine, clean	5	220
Till, gray	5	225
Sand, silty, gray, fine, little gravel	50	275
Till, grayish brown	15	290
Silurian system		
Alexandrian series		
Kankakee dolomite	55	345
Edgewood dolomite	10	355
Ordovician system		
Maquoketa shaly dolomite	85	440
"Shale"	3	443

LA MOILLE
Bureau County
Sept. 9, 1947

A public water supply was installed by the village of La Moille (509) in 1916 following a disastrous fire to store buildings north of the Chicago, Burlington, & Quincy R. R. tracks. The water supply is obtained from 2 wells.

A well was drilled by R. M. Lippincott, La Moille, in 1916 and located at the S. E. corner of Gurney and Sheldon St. (or approximately 2600 ft. N. and 2400 ft. W. of the S. E. corner of Section 24, T. 18 N., R. 10 E.).

The well was 268 ft. deep below a ground surface elevation of 805t ft., and was cased with 200 ft. 2 in. of 8-in. pipe; 51 ft. 7 in. of 6-in. pipe; 10 ft. of 4 1/2-in. pipe. The latter casing was attached to the 6-in. casing by brass and rubber packing, and a 14-ft. length of 4 1/2-in. id. Mark screen was set beneath the 4 1/2-in. casing. The strainer was made of perforated iron, galvanized after perforation, and covered with No. 60 gauze which was enclosed in brass with 1/8-in. perforations.

In Oct. 1916, the non-pumping water level was 137 ft.; and after pumping for 1 1/2 hr. at 29 to 34 gpm., the drawdown was 3 1/2 ft.

This well is maintained for emergency use.

Analysis of a sample (Lab. No. 50232) collected Oct. 3, 1923, showed the water from this well to have a hardness of 17.0 gr. per gal., a mineral content of 441 ppm., and an iron content of 4.8 ppm.

In 1936 a new well was drilled by Layne Western Co., Chicago, and located in the south part of town at the southwest corner of the intersection of Church and High St. (or approximately 1900 ft. N. and 1600 ft. W. of the S. E. corner of Section 24). The ground surface elevation is 805± ft.

Sample-study log of well drilled in 1936 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Till	45	45
Sand, silty	10	55
Till	100	155
Soil, silt, gravelly at base	15	170
Gravel, partly silty	15	185
Till	30	215
Sand and gravel, fine, clean	45	260
Till	15	275
Gravel, silty	10	285
Till	15	300
Sand and gravel	31	331

The well is 331 ft. deep and cased with 306 ft. of 10-in. pipe and 26 ft. of 8-in. Layne screen with No. 30 slot openings.

The pumping equipment consists of 200 ft. of column pipe; 8-in., 9-stage American Well Works turbine pump rated at 150 gpm. against 215 ft. of head at 1750 rpm.;the length of the pump is 5 ft.; 199 1/2 ft. of air line; 10 ft. of suction pipe; 15-hp. U. S. electric motor.

On Aug. 8, 1936, a production test was made by the State Water Survey. The non-pumping water level was 136 1/2 ft. below the top of the casing; and after pumping 20 hr. at 152 gpm., the drawdown was 14 ft.; and after 3-hr. additional pumping at 190 gpm., the drawdown was 18 ft.

Analysis of a sample (Lab. No. 111,801) collected Sept. 9, 1947 after 20-hr. pumping at 152 gpm., showed this water to have a hardness of 14.2 gr. per gal., a residue of 291 ppm., and an iron content of 1.9 ppm.

LABORATORY NO. 111, 801

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.9		Silica	SiO_2	24.9	
Manganese	Mn	0.0		Fluoride	F	0.5	
Calcium	Ca	50.8	2.54	Chloride	Cl	1.0	0.03
Magnesium	Mg	22.8	1.88	Nitrate	NO_3	4.7	0.08
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	1.2	0.03
Sodium	Na	23.0	1.00	Alkalinity (as $CaCO_3$)		264.	5.28
Color		15		Hardness (as $CaCO_3$)		221.	4.42
Odor		0		Residue		291.	
Turbidity		10		Temperature 53° F.			

The water is treated for iron removal. A softening unit is installed but is not used.

Analysis of a sample (Lab. No. 111,800) collected Sept. 9, 1947, showed the treated water to have a hardness of 13.1 gr. per gal., a mineral content of 300 ppm., and an iron content of 0.6 ppm.

Pumpage is estimated at 60,000 gpd.

LABORATORY NO. 111,800

	ppm.	epm.			ppm.	epm.
Iron (total) Fe	.6		Fluoride	F	0.5	
Turbidity	0		Chloride	Cl	1.0	
Color	25		Alkalinity	(as $CaCO_3$)	280.	
Odor	0		Hardness	(as $CaCO_3$)	225.	
			Total Mineral Content		300.	

LANARK
Carroll County
Jan. 27, 1947

The public water supply for the city of Lanark (1292) was installed in 1888.

An open well was constructed 20 ft. in diameter to a depth of 60 ft. and in the bottom 2 wells were drilled, one to a depth of 400 ft., the other somewhat less. The lower 40 ft. of the large diameter hole was filled in, and a deep-well pump installed in the 400-ft. well. In 1895 the water supply became inadequate, the well was capped, and the 20-ft. hole converted into a collecting reservoir, which is still in use, permitting the aeration of the water from Wells No. 1 and 2.

A new well was drilled to a depth of 600 ft. into the St. Peter sandstone and located 20 ft. southeast from the first source on North Boyd St. about 125 ft. north of the center of the Chicago, Milwaukee & St. Paul R. R. main tracks (or approximately 2940 ft. N. and 2900 ft. W. of the. S.E. corner of Section 5, T. 24 N., R. 6 E.). The top of the well is 895t ft.

The well was cased with 10-in. pipe to a depth of 200 ft., and below 200 ft. the hole diameter was 6 in.

In 1913 the non-pumping water level was 80 ft. below the surface; the same in 1924.

In June 1940 a production test was conducted by the State Water Survey. Before the test, the water level was 60 ft. below the surface; and after pumping for 1 hr. and 5.min. at a rate of 160 gpm., the water was drawn down more than 117 ft., and the pump broke suction. For the test an Aurora turbine pump, No. 7234, rated at 200 gpm. against 290 ft. of head, was acquired from the local canning company and installed. Following the test, the pump was pulled and 4 stages removed.

The pumping installation now in service consists of 160 ft. of 6-in. column pipe; 8-in., 9-stage Aurora Pump Co. turbine pump, No. 7234; 25-hp. General Electric motor.

In Jan. 1946, while the pump was being overhauled, the well depth was found to be 510 ft. At the same time, the water level was 64 ft. below the pump base after a non-pumping period of 5 days.

Well No. 1 supplies about 1/3 of the normal public demand, and pumping is at a rate of 100 to 110 gpm.

Analysis of a sample (Lab. No. 108,670) collected Dec. 16, 1946 after 1-hr; pumping at 100 gpm., showed the water from Well No. 1 to have a hardness of 19.3 gr. per gal., a residue of 341 ppm., andan iron content of 1.5 ppm. The general character of this sample and that of previous samples appear to be typical for waters from the drift or the underlying dolomite in this vicinity.

Well No. 2 was drilled in 1936by C. W.Varner, Dubuque, Iowa, at a point 15 ft. north of Locust St. and 15 ft. west of Bruce St. (or approximately 2250 ft. N. and 3650 ft. W. of the S. E. corner of Section 5). This well is 2 blocks south and 2 blocks west of the first well.

The well was drilled to a depth of 447 ft. below a ground surface elevation of 860t ft.

Sample-study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Till	15	15
Gravel, very fine, sandy	12	27
Till	73	100
Ordovician system		
Galena-Platteville dolomites	197	297
Glenwood sandstone, dolomite and some shale	23	320
St. Peter sandstone	127	447

The well is cased with 10-in. pipe to a depth of 315 ft., and below that depth the hole is reported to be 10 in. in diameter.

On Mar. 12, 1937 the non-pumping water level was reported to be 135 ft., and the water was drawn down 30 ft. while pumping at a rate of 225 gpm. On June 13, 1940 the non-pumping water level was reported to be 132 ft.

This well is the principal source of the public water supply and is pumped continuously during the canning season. In June 1945 the pumping water level dropped below the 180-ft. turbine setting, and the pump broke suction after continuous operating for a period of 6 weeks. Fifty ft. of column pipe was added, and the present installation consists of 230 ft. of 5-in. column pipe; 10-in., 9-stage American Well Works turbine pump rated at a capacity of 200 gpm. against 310 ft. of head; 230 ft. of air line; 10 ft. of 5-in. suction pipe; 25-hp. U. S. electric motor. A 2-hr. test made in May 1946 indicated a production of 300 gpm. to free discharge.

Analysis of a sample (Lab. No. 108,671) collected Dec. 16, 1946 after 1-hr. pumping at 250 gpm., showed the water in Well No. 2 to have a hardness of 16.7 gr. per gal., a residue of 300 ppm., and an iron content of 0.1 ppm.

Since Aug. 1944 the village has furnished water to the Chicago, Milwaukee & St. Paul R. R., which previously had obtained a surface water supply from Straddle Creek near their Kittridge Station. In Nov. 1946 the railroad demand averaged about 27,000 gpd. Water is furnished to the Uhremann Canning Co. to put up pea and corn packs.

The total average pumpage is normally about 125,000 gpd. The maximum pumpage occurs during the canning season. The average demand during the pea pack from about June 12 to Aug. 1, 1946 was 140,000 gpd., and the same demand was reported during the corn pack from about Aug. 15 to Oct. 1, 1946.

LABORATORY NO. 108,670

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.5		Silica	SiO_2	20.9	
Manganese	Mn	Tr.		Fluoride	F	0.2	
Calcium	Ca	79.0	3.95	Chloride	Cl	7.0	0.20
Magnesium	Mg	32.3	2.66	Nitrate	NO_3	0.9	0.01
Ammonium	NH_4	0.4	0.02	Sulfate	SO_4	12.3	0.26
Sodium	Na	1.8	0.08	Alkalinity (as $CaCO_3$)		312.	6.24
Color		0		Hardness (as $CaCO_3$)		331.	6.62
Odor		Tr.		Residue		341.	
Turbidity		20		Free CO_2 (calc.)		41.	
Temperature 52° F.				pH = 7.3			

LABORATORY NO. 108,671

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	17.6	
Manganese	Mn	Tr.		Fluoride	F	0.2	
Calcium	Ca	65.2	3.26	Chloride	Cl	1.0	0.03
Magnesium	Mg	29.9	2.46	Nitrate	NO_3	0.6	0.01
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	27.8	0.58
Sodium	Na	2.3	0.10	Alkalinity (as $CaCO_3$)		260.	5.20
Color		0		Hardness (as $CaCO_3$)		286.	4.72
Odor		Tr.		Residue		300.	
Turbidity		10		Free CO_2 (calc.)		34.	
Temperature 52.5° F.				pH = 7.3			

LA ROSE
Marshall County
Jan. 10, 1947

The village of La Rose (179) has no public water supply. In 1915 it was reported that many residents were using water from a tubular well at Main and Walnut St. on the east side of the Gulf, Mobile and Ohio R. R. (or approximately 1320 ft. S. and 1320 ft. E. of the N. W. corner of Section 16, T. 29 N., R. 1 W.). The well was 4 in. in diameter and 28 ft. in depth terminating in an 8-ft. gravel, water-bearing stratum. It was reported that shortly after completion of this well, a nine-hour test was made with a deep-well pump; and, when pumping at a rate of about 25 gpm., the water level was not lowered appreciably.

Prior to the construction of the 4-in. well, a tubular well was drilled to a depth of 150 ft. near the west side of town. Slate was penetrated at a depth of 112 ft., and the drilling continued in this stratum to a depth of 150 ft. without finding water. The work was abandoned.

The high school at La Rose has a well that furnished water for the high school only. This 6-in. well was drilled in 1938 to a depth of 85 ft. bv J. Bolliger & Son, Fairbury.

Sample-study log of the high school well furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil, silt, and till	84	84
Gravel, granule to 1/4 inch	1	85

The well is equipped with a Myers-Ejecto pump with the jet set at 65 ft. and is powered by a 1-hp. General Electric motor. Water is pumped to a 500-gal. pressure tank. The pump starts automatically when the pressure drops to 20 psi. and stops when the pressure reaches 40 lb. It is estimated that the school uses 1000 gpd. during the school term.

Analysis of a sample (Lab. No. 108,880) collected Jan. 10, 1947, showed the water from the high school pressure tank to have a hardness of 20.5 gr. per gal., a residue of 364 ppm., and an iron content of 12.6 ppm.

LABORATORY NO. 108,880

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	12.6		Silica	SiO_2	23.6	
Manganese	Mn	0.1		Fluoride	F	0.3	
Calcium	Ca	82.7	4.14	Chloride	Cl	1.0	.03
Magnesium	Mg	35.1	2.88	Nitrate	NO_3	0.5	.01
Ammonium	NH_4	3.1	.17	Sulfate	SO_4	0.4	.01
Sodium	Na	6.9	0.30	Alkalinity	(as $CaCO_3$)	372.	7.44
Color		0		Hardness	(as $CaCO_3$)	351.	7.02
Odor		0		Residue		364.	
Turbidity		20					

The public water supply was installed by the city of La Salle (12,812) in 1888.

Water was obtained from a spring about 2 miles east of the pumping station. In 1904, because the spring supply became inadequate and the pipe line troublesome and expensive to maintain, the spring was abandoned. The supply is now obtained from 3 wells located in the Illinois River bottom land at the southeastern corner of the city, just south of the Illinois-Michigan Canal and between the Little Vermillion River and the Illinois Central R. R.

Two shallow wells of identical design were constructed in 1904 and 1911. Well No. 1 is about 1100 ft. N. and 780 ft. E. of the S. W. corner of Section 14, T. 33 N., R. 1 E., and Well No. 2 is 297 ft. south and 38 ft. west of No. 1. Both wells are about 60 ft. from the Little Vermillion River and from 1000 to 850 ft., respectively, from the Illinois River. When the wells were constructed, the top of each projected about 1 ft. above the ground surface, the elevation of which was 460± ft. In Apr. 1946 the depth of No. 1 was 37.6 ft. below the top cover and No. 2 was 37.9 ft. The construction of the wells consisted of a 1/4-in. iron shell 9 ft. in diameter and about 15 ft. in length placed vertically at the bottom of the well.

A 3-in. by 3-in. by 5/16-in. angle is riveted around the inside of the shell at the bottom, and an 8-in. by 8-in. by 1/2-in. angle is likewise riveted on the inside of the shell and about 5 ft. above the bottom. Upon the outstanding leg of the latter angle, a 9-in. brick wall is built up within and to the top of the shell where an 8-in. by 8-in. by 1/2-in. angle is riveted to the outside. Upon this angle at the top and the 9-in. brick wall, a 17-in. brick wall is built up to the ground surface and narrows in toward the top, similar to a standard manhole, to a diameter of 24 in. Since the well site may be flooded by as much as 5 ft. or more, the top of each well is closed tight with a standard boiler manhole, and this is covered with a standard locked manhole cover. The bottom of the iron casing, between the bottom angle and the angle supporting the 9-in. brick wall, is perforated with 1/2-in. round holes spaced at 1 1/2-in. centers vertically and horizontally.

In 1915 Well No. 3 was constructed at a location 350 ft. south and 9 ft. west of Well No. 2. It is 12 ft. in diameter and 39.6 ft. deep from the top of the cover. It is lined with brick, and the top is sealed, similar to the other 2 wells. The upper 10 ft. of the lining is laid in cement grout. The well is connected to the intake of the low-stage pumps.

The pumping equipment originally consisted of 2 low lift centrifugal pumps of 3 mgd. capacity; 12—in., suction pipe enters the side of each well about 13 ft. below the surface and then, making a right angle bend, extends to within 1 1/2 ft; of the bottom. The suction pipes have a T-connection to a 20-in. suction line leading to the pumping station about 600 ft. distant. The low lift pumps were located in a pit 26 ft. deep by 12-ft. diameter with 18-in. brick and cement walls. The pumps were set 15 ft. above the bottom of the wells and discharged water into a collecting reservoir, which was 28 ft. deep, and the bottom of which was 7 ft. below the elevation of the low lift pumps.

In 1921 a new pumping station was constructed beside the old one, and the latter was abandoned. The old pumping units were replaced by 8-in., 3-stage Fairbanks-Morse turbine pumps rated at 1800 gpm. Power is furnished by 225-hp., 1200 rpm. Allis-Chalmers electric motor.

In June 1946, Well No. 1 was de-watered, and all the slots in the screen were cleaned out. Before cleaning, the well produced 150 gpm., and no noticeable increase in production was reported after the cleaning. It was also reported that the old original heavy timber cribbing around the well screen had never been removed. In Well No. 2 screen, 12 slots were cleaned, and the flow increased.

Analysis of a sample (Lab. No. 110,982) collected July 8, 1947, showed the water from Wells No. 2, and 3 to have a hardness of 32.8 gr. per gal., a residue of 751 ppm.,and an iron content of 0.1 ppm.

The water is chlorinated.

Due to the inadequate supply of water which was progressively becoming more acute, some test hole drilling was made in Jan. 1946 by Chas. E. Woodruff Co., Ottawa. Test Well No. 1 was drilled at a point midway between city wells 2 and. 3, or 199 ft. north and 83 ft. east of Well No. 3. It was drilled to a depth of 50 ft. and cased with 40 ft. of 12-in. flank pipe and 10 ft. of screen. The screen was made up of 12-in. diameter pipe with vertical slots, 3/16by 8-in., spaced 4-in. center to center horizontally and 4-in. spacing between the slots vertically.

Test Well No. 2 was drilled 486 ft. due south of Test Well No. 1 and was 287 ft. south and 84

ft. east of Well No. 3. It was constructed with 41 ft. of 12-in. casing and 9 ft. of 12-in. diameter pipe made up into a screen with openings of the same size and arranged in the same manner as in Test Well No. 1, except there were 10 less slot openings.

A production test was made of Test Well No. 2 on Feb. 5, 1946 by the State Water Survey. The results were not indicative of the capacity of the aquifer and were attributed to the inadequacy of the screen, due to its design.

A production test was made on Test Well No. 1 on Feb. 13, 1946 by the State Water Survey. In order to obtain more accurate data on the capacity of the aquifer, three observation wells were placed in a line west from the test well and spaced at 1.4, 7.1, and 19.1 ft. from the edge of the test well's 12-in. casing. Each observation well was a 1 1/2-in. pipe with a 3 1/2-ft. length of sand point driven to a depth of 50 ft. The results of the test are shown in Table 1.

The turbine pump was operated from a gas engine which caused the variations in pumping rates and prevented any establishment of apparent equilibrium at a constant pumping rate. The results of this test were still unsatisfactory but gave promise of a better capacity in the formation when pumping at 109 gpm. The specific capacity of the test well was calculated at 14 1/2 gpm. per ft. of drawdown. The screen in each test well was changed, and an additional production test made in May 1946.

Test Well No. 2 was deepened from 50 to 56 ft., and a 10-ft. length of 8-in. diameter slotted screen was placed in the bottom of the well and overlapped 1 ft. by the casing. Pea gravel was placed around the screen, and the old pipe screen was removed. The driller reported that the best water-bearing gravel was encountered between depths of 36 and 44 ft. The slots in the screen were 1/8-in. horizontal by 2 1/2-in. vertical and spaced 3/16 in. apart. The vertical space between slot rows was 3/16 in. Alternate rows of slots were staggered horizontally at 2 in. Three observationholes were drilled in an approximate straight line and intersecting a line between the test well and City Well No. 3 at an approximate angle of 60P. Hole 1 was 2 ft. north of the center of the test well; hole 2 was 8.3 ft. northwest, and hole 3 was 20.8 ft. northwest of the test well. Hole 1 was cased with 6-in. pipe to a depth of 49 ft. with the bottom 9 ft. slotted. The slots were 3/16-in. horizontal by 9-in. vertical. The slot rows were 6 in. apart. Hole 2 was cased with 6-in. pipe to a depth of 48 ft. with the bottom 15 ft. slotted as in hole 1. Hole 3 was cased with 5-in. pipe to a depth of 47 ft. with the bottom 9 ft. slotted as in hole 1.

On May 23, 1946, a production test of Test Well No. 2 was made by the State Water Survey. Automatic water level recorders had been installed in observation holes 2 and 3, and continuous graphs became available for conditions existing before, during, and for 5 hr. after the test. Water levels in hole 1 were measured by steel tape. When pumping at 196 gpm., the specific capacity of the well was 130; and when pumping at 265 gpm., the specific capacity was 110. During the production test of Feb. 6, 1946 the highest specific capacity was 5.8. During this production test, there was continuous interference from City Well No. 3 from which water was being pumped during the entire test period.

Analysis of a sample (Lab. No. 106,541) collected May 23, 1946 after 30-min. pumping at 196 gpm., showed the water from Test Well No. 2 to have a hardness of 19.0 gr. per gal., a mineral content of 404 ppm., and an iron content of 3.1 ppm.

A production test was made of Test Well No. 1 on May 29, 1946. The 8-in. screen which had just been used in Test Well No. 2 on May 23, was installed in this test well. *A* gravel wall was placed around the screen, and the old 12-in. pipe casing was pulled up to give exposure. The three 1 1/2-in. observation holes, in place for the first production of this test well on Feb. 13, were used again in this test. Automatic water level recorders were installed in Test Well No. 2 and City Well No. 3.

For the first 3 1/2 hr. of the test, the pumping rate was 150 gpm., and the specific capacity calculated at 115; for the next 1 3/4 hr., the pumping rate was 215 gpm., and the specific capacity calculated at 83; for the last hour the pumping rate was 300 gpm., and the specific capacity 54.

Analysis of a sample (Lab. No. 106,596) collected May 29, 1946 after 3 1/2-hr. pumping at 150 gpm., showed the water in this test well to have a hardness of 30.5 gr. per gal., a mineral content of 646 ppm., and an iron content of 3.4 ppm.

Two new wells are under construction.

A new pump has been installed in a pit 30 ft. deep, located in the west part of the pumping sta-

tion. The pump is 10-in. by 8-in. Allis Chalmers centrifugal, No. 44441, rated at 2250 gpm. against 330 ft. head at 1800 rpm. Power is furnished by a 250-hp. Allis Chalmers motor, No. 14572. This pump will pump from all 5 wells, and the other turbine pumps will be kept for emergency use.

LABORATORY NO. 110,982

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	21.3	
Manganese	Mn	0.4		Fluoride	F	0.4	
Calcium	Ca	140.1	7.00	Chloride	Cl	24.0	0.68
Magnesium	Mg	51.9	4.27	Nitrate	NO_3	11.0	0.18
Ammonium	NH_4	2.2	0.12	Sulfate	SO_4	262.5	5.46
Sodium	Na	25.1	1.09	Alkalinity	(as $CaCO_3$)	308.	6.16
Color		0		Hardness	(as $CaCO_3$)	564.	11.28
Odor		0		Residue		751.	
Turbidity		0		Temperature 55° F.			

TABLE 1

Time	Pumping Rate gpm.	Depth to Water ft. below top casing			
		T.W.	Observation Wells		
A.M.		1	1	2	3
10:00		12.75	12.05	12.00	11.98
10:05	102	20.25			
10:30	109	20.25	12.75	12.38	12.00
11:30	109	20.25	12.75	12.38	12.00
11:50	138	25.25	12.81	12.48	12.00
P.M.					
1:30	79	17.75	12.76	12.81	12.24
2:00	156	32.75	13.55	13.11	12.42
2:30	138	31.25	13.51	13.02	12.39
2:33	0	17.75			
2:35	0	12.75	12.42	12.56	12.23
3:00	0	12.50	11.95	11.91	11.91

A public water supply was installed in 1941 by the village of Latham (369).

After an electrical earth resistivity survey was made by the State Geological Survey in 1940, two test wells were drilled to depths of 78 and 71 ft. and located on Macon St. in the south part of the village. It was necessary to find an adequate water supply within the corporate limits, because the village could not afford the expense incidental to bringing in a water supply from beyond the limits. In Jan. 1941, a well was completed by Hayes and Sims, Champaign, to a depth of 72 ft. 4 in. below a ground surface elevation of 611± ft. The well was located about 30 ft. east of Main St., south of First St., and about 75 ft. east of No. 2 Test Well and about 300 ft. south of Test Well No. 1, back of the village hall, (or approximately 840 ft. N. and 450 ft. E. of the S. W. corner of Section 36, T. 18 N., R. 1 W.).

Sample-study log of Test Hole No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil, silt and till	54	54
Sand and gravel	1	55
Till	11	66
Sand and gravel at top, silty	4	70
Sand, clean	3	73

The permanent well was cased with 66 1/2 ft. of 6-in. pipe and 6 ft. exposed length of Johnson brass screen, having No. 50 slot openings. The top of the casing was 2 1/2 ft. above ground level.

A production test was made by the State Water Survey on Jan. 27, 1941 using, for test purposes, a single-stroke pump operated by the well rig. Before the test, the water level was 13 ft. below the ground surface. After 4-hr. pumping at 33 gpm. the drawdown was 20 ft. and after an additional 5-hr. pumping at rates decreasing from 35 to 32 gpm. the final drawdown was 39 ft. The well was not fully developed, and much fine sand was pumped during the test. An air line of unknown length is installed.

On Sept. 17, 1948, after 20-min. pumping at 35 gpm., the water level was 12 ft. above the bottom of the air line and after 1/2-hr. non-pumping, the air line gauge read 28 ft. The same water levels have been reported for several years.

The pumping equipment includes a Fairbanks-Morse turbine pump, No. 13339, and 2-hp. electric motor.

Analysis of a sample (Lab. No. 115,939) collected Sept. 17, 1948 after 20-min. pumping, showed this water to have a hardness of 13.9 gr. per gal., a residue of 712 ppm., and an iron content of 0.8 ppm.

The water is aerated and filtered.

From Sept. 1, 1948 to Sept. 16, 1948, pumpage averaged 8,200 gpd.

LABORATORY NO. 115,839

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.8		Silica	SiO_2	25.1	
Manganese	Mn	0.1		Fluoride	F	0.7	
Calcium	Ca	51.7	2.59	Chloride	Cl	240.0	6.77
Magnesium	Mg	26.5	2.18	Nitrate	NO_3	0.4	0.01
Ammonium	NH_4	1.7	0.10	Sulfate	SO_4	6.6	0.14
Sodium	Na	179.6	7.81	Alkalinity (as $CaCO_3$)		288.	5.76
Turbidity		0		Hardness (as $CaCO_3$)		239.	4.77
Color		0		Residue		712.	
Odor		0		Free CO_2 (calc.)		29.	
Temperature 54.7° F.				pH = 7.4			

LAWRENCEVILLE
Lawrence County
May 5, 1948

A public water supply was installed for the city of Lawrenceville (6213) in 1898. The system was originally installed by Trowbridge and Niver Co., but was purchased in 1940 by the Illinois Municipal Water Co., Robinson, after several changes in ownership, and is now owned by Illinois Cities Water Co.

The original supply consisted of 3 wells. Most of the water was obtained from the first well, drilled in 1898, which was reported to be about 250 ft. deep, and to have yielded about 20 gpm. The second well was reported to be about 375 ft. deep and to produce about 20 gpm. The third well was reported to be about the same depth as the first well. Water was also obtained from a well some distance from the water plant.

These wells were apparently abandoned when the production became inadequate for the increasing population. Water was obtained from the Embarrass River until Dec. 25, 1924. This source was considered unsatisfactory because of the variations in taste caused by salt water from oil wells in the drainage area.

In the attempt to locate a suitable ground water supply, production tests were made in several gravel pits located east of Lawrenceville, and since 1924 the supply has been obtained from sand and gravel wells located about 4 miles east of the city.

Well No. 1 was drilled in 1924 by Sickle Water Production Co., Aurora, and is located approximately 2300 ft. N. and 600 ft. E. of the S. W. corner of Section 2, T. 3 N., R. 11 W. The surface elevation at this site is about 413 ft.

This well was 59 ft. 7 1/2 in. deep with the top in a concrete pit about 5 ft. deep and was cased with 36-in. steel pipe from the ground surface to a depth of 20 ft. and with 24-in. steel pipe from a little above the top of the pit to a depth of 19 ft. 7 in. A40 ft. 8-in. length of 24-in. steel screen having 1/16-in. slot openings, is installed in the well with a 2-ft. shoe in the bottom.

When completed, water was pumped at a rate of 700 gpm. with a drawdown of 6 ft. from a non-pumping water level of 6 ft. below the ground surface. In 1937, it was reported that the well was producing about 150 gpm.

The well was given acid treatments in **1942** and 1947, and is in service. Water is pumped by either of 2 Manistee **multi-stage centrifugal** pumps and with no pumping **in other wells, the yield rate** is estimated to be 500 gpm.

The siphon connection from Well No. 3 has been disconnected.

Analysis of a sample (Lab. No. 114,409) of water from Wells 1 and 4 collected at the main plant 4 miles from the wells, showed this water to have a hardness of 11.7 gr. per gal., a residue of 227 ppm. and an iron content of 0.3 ppm.

Well No. 2 was constructed about 1927 to a depth of 60 ft. by Thorpe Concrete Well Co., Alton, and was located about 25 ft. southeast of Well No. 1. The well was cased with 30-in. id. by 40-in. od. concrete pipe, with porous concrete pipe set between depths of 10 and 50 ft. The non-pumping water level was reported to be 10-12 ft. and the pumping level 15-18 ft.

The porous concrete screen collapsed on Nov. 15, 1937 and the well has not been rehabilitated.

Well No. 3 was drilled in 1932 to a depth of 75 ft. by J. A. Rue of the Central Illinois Public Service Co. and was located 100 ft. south-south east of Well No. 1. The well was cased with 10-in. pipe with the lower 10 ft. of the casing perforated.

Water from Well No. 3 was originally siphoned into Well No. 2, with a production of 350,000 gpd. from the 2 wells. After the failure of Well No. 2, water from Well No. 3 was siphoned into Well No. 1, but the siphon is now disconnected. The well was given acid treatments in 1942 and 1947 but the production was not improved. It is planned to abandon the well.

Well No. 4 was drilled in Feb. 1938 to a depth of 64 ft. 5 in. by J. A. Rue and is located about 65 ft. east of Well No. 1. The well was cased with 16-in. steel pipe and with 31 ft. 2 in. of 16-in. Cook strainer, having No. 20 slot openings.

Water is pumped by either of the 2 Manistee pumps and the well has a normal yield of 600 gpm. but requires acid treatments about every 5 yr. to restore capacity. Water levels fluctuate with the stages in the Embarrass and **Wabash** Rivers. Since the well was drilled the variation in non-pumping water levels has been from 4 **to** 10 ft. below the ground surface.

Well No. 5, also called West **Well, was constructed in** Dec. **1947 to a depth of 72 ft. by Kelly WellCo., Grand Island, Neb., and is located about 90 ft. west of Well No. 3. The well is of the**

gravel-packed type having an outer casing diameter of 48 in. at the top and 42 in. at the bottom. The inner casing is solid concrete pipe, 17-in. id. and 22-in. od. from 5 ft. below to 28 ft. below ground level and with 17-in. id. porous concrete screen from 28 ft. to the bottom of the well. The annular space outside the 17-in. casing and screen was filled with selected pea gravel. It is planned to construct a concrete box at the top of the well.

After completion of the well, a yield test was made by the driller with all other pumps on the site, shut down. Water level observations (Table 1) were made in Well No. 1 and No. 4 during the pumping from Well No. 5. The total pumping period was 70 min. with 10-min. periods for rates from 700 to 2000 gpm. and a 30-min. period for the last pumping rate of 2280 gpm.

Well No. 1 is about 110 ft. northeast of Well No. 5 and Well No. 4 is 65 ft. east of No. 1 and about 160 ft. from No. 5.

In May 1948, Well No. 5 was not yet in service.

Well No. 6, also called East Well, was drilled in Dec. 1947 to a depth of 73 ft. by Kelly Well Co. and is located about 105 ft. east of Well No. 5.

After completion of the well, a yield test (Table 2) was made by the driller, with all other pumps on the site shut down. Influence of pumping in Well No. 6 was observed in Well No. 1, about 105 ft. northwest of No. 6. The total pumping period was 70 min. with 10-min. periods for rates from 500 to 1480 gpm. followed by a 40-min. period at 2000 gpm.

In May 1948, Well No. 6 was not yet in service.

All water is chlorinated.

From Apr. 1, 1947 to Apr. 1, 1948 metered pumpage averaged 601,050 gpd. of which an average of 166,900 gpd. was sold to the city of Bridgeport.

GEORGE FIELD

Two wells in this field, now controlled by the W.A.A., are, located about 2 miles north of the Lawrenceville wells. Water from the George Field wells is furnished to 72 apartments of the University of Vincennes housing. Metered pumpage from Mar. 2 to Apr. 23, 1948 averaged 46,800 gpd.

LABORATORY NO. 114,409

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.3		Silica	SiO_2	16.1	
Manganese	Mn	Tr.		Fluoride	F	0.1	
Calcium	Ca	61.3	3.07	Chloride	Cl	7.0	0.20
Magnesium	Mg	11.6	0.95	Nitrate	NO_3	11.6	0.19
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	26.5	0.55
Sodium	Na	0.9	0.04	Alkalinity	(as $CaCO_3$)	156.	3.12
Turbidity		0		Hardness	(as $CaCO_3$)	201.	4.02
Color		0		Residue		227.	
Odor		0		pH = 7.05			
Temperature 56° F.				Free CO_2 (calc.)		35.	

TABLE 1

Well No. 5 Pumping rate gpm.	Pumping Period min.	Water Levels below ground surface (El. 413.0) No. 5 ft.	in.	No. 1 ft.	in.	No. 4 ft.	in.
0	0	7	6	8	6	8	6
700	10	10	0	8	6	8	6
1000	10	11	0	8	6	8	6
1500	10	13	1	8	6	8	7
2000	10	15	4	8	7 1/2	8	9
2280	30	17	2	9	2	9	2
Recovery		Complete in 30 sec.		50% in 5 min. Complete in 20 min.		Complete in 5 min.	

TABLE 2

Well No. 6 Pumping rate gpm.	Pumping Period min.	Water Level No. 6 ft.	in.	No. 1 ft.	in. (El. 413.0)
0	0	8	1	8	4
500	10	12	10	8	4
1200	10	14	9	8	7
1480	10	16	6	8	7
2000	10	19	3	8	9
2000	30	19	5	8	11
Recovery		Complete in 30 sec.		Complete in 10 min.	

LEAF RIVER
Ogle County
Nov. 20, 1947

The village of Leaf River (415) installed a public water supply in 1914.

Water was obtained from a well drilled in 1914 to a depth of 125 ft. by William Piper, Pecatonica, and located in the central part of the business district (or approximately 1400 ft. S. and 2800 ft. E. of the N. W. corner of Section 36, T. 25 N., R. 9 E.). The surface elevation is 710± ft. The well was cased with 8-in. pipe to a depth of 22 ft., below which the hole was 8-in. in diameter to the bottom.

Analysis of a sample (Lab. No. 82735) collected Jan. 7, 1938, showed water from this well to have a hardness of 14.8 gr. per gal., a residue of 297 ppm., and a trace of iron.

The well became contaminated with surface water and was plugged and abandoned.

A new well was drilled to a depth of 325 ft. in 1945 by C. W.Varner Dubuque, Iowa, and located in the south part of town (about 2200 ft. N. and 2550 ft. W. of the S. E. corner of Section 36). The surface elevation is 765- ft.

Sample-study log of well drilled in 1945 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Sand, silty; soil at top	10	10
Ordovician system		
Platteville dolomite	90	100
Glenwood sandstone and thin siltstone beds	45	145
St. Peter sandstone		
Sandstone, incoherent	170	315
Sandstone, partly incoherent	10	325

The hole and casing record is shown in Table 1.

TABLE 1

Hole Record

12-in. from surface to 141 ft.
8-in. from 141 to 325 ft.

Casing Record

12-in. od. casing from surface to 14 ft.
8-in. casing from surface to 141 ft.

The annular space outside the casing was filled with grout.

The pump assembly consists of 160 ft. of 5-in. column pipe; 9-stage American Well Works oil lubricated pump, No. 66536, rated at 250 gpm. against 265 ft. of head at 1750 rpm.; the overall length of the pump is 10 ft.; 16 ft. of 5-in. suction pipe; 25-hp. U. S. electric motor. No. 285999.

A production test was made by the driller on Dec. 21, 1945. The pump setting at that time was 120 ft. to the top of the bowls. When pumping at 200 gpm., the drawdown was 48 ft. from a non-pumping water level of 67 ft. On Nov. 20, 1947, the non-pumping water level was 69 ft.

Analysis of a sample (Lab. No. 112,651) collected Nov. 20, 1947 after 1-hr. pumping at 250 gpm., showed this water to have a hardness of 14,6 gr. per gal., a residue of 291 ppm., and a trace of iron.

Pumpage is estimated at 25,000 gpd.

LABORATORY NO. 112,651

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	Tr.		Silica	SiO_2	21.8	
Manganese	Mn	Tr.		Fluoride	F	0.1	
Calcium	Ca	58.8	2.94	Chloride	Cl	2.0	0.06
Magnesium	Mg	25.2	2.07	Nitrate	NO_3	9.4	0.15
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	4.9	0.10
Sodium	Na	13.3	0.58	Alkalinity (as $CaCO_3$)		264.	5.28
Turbidity		Tr.		Hardness (as $CaCO_3$)		251.	5.01
Color		0		Residue		291.	
Odor		0		Temperature 51° F.			

Apublic water supply was installed in 1925 by the city of Lebanon (1867).

A well was drilled in 1925 to a depth of 46 ft. by Thorpe Concrete Well Co., Alton, and located in Silver Creek bottoms, 1 1/2 mile southwest of Lebanon. The well was cased with 16-in. id. (22-in. od.) concrete pipe, the bottom 32 ft. being porous concrete. The elevation of the ground surface at the well-site is 436± ft.

On May 12-13, 1925, the driller reported the static water level at 11 ft. below the top of the casing and after 16-hr. pumping at 172 gpm. the drawdown was 18 ft.

In 1934, due to a clogged strainer, the yield had decreased to about 90 gpm. and the well was maintained for a while as an emergency unit. The well has been plugged and abandoned.

Well No. 1 was drilled in June 1934 to a depth of 47 ft. by Thorpe, and located 20 ft. west of the old well (or approximately 1000 ft. S. and 2150 ft. E. of the N. W. corner of Section 25, T. 2 N., R. 7 W.).

Correlated driller's log of Well No. 1 furnished by the State Geolo'gical Survey:

Formation	Thickness ft.	Thickness in.	Depth ft.	Depth in.
Pleistocene system				
Clay with gravel	23		23	
Sand and clay lumps	4		27	
Gravel	6	1	33	1
Gravel and sand	6	6	39	7
Gravel	7	5	47	

Well No. 1 was cased with 24-in. id. (34-in. od.) concrete pipe. On Feb. 4, 1936, the non-pumping water level was 25 ft. 9 in. below the top of the casing, which was at floor level at the pumping station. After 3 1/2-hr. pumping at 150 gpm. the drawdown was 7 ft. 9 in. Two hours after stopping the pump the depth to water level was 26 ft.

The pumping equipment includes a 4 1/2-in. column pipe; 7 5/8-in., 3-stage Cook turbine pump, No. 1262, having an overall length of 24 in.; air line of unknown length and in poor condition; 4 ft. of 4 1/2-in. suction pipe; 5-hp., 1800 rpm. U. S. electric motor, No. 109820.

The bottom of the suction pipe is reported to be close to the bottom of the well. The pump discharges at a rate of 150 gpm. but is used only when the water level is high in the well. The screen is believed to be partially clogged.

Non-pumping water levels in feet below the top of the well have been reported as follows:

Date	Water Level ft.	Water Level in.
June 1934	29	4
Mar. 1935	27	11
Mar. 1935	23	0
Sept. 26, 1938	25	0
Oct. 1939	26	6
June 7, 1940	25	0
Dec. 1, 1941	32	0
July 14, 1942	25	3

The water levels shown above for June 1934, and Dec. 1, 1941 may be pumping levels.

Analysis of a sample (Lab. No. 77374) collected Feb. 4, 1936 showed this water to have a hardness of 27.2 gr. per gal., a residue of 526 ppm., and an iron content of 1.8 ppm.

Well No. 2 was drilled in 1940 to a depth of 47 ft. by Kelly Concrete Well Co., Grand Island, Neb., and located 18 ft. north of Well No. 1 or 12 ft. north of the northwest corner of the pump house.

The well was cased with 26 ft. 2 in. of plain concrete pipe and 21 ft. 8 in. of porous concrete pipe strainer enveloped with a gravel filter. The outside diameter of the screen and filter was 46 in.

When completed, the static water level was 30 ft. below ground level and when pumping at 160 gpm. the drawdpwn was 10 ft. Non-pumping water levels have been reported in feet below top of well as follows:

Date	Water Level ft.
May 1948	31.0
Sept. 1948	34.0
Oct. 1948	34.0

On Nov. 30, 1948 the water level at 6 AM., before any pumping, was 33 ft. 8 in., and then after 4-hr. pumping at 100 gpm. the drawdown was 6 ft. 4 in.

The pumping equipment includes a 4 1/2-in. column pipe; 3-stage Cook turbine pump, No. 4630,

having an overall length of 2 ft. 7 in.; 4 ft. of 4 1/2-in. suction pipe; 5-hp., 1800 rpm. U. S. electric motor, No. 211826.

The bottom of the suction pipe is reported to be close to the bottom of the well. Power for pumping can be furnished from a gasoline engine belt-connected to the pump.

The pump is throttled at 100 gpm. to avoid over-pumping. It was reported that the screen would not permit a greater inflow.

A well, drilled in 1941 or 1942 for Pfeffer Milling Co., was acquired by the city in 1946 and is now known as Well No. 3. The well was drilled to a depth of 62 1/2 ft. by Kelly Concrete Well Co. and located about 200 ft. northeast of city Well No. 2. The ground elevation at the well-site is 451± ft. The well is cased with 26-in. id. concrete pipe, with the lower part being porous concrete. The pump base is 2.7 ft. above ground level.

The pumping equipment includes a 4 1/2-in. column pipe; 3-stage Pomona turbine pump, operated at a discharge rate of 160 gpm.; 4 ft. of 4 1/2-in. suction pipe with the bottom set close to the bottom of the well; 5-hp. Sterling electric motor.

On Nov. 19. 1948 the non-pumping water level was 49 ft. below ground level. The well is about six feet from a pond having one-half acre water surface area. The elevation of the water surface of the pond on Nov. 19, 1948 was three feet lower than the ground surface at the well.

Analysis of a sample (Lab. No. 116,490) collected Nov. 19, 1948 showed the water from Well No. 3 to have a hardness of 28.2 gr. per gal., a residue of 541 ppm., and an iron content of 1.6 ppm.

The water is aerated, softened and chlorinated. Analysis of a sample (Lab. No. 116,487) collected Nov. 19, 1948 showed the treated water to have a hardness of 7.7 gr. per gal., a mineral content of 195 ppm., and an iron content of 0.1 ppm.

Pumpageis estimated to average 107,500 gpd.

An electrical earth resistivity survey was made by the State Geological Survey in May 1948, following which some test wells were drilled in Sept. and Oct. 1948. Test wells No. 1, 2 and 3 were drilled by Harold Watson, East St. Louis, and located east and north of the pumping station. Test wells 4, 5 and 6 were drilled by Hayes and Sims, Champaign. Test wells 4 and 5 were located along the easterly bank of the old channel of Silver Creek and due west of the pumping station. Test Well No. 6 was located about 3/4 mile northwest of the station, in the valley flat.

LABORATORY NO. 116,490

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.6		Silica	SiO_2	24.9	
Manganese	Mn	0.2		Fluoride	F	0.3	
Calcium	Ca	126.5	6.33	Chloride	Cl	12.0	0.34
Magnesium	Mg	40.6	3.34	Nitrate	NO_3	0.2	Tr.
Ammonium	NH_4	0.2	0.01	Sulfate	SO_4	80.6	1.68
Sodium	Na	7.8	0.34	Alkalinity (as $CaCO_3$)		400.	8.00
Turbidity		7		Hardness (as $CaCO_3$)		484.	9.67
Color		0		Residue		541.	
Odor		0					

A limited public water supply owned by a private company was operated for a number of years until 1904 when the village of Lee (257) acquired the water works and made extensive improvements.

The initial source of supply was obtained from a well reported to have a diameter of 3 in. and a depth of 315 ft. This well was located 6 ft. south of the existing well and is now abandoned and capped.

In 1904 a well was drilled for the village to a reported depth of 335 ft., and located north of Fourth St. and 90 ft. east of the De Kalb-Lee county line (approximately 2300 ft. N. and 90 ft. E. of the S. W. corner of Section 6. T. 38 N., R. 3 E.).The elevation of the ground surface is 940± ft.

Correlated driller's log of Well drilled in 1904 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Hard clay to sand and gravel	335	335

The well diameter was reported to be 6-in. in hard clay to a depth of 235 ft. and 4 1/2 in. at the bottom where sand and gravel was penetrated. The well was cased the entire depth with a screen at the bottom.

On Feb. 6, 1947 the old single-acting plunger pump having a 4 1/2-in. cylinder setting at a depth of 234 ft. was removed. The well was sounded and found to have a depth of 325 ft. and a standing water level of 188 ft. below the pump base.

The existing pump installation was made on Feb. 7, 1947; 200 ft. of 4 1/2-in. od. column pipe; 6-in., 23-stage Fairbanks-Morse oil-lubricated turbine pump, No. S. W. 42430, having a rated capacity of 65 gpm. against a head of 320 ft.; 10 ft. of 4-in. id. suction pipe and strainer; 10-hp. Fairbanks-Morse electric motor, No. 1375844. This unit delivered 118 gpm. to free discharge at ground level and 60 gpm. against a pressure of 40 psi.

Analysis of a sample (Lab. No. 112,126) collected Oct. 4, 1947 after 30-min. pumping at 60 gpm., showed this water to have a hardness of 8.7 gr. per gal., a residue of 240 ppm., and an iron content of 0.4 ppm.

The estimated pumpage is 12,000 gpd.

LABORATORY NO. 112,126

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.4		Silica	SiO_2	15.0	
Manganese	Mn	0.0		Fluoride	F	0.6	
Calcium	Ca	29.5	1.48	Chloride	Cl	2.0	0.06
Magnesium	Mg	18.1	1.49	Nitrate	NO_3	0.8	0.01
Ammonium	NH_4	0.4	0.02	Sulfate	SO_4	2.5	0.05
Sodium	Na	38.9	1.69	Alkalinity	(as $CaCO_3$)	228.	4.56
Turbidity		Tr.		Hardness	(as $CaCO_3$)	149.	2.97
Color		5		Residue		240.	
Odor		0		Free CO_2	(calc.)	10.	
Temperature 52° F.				pH = 7.8			

LELAND
La Salle County
May 18, 1949

A public water supply was installed by the village of Leland (538) in 1915. A well was drilled in the north part of the pumping station 60 ft. east of Main St. (or approximately 570 ft. S. and 2550 ft. W. of the N. E. corner of Section 8, T. 36 N., R. 4 E.).

The well, now called the North Well, was 230 ft. deep below a ground surface elevation of 701± ft. It was cased to rock at about 100 ft. with 10-in. pipe and was equipped with an 8 by 24-in. Gould single-acting cylinder pump, No. 28400, with 100-ft. od. drop pipe. Power was furnished by a 15-hp.,870 rpm. Westinghouse electric motor. When the well was completed, the water level was 8 ft. below the surface.

In 1938 this well was being maintained for emergency use and was seldom used.

In May 1941 the following pump assembly was installed: 102 ft. of 4-in. id. column pipe; Aurora turbine pump, No. 11021, rated at 100 gpm. against a head of 220 ft. at 1750 rpm.; the overall length of the pump is 6 ft.; 19 in. of suction pipe and strainer; 7 1/2-hp. U. S. motor, No. 192479.

The pump was pulled in 1946 to repair the motor, and a short time later the pump was again pulled to repair the column pipe. When the pump was replaced, the column pipe was shortened to 82 ft.

At present this well furnishes all the water for the village. The pump operates 14 to 15 hr. per day.

Analysis of a sample (Lab. No. 118,247) collected May 18, 1949 after 1-hr. pumping, showed the water to have a hardness of 18.2 gr.per gal., a, residue of 328 ppm., and an iron content of 0.9 ppm.

In 1922 a second well was drilled 15 ft. south and 10 ft. west of the old well. This well, now called the South Well, was 220 ft. deep and cased to rock at a depth of about 100 ft. with 10-in. pipe. The well is equipped with an A. Y. McDonald double-acting 6 by 24-in. cylinder pump, No. 502, rated at 150 gpm.; 100 ft. of 6-in. drop pipe. Power is furnished by a 15-hp. Westinghouse electric motor.

In Apr. 1938 the water level in both wells was reported at 20 ft.

Pumpage is estimated at 90,000 gpd. There is apparent leakage in the mains.

LABORATORY NO. 118,247

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.9		Silica	SiO_2	19.2	
Manganese	Mn	0.0		Fluoride	F	.1	
Calcium	Ca	75.4	3.77	Chloride	Cl	1.	.02
Magnesium	Mg	30.0	2.47	Nitrate	NO_3	2.5	.04
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	7.0	.14
Sodium	Na	2.8	.12	Alkalinity	(as $CaCO_3$)	308.0	6.16
Turbidity		11		Hardness	(as $CaCO_3$)	312.0	6.24
Color		0		Residue		328.0	
Odor		0					
Temperature 54.5° F.							

Water works were installed for the village of Lemont (2557) about 1882.

Water was obtained from a well 1366 ft. deep located on the east side of Stephen St. and north of the Illinois and Michigan Canal right-of-way (or approximately 1900 ft. N. and 2300 ft. W. of the S.E. corner of Section 20, T. 37 N., R. 11 E.).

The well was 4 in. in diameter and flowed at the ground surface when drilled. The head was estimated to be about 60 ft. above the ground surface. On Nov. 28, 1916, water was pumped with air lift equipment producing 35 to 40 gpm. The well was abandoned several years later and is now filled with concrete.

A second well was later drilled to a depth of 2284 ft. and is located about 50 ft. east of the older well. The elevation of the pump base is 596.1 ft., and rock was encountered about 2 ft. below the surface. Records of its original construction are incomplete, but the well was reported to be cased to a depth of 297 ft. with 10-in. pipe and to have a 6-in. diameter hole to the bottom.

A sample, collected in 1915, showed this water to have a chloride content of 590 ppm., a mineral content of 1300 ppm., and a hardness of 15 gr. per gal. In 1923 a sample showed a chloride content of 500 ppm. In 1927 after cleaning to 1700 ft., the chloride content was 327 ppm., the mineral content 911 ppm., and the temperature 62.5° F.

On Dec. 5, 1923 the non-pumping water level was 60 ft. below the top of the casing; and the production was reported to be 142 gpm. after pumping 1 hr. In Jan. 1924 the airlift equipment dropped into the well and was fished out from a depth of about 325 ft.

During repairs, the water level rose to 40 ft. below the top of the casing. The air lift equipment was re-installed with an airline to a depth of 291 ft., and the yield of the well was good until Oct. 1924 when it began to fluctuate. By Oct. 18, 1924, the yield had decreased to about 1 gpm.

The well was reported to be bridged at a depth of about 300 ft. but was not repaired and cleaned out until 1927, when it was cleaned out to a depth of about 1700 ft. A 7-in. liner, 92 1/2 ft. long, was set with its top 277 ft. below the top of the 10-in. casing. An air lift pump was installed with the **air** pipe outlet set at a depth of 496 ft. During a production test Jan. 1927 when pumping at 210 gpm., the drawdown was 55 ft. from a water level of 175 ft. When pumping at 320 gpm., the drawdown was 84 ft.

The well was again in service on Apr. 1, 1927. On Oct. 25, 1927 after pumping for 6 hr., the discharge rate was 321 gpm. The depth to water on Oct. 26, 1927 when the airlift had been idle for 16 hr., was 173.6 ft. below the top of casing.

A report dated July 7, 1942 stated that Well No. 2 was again the source of the public supply and was pumped 10 to 12 hr. daily at a rate of 200 to 250 gpm. On July 5, 1942 the non-pumping water level was 223 ft. after the pump had been idle overnight.

From July 1942 to July 1946, this well was the source of supply, but during this time a general recession in the water levels occurred. On Nov. 8, 1945, a non-pumping water level of 289 ft. was reported, and from June 1 to 5, 1946, the pumping water level was 365 ft. when pumping at 280 to 285 gpm.

In Oct. 1947, due to a decrease in production from the well, the pump was lowered 60 ft. from a setting of 380 ft. The production was not increased and a hole was then found in the third from top bowl section. This section was removed and the pump replaced. The depth of the well was measured at 1493 ft. After 15-min. pumping at 265 gpm. the drawdown was 113 ft. On June 21, 1948 the pump had been replaced with a new set of bronze bowls. The pumping equipment now includes 440 ft. of 6-in. column pipe; 9 3/8-in., 15-stage Peerless turbine pump having an overall length of 10 ft. 10 1/2 in.; 440 ft. of air line; 40 1/2 ft. of suction pipe; 50-hp. U. S. electric motor. Before the repair work, the discharge rate was 185 gpm. and, after, the r ate was 310 gpm. On June 21, 1948, after 2-hr. pumping, the water level was 414 ft.'

Analysis of a sample (Lab. No. 117,088) collected Jan. 21, 1949 showed this water to have a hardness of 16.2 gr. per gal., a residue of 472 ppm., and an iron content of 1.8 ppm.

A third well was drilled between Oct. 25, 1924 and Oct. 25, 1927 on a site located at the southwest corner of State and Short St. (or approximately 1550 ft. S. and 2450 ft. E. of the N. W. corner of Section 27). The well was drilled by W. L. Thorne, Des Plaines, to a depth of 1235 ft. where a drill was lost. It was not used, and a wood plug was placed in the top. It was reported on Oct. 25, 1927 that the well would produce 100

to 150 gpm.

In 1931 the following pump installation was made which is still in place: 400 ft. of 5-in. column pipe; 8-in., 31-stage Peerless turbine pump rated at 150 gpm. against 450 ft. of head; 30 ft. of 5-in. suction pipe with a strainer; 30-hp. U. S. electric motor.

Very little data are available relative to the performance and use of this well as a water supply unit. During a 50-min. test on Mar. 15, 1938, with the above equipment, the pump went dry seven times, and the water became cloudy.

Between Oct. 24, 1924 and Apr. 1, 1927 when Well No. 2 was out of service, water for the public supply was obtained from a stone quarry located in Du Page County just north of the Atchison, Topeka, and Santa Fe R. R. about 4700 ft. northeast of the old pumping station (or approximately 900 ft. N. and 500 ft. W. of the S. E. corner of Section 17).

No noticeable lowering of the water level in the quarry was reported when pumping at a rate of about 300 gpm. The quarry is reported to have a maximum depth of 20 ft.

In 1939 the village proposed to use this stone quarry as a permanent source of their water supply. Plans were made for a treatment plant, and construction was under way in 1942 but was interrupted by the war.

The metered pumpage for the period from June 1, 1945 to June 1, 1946 averaged 242,000 gpd. and varied from a minimum winter pumpage of 227,000 gpd. to a maximum summer pumpage of 250,000 gpd.

The water is not treated.

LABORATORY NO. 117,088

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.8		Silica	SiO_2	11.5	
Manganese	Mn	0.1		Fluoride	F	1.1	
Calcium	Ca	76.6	3.83	Chloride	Cl	46.0	1.30
Magnesium	Mg	20.7	1.71	Nitrate	NO_3	0.3	0.01
Ammonium	NH_4	1.3	0.07	Sulfate	SO_4	78.0	1.62
Sodium	Na	61.6	2.68	Alkalinity	(as $CaCO_3$)	268.	5.36
Turbidity		125.		Hardness	(as $CaCO_3$)	277.	5.54
Color		0		Residue		472.	
Odor		Tr.					
Temperature		55.4° F.					

LENA
Stephenson County
Nov. 12, 1947

The town of Lena (1169) established a public water supply in 1895. In 1911 the town made a 10-year contract with the local electric light and power company to supply water at a flat rate, but in 1920, apparently, the town had acquired control of the water system.

Water is obtained from 2 wells. Well No. 1 was drilled in 1895 and located in a triangular plot bounded by Vernon, Freedom, and South Railroad St. (or approximately 3085 ft. N. and 150 ft. E. of the S. W. corner of Section 33, T. 28 N., R. 6 E.). The surface elevation is 964± ft.

The well is 604 ft. deep and 10 in. in diameter from the surface to 300 ft. and 6 in. in diameter for the remaining depth. The 10-in. casing extends to a depth of 150 ft.

In 1913 the well was equipped with a 7 3/4-in. x 24-in. Deming deep well power pump, rated at 197,000 gpd. against 139 ft. of head at 28 rpm. The pump was directly connected to a 10-hp. motor. Pumpage at that time was estimated to average 66,500 gpd. with a maximum of 111,000 gpd.

In 1920 the power company's equipment was removed and an air lift was installed with 200 ft. of 1 1/2-in. air pipe, and 80 ft. of 3/4-in. air pipe, the bottom at a depth of 280 ft. In 1923 the well was reported to produce 100 gpm. with a drawdown of 64 ft. from a non-pumping water level of 70 ft. below the ground surface. This well is used about 4 hr. daily.

Pumping installation consists of 300 ft. of 4-in. column pipe; 6-in., 17-stage water lubricated Pomona turbine pump No. 806; 300 ft. of 1/4-in. air line; 5 ft. of 4-in. suction pipe; 20-hp., 1750 rpm. Westinghouse electric motor, No. 2340.

Analysis of a sample (Lab. No. 112,583) collected Nov. 12, 1947 after 25-min. pumping at 200 gpm., showed this water to have a hardness of 28.1 gr. per gal., a residue of 518 ppm., and an iron content of 0.2 ppm.

Well No. 2 was drilled to a depth of 998 1/2 ft. by C. W. Varner, Dubuque, Iowa, in 1931 and located about 25 ft. north of Well No. 1.

The hole and casing record is as shown in Table 1.

TABLE 1

Hole Record

16-in. from surface to 24 ft.
15 1/4-in. from 24 to 106 1/2 ft.
12 1/4-in. from 106 1/2 to 998 1/2 ft.

Casing Record

16-in. od. wi. pipe from surface to 24 ft.
12 1/2-in. od. wi. pipe from surface to 106 1/2 ft.

The annular space between the 2 casings was filled with neat cement under pressure.

On June 18, 1931 the well was tested with the turbine set at a depth of 220 ft. When pumping at 330 gpm. the drawdown was reported to be 36 ft. from a non-pumping water level of 179 ft. below the surface.

In 1937 the non-pumping water level was reported to be 195 ft. below the surface and when pumping between 250 and 300 gpm. the drawdown was reported to be about 35 ft.

LABORATORY NO. 112,583

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	17.8	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	106.2	5.31	Chloride	Cl	19.0	0.53
Magnesium	Mg	52.5	4.32	Nitrate	NO_3	Tr.	Tr.
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	91.3	1.90
Sodium	Na	7.4	0.32	Alkalinity (as $CaCO_3$)		376.	7.52
Turbidity		5		Hardness (as $CaCO_3$)		482.	9.63
Color		0		Residue		518.	
Odor		Tr.		Temperature 51.8° F.			

A check was made on the water levels in Well No. 2 on Nov. 12, 1947. Prior to the check the pumps in Wells No. 1 and No. 2 had been idle 2 hr. The water level in No. 2 was 180 ft. below the pump base. The pump in Well No. 1 was operated for 5 min. with No. 2 idle. The drawdown in Well No. 2 was negligible. Pumping was stopped in Well No. 1 and started in No. 2 at a rate of between 250 and 300 gpm. The drawdown in Well No. 2 was 105 ft. and later with both pumps operating simultaneously the total drawdown in Well No. 2 was 113 ft. The pumping equipment in Well No. 2 consists of 300-ft. of 6-in. od. column pipe; 13-stage water lubricated Pomona turbine pump No. H 2025, rated at 350 gpm. against 150 ft. of head; 300 ft. of 1/4-in. air line; 5 ft. of 6-in. suction pipe; 30-hp. Westinghouse electric motor, No. 8031777.

Analysis of a sample (Lab. No. 112,579) collected Nov. 12, 1947 after pumping 25 min. at 250 to 300 gpm., showed this water to have a hardness of 27.1 gr.per gal., a residue of 528 ppm., and no iron content. The character is very similar to that obtained from Well No. 1.

The water is not treated.

Pumpage is estimated to average 100,000 gpd.

Sample-study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and silt	20	20
Ordovician system		
Galena-Platteville dolomites	315	335
Glenwood sandstone and shale	10	345
St. Peter formation		
Sandstone, incoherent	305	650
Sandstone, shale and chert	80	730
Cambrian system		
Trempealeau dolomite	40	770
Franconia siltstone, sandstone and shale	95	865
Galesville sandstone		
Sandstone, incoherent	45	910
Sandstone, partly dolomitic	10	920
Sandstone, incoherent	60	980

LABORATORY NO. 112,579

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.0		Silica	SiO_2	17.4	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	103.7	5.19	Chloride	Cl	18.0	0.51
Magnesium	Mg	49.9	4.10	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	82.3	1.71
Sodium	Na	4.8	0.21	Alkalinity (as $CaCO_3$)		364.	7.28
Turbidity		0		Hardness (as $CaCO_3$)		465.	9.29
Color		0		Residue		528.	
Odor		Tr.		Temperature 51.8° F.			

A public water supply was installed for the village of Leonore (179) in 1900 and sold to the village the following year.

The village then constructed a well and abandoned a well which had been in use. Water is obtained from a well located in the eastern part of the village (or approximately 1250 ft. S.and 2500 ft. E. of the N. W. corner of Section 3, T. 31 N., R. 2 E.).

The well is dug 10 ft. in diameter and 34 ft. deep, terminating in a 4-ft. stratum of water-bearing gravel. The elevation of the ground surface is 680± ft.

Before the well was dug, an effort was made to drill a deep well; but when the drill struck rock, it was broken and further drilling abandoned. The casing was not removed and is in the center of the dug well.

Water is pumped by a Deming 6 by 8-in. triplex pump, No. 5869, rated at 176 gpm. with the working barrel attached to 28 ft. of 3-in. drop pipe. Power is furnished by a 10-hp., 1160 rpm. Westinghouse electric motor, No. 798825.

In 1923 the water level was 22 ft. below the surface, and it was reported that no change in the non-pumping water level had taken place for several years. Pumping, except for fire or other long period needs, did not lower the water to any extent.

Analysis of a sample (Lab. No. 110,702) collected June 17, 1947 from a tap in a tavern on Main St. about 1000 ft. from the village well, showed this water to have a hardness of 20.6 gr. per gal., a residue of 433 ppm., and an iron content of 0.7 ppm.

The water is not treated.

Pumpage is estimated to average 4,000 gpd.

LABORATORY NO. 110,702

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.7		Silica	SiO_2	20.4	
Manganese	Mn	0.0		Fluoride	F	0.5	
Calcium	Ca	74.9	3.74	Chloride	Cl	6.0	0.17
Magnesium	Mg	42.7	3.51	Nitrate	NO_3	1.8	0.03
Ammonium	NH_4	1.4	0.08	Sulfate	SO_4	79.7	0.41
Sodium	Na	25.8	1.12	Alkalinity	(as $CaCO_3$)	392.	7.84
Color		0		Hardness	(as $CaCO_3$)	363.	7.26
Odor		0		Residue		433.	
Turbidity		10-					

The city of LeRoy (1783) installed a public water supply in 1895.

Water was obtained originally from 2 wells located about 20 ft. apart in the old pumping station near the center of town. These 2 wells were reported to be 87 ft. deep each and cased with 8-in. pipe.

Each of the wells was equipped with a Gould deep-well pump. Power was furnished originally by a 20-hp. Joliet gasoline engine, but this was replaced by a 20-hp. electric motor.

Analysis of a sample (Lab. No. 21706) collected Dec. 30, 1910, showed the water from these wells to have a hardness of 25.1 gr. per gal., a residue of 493 ppm., and an iron content of 0.8 ppm.

A third well was drilled about 1912. This well was 12 in. in diameter, 90 ft. deep, and was equipped with a Deming single-acting plunger pump, rated at 265,000 gpd.

In 1918, the well was deepened to 321 ft., and casing was added as follows: 10-in. pipe to a depth of 135 ft.; 8-in. pipe to a depth of about 200 ft.; 4-in. pipe to a depth of 321 ft. Little water was obtained below the original depth.

A well was then drilled south of the elevator on the New York Central R.R. This well was 105 ft. deep. Little water was obtained.

Another well was drilled near the southwest corner of Green and White St. This well was 175 ft. deep. Little water was obtained.

The 3 original wells, and water works were abandoned about 1918.

Wells No. 1, 2 and 3 were drilled in 1918 by N. J. Ross, Bloomington, and are located about 10 ft. apart in a line near the southwest corner of Green and White St. (or approximately 700 ft. S. and 400 ft. W. of the N. E. corner of Section 20, T. 22 N., R. 4 E.). The surface elevation is 790± ft.

The East Well, called Well No. 1, is 10 in. in diameter and 86 ft. deep and is equipped with a Cook screen. The original pumping equipment consisted of a 5 1/4-in. by 24-in. Gould single-acting pump with the cylinder set at a depth of about 71 ft. In 1922, the well was reported to produce 40 gpm. with a non-pumping water level of 36 ft. In Apr. 1924, a 6 1/2-in. Erb cylinder pump, originally in Well No. 3, was installed. A 5-hp. Fairbanks-Morse electric motor is in place. The non-pumping water level was reported to be 36 ft.

Well No. 1 is maintained as a stand-by unit.

The center Well, called Well No. 2, is 10 in. in diameter, 86 ft. deep, and equipped with a Cook screen. Pumping equipment consists of a 5 1/2-in. by 24-in. Gould double-acting pump, No. 5702 with the cylinder set at a depth of about 71 ft. and with 6 ft. of suction pipe below the cylinder. In 1922, it was reported that the non-pumping water level was 36 ft., and that the well was producing 40 gpm. In 1924, the non-pumping water level was reported to be 36 ft.

Well No. 2 is maintained as a stand-by unit.

The West Well, called Well No. 3, was 12 in. in diameter, 86 ft. deep, and equipped with a Cook screen. This well was originally equipped with a 6 1/2-in.by 48-in. Deming chain-drive pump. In 1922, it was reported that the non-pumping water level was 36 ft., and that the well was producing 100 gpm.

In 1924, new pumping equipment was installed as follows: 76 ft. of column pipe; 7 1/2-in. by 24-in. American double-acting, deep-well pump operating at 22 rpm; 8 ft. of 6-in. suction pipe.

In 1924, this pump was operated infrequently, but the speed was later reduced to 16 rpm., and the pump operated daily.

In 1939, Well No. 3 was repaired by Hayes & Sims, Champaign. The well was case d with 64 1/2 ft. of 12-in. pipe and equipped with an 11-ft. 3-in. length of homemade screen having 10 ft. of exposed screen with 1/16-in. slot openings. The bottom of the screen was set at a depth of 72 ft. 10 in. A 6-in. concrete plug was placed at the bottom of the screen. Following the repairs, the well produced 100 gpm. with a drawdown of 22 ft. below a non-pumping water level of 38 ft. 2 in.

Analysis of a sample (Lab. No. 51783) collected July 8, 1924, showed the water from Wells No. 1, 2 and 3 to have a hardness of 23.6 gr. per gal., a residue of 458 ppm., and an iron content of 3.6 ppm.

Well No. 3 was filled-in in **1941** when the treatment plant was under construction.

A test hole was drilled in **1940** by Hayes &

Sims, Champaign, near the corner of Pine and East St. (or approximately 2340 ft. N. and 1320 ft. E. of the S. W. corner of Section 21). The hole was 4 in. in diameter and 99 ft. deep.

The test well did not produce sufficient water to warrant development.

Well No. 4 was drilled in Jan. 1940 by Hayes & Sims, and is located 100 ft. south of Well No. 1; 135 ft. south of W. Green St. and 35 ft. west of N. White St. (or approximately 850 ft. S. and 300 ft. W. of the N. E. corner of Section 20.). This well is 78 ft. deep and 12 in. in diameter. The ground elevation at the well-site is 790± ft.

Correlated driller's log of Well No. 4 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Top soil	2	2
Yellow and blue clay	58	60
Gravel, sand, dirty	2	62
Gravel, sand, clean	16	78

The well is cased with 66 ft. 8 in. of 12-in. pipe and a 12-in. drive shoe. A 12-ft. 11-in. length of Johnson silicon red-brass screen is installed in the well with the top at 65 ft., and the bottom at 77 ft. 11 in. below the top of the casing. The screen has No. 60 slot openings.

When tested by the drillers, this well produced 210 gpm. for 12 hr. with a drawdown of 10 ft. below a non-pumping water level of 45 ft.

Pumping equipment consists of 60 ft. of 5-in. column pipe; 8-in., 5-stage Anne rican Well Works turbine pump, No. 63233, rated at 200 gpm. against 95 ft. of head when operating at 1745 rpm.; 10 ft. of 5-in. suction pipe; 65 ft. of 1/4-in. air line; 7 1/2-hp. U. S. electric motor, No. 194759, operating at 1800 rpm.

On Sept. 24, 1948 while the Well No. 5 pump was being operated and after 35-minutes pumping in Well No. 4, the water level in Well No. 4 was 59 ft. below the pump base. Well No. 4 is in daily service as an auxiliary supply unit.

Analysis of a sample (Lab. No. 115,895) collected Sept. 24, 1948 after 35-minutes pumping at 205 gpm. showed the water to have a hardness of 24.8 gr. per gal., a residue of 473 ppm., and an iron content of 6.0 ppm.

Well No. 5 was drilled about 1943 by Hayes & Sims, and is located about 335 ft. west of Well No. 4, or about 140 ft. south of W. Green St. and 40 ft. west of N. Buck St.

The pumping installation includes an 8-in. American Well Works turbine pump, No. 71331, having a rated capacity of 200 gpm. against 102 ft. of head at 1745 rpm., and a 7 1/2-hp. U. S. electric motor. The balance of the installation is reported to be identical to that in Well No. 4 but this could not be confirmed.

On Sept. 24, 1948 the pumping water level was 62 ft. below the pump base, assuming a 65-ft. length of air line.

The well is in daily service and is the principal source of supply.

Analysis of a sample (Lab. No. 115,897) collected Sept. 24, 1948 after 5-hr. pumping at 250 gpm., showed the water from Well No. 5 to have

LABORATORY NO. 115,895

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	6.0		Silica	SiO_2	33.6	
Manganese	Mn	0.0		Fluoride	F	0.3	
Calcium	Ca	101.0	5.05	Chloride	Cl	5.0	0.14
Magnesium	Mg	42.2	3.47	Nitrate	NO_3	1.2	0.02
Ammonium	NH_4	9.5	0.53	Sulfate	SO_4	2.5	0.05
Sodium	Na	13.8	0.60	Alkalinity (as $CaCO_3$)		472.	9.44
Turbidity		50		Hardness (as $CaCO_3$)		426.	8.52
Color		15		Residue		473.	
Odor		Tr.		Free CO_2 (calc.)		136.	
Temperature 53.5° F.				pH = 6.95			

a hardness of 24.8 gr.per gal., a mineral content of 504 ppm., and an iron content of 5.5 ppm.

All water is aerated, filtered and softened. Analysis of a sample (Lab. No. 116,035) collected Sept. 24, 1948 showed the treated water to have a hardness of 3.9 gr. per gal., a mineral content of 491 ppm., and an iron content of 0.14 ppm.

From Sept. 1, 1947 to Sept. 1, 1948 pumpage averaged 87,120 gpd.

LABORATORY NO. 116,035

	ppm.	epm.			ppm.	epm.
Iron (total) Fe	0.14		Fluoride	F	0.3	
			Chloride	Cl	3.0	0.08
Turbidity	Tr.		Alkalinity (as $CaCO_3$)		468.	9.36
Color	20		Hardness (as $CaCO_3$)		66.	1.32
Odor	0		Total Mineral Content		491.	
Temperature 54.5° F.			Free CO_2 (calc.)		9.	
			pH = 8.1			

A public water supply was installed by the city of Lewistown (2355) in 1888.

Water is obtained from wells located atthe water works pumping station about 2 1/2 miles southwest of the city in the Spoon River Valley (or approximately 100 ft. N. and 2100 ft. W. of the S. E. corner of Section 32, T. 5 N., R. 3 E.).

In 1888, the supply was obtained from 28 driven wells located along the south side of the pump station and spaced 8 ft. apart in two parallel, staggered rows. The wells were 24 ft. deep and 1 1/2 in. in diameter. On the bottom of each drive pipe, a 3-ft. length of strainer was attached. The strainer was covered with No. 80 wire cloth. These wells were abandoned in 1911, because of clogged strainers.

In 1911, a dug well was constructed by the Fuller-Coult Co., St. Louis, and the Cook Construction Co., Des Moines, Iowa. The well was 29 ft. deep with the top at 4 1/2 ft. above a ground surface elevation of 454± ft. The bottom 16 ft. was walled with brick, 8-in. in thickness, and the inside diameter of that part of the well was 12 ft. Above the brick wall, the top tapered in, as a bottle, to an inside diameter of 3 1/2 ft. from the ground surface to the top of the well. The well curb was supported by a 1/4-in. steel boiler plate, 13 1/2 ft. od., and with an 18-in. vertical cutting edge. During construction, a 6-in. centrifugal sand pump was unable to dewater the hole when pumping at 100 gpm.

In Mar. 1914, the non-pumping water level was about ground surface; and when pumping at a rate of approximately 70 gpm., the drawdown was 16 1/2 ft. During the 1913 flood, the highest stage was 2 ft. below the top of the well. At the same time, the water level in the well was 4 ft. below flood stage.

In 1917, the river flood stage was within 1 ft. of the top of the well, but it was reported that the water level within the well was not influenced. The upper 15 ft. of the well was re-concreted.

Between 1917 and 1921, three wells were drilled near the dug well. Each was drilled to about 25 ft. depth and cased with 8-in. pipe and Cook strainers. Gravel, of wheat-grain size, was placed around each strainer to a thickness of about 4 in.

These wells have been abandoned and filled in.

In 1927, Thorpe Concrete Well Co., Alton, constructed a well, now called Well No. 1, near the old wells to a depth of 28 ft. below normal ground surface and cased with 26-in.id. pipe and 12 ft. of porous concrete pipe screen. The production was reported to be 500 gpm.

A production test was made by the State Water Survey Jan. 19, 1942. Measurements were made from the top of the 26-in. casing to which 6 ft. of pipe had been added since the original construction of the well. The well was then 35 1/2 ft. deep below the top of the casing. Before the test was started, the water level was 14 1/2 ft. After 2-hr. pumping at 145 gpm., the drawdown was 6 1/6 ft. The next 2 hr. the pumping rate was 190 gpm., and the drawdown was 9 ft., and at the end of another 2-hr. pumping at 220 gpm., the drawdown was 11 3/4 ft. The last drawdown was 3 ft. below the top of the screen.

A second well was drilled about the same time to a depth of 41 1 /2 ft. and cased with 12-in. pipe with 14 ft. of 12-in. Johnson screen. This well has been abandoned and plugged because of a badly clogged screen.

In 1938, Thorpe Concrete Well Co. constructed Well No. 2 about 10 ft. south of the abandoned 12-in. well and 50 ft. south of Well No. 1. The well is 45 1/2 ft. deep. A 60-in. steel casing was sunk into blue mud at a depth of 31 1/2 ft. below the ground surface. The 30-in. id. concrete casing extends 10 ft. above normal ground surface, and the lower 20 ft. of the casing is porous concrete pipe screen. The annular space between the concrete casing and screen, and the 60-in. steel casing was filled with gravel, after which the steel casing was removed.

On June 17, 1942, a production test was made by the State Water Survey. Water levels were measured from the top of the 30-in. casing which is 1 ft. higher than the top of Well No. 1. Before the test was started, the water level was 15 1/2 ft.; and after pumping 3 hr. at 325 - 335 gpm., the drawdown was 20 1/2 ft. The water level did not reach equilibrium during the test; and when pumping at 325 gpm., a section of the screen and of the bowl section was exposed. The top of the bowl-section was 30 ft. below the top of the casing.

This well is not in use because of a ruptured casing. The pump has been removed and installed in Well No. 3.

Well No. 3 is located approximately 85 ft. west and 25 ft. north of Well No. 1, and was drilled in 1942 by Thorpe Concrete Well Co. It is 42 ft.

deep from the top of the casing. A 5-ft. fill has been made around the pumping station, and the well casing extends 3 to 4 ft. above this fill. It is cased with 30-in. id. concrete casing witn porous concrete pipe at the bottom.

Well No. 3 is equipped with 30 ft. of 6-in. column pipe; 10-in., 10-stage Fairbanks-Morse turbine pump, Fig. 6920 "WJXTT" with bronze impellers and rated at 400 gpm. against 366 ft. of head at 1750 rpm.; overall length of pump is 8 ft. 2 in.; 5 ft. 2 in. of 6-in. suction pipe; 42 1/2 ft. of 1/4-in. air line; 50-hp. Fairbanks-Morse electric motor.

This pump is maintained for emergency use. When in use, the pump is throttled down to 100 gpm. to avoid breaking suction.

Well No. 4, located about 50 ft. north and 50 ft. west of Well No. 3, was drilled by the Thorpe Concrete Well Co., in 1942 and is same as Well No. 3 as to depth and casing.

Well Nos. 1,3, and 4 are connected to centrifugal pumps and all three wells are pumped simultaneously. The pump house is located 25 ft. south and 35 ft. west of Well No. 1. An Aurora centrifugal pump, rated at 400 gpm., powered by a 75-hp. Fairbanks-Morse motor operating at 1750 rpm. and a Fairbanks-Morse centrifugal pump, rated at 250 gpm. and powered by a 40-hp. Fairbanks-Morse motor operating at 2300 rpm., are located in a pit in the pump house. The pit is 12 ft. deep. The smaller centrifugal pump is used most of the time with the larger centrifugal held for emergency.

The centrifugal pumps are connected to the three wells with 8-in. pipe. The suction pipes extend into Wells No. 3 and No. 4 to within 4 1/2 ft. of the bottom and in Well No. 1 to within 2 1/2 ft. of the bottom. A 4-in. discharge pipe leads from the pumps to an 8-in. main.

It is estimated that, when not pumping, the wells have 17 ft. of water or a non-pumping water level of 25 ft. below the top of the Wells No. 3 and No. 4. When pumping from all three wells simultaneously with the 400 gpm. Aurora pump, the drawdown is 4 ft. and when pumping with the 250 gpm. Fairbanks-Morse centrifugal, the drawdown is 1 1/2 ft.

Analysis of a sample (Lab. No. 113,442), collected Feb. 10, 1948 from Well Nos. 1, 3, and 4, showed this water to have a hardness of 23.4 gr. per gal., a residue of 470 ppm., and an iron content of 0.2 ppm.

The water is chlorinated. Pumpage ranges from a low of 180,000 gpd. to a high of 280,000 gpd. with an average of 250,000 gpd. Half of the total pumpage is used by the C. B. & Q. R. R.

LABORATORY NO. 113,442

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	20.1	
Manganese	Mn	0.4		Fluoride	F	0.3	
Calcium	Ca	93.5	4.68	Chloride	Cl	8.0	0.23
Magnesium	Mg	41.0	3.37	Nitrate	NO_3	2.6	0.04
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	127.9	2.66
Sodium	Na	3.7	0.16	Alkalinity	(as $CaCO_3$)	264.	5.28
Turbidity		Tr.		Hardness	(as $CaCO_3$)	403.	8.05
Color		0		Residue		470.	
Odor		0					
Temperature		55° F.					

LEXINGTON
McLean County
Oct. 9, 1948

A public water system was installed by the city of Lexington (1284) in 1894.

Well No. 1, the West Well, was drilled in 1894 and is located about 70 ft. north of Chestnut St. and 30 ft. east of Center St. (or approximately 2170 ft. S. and 800 ft. E. of the N. W. corner of Section 8, T. 25 N., R. 4 E.). The surface elevation is 750± ft.

This well is reported to be 115 ft. deep, and to be cased with 10-in. pipe to a depth of 100 ft., with 15-ft. length of Cook screen below the casing.

The well was originally equipped with a steam pump. In 1902, the well was also equipped with a 9 3/4-in. by 24-in. Gould deep-well pump, rated at 278,000 gpd., with the cylinder set at a depth of 90 ft.

In 1914, it was reported that the non-pumping water level was about 40 ft. below the ground surface and that after 4-hr. pumping from Well No. 2 the water level in Well No. 1 was lowered 'about 3 ft. In 1921, the non-pumping water level was reported to be about 50 ft. below the surface. In 1924 the yield rate was reported to be about 125 gpm.

The Gould pump is still in place and both pumps connected to a 15-hp. General Electric motor. The unit is maintained for extreme emergency.

Analysis of a sample (Lab. No. 51171) collected Mar. 25, 1924, showed the water to have a hardness of 17.7 gr. per gal., a residue of 390 ppm., and an iron content of 1.4 ppm.

Well No. 2, the East Well, was drilled in 1902 to a depth of 115 ft.'and located about 14 ft. east of Well No. 1. This well is cased with 8-in. pipe to a depth of 100 ft. with a 15-ft. length of Cook screen installed below the casing.

The original pumping equipment consisted of a 7 1/2-in. by 24-in. Cook deep-well pump rated at 165,000 gpd. with the cylinder set at a depth of 90 ft. It was reported that the non-pumping water level in 1914 was about 40 ft. and in 1921 about 50 ft. below the ground surface.

The well is maintained as an emergency supply unit. On Oct. 4, 1948, when Well No. 3 was out of service for a few days, the altitude gauge showed a pumping water level reading of 15 1/2 ft. above the bottom of the air line and on Oct. 5, 1948, after a 3-hr. idle period the gauge reading was 53 ft. Well No. 3 was still out of service. The pumping equipment, installed in 1947, includes a 6-in. Aurora Pump Co. turbine pump, No. 33310, having a rated capacity of 125 gpm. against 185 ft. of head; 10-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 116,020) collected Oct. 4, 1948 after 1-hr. pumping at 125 gpm. showed the water to have a hardness of 17.6 gr. per gal., a residue of 416 ppm., and an iron content of 1.2 ppm.

Well No. 3 was drilled to a depth of 113 1/2 ft. by Hayes & Sims, Champaign, in 1947, and is located about 60 ft. southeast of Well No. 1.

A 10-in. casing was set from 2 ft. above to 106 ft. 7 in. below the ground surface, and a Johnson silicon red-brass wire-wound screen, overall length 10 ft. 10 in., was placed below the casing. The top 3 ft. of the screen has No. 14 slot openings and the bottom 7 ft. has No. 50 slots.

A production test was made by the State Water Survey on Mar. 28, 1947. For test purposes, the well was equipped with an 8-in., 8-stage turbine pump with the bottom of the suction pipe set at a depth of 74 ft. below the ground surface. The well produced 170 gpm. with a drawdown of 16 ft. from a non-pumping water level of 41.5 ft. below the ground surface. The test showed that simultaneous pumping from Wells No. 1 and 2 lowered the water level in Well No. 3 about 3 ft.

The pumping equipment includes an 8-in. Aurora Pump Co. turbine pump, No. 33111, having a rated capacity of 150 gpm. against 133 ft. of head; 7 1/2-hp. U. S. electric motor.

Well No. 3 has been the principal source of supply since July 1948. The 7 1/2-hp. electric motor burnt out on Oct. 2, 1948 necessitating the use of Well No. 2.

Correlated driller's log of the Hemp Processing Plant well furnished by the state Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and clay	63	63
Sand, dirty	7	70
Sand, clean, water-bearing	14	84

Analysis of a sample (Lab. No. 109,726) collected after 6-hr. pumping on Mar. 28, 1947, showed the water to have a hardness of 17.7 gr. per gal., a residue of 368 ppm. and an iron content of 1.4 ppm. The water was reported to be milky indicating the possible presence of methane gas.

All water is softened., Analysis of a sample (Lab. No. 116,038) collected Oct. 5, 1948 showed the treated water to have a hardness of 6.6 gr. per gal., a mineral content of 228 ppm., and an iron content of 0.22 ppm.

For Aug. 1948,pumpage averaged 30,500 gpd.

The Hemp Processing Plant at Lexington has a well drilled by H. L.Schuler & Son., Normal, and located approximately 2040 ft. N. and 720 ft. W. of the S. W. corner of Section 8, T. 25 N., R. 4 E. This well was reported to be 6 in. in diameter and 86 ft. deep. The ground elevation is 750t ft.

LABORATORY NO. 116,020

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.2		Silica	SiO_2	25.1	
Manganese	Mn	Tr.		Fluoride	F	0.5	
Calcium	Ca	76.4	3.82	Chloride	Cl	1.0	Tr.
Magnesium	Mg	26.8	2.20	Nitrate	NO_3	10.8	0.17
Ammonium	NH_4	Tr.	Tr.	Sulfate	So4	40.5	0.84
Sodium	Na	41.2	1.79	Alkalinity (as $CaCO_3$)		340.	6.80
Turbidity		20		Hardness (as $CaCO_3$)		301.	6.02
Color		15		Residue		416.	
Odor		0		Free CO_2 (calc.)		50.	
Temperature 54° F.				pH = 7.25			

LABORATORY NO. 116,038

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Fluoride	F	0.5	
				Chloride	Cl	2.0	0.06
Turbidity		Tr.		Alkalinity (as $CaCO_3$)		152.	3.04
Color		10		Hardness (as $CaCO_3$)		113.	2.26
Odor		M		Total Mineral Content		228.	
Temperature 57° F.				Free CO_2 (calc.)		0.3	
				pH = 9.1			

The system of water works is owned by the village of Libertyville (3930) and was installed in 1905. The source of the public water supply has been from 6 wells terminating in sand, gravel, and limestone.

For a number of years water was obtained from a group of 4 wells located at the old Cook Ave. station at the northeast corner of Cook Ave. and First St. These wells are no longer in service and have been abandoned. The first 3 wells were sand and gravel wells which flowed by gravity into the reservoir from underground connections to the well casings. The natural flow from these wells was sufficient to supply demands of the village except during periods of high consumption when air lift equipment was used during the day time. In 1917, these wells supplied an average of 60,000 gpd. and in 1921 the natural flow to the reservoir during the night was estimated to be 30,000 gal.

The first well in this group was drilled in 1905 to a depth of 170 ft. and was cased with 4-in. pipe. The second was drilled in 1906 to a depth of 180 ft. and was 5 in. in diameter. A third well drilled in 1910 was 180 ft. deep and 8 in. in diameter and was reported to have a 6-in. diameter Johnson strainer at the bottom to exclude fine sand. The fourth well in this group was a limestone well 240 ft. deep. It was located about 65 ft. north of Cook Ave. and 90 ft. west of First Ave. and was drilled in 1921. The well was reported cased to rock, at a depth of 200 ft., with 8-in. pipe. The sand encountered was very fine, and little water was pumped during a test made before drilling into rock. The well was not equipped with a strainer at the time of the test. When the well was completed to a depth of 240 ft., water was pumped for 4 or 5 hr. at 70 gpm., and the water level was lowered about 35 ft. Later tests of longer pumping periods indicated a maximum yield of about 50 gpm. and a pumping water level of 140 ft. below the pump base.

The best producing well in the group was the second well. In Aug. 1926, when pumping by air-lift pipe set at a depth of 150 ft., the average production was 280 gpm., discharged into the reservoir.

Well No. 4 was equipped with a plunger pump having a cylinder setting of 150 ft., and when tested on Aug. 5, 1926, it discharged 50 gpm. into the distribution system.

All wells at the old Cook Ave. Station were abandoned as sources of supply by 1936.

The fifth well (now known as the Second St. well) in the water supply system was drilled by Wm. Cater in 1928 - 1929. It is located on the west side of Second St. about 200 ft. south of North Ave. (or approximately 1400 ft. N. and 1100 ft. W. of the S. E. corner of Section 16, T. 44 N., R. 11 E.). The elevation of the ground surface is 680t ft.

The construction of this well was planned as a gravel packed well with 24-in. outer casing and 16-in. inner casing and a 16-in. screen. It was first drilled to a depth of 180 ft. and later extended to a depth of 251 ft. The depth of limestone was reported to be 187 ft. but no screen was reported installed in the drift above the rock.

A 5-hr. production test was made by the State Water Survey on Oct. 3, 1935. Pumping was started at a rate of 500 gpm. and decreased to a rate of 442 gpm. at which rate, the drawdown was 129 ft. from a non-pumping water level of 1 ft. above the top of the pump base.

The existing pump installation, made in the latter part of 1944, consists of 200 ft. of 6-in. od. column pipe; 8-in., 12-stage Pomona turbine pump rated at 300 gpm. against 230 ft. of head; 200 ft. of air line;25-hp. General Electric motor.

On July 1, 1943, the water level was still about ground level; and when pumped at 450, gpm., the drawdown was 196ft. A water level of 100 ft. below the pump base was reported on Oct. 19, 1945 after 8-hr. pumping at 300 gpm.

Analysis of a sample (Lab. No. 104,556) collected Oct. 19, 1945 after 8-hr. pumping at 300 gpm., showed the water from this well to have a hardness of 16.9 gr. per gal., a mineral content of 531 ppm., and an iron content of 0.3 ppm.

This well is now the principal producing unit in the public water supply.

A sixth well (now known as the Garfield Ave. well) was constructed in 1935 by the Kelly Well Co. of Grand Island, Nebraska, in the southwestern part of the village about 65 ft. east of Garfield Ave. and 200 ft. south of Lincoln Ave. (or approximately 1700 ft. S. and 1000 ft. E. of the N. W. corner of Section 21). The elevation of the ground surface at this location is 690± ft.

The well is 83 ft. deep and has a concrete casingthrough clay from the surface to a depth of 53 ft., and 30 ft. of concrete screen through sand and gravel at the bottom.

Analysis of a sample (Lab. No. 83,847) collected July 11, 1938 showed the water to have a hardness of 20.4 gr. per gal., a residue of 494 ppm., and an iron content of 0.4 ppm.

The existing pump installation consists of 50 ft. of 7-in. od. column pipe; 10-in., 6-stage Pomona turbine pump rated at 400 gpm. against 188 ft. of head; the length of the pump is 51 in.; 20 ft. of 7-in. suction pipe; 30-hp. General Electric motor.

In June 1943, the water level was reported to be 28 ft. below the pump base and the drawdown 14 ft. after 8-hr. pumping at 380 gpm.

This well supplied 35% of the water supply for the period from Jan. 1, 1946 to Aug. 21, 1946.

Well No. 7 was completed to a depth of 287 ft. in Jan. 1947 by Henry Boysen, Jr., Libertyville, and located hear the intersection of Appley Ave. and First St., extended, (or approximately 2500 ft. S. and 1150 ft. W. of the N. E. corner of Section 16). The ground elevation at the site is 675± ft.

Prior to drilling the permanent well, a 6-in. test well No. 46-1 was drilled to a depth of 286 ft. and located about 10 ft. south from the permanent well. The driller reported that the test well yielded about 200 gpm. with a drawdown of 11 ft. from a static level of 20 ft.

The permanent well was cased with 12-in. id. pipe from 1.2 ft. above to 172 ft. below ground level. Below the casing, the hole was finished 12 in. in diameter. A production test was made on Jan. 17-18, 1948 using State Water Survey calibrated measuring equipment. For the test, the temporary pumping equipment included a gasoline engine-driven turbine pump set at 160 ft. Water level observations were made, during the test of Well No. 7, in the Second St. well (No. 5) located 1400 ft. south of Well No. 7. Observations were also made in the test well, 10 ft. distant. Before the test the water level was 15 ft. below the top of the casing and after 24-hr. pumping at 495 gpm. the drawdown was 82 ft. Equilibrium conditions were not attained but were close enough to approximate the well characteristics. The rate of production was limited by the available power.

Correlated driller's log of Test-hole No. 46-1 furnished by State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil	3	3
Clay, yellow	10	13
Clay, blue	29	42
Clay, soft, blue	9	51
Clay, stony, blue	7	58
Clay, blue	9	67
Clay, stony, blue, hard	52	119
Clay, sandy	21	140
Clay and gravel	14	154
Sand and gravel	2.5	156.5
Silurian system		
Limestone, very hard	28.5	185
Limestone, shaly, not so hard	101	286

Analysis of a sample (Lab. No. 108,977) collected Jan. 18, 1947 after 24-hr. pumping at 500 gpm. showed this water to have a hardness of 20.7 gr. per gal., a residue of 706 ppm., and an iron content of 0.2 ppm.

All water has been chlorinated since 1940.

The average metered pumpage for the public supply for the period from Jan. 1, 1943 to July 1, 1943 was 214,240 gpd., and for the period from Jan. 1, 1946 to Aug. 21, 1946, it was 300,180 gpd. This increase of about 40% is attributed to the residential and industrial growth of the village.

LABORATORY NO. 104,556

	ppm.		ppm.
Iron (total) Fe	0.3	Chloride Cl	5.0
Turbidity	0	Alkalinity (as $CaCO_3$)	108.
Color	0	Hardness (as $CaCO_3$)	291.
Odor	Tr.	Total Mineral Content	531.

LABORATORY NO. 83,847

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.4		Silica	SiO_2	20.2	
Manganese	Mn	0.0		Chloride	Cl	4.0	0.11
Calcium	Ca	73.6	3.68	Nitrate	NO_3	Tr.	Tr.
Magnesium	Mg	40.8	3.35	Sulfate	SO_4	221.0	4.60
Ammonium	NH_4	0.3	0.02	Alkalinity	(as $CaCO_3$)	186.	3.72
Sodium	Na	31.7	1.38				
Turbidity		4		Hardness	(as $CaCO_3$)	351.5	7.03
Color		0		Residue		494.	
Odor		M					

A community water supply system was first installed under private ownership in 1942 to serve a residential development later known as the Lidice Real Estate Development Co. The area includes a re subdivision of Stern Park Garden lying north of Theodore Ave., Joliet, and about 1/3 mile west of Broadway and new developments west of Kelley Ave.

The initial water supply was obtained from a well drilled to a depth of 204 ft. by Joe Kramer, Joliet, in 1942. It is located about 18 ft. north of Ludwig Ave. and 40 ft. west of Kelley Ave. (or approximately 1315 ft. N. and 217 ft. E. of the S. W. corner of Section 33, T. 36 N., R 10 E.). The elevation of the pump base is 629.37 ft.

It is reported to be cased to a depth of 50 ft. with 6-in. pipe terminating in a limestone formation.

The well was equipped with a Wintroath turbine pump, SerialNo. 13786, and a 15-hp.U. S. electric motor, Serial No. 261955.

No authentic data are available on the original productive capacity of the well. An hour's production test, run on Aug. 29, 1944, indicated a sustained yield of 15 gpm. On Nov. 24, 1943 a non-pumping water level of 40 ft. below the pump base was reported after an idle period of 30 min.

The capacity of the well proved inadequate to meet the demands of the original group of 125 homes constructed in 1942. One hundred additional homes were under construction in May 1944. To meet this demand, a second well was drilled by the Feltis Well Co., Joliet, and completed in Oct. 1944.

Well No. 2 is located about 17 ft. west of the old well. The elevation of the pump base is 629.56 ft. The well was reported to be drilled to a depth of 1060 ft. but measured 1023.75 ft. on Aug. 28, 1944. It was cased with 10-in. pipe from the surface to rock at a depth of 65 ft., below which the hole was 10 in. in diameter to a depth of 386 ft. where it was reduced to 8 in. in diameter. An 8-in. diameter casing was placed from the surface to a depth of 386.5 ft., and the annular space between the casings was filled with cement grout.

A production test was conducted on Oct. 4, 1944 by the State Water Survey. After 8-hr. pumping at 53 gpm. against a pressure of 25 lb., the drawdown was 116 ft. below a water level of 395 ft. below the pump base. Analysis of a sample (Lab. No. 101,476) collected after 7 1/2-hr. pumping showed this water to have a hardness of 6.5 gr. per gal., a residue of 600 ppm., and an iron content of 2.3 ppm.

The following pump installation, made in Oct. 1944, is still in service: 520 ft. of 4-in. column pipe; 7-in., 25-stage Peerless turbine pump, No. 21427, having a rated capacity of 100 gpm.; the overall length of the pump is 13 ft.; 520 ft. of air line; 25-hp. U. S. electric motor.

Observations of water levels were made on Nov. 20, 1944 over a 7-hr. pumping period. Before the pump was started, the distance to water below the pump base was 406 1/2 ft. After 3 1/2-hr. pumping at an estimated rate of 50 gpm. against a discharge pressure of 45 lb., the drawdown was 67 ft. which held constant for the remaining period under the same operating conditions.

Another production test of 6 1/2-hr. duration was made on Jan. 8, 1945 to determine whether any changes had taken place in the well. The pump was throttled during most of the test to prevent over-pumpage of the well. Approximate equilibrium was reached after 4 1/2-hr. pumping at a final rate of 63 gpm., and the drawdown was 94 1/2 ft. from a water level of 411 ft. below the pumpbase, or a specific capacity of 2/3 gpm. per ft. of drawdown. The test was continued with the pump throttled so that the discharge pressure was 45 lb., or equivalent to the pressure required to pump into the elevated storage tank, decreasing the rate of production to 3 7 gpm. and the drawdown to 68 ft. During the final period of the test, the pump was operated against zero discharge pressure and began to break suction after 1 hr. at a final rate of 85 gpm.

On Mar. 21, 1945 the following water levels below the pump base were reported: non-pumping level of 415 ft. after an idle period of 16 hr.and a pumping level of 472 ft. after 1 hr. of operating.

On Oct. 19 - 20, 1945 when a production test was being conducted by the State Water Survey in Well No. 3, an additional drawdown of 1 1/2 ft. was observed in Well No. 2.

A third well, called No. 3, was drilled in Oct. 1945 by the J. P. Miller Artesian Well Co., Brookfield, to a depth of 1652 ft. It is located at the northeast corner of Theodore and Raynor *Ave.* (about 120 ft. N. and 55 ft. W. of the S. E. corner of Section 32). The elevation of the top of the casing is 658.52 ft.

The hole and casing record is shown in Table 1.

TABLE 1

Hole Record

10-in. from 432 to 975 ft.
8-in. from 975 to 1652 ft.

Casing Record

18-in. od. from surface to 112 ft.
10-in. id. from surface to 432 ft.
8-in. id. liner from 810 to 975 ft.

The annular space between casings from the top to 432 ft. was filled with cement grout.

The following pump installation is in service: 500 ft. of 4-in. column pipe; 7-in., 26-stage Peerless turbine pump, No. 31812, rated at a capacity of 100 gpm. against 566 ft. of head; the overall length of the pump is 13 ft. 4 5/8 in.; 30 ft. of 4-in. suction pipe; 500 ft. of air line; 25-hp. U. S. electric motor, Serial No. 369541.

A production test was made by the State Water Survey on Oct. 19 - 20, 1945. Approximate equilibrium was reached after 12 hr. of pumping at a final rate of 109 gpm. against a discharge pressure of 5 lb. The drawdown was 20 ft. below a water level of 440 ft. below the pump base, or a specific capacity of 5.45 gpm. per ft. of drawdown.

Analysis of a sample (Lab. No. 104564) collected on Oct. 20, 1945 after 12-hr. pumping at a rate of 109 gpm., showed this water to have a hardness of 13.6 gr. per gal., a residue of 413 ppm., and an iron content of 0.9 ppm. The general character appears to be typical for waters from this depth in this vicinity. The iron content is somewhat high.

The status of these wells on Oct. 28, 1946 was as follows: Well No. 1 has been rarely used since Well No. 3 was placed in service; Well No. 2 is used only occasionally to keep the equipment in operating condition for emergency purposes; Well No. 3 is the principal producing unit supplying about 225 separate dwelling units. The estimated average pumpage is 50,000 gpd. The water is chlorinated at the pump house.

LABORATORY NO. 104,564

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.9		Silica	SiO_2	11.5	
Manganese	Mn	0.0		Fluoride	F		
Calcium	Ca	62.0	3.10	Chloride	Cl	24.0	0.68
Magnesium	Mg	19.0	1.56	Nitrate	NO_3	1.5	0.02
Ammonium	NH_4	1.0	0.05	Sulfate	SO_4	76.5	1.59
Sodium	Na	60.3	2.62	Alkalinity	(as $CaCO_3$)	252.	5.04
Turbidity		30.		Hardness	(as $CaCO_3$)	233.	4.66
Color		0		Residue		413.	
Odor		0					
Temperature		61.4° F.					

Sample-study and driller's log of Well No. 3 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Glacial drift"	69	69
"Gravel"	6	75
Post-Silurian system		
"Shale, thin bed of limestone"	37	112
Silurian system		
Niagaran-Alexandrian series		
"Limestone"	168	280
Dolomite, shaly	15	295
Ordovician system		
Maquoketa formation		
"Limestone"	41	336
Shale	50	386
Galena-Platteville dolomite, some limestone	367	753
St. Peter formation		
Sandstone, incoherent	129	882
Shale, some dolomite, sandstone, chert	48	930
Shakopee dolomite, thin bed of sandstone	20	950
Oneota dolomite, some sandstone, thin beds of shale	221	1171
Cambrian system		
Trempealeau dolomite	164	1335
Franconia dolomite, sandstone, shale	124	1459
Galesville sandstone		
Sandstone, partly dolomitic	66	1525
Sandstone, incoherent	65	1590
Sandstone, partly dolomitic	45	1635
Eau Claire dolomite and shale	17	1652

A public water supply for the city of Lincoln (12,752) was installed in 1884.

Water was first obtained from a large dug well in the gravel deposits of Salt Creek, south of the city. The well supply became inadequate and a direct intake from. Salt Creek was installed which was the principal source of supply for several years. After several years, an attempt was made to increase the ground water supply by constructing another shallow well near the first well. The wells were too close and the second well, being too shallow in depth, did not provide any considerable amount of water in addition to that obtained from the first well. Then followed attempts to obtain additional water from tubular wells and from tile collecting drains.

In 1902 the water works were taken over by the Lincoln Water and Light Co., now the Central Illinois Electric and Gas Co. Efforts were made immediately, by the new owners, to obtain an adequate ground water supply and make it unnecessary to use potentially polluted creek water at any time.

In 1911, a 12-ft. diameter well was dug to a depth of 22 ft. and located 60 ft. east of Walt Creek and 300 ft. south of the Illinois Traction R. R. bridge. This well is in service as a collection well and is equipped with a Pomona turbine pump, having a rated capacity of 1000 gpm. against 85 ft. of head. Power is furnished by a 30-hp. electric motor.

In 1911 an infiltration gallery with a line of 30-in. collection tile was constructed on the west bank of Salt Creek, opposite the wells. The interior dimensions of the gallery were 12 ft. wide by 92 ft. long by 12 ft. deep. The gallery is in service. Water flows by gravity to the 12-ft. collection well, which is 200 ft. east of the center of the gallery.

In 1925, water was obtained from three dug wells and the infiltration gallery. The largest dug well was 26 ft. in diameter and 16 ft. deep, with sand points driven to a depth of 11 ft. below the dug portion of the well and other tubes driven horizontally out from three feet above the bottom of the dug portion.

This well is in service. Water flows by gravity to the 12-ft. collection well. The center of the well is 60 ft. south of the 12-ft. well (or approximately 2600 ft. N. and 120 ft. E. of the S. W. corner of Section 1, T. 19 N., R. 3 W.). The elevation of the ground surface is 548± ft., about seven feet above normal water level in Salt Creek.

A 14 by 46-ft. rectangular well which was 60 ft. south of, and connected to, the 26-ft. well, has been abandoned.

The wells and the infiltration gallery are connected to a 14-in. suction line leading to the pumping station, about 2000 ft. northeast of the wells. The present combined yield from the old wells and the infiltration gallery is estimated to be 1.25 mgd.

Well No. 1 was constructed to a depth of 46 ft. in 1932 and located 2380 ft. N. and 400 ft. W. of the S.E. corner of Section 2. A water-bearing gravel was found between depths of 6 and 46 ft. A 12-ft. od. (10-ft. id.) screen, made of boiler-plate, and perforated with two-inch round holes, was set from 36 to 46 ft. Water-bearing gravel was encountered at 5 to 6 ft. below ground level and continued to the bottom. Gravel and sand were excavated from within the screen as the structure was lowered and anchored on top of a reinforced concrete shoe. Boulders and slab rock were excavated from the bottom of the hole. As the screen was lowered, a cylindrical concrete casing, 10 ft. id., was constructed above the screen. When completed, the top of the casing was about 15 ft. above ground level. The inside face of the boiler-plate was covered by 1/4-in. galvanized wire screen. Hoops of 1/2-in. metal, spaced about. 1/2 in. apart, were anchored to reinforced concrete columns, constructed at each of the spliced joints on the boiler-plate. The space between the hoops and screen, about one foot, was filled with selected gravel.

The static water level, when the well was completed, was eight feet below ground level. During a production test, with a six-inch centrifugal pump powered by a traction engine, the total discharge was 1 1/4mg in 24 hr.with a drawdown of five to six feet.

The pumping equipment consists of a 6-in., 3-stage Worthington turbine pump, discharging about 520 gpm. against a head of 85 ft. The pump base is about 12 ft. above ground level. Power is furnished by a 25-hp. U. S. electric motor.

Well No. 1 is in daily service and supplies about 3/4 mgd.

Well No. 2 was completed in 1942 by the owner, under the supervision of B. P. Hollock, to a depth of about 50 ft. and located 100 ft. south and 375 ft. east of Well No. 1.

Correlated driller's log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Thickness in.	Depth ft.	Depth in.
Pleistocene system				
Dirt	9		9	
Gravel and sand	13	3	22	3
Clay		2	22	5
Gravel	7	4	29	9
Clay		3	30	
Sand and gravel	5		35	
Clay		2	35	2
Sand and gravel	19	2	54	4
Pennsylvanian system				
Clay, hard shale-like	5		59	4
Coal	1		60	4

The construction of the well was similar to that of Well No. 1, except that two 10-ft. sections of 12-ft. od. boiler-plate screens were placed in the bottom and the gravel-pack is held by 7/8-in. diameter rods placed one foot from the inside face of the boiler plate.

The pumping equipment consists of a 10-in., 3-stage Worthington turbine pump, rated at 1000 gpm. against 85 ft. of head; 60-hp. General Electric motor. The pump base is about 12 ft. above ground level.

The well is in daily service and supplies about 1 1/2 mgd.

Analysis of a sample (Lab. No. 118,252) from a composite of 3 wells and the infiltration gallery, collected May 18, 1949 showed this water to have a hardness of 18.2 gr. per gal., a mineral content of 323 ppm., and an iron content of 1.0 ppm.

All water is chlorinated at the main pumping station.

Well No. 3 was completed to a depth of 49 ft. 3 in., in 1946, by the owner under the supervision of H. B. Whitcomb and located 275 ft. south and 75 ft. east of Well No. 2 (or approximately 2000 ft. N. and 50 ft. E. of the S. W. corner of Section 1). Fine sand was encountered from the surface to a depth of 15 ft., gradually grading to coarse sand at the bottom, where blue clay was found.

The construction of the well is identical to Well No. 2. When completed, the water level was 8 ft. below ground level. The pump equipment, installed on Mar. 1, 1947, consists of 49 ft. of 8-in. column pipe; 8-in., 3-stage Worthington turbine pump rated at 695 gpm. against 85 ft. of head; 40-hp. General Electric motor.

Well No. 3 is in daily service for periods of 16 to 18 hr. at an estimated maximum production of 1 1/2 mgd.

For the year ending Dec. 31, 1947 the metered consumption averaged 1.79 mgd. of which about 68% was industrial and commercial and 32% was residential consumption.

In Feb., 1945, a special investigation was made by the State Water Survey to determine the amount of available storage in the sand and gravel deposits under the property of the Lincoln Water Works.

Under conditions of normal precipitation, it was concluded that 1.85 mgd. could be withdrawn from the property without a perceptible lowering of the ground water level. Due to the fact that the demand, at some times, is in excess of the estimated available supply, and the city is definitely increasing in size to the north, more than two miles from the water works, an effort is being made to locate a supplemental source of supply, north of the city.

LABORATORY NO. 118,252

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.0		Silica	SiO_2	9.2	
Manganese	Mn	.3		Fluoride	F	.1	
Calcium	Ca	76.4	3.82	Chloride	Cl	9.0	.25
Magnesium	Mg	29.4	2.42	Nitrate	NO_3	1.3	.02
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	62.	1.29
Sodium	Na	.9	.04	Alkalinity	(as $CaCO_3$)	236.	4.72
Turbidity		8		Hardness	(as $CaCO_3$)	312.	6.24
Color		0		Residue		323.	
Odor		0					

LISLE
Du Page County
June 20, 1947

The village of Lisle, unincorporated, (1500) has no public-owned water supply. The A. T. Mcintosh Co. constructed a water supply system to serve 4 subdivisions. This system has been leased and is operated by the Suburban Water Co.

Water is obtained from a well drilled in 1926 to a depth of 231 ft. and located about 135 ft. south of Railroad Ave. and 400 ft. west of Joliet Road (approximately 950 ft. S. and 1100 ft. W. of the N. E. corner of Section 10, T. 38 N., R. 10 E.). The elevation of the ground surface is 673± ft.

The well was cased with 12-in. wi. pipe from 4 ft. below surface to a seat in the limestone at a depth of 44 ft. below which it was finished as a 12-in. hole through limestone and shale, penetrating a few feet of the second limestone. A 10-in. wi. liner 43 ft. 7 in. long was set on the bottom of the hole to case off the shale.

When completed the standing water level was 10 ft. below the surface. The well was tested by suction lift and produced 500 to 600 gpm.

The existing pump installation, made in 1927, is: 24 ft. of 8-in. wi. column pipe; 12-in., 2-stage American Well Works turbine pump, No. 49436, having a rated capacity of 400 gpm. against 30 ft. of head at 1150 rpm.; the overall length of the pump is 3 ft.; 10-hp. General Electric motor. An airline of unknown length is in place which indicated an altitude of 12 ft. after 11 hr. of pumping on June 6, 1947. The top of the air line is 1 ft. above the casing.

Analysis of a sample (Lab. No. 110,556) collected June 6, 1947 after 9-hr. pumping at 400 gpm. showed this water to have a hardness of 34.8 gr. per gal., a residue of 779 ppm, and an iron content of 0.1 ppm.

All water is chlorinated.

In June, 1947, the estimated average pumpage was 48,000 gpd.

A second water supply serving 15 homes is owned, and operated by Mrs. J. L. Riedy. Water is obtained from a well drilled in 1923 to a depth of 115 ft. by Joe E. Holder, Naperville, and located about 524 ft. east of Joliet Road and 844 ft. south of the Chicago, Burlington & Quincy Rail-; road (approximately 1700 ft. S. and 75 ft. W. of the N. E. corner of Section 10). The elevation of the ground surface is 695± ft.

The well was cased with 6-in. pipe to rock at a depth of 90 ft. below which it was finished a 6-in. hole to the bottom. The static water level in 1934 was reported to be 45 ft. below the surface.

The existing pump installation made in 1943 is: a Myers jet pump rated at a capacity of about 25 gpm. set at a depth of 90 ft. and powered by a 1 1/2-hp. electric motor.

Another well serving as an auxiliary supply unit is connected to the distribution system. It is owned by Mr. J. L. Riedy and is located about 200 ft. N. and 625 ft. W. of Mrs. J. L. Riedy's well. The well was drilled to a depth of 85 ft. by Joe E. Holder in 1923 and cased with 4-in. pipe to rock at a depth of 60 ft.

On June 23, 1938, the static water level was 20 ft. below a ground surface elevation of 675± ft.

The pump installation consists of a Challenger plunger pump having a cylinder setting of 22 ft. and 10 ft. of suction pipe, and powered by a 1 1/2-hp. electric motor.

LABORATORY NO. 110,556

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	18.6	
Manganese	Mn	0.0		Fluoride	F	0.2	
Calcium	Ca	134.2	6.71	Chloride	Cl	25.0	0.71
Magnesium	Mg	63.9	5.25	Nitrate	NO_3	3.3	0.05
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	293.1	6.10
Sodium	Na	26.2	1.14	Alkalinity (as $CaCO_3$)		312.	6.24
Turbidity		0		Hardness (as $CaCO_3$)		598.	11.96
Color		0		Residue		779.	
Odor		0		Free CO_2 (calc.)		41.	
Temperature 51.9° F.							

A public water supply was installed for the village of Little York (318) in the latter part of 1915.

A well, now called the South well, was drilled to a depth of 326 ft. by W. Van Tuyl at a location 260 ft. N. and 230 ft. E. of the S. W. corner of Section 2i, T. 12 N., R. 3 W. The ground elevation is 626± ft.

Correlated driller's log of the South Well furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay and dirt	66	66
Mississippian system		
Kinderhook group		
Shale	78	144
Soapstone	56	200
Devonian and Silurian systems		
Limestone	126	326

The well was cased with 6-in. black iron pipe from the surface to 326 ft.

The well is equipped with an American Well Works deep-well pump with a 3 1/4-in. by 24-in. working barrel set at 105 ft.; the pump has a 24-in. stroke and operates at 24 strokes per min. for 9 hr. each day. Power is furnished by a 5-hp. General Electric motor.

The non-pumping water level in 1915, when the well was finished, was 45 ft. below the ground surface. It was reported that about 10-hr. time was required to pump 20,000 gal., and that the pumping water level was probably lowered to the bottom of the suction pipe.

At the present time, the village is getting all of its water from the south well as the pump in the North well is being replaced with an air ejector pump.

Analysis of a sample (Lab. No. 108,056), collected Oct. 21, 1946, showed the water in the South well to have a hardness of 21.7gr.per gal., a residue of 580 ppm., and an iron content of 3.1 ppm.

The North Well was drilled in 1933 to a depth of 142 ft. and located about 10 ft. north of the South Well.

The well is cased with 6-in. pipe from 0 to 135 ft.; with 4-in. pipe from 135 to 138 ft.; and a 3-in. screen from 138 to 142 ft.

A Crocker Wheeler piston pump, No. 543, was set at 90 ft. below the top of the casing. The piston was 3 1/4-in. by 24-in. The pump is being replaced with an air ejector pump. Non-pumping water levels in both wells were reported in 1938 to be 48 ft. below the ground surface.

Analysis of a sample (Lab. No. 83974), collected July 28, 1938, showed the water in the North Well to have a hardness of 22.4 gr. per gal., a mineral content of 540 ppm., and an iron content of 2.8 ppm.

Pumpage is estimated to be 4000 gpd.

LABORATORY NO. 108,056

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	3.1		Silica	SiO_2	15.3	
Manganese	Mn	Tr.		Fluoride	F	0.1	
Calcium	Ca	96.2	4.81	Chloride	C.	16.0	.45
Magnesium	Mg	31.7	2.60	Nitrate	NO_3	0.0	0.0
Ammonium	NH_4	4.1	.23	Sulfate	SO_4	25.9	0.54
Sodium	Na	77.1	3.35	Alkalinity	(as $CaCO_3$)	500.	10.00
Color		0		Hardness	(as $CaCO_3$)	371.	7.42
Odor		0		Residue		580.	
Turbidity		10±					
Temperature		53.8° F.					

The water works system at Lockport (3475) is owned and operated by the city and was installed in 1896.

Water was first obtained from a well drilled to a depth of 1922 ft. by the J. P. Miller Artesian Well Co., Brookfield. The well was located on a site 70 ft. north of the center line of Tenth St. and 70 ft. east of the center line of Ames St. (or approximately 2620 ft. N. and 625 ft. E. of the S. W. corner of Section 23, T. 36 N., R. 10 E.). The elevation at the ground surface is 563± ft. This well was the source of the entire public water supply until a second well was drilled in 1927. It was abandoned about 1928 and plugged in 1940.

A log of the well, hole, and casing record, productive capacity, water levels, and mineral analyses of the water may be found in Bulletin No. 34.

Well No. 2 was placed in service in Aug. 1927 and was drilled by the J. P. Miller Artesian Well Co. to a depth of 1475 ft. It is located 180 ft. south of the center line of Ninth St. and 165 ft. west of the center line of State St. (or approximately 2420 ft. N. and 1650 ft. E. of the S. W. corner of Section 23). The elevation of the pump base is 589± ft.

The driller's record of hole and casing diameters is given in Table 1.

TABLE 1

Hole Record

25-in. from surface to 9 ft.
19-in. from 9 to 364 ft. 10 in.
15 1/4-in. fr om 364 ft. 10 in. to 406 ft. 3 in.
12-in. from 406 ft. 3 in. to 913 ft. 5 in.
10-in. from 913 ft. 5 in. to 1475 ft.

Casing Record

24-in. od. from surface to 9 ft.
16-in. od. from surface to 364 ft. 10 in.
12-in. from 351 ft. 3 in. to 406 ft. 3 in.
10-in. liner from 543 to 913 ft. 5 in.

The annular space between the 12 and 16-in. casings was closed with a lead seal.

On June 28, 1928, after a shut-down of 43 days, the distance to water below the pump house floor was 205 ft. 5 in.

In 1935 the non-pumping water level was reported at a depth of 207 ft., and the drawdown was 90 ft. when pumping at a rate of 375 gpm. In 1940 the distance to water was 220 ft. below the pump house floor when the pump was idle. By July 1943 the production of the well had dropped to 180 gpm.

An electric log of the well was made by the Halliburton Co. on Nov. 24 and 26, 1943. The depth of the well was found to be 1453 ft., and the distance to water was 285 ft.

The J. P. Miller Artesian Well Co. cleaned out the well to its original depth of 1475 ft. and deepened it to 1553 ft. After completion of this work, a production test was run on Feb. 7, 1944 indicating a specific capacity of only 2 gpm. per ft. of drawdown. The well was then "shot" with 5 charges of nitroglycerine placed 8 ft. apart with the first shot at the lower level of 1458 ft.

The 10-in. liner originally placed between the depths of 843 and 913 ft. 5 in. was replaced in May 1944. Also 2 ft. 8 in. of 16-in. casing was welded to the top of the old 16-in. casing to bring the elevation of the top of the casing a few inches above the pump house floor. The 24-in. drift pipe was removed above the pump pit.

A production test was conducted by the State Water Survey on July 15 and 16, 1944. The rate of pumping was varied from 250 gpm. at the start to 455 gpm. for the last 4 hr. of the test. After 22 hr. the total drawdown was 73 ft. from a non-pumping water level of 3 16 ft. below the pump base, a specific capacity of about 6 gpm. per ft. of drawdown. Samples of water were collected throughout the test and temperatures varied from 59.1 to 59.4° F.

The existing pump installation, made in May 1944, consists of 412 ft. of 8-in. column pipe; 12-in., 15-stage Peerless turbine pump rated at a capacity of 350 gpm. against 485 ft. of head; the overall length of the pump is 9 ft. 7 in.; 30 ft. of 8-in. suction pipe; 409 ft. of air line; 60-hp. U. S. electric motor.

Following its rehabilitation, the well furnished the major portion of the public water supply but has shown a steady recession in its water levels. On Sept. 15, 1944 the water level was 317 ft. below the pump base after a shut-down of a week. During the summer of 1946 the pumping water

level could no longer be determined by the 409-ft. air, line; and on Oct. 13, 1946 a non-pumping water level of 356 ft. was reported after 45 min. of idle period.

For the period from Oct. 1 to Oct. 14, 1946 the average metered pumpage was 189,000 gpd., and the pump operated about 8 hr. daily at a rate of about 400 gpm.

Analysis of a sample (Lab. No. 107,963) collected Oct. 15, 1946 after 2 1/2-hr. pumping at 400 gpm., showed this water to have a hardness of 15.4 gr. per gal., a residue of 525 ppm., and an iron content of 0.1 ppm.

All water for the public supply has been chlorinated since 1927. The chlorine residual at the pump house on Oct. 15, 1946 was 1.0 ppm.

Well No. 3 was drilled to a depth of 1571 ft. by S. B. Geiger & Co., Chicago, and completed in July 1940. It is located at the intersection of 14th and Division St. (or approximately 100 ft. N. and 2490 ft. E. of the S. W. corner of Section 23). The elevation of the top of the casing is 661.5± ft.

The hole and casing record(Table 2) was furnished by the driller.

TABLE 2

Hole Record

13-in. from surface to 1290 ft.
8-in. from 1290 to 1571 ft.

Casing Record

14-in. od. from surface to 442 ft.
10-in. liner from 1111 to 1290 ft.
8-in. liner from 1281 to 136'1 ft.

The 14-in. casing was cement grouted for about 27 to 30 ft. at the bottom and annular space above it was filled to the surface with clay from drillings.

A production test was made after the completion of the well. When pumping at a rate of 340 gpm., the drawdown was 127 ft. below a water level of 322 ft. below the pump base, and a drawdown of 177 ft. at the end of 24 hr. when pumping at 450 gpm.

The following pump installation was in service on Oct. 14, 1946: 500 ft. of 7-in. column pipe; 10-in., 14-stage Peerless turbine pump rated at a capacity of 325 gpm. against 560 ft. of head; the overall length of the pump is 9 ft.; 500 ft. of air line; 20 ft. of 6-in. suction pipe; 75-hp. U. S. electric motor.

This well has been in active service since Jan. 1941 and also shows a steady recession in its water levels. During and since the summer of 1946, its pumping water level can no longer be determined by the 500 ft. air line. In Sept. 1946 an average non-pumping water level of 430 ft. was reported.

For the period from Oct. 1 to Oct. 14, 1946, the average metered pumpage was 161,200 gpd., and the pump was operated about 8 hr. daily at a rate of 340 gpm.

Analysis of a sample (Lab. No. 107,964) collected on Oct. 14, 1946 showed this water to have a hardness of 13.6 gr. per gal., a residue of 463 ppm., and an iron content of 0.1 ppm.

The quality is typical for waters fromthe St. Peter and Galesville sandstone in this vicinity.

All water pumped for the public supply is chlorinated.

Total pumpage is estimatedto average 350,000 gpd.

Sample-study log of Well No. 3 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and till	60	60
Silurian system		
Niagaran-Alexandrian dolomites	190	250
Silurian and Ordovician systems		
Alexandrian series and Maquoketa formation "Shale and lime shells"	75	325
Ordovician system		
Maquoketa shale, some dolomite	97	422
Galena-Platteville dolomite, some limestone	308	730
Glenwood sandstone, dolomitic	7	737
St. Peter formation		
Sandstone, incoherent	313	1050
Sandstone, partly compact	112	1162
Shale, chert, some sandstone	153	1315
Cambrian system		
Franconia sandstone, dolomite, some shale	60	1375
Galesville sandstone, partly dolomitic	194	1569
Eau Claire dolomite	2	1571

LABORATORY NO. 107,963

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.1		Silica	SiO_2	21.4	
Manganese	Mn	Tr.		Fluoride	F	1.2	
Calcium	Ca	72.1	3.61	Chloride	Cl	70.0	1.97
Magnesium	Mg	20.5	1.69	Nitrate	NO_3	0.0	.00
Ammonium	NH_4	0.9	.05	Sulfate	SO_4	87.6	1.82
Sodium	Na	92.9	4.04	Alkalinity	(as $CaCO_3$)	280.0	5.60
Turbidity		0		Hardness	(as $CaCO_3$)	265.	5.30
Color		0		Residue		525.	
Odor		0		Free CO_2 (calc.)		54.6	
Temperature 59° F.				pH = 7.1			

LABORATORY NO. 107,964

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	11.1	
Manganese	Mn	Tr.		Fluoride	F	1.3	
Calcium	Ca	62.4	3.12	Chloride	Cl	35.0	0.90
Magnesium	Mg	18.7	1.53	Nitrate	NO_3	0.3	1.5
Ammonium	NH_4	1.0	0.57	Sulfate	SO_4	92.6	1.92
Sodium	Na	92.9	4.03	Alkalinity	(as $CaCO_3$)	276.	5.52
Turbidity		0		Hardness	(as $CaCO_3$)	233.	4.66
Color		0		Residue		463.	
Odor		0		Free CO_2 (calc.)		43.7	
Temperature 59.5° F.				pH = 7.2			

LODA
Iroquois County
Nov. 18, 1948

A public water supply was installed in 1940 by the village of Loda (507).

An electrical earth resistivity survey was made by the State Geological Survey in June 1940. As a result a well was drilled to a depth of 156 ft. by Hayes and Sims, Champaign, and located on the west side of Poplar St. south of South First St. (or approximately 190 ft. S. and 2520 ft. W. of the N.E. corner of Section 28, T. 24 N., R. 10 E.). The ground surface elevation is 780± ft.

Correlated driller's log of well drilled in 1940 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and clay	105	105
Sand, gravel, clay streaks	15	120
Sand and gravel	36	156

The well was cased with 8-in. pipe from 2 ft. 5 in. above to 144 ft. below ground level and with 14 ft. 10 1/2 in. of 8-in. Johnson silicon red brass screen, with the bottom of the screen set at 156 ft. below ground level. The screen had No. 20 slot openings.

The driller reported that on Sept. 4, 1940 water was pumped for 6 hr. at a rate of 168 gpm. with a drawdown of 10 ft. from a static water level of 99 ft. from the top of the casing.

A production test was made by the State Water Survey on Sept. 5, 1940. After 2-hr. pumping at 160 gpm. the drawdown was 10 ft. and after an additional 1-hr. pumping at 120 gpm. the drawdown was 8 ft. After stopping the pump, recovery to normal static water level occurred in 5 min.

The present pumping equipment, installed in July 1948, consists of 120 ft. of 4-in. column pipe; 8-in. Aurora Pump Co. turbine pump, No. 39806 rated at 112 gpm. against 220 ft. of head; 10 ft. of 4-in. suction pipe; 15-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 116,415) collected Nov. 8, 1948 after 45-minutes pumping, showed this water to have a hardness of 35.2 gr. per gal., a residue of 891 ppm., and an iron content of 1.6 ppm.

The municipality owns a water treatment plant for softening and iron removal. The plant has been out of service for more than one year.

Pumpage is estimated to average 23,700 gpd.

LABORATORY NO. 116,415

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.6		Silica	SiO_2	23.0	
Manganese	Mn	Tr.		Fluoride	F	0.3	
Calcium	Ca	131.4	6.57	Chloride	Cl	3.0	0.09
Magnesium	Mg	67.0	5.51	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	1.7	0.10	Sulfate	SO_4	364.3	7.58
Sodium	Na	56.4	2.45	Alkalinity (as $CaCO_3$)		348.	6.96
Turbidity		16		Hardness (as $CaCO_3$)		604.	12.08
Color		0		Residue		891.	
Odor		0		Free CO_2 (calc.)		56.	
Temperature 54° F.				pH = 7.2			

LOG CABIN ARBOR
Winnebago County
Nov. 1, 1947

Thirty homes obtain a water supply from a well leased and operated by the Log Cabin Arbor Association. The well is located east of Route 5, Cherry Valley Road, on Lot 88 of the. First Subdivision (approximately 630 ft. S. and 2090 ft. W. of the N. E. corner of Section 32, T. 44 N., R. 2 E.). The elevation of the pump base is 860± ft.

The well was drilled in Nov. 1926 to a depth of 388 ft. by Tom James, Ogle County. It is reported cased to rock with 8-in. pipe below which the hole is 8 in. in diameter to the bottom. At a depth of about 60 ft., the driller encountered a large cavity in the rock formation in which the drill bit dropped 6 ft. The well was reported to have penetrated sandstone and had a standing water level of 60 ft. below the top of casing when completed.

The existing pump installation is: 150 ft. of 5-in. od. column pipe; 6-in., 23-stage Fairbanks-Morse turbine pump, Serial No. 9185, having a rated capacity of 100 gpm., against 290 ft. of head; 20 ft. of 5-in. od. suction pipe; 150 ft. of air line; 15-hp. Fairbanks-Morse electric motor.

On Oct. 29, 1947 the water level was 100 ft. below the pump base after 1-hr. idle period and after 5-min. pumping at 100 gpm. the drawdown was 20 ft.

Analysis of a sample (Lab. No. 112,386) collected after 5-min. pumping at 100 gpm., showed this water to have a hardness of 21.7 gr. per gal., a residue of 386 ppm., and an iron content of 0.1 ppm.

Pumpage is estimated 7500 gpd.

LABORATORY NO. 112,386

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	23.0	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	82.4	4.12	Chloride	Cl	7.0	0.20
Magnesium	Mg	40.6	3.34	Nitrate	NO_3	16.2	0.26
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	25.3	0.53
Sodium	Na	0.2	0.01	Alkalinity (as $CaCO_3$)		324.	6.48
Turbidity		Tr.		Hardness (as $CaCO_3$)		373.	7.46
Color		0		Residue		386.	
Odor		0		Temperature 53° F.			

LOMBARD
Du Page County
Mar. 24, 1949

A public water supply was installed by the village of Lombard (7075) about 1907.

The initial supply was obtained from a well drilled to a depth of 84 ft. below the ground surface and located about 110 ft. north of St. Charles Road and 210 ft. east of Main St. (approximately 300 ft. S. and 700 ft. E. of the N. W. corner of Section 8, T. 39 N., R. 11 E.). The top of the existing well is located in a pit about 6 ft. below the ground surface and has an elevation of 692t ft. The well is reported to be cased with 8-in. pipe to rock and is 8 in. in diameter in the rock.

A test made after the completion of the well reported a production of 800 gpm. with a drawdown of 2 ft. from a non-pumping water level of 3 ft. below the top of the well.

On May 24, 1939 when pumping at a rate of 465 gpm. the drawdown was 21 ft. from a non-pumping water level of 10 ft. below the pump base. On Nov. 4, 1943, after the pump had been out of the well 5 days, the distance to water below the pump base was 10 ft.

The. pump installation is: 60 ft. of 5-in. column pipe; 8-in., 5-stage American Well Works turbine pump, Shop No. 64519, having a rated capacity of 400 gpm. against 90 ft. of head; 10 ft. of 5-in. suction pipe; 15-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 110,413) collected May 23, 1947 after 20-min. pumping at 465 gpm. showed this water to have a hardness of 29.2 gr. per gal., a residue of 587 ppm., and an iron content of 2.1 ppm.

This well serves as an auxiliary supply unit and is in operation every night.

Well No. 2 was drilled in 1926 and located about 75 ft. north of the original well in a pit about 3 ft. below the ground surface. The elevation at the top of the existing casing is 694.8 ft.

This well was finished at a depth of 2028 ft. by the Gray Well Drilling Co., Chicago.

A record of hole diameters, casing and liner is given in Table 1.

When drilling had reached a depth of 1375 ft. the water stood at 196 ft. below the ground surface. After completion of the well, the water was 136 ft. below the ground surface, and when pumping at 95 gpm. the drawdown was 52 ft. In 1939 the non-pumping water level was reported to be 240 ft. below the top of the casing. In July 1944, when the pump was out of the well for repairs and overhauling, a water level recorder was installed in the well for a period of about 3 weeks. During that time the water level varied from 287.7 to 290 ft. below the top of the casing. On Sept. 21, 1946, the non-pumping water level was 301 ft. below the top of the casing after a 5-day idle period. On Mar. 3, 1948, after 7-hr. pumping at 402 gpm. the drawdown was 56 ft. from a non-pumping water level of 323.0 ft. Ten minutes after stopping the pump, the water level was 330.5 ft. and 1 hr. later the water level was 327.0 ft. On Mar. 14, 1949 after the pump had been out several days for repair the water level was 324.0 ft. and the well depth was measured to be 1594.0 ft.

TABLE 1

Hole Diameter Record

19-in.	from	0	to	67 ft.
17-in.	from	67	to	264 ft.
14-in.	from	264	to	1100 ft.
12-in.	from	1100	to	1175 ft.
10-in.	from	1175	to	2000 ft.
8-in.	from	2000	to	2028 ft.

Casing and Liner Diameter Record

18-in. od.	from	0	to	67 ft.
15-in. od.	from	0	to	264 ft.
12-in. od.	from	245	to	500 ft.
12-in.	from	1059	to	1100 ft.
10-in.	from	1077	to	1175 ft.

The existing pump installation, made in Aug. 1944, is: 384 ft. of 8-in. column pipe; 12-in., 15-stage American Well Works turbine pump, Shop No. 50154, having a rated capacity of 500 gpm. against 400 ft. of head at 1150 rpm.;40 ft. of 8-in. suction pipe; 384 ft. of 1/4-in. air line; 75-hp. Westinghouse electric motor.

Analysis of a sample (Lab. No. 110,414) collected May 23, 1947, after 8-hr. pumping at about 525 gpm. showed this water to have a hardness of 13.1 gr. per gal., a residue of 439 ppm., and an iron content of 0.3 ppm. The quality is largely typical of waters from the Galesville sandstone in this vicinity.

A quality source test (Laboratory Nos. 113,673 -113,680) on March 3, 1948 after a 50-hr. idle period showed the presence of waters from the Silurian system, the Galena Platteville dolomite and from the Mt. Simon sandstone entering the well at various times. See Table 2.

The well is operated during the day time and contributes a little over 60% of the total supply.

The water from both wells is aerated. From Aug. 1, 1943 to Aug. 1, 1945 metered pumpage averaged 598,500 gpd. and varied from a winter minimum average of 500,000 to a summer maximum average of 655,600 gpd.

Well No. 3 was completed in June 1948 to a depth of 175 ft. and located about 850 ft. west of Well No. 1 (or approximately 350 ft. S. and 650 ft. W.of the N. E. corner of Section 7). An 8-in. test hole had been drilled to a depth of 175 ft. at the site. The ground elevation is 693± ft.

The permanent well was cased with 20-in. od. pipe from 2.0 ft. above to 62 ft. below the ground and with 18-in. od. pipe from 58 ft. to 73 ft. Below the casing the hole was finished 17 in. in diameter. A production test was made on June 7, 1948 using a temporary engine-driven 12-in. turbine pump attached to 120 ft. of 8-in. column pipe; Calibrated measuring equipment belonged to the State Water Survey. Before the test was started the water level in Well No. 3 was 9.0 ft. below the top of the casing. After 16-hr. pumping at 600 gpm.,the drawdown was 80 ft. Seven hours after stopping the test, the water level was 10.0 ft.

On Mar. 17, 4949 the water level was 15.0 ft. from the top of the pump base. Permanent pumping equipment was not yet installed.

Analysis of a sample (Lab. No. 114,953) collected June 7, 1948 after 12-hr. pumping at 600 gpm. showed this water to have a hardness of 26.6 gr. per gal., a residue of 510 ppm., and an iron content of 1.3 ppm.

LABORATORY NO. 110,413

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.1		Silica	SiO_2	23.2	
Manganese	Mn	0.2		Fluoride	F	0.3	
Calcium	Ca	112.8	5.64	Chloride	Cl	6.0	0.17
Magnesium	Mg	52.9	4.35	Nitrate	NO_3	1.0	0.02
Ammonium	NH_4	0.3	0.02	Sulfate	SO_4	166.8	3.47
Sodium	Na	3.0	0.13	Alkalinity (as $CaCO_3$)		324.	6.48
Turbidity		30		Hardness (as $CaCO_3$)		500.	9.99
Color		0		Residue		587.	
Odor		0		Free CO_2 (calc.)		135.	
Temperature 51.8° F.				pH = 6.8			

LABORATORY NO. 110,414

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.3		Silica	SiO_2	12.3	
Manganese	Mn	Tr.		Fluoride	F	1.8	
Calcium	Ca	61.3	3.07	Chloride	Cl	24.0	0.68
Magnesium	Mg	17.1	1.41	Nitrate	NO_3	1.2	0.02
Ammonium	NH_4	0.6	0.03	Sulfate	SO_4	70.1	1.46
Sodium	Na	71.1	3.09	Alkalinity (as $CaCO_3$)		272.	5.44
Turbidity		Tr.		Hardness (as $CaCO_3$)		224.	4.48
Color		0		Residue		439.	
Odor		0		Free CO_2 (calc.)		33.	
Temperature 61.0° F.				pH = 7.3			

Sample-study log of Well No. 2 furnished by State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Glacial drift	50	50
Gravel and broken bed rock	10	60
Silurian system		
Niagaran - Alexandrian dolomites	120	180
Ordovician system		
Maquoketa shale and dolomite	200	380
Galena - Platteville dolomites	345	725
St. Peter formation		
Sandstone	345	1070
Conglomerate of sandstone, chert, and shale	100	1170
Cambrian system		
Franconia dolomitic sandstone	80	1250
Galesville sandstone	160	1410
Eau Claire sandstone, dolomite, and shale	390	1800
Mt. Simon sandstone	100	1900
Pre-Cambrian system		
Fond du Lac sandstone	138	2038

TABLE 2

LABORATORY NO. 113,673 - 113,680

Time	Temp. °F.	Fe	Gallons Removed	Cl	SO_4	Alk.	Hd.	Res.
10:40 AM	Started pumping							
10:41	Stopped pumping							
10:43	Started pumping -			rate 100 gpm.				
10:44	55.3	3.6	200	26	70.8	316	259	468
10:45	55.7	3.3	3300	25	68.1	272	216	414
10:48	56.0	2.3	600	25	71.4	312	252	462
10:52	57.5	1.5	1000	24	66.6	288	230	443
11:10	57.8	0.9	2800	67	204.1	388	310	772
11:40	61.6	0.4	5800	43	57.8	300	144	474
11:50				rate 200 gpm.				
1:05 PM.	62.3	0.4		43	60.1	300	151	477
1:15				rate 310 gpm.				
2:15	62.1	0.4		41	61.1	308	158	483
3:30				rate 338 gpm.				
4:30				rate 260 gpm.				
5:15				rate 400 gpm.				
5:40	Stopped pumping							

LONDON MILLS
Fulton County
Jan. 26, 1948

A public water supply was installed by the village of London Mills (579) in 1942.

Prior to that time water for fire protection purposes had been obtained from Spoon River through the facilities of the Minneapolis & St. Louis R. R.

In Oct., 1941, a well was completed by Hayes & Sims, Champaign, and located on the west side of town just south of the Minneapolis & St. Louis R.R. (or approximately 1750 ft. S. and 1000 ft. W. of the N. E. corner of Section 4, T. 8 N., R. 2 E.). The well was finished in sand and gravel at a depth of 22 ft. 8 in. below a ground surface elevation of 535± ft.

The well is of gravel-pack type with a 16-in. outer casing and 8-in. inner casing. The 8-in. blank casing extends from 3 ft. above the pump house floor to 18 ft. 3 in. below the surface and threaded to the bottom of the 8-in. casing is 6 ft. 7 in. of Armco-iron screen with No. 65 slot openings. The screen extends 4 ft. 5 in. below the bottom of the 16-in. casing. About 1 cu. yard of 1/8-in. to 1/2-in. gravel was placed around the screen.

A production test was made by the State Water Survey on Oct. 14, 1941. Permanent pumping equipment was not installed, and, for test purposes, water was pumped by direct suction by the pump on the rotary drill rig. Before the test was started, the water level was 15 ft. below the top of the casing; and after pumping 5 hr. at 56 gpm., the drawdown was 3 ft. 4 in. After stopping the pump, the water level returned to 15 ft. 5 in. in 30 min.

The pumping equipment consists of: 20 ft. of 5-in. column pipe; 6-in., 5-stage American Well Works L.C. turbine pump, No. 65486, rated at 70 gpm. against a head of 40 ft. at 1750 rpm; overall length of pump about 4 ft.; unknown length air line; 3-hp., 1750-rpm. Century electric motor, No. 27035.

Analysis of a sample (Lab. No. 113,287), collected Jan. 26, 1948, after 25-min. pumping, showed the water from this well to have a hardness of 17.1 gr. per gal., a residue of 336 ppm., and a trace of iron.

Pumpage is estimated to average 10,000 gpd.

LABORATORY NO. 113,287

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	Tr.		Silica	SiO_2	22.6	
Manganese	Mn	Tr.		Fluoride	F	0.1	
Calcium	Ca	75.8	3.79	Chloride	Cl	7.0	0.20
Magnesium	Mg	25.0	2.06	Nitrate	NO_3	14.8	0.24
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	55.3	1.15
Sodium	Na	3.2	0.14	Alkalinity	(as $CaCO_3$)	220.	4.40
Turbidity		0		Hardness	(as $CaCO_3$)	293.	5.85
Color		0		Residue		336.	
Odor		0					
Temperature 54° F.							

The public water supply was installed by the village of Lostant (399) in 1913.

Water was obtained from a well drilled in 1911 at the rear of the village hall (or approximately 2300 ft. S. and 1800 ft. E. of the N. W. corner of Section 24, T. 31 N., R. 1 E.).

The well was dug to a diameter of 5 ft. and to a depth of 70 ft. below a ground surface elevation of 705t ft. It was walled with brick with the top 10 ft. laid in cement mortar. The top diameter was drawn in to 3 ft., and surrounded by the concrete floor of the pumping station. The brick wall was laid as the digging proceeded. The material dug was gray clay until, at 70 ft., a water-bearing stratum was penetrated. Water came in so rapidly that all of the clay could not be removed, and about 4 ft. of the wall on one side was left unfinished; and in order to avoid caving, a large quantity of broken stone and brick was tossed into the well.

In 1913 the water level was 35 ft. below the top. It was reported that, after pumping a little over 1 hr. at approximately 70 gpm., the water level was drawn down nearly to the bottom of the well, a drawdown of between 30 and 35 ft. It would require about 2 1/2 hr. for the water to recover to its original level. The rate of inflow was calculated at approximately 30 gpm. In Oct. 1922, when pumping for 53 min., the water was drawn down 25.75 ft. After 2 hr. non-pumping, the water level returned 9.25 ft., a calculated inflow rate of 11 1/2 gpm.

Analysis of a sample (Lab. No. 79649) collected Mar. 9, 1937, showed the water from this well to have a hardness of 9.7 gr. per gal., a mineral content of 413 ppm., and an iron content of 0.6 ppm.

In Apr. 1937 the State Geological Survey made an electrical earth resistivity survey in the area surrounding the village. As a result, two 4-in. test holes were drilled by Mike Ebert, Washington. In 1938 a well was completed at the location of one of the test holes at First and Putnam St. intersection (or approximately 1800 ft. S. and 1100 ft. E. of the N. W. corner of Section 24).

The well is 96 ft. deep below the ground surface or 92 ft. below the pump pit floor. It is cased with 6-in. pipe with 4 ft. of brass screen exposed to the aquifer. The pumping installation consists of 84 ft. of 4-in. column pipe; 2 1/2-in. Myers brass cylinder 2 ft. in length; 2 ft. of 3-in. suction pipe. The depth to the bottom of the suction is 88 ft., which is the top of the screen.

The water level in 1938 was reported to be about 40 ft. below the ground surface. In Apr. 1946 it was 60 ft., and the pump would break suction after 1-hr. pumping at 9 gpm. At that time it was -reported that on 2 occasions, one carboy of commercial hydrochloric acid had been poured into the well. The well continued to improve for 2 or 3 weeks after the acid treatment.

In June 1947 the well was not in use. The pump was out, and it was intended to clean the well and install a new screen.

Analysis of a sample (Lab. No. 106,312) collected Apr. 25, 1946 after 5-min. pumping at 9 gpm., showed the water in this well to have a hardness of 6.2 gr. per gal., a mineral content of 455 ppm., and an iron content of 3.7 ppm.

In 1946, Charles Woodruff, Ottawa, drilled a test well at the northwest corner of the intersection of Railroad Ave. and East First St. The test well was 6 in. in diameter and 133 ft. deep and cased with 6-in. pipe with 10 ft. of screen at the bottom. This well is capped but can be equipped and placed in service if necessary.

In Oct. 1946, Mr. Woodruff completed a 10-in. well 25 ft. south of the test well and located at the intersection of Railroad Ave. and East First St., about 120.0 ft. east of the well at First and Putnam St. (or approximately 1800 ft. S. and 2300 ft. E. of the N. W. corner of Section 24). The well is 135 ft. deep and cased with 10-in. pipe with 20 ft. of 10-in. screen at the bottom. There is a lead packer between the bottom of the casing and the screen.

The pumping equipment consists of 119 ft. of 3-in. column pipe; 3-in. Myers cylinder pump with a 12-in. stroke and rated at 10 gpm.; the length of the cylinder is 3 ft.; 2 1/2 ft. of 3-in. suction pipe; 2-hp., 1750 rpm. Westinghouse electric motor.

Shortly after installation, the pump was not in operation for several days due to an electric power-line failure. The water level was reported to be 92 ft. below the ground surface. After the electric power was restored, pumping was continuous for 8 1/2 days at 10 gpm., and the drawdown was 2 1/2 ft.

Analysis of a sample (Lab. No. 110,652) collected June 13, 1947 after 8 1/2-days pumping at 10 gpm., showed the water in this well to have a hardness of 8.2 gr. per gal., a residue of 440 ppm., and an iron content of 0.4 ppm.

The water is not treated.

Pumpage is estimated at 7800 gpd.

LABORATORY NO. 110,652

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.4		Silica	SiO_2	24.2	
Manganese	Mn	Tr.		Fluoride	F	1.0	
Calcium	Ca	33.7	1.69	Chloride	Cl	24.0	0.68
Magnesium	Mg	13.5	1.11	Nitrate	NO_3	3.3	0.05
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	33.9	0.71
Sodium	Na	114.1	4.96	Alkalinity (as $CaCO_3$)		316.	6.32
Color		0		Hardness (as $CaCO_3$)		140.	2.80
Odor		0		Residue		440.	
Turbidity		10-		Temperature 53.5° F.			

A public water supply was installed by the village of Lovington(12 15) in 1891. The well from which the water was obtained originally was owned by Mr. A. J. Lewis, but, in 1909, the village purchased the entire system.

Water was first obtained from a well dug in 1891, and located, with the pumping station, near the northwest corner of County and Buck St. (or approximately 1650 ft. N. and 2500 ft. E. of the S. W. corner of Section 27, T. 15 N., R. 5 E.). The ground surface at the site is approximately 680t ft.

This well was reported to have been between 40 and 60 ft. deep, and furnished the entire public supply until 1906, when the yield became inadequate.

In 1906, the village drilled two wells, located about 15 ft. apart, at the pumping station. These wells were 6 in. in diameter and 147 ft. deep.

It was reported in 1914, that the non-pumping water level in the wells was about 40 ft. below the ground surface, and that the wells were capable of supplying the demand of about 20,000 gpd. The wells were equipped with deep-well pumps, with the cylinders set at a depth of 100 ft.

The west well was abandoned in 1921, when the pump rods wore a hole in the casing. The well was filled and sealed and is covered by the concrete floor of the treating plant.

In 1923, the east well was equipped with a Cook single-acting deep-well pump, with the cylinder set at a depth of 114 ft. Power was furnished by a 7 1/2-hp. electric motor. It was reported that the pump was operated an average of 15 hr. daily, and that the average production was estimated at 50,000 gpd.

Analysis of a sample (Lab. No. 49,412) collected Apr. 26, 1923, showed the water from the east well to have a hardness of 16.6 gr. per gal., a residue of 582 ppm., and an iron content of 1.0 ppm.

The east well was abandoned in 1926. The water level at that time was reported to be 43 ft. The well has been filled and sealed and is covered by the concrete floor of the treating plant.

In 1923, the present East Well now called Well No. 1 was drilled to a depth of 144 ft. by Meister Bros., Tuscola, and located near the old east well.

The well was cased with 10-in. pipe to a depth of 144 ft. but, in pulling back the casing, two sections were broken off. The remainder of the 10-in. casing was then pulled, and the well was cased with 8-in. pipe. A 10-ft. section of 8-in. Cook screen, having No. 25 slot openings, was installed with the bottom at a depth of 129 ft. The non-pumping water level, when the well was completed, was reported to be about 40 ft. below the ground surface.

The well was originally equipped with a deep-well pump rated at 185 gpm., with the top of the cylinder set at a depth of 115 ft. In 1930, pumping equipment was installed as follows: 80 ft. of 5-in. column pipe; 8-in., 10-stage Cook turbine pump, No. 250, having 5 ft. 5 in. overall length and rated at 200 gpm. against 182 ft. of head, operating at 1760 rpm.; 80 ft. of 1/4-in. air line; 20 ft. of 4-in. suction pipe; 15-hp. U. S. electric motor, operating at 1800 rpm.

In 1934, it was reported that the non-pumping water level was 58 ft. below the ground surface, and that it was necessary to throttle the pump to avoid breaking suction. The pump was operated an estimated three hours daily.

The well was reported to have been backwashed with air in 1940, and in 1944, L. R. Burt, Decatur, repaired the pump and was awarded a contract to clean the screen. In 1945, the drawdown was reported to be 53 ft. On Sept. 20, 1946, the well is reported to have yielded 110 gpm., and 84 gpm. on June 10, 1947. After air surging in Jan. 1948, the well yielded 24 gpm. It was concluded that the screen openings had become sand clogged. The well has not been used since May 25, 1948.

Analysis of a sample (Lab. No. 82,643) collected Dec. 22, 1937, showed the water to have a hardness of 23.4 gr. per gal., a residue of 517 ppm., and an iron content of 0.2 ppm.

Well No. 2 was drilled to a depth of 130 ft. in 1926 by L. R. Burt, and is located 15 ft. west of the East Well.

The well was cased with 8-in. pipe and with an 8-in. Cook screen, having No. 25 slot openings.

The original pumping equipment-is not known, but in 1930, a Cook turbine pump, No. 249, was installed identical to that in Well No. 1.

In 1934, the non-pumping water level was reported to be 59 ft. below the ground surface, and

the pump was operated an estimated four hours per day. It was necessary to throttle the pump to keep from breaking suction. The pump was repaired in 1939 by A. D. Cook, Inc., and the well is reported to have been backwashed with air in 1940. In 1945, the drawdown was reported to be 63 ft. On Sept. 20, 1946, the well is reported to have yielded 106 gpm., and 71.5 gpm. on June 10, 1947.

After air surging in Jan., 1948, the yield was reported to be 20 gpm. It was concluded that conditions of sand-clogging existed in the well similar to the condition in Well No. 1. The well has not been in service since May 25, 1948.

Well No. 3 was drilled to a depth of 130 ft. by L.R.Burt and placed in service on May 25, 1948. It is located 40 ft. south and 45 ft. west of Well No. 2, and was cased with 10-in.pipe from 1 ft. above to 118 ft. below ground level, and with 12 ft. of 10-in. Johnson Everdur screen, having No. 25 slot openings. The bottom of the well penetrated a stratum of fine, water-bearing sand.

The pumping equipment, installed May 25, 1948, consists of 120 ft. of 4-in. column pipe; 6-in., 19-stage Fairbanks-Morse turbine pump, having an overall length of about 9 ft. and rated at 100 gpm. against 210 ft. of head; 7 1/2-hp. Fairbanks-Morse electric motor.

When completed, water was pumped over the coke tray aerator, at a rate of 125 gpm. with a drawdown of 40 ft. from a static water level of 56 ft. below the top of the casing.

Well No. 3 has been the sole source of supply since May 25, 1948 and the pump is operated at 115 gpm.

Analysis of a sample (Lab. No. 115,189) collected July 1, 1948 after 30-min. pumping at 115 gpm., showed the water to have a hardness of 24.4 gr. per gal., a residue of 507 ppm., and an iron content of 3.3 ppm.

The water is aerated, filtered and softened.

From June 1, to July 1, 1948 the metered pumpage averaged 57,000 gpd.

Well No. 4 was being drilled in July 1948 by L. R. Burt, and located 78 ft. west of Well No. 3. On July 2, 1948 the drilling had reached 117 ft. and a 12-ft. section of 10-in. Johnson Everdur screen was baled in, after which the water level was 46 ft. below the top of the casing.

The pump, on order, was a Fairbanks-Morse turbine, No. SJ 2015 with a rated capacity of 100 gpm. against 210 ft. of head at 1760 rpm. The balance of the installation was to be identical to that in Well No. 3.

Correlated driller's log of Well No. 4 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and clay	65	65
Sand (water and gas)	2	67
Clay with gravel	23	90
Sand and gravel	2	92
Clay	8	100
Sand, muddy	10	110
Sand, loose	7	117

LABORATORY NO. 115,189

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	3.3		Silica	SiO_2	30.2	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	98.1	4.91	Chloride	Cl	15.0	0.42
Magnesium	Mg	42.2	3.47	Nitrate	NO_3	0.2	Tr.
Ammonium	NH_4	7.9	0.44	Sulfate	SO_4	0.0	0.00
Sodium	Na	33.1	1.44	Alkalinity	(as $CaCO_3$)	492.	9.84
Turbidity		40		Hardness	(as $CaCO_3$)	419.	8.38
Color		20		Residue		507.	
Odor		Dp		Free CO_2 (calc.)		63.	
Temperature 56° F.				pH = 7.3			

LOWPOINT
Woodford County
Mar. 11, 1947

Lowpoint, unincorporated, (215) has no publicly owned water supply. A privately owned water system furnishes water for the village. About 1915 one of the merchants built a private water supply system for his residence and store. Water was obtained from a 5-ft. diameter dug well, 51 ft. in depth.

Since about 1920 water has been obtained from two wells located south of the east and west road through Lowpoint and east of the Chicago & Alton R. R. The West Well is located approximately 2400 ft. N. and 1200 ft. W. of the S. E. corner of Section 22, T. 28 N., R. 2 W., and the East Well is located about 400 ft. east of the West Well. Both of these wells were constructed by H. W. Packard, Washburn. The elevation of the ground surface is 705± ft.

The West Well is dug 10 ft. in diameter and 90 ft. deep. It is equipped with an American deep-well cylinder type pump, belt-driven by a General Electric 5-hp. motor. This well runs dry after one hour of pumping.

The East Well is a 6-in. drilled well, 90 ft. deep. It is equipped with an American Well Works, cylinder type pump, powered by a 1 1/2-hp. Century electric motor.

Analysis of a sample (Lab. No. 109,511), collected Mar. 11, 1947 from a tap in a store about 600 ft. from the elevated tank, showed the water to have a hardness of 20.1 gr. per gal., a residue of 417 ppm., and an iron content of 0.2 ppm.

The water system is now owned by Mr. Lynn L. Banta. There are 25 service connections at the present time, and the consumption is estimated at 4000 gpd. Plans have been made for drilling another well as soon as possible.

LABORATORY NO. 109,511

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	19.7	
Manganese	Mn	0.0		Fluoride	F	0.3	
Calcium	Ca	75.3	3.77	Chloride	Cl	8.0	0.23
Magnesium	Mg	38.1	3.13	Nitrate	NO_3	7.5	0.12
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	43.8	0.91
Sodium	Na	23.0	1.00	Alkalinity	(as $CaCO_3$)	332.	6.64
Color		0		Hardness	(as $CaCO_3$)	345.	6.90
Odor		0		Residue		417.	
Turbidity		Tr.					

LUDLOW
Champaign County
Dec. 21, 1948

A public water supply was installed by the village of Ludlow (318) in 1948.

Well No. 1 was drilled in Oct. 1948 to a depth of 122 ft. by Hayes and Sin-is, Champaign and is located about 50 ft. north of Ludlow St. and about 125 ft. east of Oak St. (U. S. Route No. 45) or approximately 830 ft. N. and 2140 ft. W. of the S. E. corner of Section 1,T. 22 N., R. 9 E. The ground surface elevation at the well-site is 765i ft.

The well is cased with 8-in. pipe from 3 ft. above to 122 ft. below ground level and with 10 ft. of Johnson Everdur screen, having No. 20 slot openings.

A production test was made by the State Water Survey on Oct. 15, 1948. For test purposes, a cylinder pump was operated from the well-rig. After 8-hr. pumping at rates gradually accelerated from 62 1/2 to 123 gpm. the final drawdown was 12 ft. from a static water level of 22 ft. below the top of the casing. One minute after stopping the pump, complete recovery of the water level occurred.

Analysis of a sample (Lab. No. 116,170) collected Oct. 15, 1948, after 4-hr. pumping, showed this water to have a hardness of 16.0 gr. per gal., a mineral content of 390 ppm., and an iron content of 2.3 ppm.

The top of the casing is capped with metal. No work has been started on the distribution system.

LABORATORY NO. 116,170

	ppm.	epm.			ppm.	epm.
Iron (total) Fe	2.3		Chloride	Cl	3.0	0.08
Turbidity	5		Sulfate	SO_4	1.9	0.04
Color	0		Alkalinity	(as $CaCO_3$)	360.	7.20
Odor	0		Hardness	(as $CaCO_3$)	274.	5.48
			Total Mineral Content		390.	

A public water supply, was installed by the city of McHenry (1596) in 1897.

The source of the original supply was a 6-in. well driven to a depth of 70 ft. and located near the south bank of Boone Creek about 3 70 ft. north of the intersection of Elgin and Waukegan Roads (approximately 400 ft. N. and 2600 ft. W. of the S.E. corner of Section 26, T. 45 N., R. 8 E.). The ground surface elevation at the well is 750t ft. It was reported that the drilling passed through 20 ft. of soft earth, 35 ft. of stiff blue clay into a water-bearing stratum of very coarse gravel. Water flowed into a collecting reservoir at the top of the well. No estimate of the original flow of water from this well is available. In time the yield of the well decreased due to an infiltration of sand blocking the gravel formation. Consequently, another well of identical construction was put down about 15 ft. west of the first well. Flowing water was again obtained and conducted to the reservoir. On Nov. 20, 1923 the flow from the 2 wells was estimated at a rate of 65 gpm.

Well No. 3 was drilled in 1925 to a depth of 70 ft. and located about 35 ft. southwest of the original well. The diameter of the well was 6 in. but the yield was so small that it was never used.

Well No. 4 was drilled about 1925 to a depth of 70 ft. and located about 15 ft. east of the original well. The diameter was 8 in. and the well was originally equipped with a deep-well cylinder pump which was later removed. The well had a free flow of water and was connected to the collecting reservoir and was the source of the public supply until the fall of 1938. It was abandoned shortly after Well No. 6 was placed in service.

Well No. 5 was drilled in 1938 by Joseph H. Hueman & Sons, McHenry, and located about 35 ft. northwest of the original well. At this site a 6-in. testwell was first drilled and cased to rock at a depth of about 85 ft. When tested for capacity it produced 250 gpm. The 12-in. permanent well was then drilled to a depth of 160 ft. and cased to 96 ft. During a test the production was approximately 100 gpm. The city officials were not satisfied with the results, and the well was never used.

Well No. 6 was constructed in 1938 as a gravel-packed well to a depth of about 104 ft. by the Kelly Well Co., Grand Island, Neb. and located on the city hall site about 100 ft. west of Green St. and 300 ft. north of Waukegan Rd. (approximately 400 ft. N. and 2600 ft. E. of the S. W. corner of Section 26). The elevation of the pump base is 755± ft.

The well is cased with 24-in. id. by 34-in. o'd. concrete pipe from the surface to a depth of 84 ft. followed by 20 ft. of concrete screen. The annular space outside the screen was filled with selected sand and gravel to form a filter. No record is available of its productive capacity.

The pump installation, made in Oct. 1938, consists of 60 ft. of 6-in. column pipe; 10-in., 5-stage American Well Works turbine pump, Shop No. 6x963, rated at a capacity of 400 gpm. against 190 ft. of head; 10 ft. of 6-in. suction pipe; 60 ft. of 1/4-in. gi. air line; 25-hp. U. S. electric motor.

On July 7, 1947, the water level was 9 ft. below the pump base after a 20-min. idle period, and after 35-min. pumping at 400 gpm. the drawdown was 22 ft.

Analysis of a sample (Lab. No. 110,958) collected July 7, 1947 after 35-min. pumping at 400 gpm. showed this water to have a hardness of 20.0 gr. per gal., a residue of 373 ppm., and an iron content of 0.1 ppm.

Well No. 6 is now the source of the entire public water supply. All other wells have been abandoned and are obliterated at the ground surface. A record consumption occurred from May 1 to Nov. 1, 1947 when the McHenry CountryClub and high school averaged 30,000 gpd. During this period it is estimated that the maximum pumpage was 175,000 gpd. The normal pumpage is estimated to average 120,000 gpd.

LABORATORY NO. 110,958

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	19.9	
Manganese	Mn	0.0		Fluoride	F	0.2	
Calcium	Ca	76.8	3.84	Chloride	Cl	8.0	0.23
Magnesium	Mg	36.8	3.03	Nitrate	NO_3	9.5	0.15
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	77.3	1.61
Sodium	Na	0.0	0.00	Alkalinity	(as $CaCO_3$)	244.	4.88
Turbidity		0		Hardness	(as $CaCO_3$)	344.	6.87
Color		0		Residue		373.	
Odor (at well)		H_2S					
Temperature 51.9° F.							

McLEAN
McLean County
Oct. 27, 1948

The village of McLean (652) installed a public water supply in 1935.

Water is obtained from a well drilled in 1934 by Chris Ebert, Washington, and located near the northwest corner of the intersection of Carlisle and East St. (or approximately 800 ft. N. and 350 ft. W. of the S. E. corner of Section 35, T. 22 N., R. 1 W.). The well is 353 ft. deep below a surface elevation of 709± ft.

The hole and casing record is shown in Table 1.

TABLE 1

Hole Record

10-in. from surface to 197 ft.
8-in. from 197 to 353 ft.

Casing Record

10-in. from surface to 200 ft.
8-in. from surface to 353 ft.

An 18-ft. section of 8-in. Cook screen extends from a depth of 335 ft. to the bottom of the well. The upper 10 ft. of the screen has No. 16 slot openings, and the lower 8 ft. has No. 20 slots.

A production test was made by the State Water Survey on Oct. 8, 1934. For test purposes the well was equipped with an 8-in. Cook turbine pump with the bottom of the suction pipe at a depth of 245 ft., and 227 ft. of air line. The non-pumping water level was 108 ft. below the ground surface, and the following data were obtained from the test.

Discharge gpm.	Drawdown ft.
43	42.0
60	64.5
80	92.0
95	111.4
115	138.0

Permanent pumping equipment was installed as follows: 200 ft. of 5-in. od. column pipe; 7-in., 20-stage Fairbanks-Morse Price turbine pump, No. 27508 (head A 2060) operating at 1800 rpm.; defective air line; 15-hp. 1735 rpm. Fairbanks-Morse induction motor.

The pump has never been removed since the installation. On Sept. 23, 1948 the average metered yield was 105 gpm. against 115 ft. of head.

Analysis of a sample (Lab. No. 115,896) collected Sept. 23, 1948 after 22-minutes pumping at 105 gpm. showed the water to have a hardness of 22.1 gr. per gal., a residue of 411 ppm., and an iron content of 1.0 ppm. The water was milky in appearance indicating the presence of an appreciable gas concentration.

From Sept. 1, 1947 to Sept. 2, 1948 metered pumpage averaged 22,400 gpd.

LABORATORY NO. 115,896

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.0		Silica	SiO_2	19.7	
Manganese	Mn	0.3		Fluoride	F	0.2	
Calcium	Ca	94.6	4.73	Chloride	Cl	5.0	0.14
Magnesium	Mg	34.4	2.83	Nitrate	NO_3	3.7	0.06
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	63.4	1.31
Sodium	Na	0.5	0.02	Alkalinity (as $CaCO_3$)		304.	6.08
Turbidity		5		Hardness (as $CaCO_3$)		378.	7.56
Color		0		Residue		411.	
Odor		0		Free CO_2 (calc.)		30.	
Temperature 55.5° F.				pH = 7.4			

McNabb, unincorporated, (150) has no public water supply exceptthat a few residences are connected to a public we'll drilled under the direction of the W.P.A.

In 1934 the Illinois Emergency Relief Commission had a well drilled by Mr. Kinsey, Wenona. The well is 172 ft. deep and cased with 6-in. pipe. It is located on the south side of Main St., east of Theodore St. (or approximately 70 ft. S. and 1870 ft. W. of the N. E. corner of Section 10, T. 31 N., R. 1 W.).

A Meyers cylinder-type pump, rated at 5 gpm., is set at a depth of 80 ft. from the top of the well. Power is furnished by a 3/4-hp. electric motor. The non-pumping water level is 50 ft. below the top of the well. No production record is available except that when the well was completed, the pump was operated at a rate of 5 gpm. for 2 weeks. Fine sand is sometimes pumped with the water.

Analysis of a sample (Lab. No. 109,927), collected Apr. 13, 1947 from a tap in the Post Office, about 50 ft. from the pump, showed this water to have a hardness of 19.4 gr. per gal., a residue of 494 ppm., and an iron content of 1.6 ppm.

A few of the residents of McNabb share the expense of keeping the well and pump in operation. There are 12 service connections with an estimated consumption of 2500 gpd.

Sample-study log of well drilled in 1934 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and till	50	50
Granule gravel, clean	5	55
Till	5	60
Sand, gravelly, clean	10	70
Sand, silty	5	75
"Clay"	111	186
"Sand, loose"	6	192

LABORATORY NO. 109,927

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.6		Silica	SiO_2	30.2	
Manganese	Mn	0.0		Fluoride	F	0.5	
Calcium	Ca	81.6	4.08	Chloride	Cl	7.0	0.20
Magnesium	Mg	31.3	2.58	Nitrate	NO_3	0.5	0.01
Ammonium	NH_4	6.5	0.36	Sulfate	SO_4	0.0	0.0
Sodium	Na	58.7	2.55	Alkalinity (as $CaCO_3$)		468.	9.36
Color		0		Hardness (as $CaCO_3$)		333.	6.66
Odor		0		Residue		494.	
Turbidity		10		Temperature 53.5° F.			

MACKINAW
Tazewell County
Feb. 6, 1947

The public water supply was established by the village of Mackinaw (845) in 1893.

Water was first obtained from a dug well, 60 ft. deep, located on the public square. The well was abandoned some time after 1914.

In 1904 the Mackinaw Electric Light Co. had taken over the water distribution for the village and established a pumping station east of Orchard St. and south of the Pennsylvania R. R. A 4-in. well was drilled at this location to a depth of 172 ft. A second well was drilled in 1906 by J. D. Mount, Delavan. It was located 8 ft. south of the 4-in. well and drilled to a depth of 172 ft. with a diameter of 5 in. Both wells were cased their entire depths.

In 1919 it was reported that the cylinders in each well were wedged in the casings at a depth of 157 ft. The non-pumping water level in 1919 was reported to be 46 ft. below the surface elevation of 640± ft. The 4-in. well pump was rated at 40 gpm., and the 5-in. well pump at 60 gpm. The drop pipe in the 5-in. well was replaced in 1923, and at that time the well depth was measured as 162 1/2 ft. A Cook screen, 3 ft. in length, was in the bottom. The 2 tubular wells were abandoned after completion of a new well drilled in 1923.

Well No. 3 was drilled in 1923 by Mike Ebert, Washington, and located 7 ft. north and 2 ft. east of the old 4-in. well (or approximately 1480 ft. S. and 1600 ft. E. of the N. W. corner of Section 17, T. 24 N., R. 2 W.). The well was drilled to a depth of 163 ft. with a diameter of 8 in.

Correlated driller's log of Well No. 3 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil	15	15
Gravel	50	65
Clay	55	120
Gravel and stone	30	150
Solid rock	1	151
Gravel	12	163

During the drilling operations, water was encountered at 151 ft. and was 120 ft. below the ground surface upon completion of the well.

The well was cased with 8-in. pipe from the surface to 151 ft. with a screen from 151 to 163 ft.

Originally the well was equipped with a Cook double-acting deep-well pump with a 5 3/4-in. by 18-in. cylinder attached to a 6-in. drop-pipe. The bottom of the cylinder was at a depth of 151 ft. No suction pipe was below the cylinder. The well was deepened in 1936 to 171 ft. and equipped with 160 ft. of 3-in. column pipe; 7-stage Sterling turbine pump, No. S-2145, rated at 50 gpm. against 260 ft. of head; 15 ft. of 3-in. suction pipe.

In 1935 a new well was drilled by E. W. Johnson, Bloomington, and located 10 ft. southeast of the 8-in. well., The well is 8-in. in diameter and 178 ft. in depth with a used Cook screen placed in the bottom 15 ft. The screen was re-slotted with 1 1/6-in. openings. The well was equipped with 150 ft. of 4-in. column pipe; 13-stage Sterling turbine pump, No. S-1690, rated at 250 gpm. against 160 ft. of head; 17 ft. of 4-in. suction pipe with strainer; 15-hp. General Electric motor.

The non-pumping water level was 141 ft. below the surface when the well was completed.

Eighteen months after the well was put in service, it was necessary to pull the pump. The steel impellers were found to be badly corroded, and they were replaced by new bronze impellers. At a point even with the top of the bowl assembly, the shaft was reduced to 50% of its original cross-sectional area.

In 1936 this well was drilled 8 ft. deeper, and a new 6-in. casing was installed inside the old 8-in. casing with a 6-in. screen placed in the bottom.

In 1941 a new well was drilled by Hayes & Sims, Champaign, about 1 mile southwest of the other wells (or approximately 2200 ft. N. and 2450 ft. W. of the S. E. corner of Section 18). It is located on second bottom land on the easterly side of the Mackinaw River Valley. The well was drilled to a depth of 43 ft. below the ground surface and was cased with 32 ft. 10 in. of 12-in. od. pipe from 2 ft. 6 in. above the ground surface. A Johnson Armco-iron screen, with No. 40 slot openings, and an over-all length of 8 ft. 8 in., was set inside the 12-in. casing and sealed with a lead packer.

A production test was made on Nov. 25 - 26, 1941 under the supervision of the State Water Survey. Before the test, the water level was measured at 26 ft. 7 in. below the top of the casing. After 8-hr. pumping at 26 gpm., the drawdown was 13 in. The rate of pumping was then increased to 41 gpm., and after 5 1/2 hr., the total drawdown was 19 in. The rate was then increased to 79 gpm.; and after

8 hr., the total drawdown was 2 ft. 11 in. For the next 1 1/2hr.,the rate was 128 gpm., and the total drawdown was 4 ft. 7 in. After stopping the pump, the water level returned, in 8'min.,to within 5 in. of its original level, and in 53 min. to its original level.

This well is equipped with: 39 ft. of column pipe; an American Well Works turbine pump, No. 65608, rated at 70 gpm. against a head of 220 ft. at 1740 rpm.; 35 ft. of airline 7 1/2-hp. Westinghouse electric motor. The pump operates 35 min. and then is off for 30 min. In Jan. 1947 this well was producing all the water for the village of Mackinaw because the other wells had been abandoned, and the new well, drilled in 1946, was not yet in operation.

A new well was drilled in the fall of 1946 by Hayes & Sims, Champaign, and located 90 ft. west of the well drilled in 1941. The well is 43 ft. deep and 12 in. in diameter. The top of the well is in a pit 8 ft. below the ground surface.

Wiring of the pump was not yet completed, but it was expected that the pump would be in operation in a few weeks. The pump assembly is: American Well Works turbine, No. 71917, rated at 75 gpm. against a head of 210 ft. at 1750 rpm.; the bottom of the bowls is 39 ft.; the airline is reported to be set at a depth of 35 ft.; 7 1/2-hp. U. S. motor, No. 451017.

Analysis of a sample (Lab. No. 109,152), collected Feb. 6, 1947 from the well drilled in 1941 after the pump had been operating 25 min., showed the water to have a hardness of 25.4 gr.per gal., a residue of 53 7 ppm., and an iron content of 0.1 ppm.

The water is softened.

The pumps will be used alternately, but either one will produce enough water for the present demand. Pumpage in Feb. 1947 was estimated at 25,000 to 29,000 gpd. Pumpage in summer months is about 36,000 gpd.

LABORATORY NO. 109,152

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	22.6	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	106.3	5.32	Chloride	Cl	37.0	1.04
Magnesium	Mg	41.4	3.40	Nitrate	NO_3	29.1	0.47
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	105.5	2.20
Sodium	Na	24.4	1.06	Alkalinity	(as $CaCO_3$)	304.	6.08
Color		0		Hardness	(as $CaCO_3$)	436.	8.72
Odor		0		Residue		537.	
Turbidity		0					
Temperature 53° F.							

MACON
Macon County
Aug. 28, 1948

A public water supply for the city of Macon (875) was installed in 1935.

In 1934, three testwells were drilled by W. L. Thorne & Co., Des Plaines, and in Feb. 1935 a permanent well was completed at the site of Test Well No. 3, at the north corporation limits, west of the Illinois Central Railroad right-of-way (or approximately 800 ft. N. and 50 ft. W. of the S. E. corner of Section 29, T. 15 N., R. 2 E.).

The well was finished at a depth of 128 ft. 5 in. below a ground surface elevation of 715± ft.

The well was cased with 26-in. pipe from the ground surface to 119 ft. and with a 12-in. inner casing extending from the ground level to 108 ft. 5 in. A 12-in. diameter screen, 20 ft. long, was placed below the 12-in. casing. The screen slots were cut 1/4 in. by 1 1/2 in. and spaced 3/8 in. apart. The annular space between the casings was filled with selected gravel to the top of the 26-in. casing, at floor level. The top of the 12-in. casing was 1 ft. above floor level.

In Apr. 1938, the non-pumping water level was 62 ft. below the top of the 12-in. casing, and when pumping at 195 gpm. the drawdown was 59 to 64 ft. In Mar. 1938, the average pumping time was two hours daily, at an average rate of 166 gpm.

In Apr. 1943, it was reported that, since 1935, severe corrosive action had eaten through three of the seven pump bowls, that 50 ft. of the 120-ft. column pipe had corroded and that the suction pipe was lost.

On June 29, 1948, the well was treated with a total of 1000 gal. of 15% hydrochloric acid and the production of the well was tested by the State Water Survey before and after the cold treatment. The water level, before the production test started, was 74 ft. below the pump base and after 35-min. pumping at a rate decreasing from 56 to 50.4 gpm. the drawdown was 46.2 ft. After 6 3/4 hr. of acid treatment, the water level had returned to 87 1/2 ft. The production test was then started and, after one hour pumping at a rate continually decreasing from 43 to 30 1/2 gpm. the drawdown was 37 ft. The production rate after the acid treatment was lower than before.

On July 14, 1948, a chlorine treatment was applied to the well, and the well was pump-surged in an effort to increase production. Following the chlorine application the pumping rate was calculated at 33 gpm., as determined from the rise in water level in the clear well. The drawdown was 34 1/2 ft., or a specific capacity of 1.05 which compared with the specific capacity prior to the acidizing on June 29, 1948.

On Aug. 16, 1948, the pump discharge was estimated to average 45 gpm.

Analysis of a sample (Lab. No. 115,652) collected Aug. 19, 1948 after 27 1/2-hr. pumping at 45 gpm., showed this water to have a hardness of 28.8 gr. per gal., a residue of 694 ppm., and an iron content of 5.7 ppm.

All water is aerated, filtered and softened. Analysis of a sample (Lab. No. 115,787) collected Aug. 19, 1948 showed the treated water to have a hardness of 0.5 gr.per gal., a mineral content of 752 ppm., and an iron content of 0.12 ppm.

Pumpage is estimated to average 35,000 gpd.

Since June 1, 1948, the city has not supplied water to the Eastern Star Home because of an increase in the public demand and the limited capacity of the well. The Eastern Star Home obtains water from a well at the Home.

LABORATORY NO. 115,652

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	5.7		Silica	SiO_2	32.6	
Manganese	Mn	0.0		Fluoride	F	0.2	
Calcium	Ca	121.4	6.07	Chloride	Cl	20.0	0.56
Magnesium	Mg	46.1	3.79	Nitrate	NO_3	5.5	0.09
Ammonium	NH_4	31.9	1.79	Sulfate	SO_4	4.9	0.10
Sodium	Na	60.2	2.62	Alkalinity (as $CaCO_3$)		676.	13.52
Turbidity		80		Hardness (as $CaCO_3$)		493.	9.86
Color		25		Residue		694.	
Odor		Tr.		Free CO_2 (calc.)		339.	
Temperature 55.5° F.				pH = 6.7			

A public water supply was installed in 1939 by the village of Mahomet (823).

Water is obtained from a well drilled in 1939 by Hayes and Sims, Champaign, and is located at the southeast corner of Vine and Dunbar St. (or approximately 2350 ft. S. and 1100 ft. E. of the N. W. corner of Section 15, T. 20 N., R. 7 E.). The ground surface elevation at the well-site is 718± ft.

Test Hole No. 1 had been drilled 10 ft. west of the permanent well.

Sample-study log of the Test Hole No. 1 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and till	55	55
Sand, some gravel, clean	68	123
Till	27	150
Sand, some gravel, clean	5	155
Till	25	180
Gravel, sandy, very silty	10	190
Sand, clean	20	210
Sand and gravel	5	215
Gravel, sandy, clean	5	220

The permanent well was finished at a depth of 94 ft. and was cased with 10-in. pipe from 2 1/2 ft. above to 84 ft. below ground level and with 10 ft. of 8-in. Johnson red brass welded screen. The top half of the screen had No. 18 slot openings and the lower half had No. 20 slot openings.

A production test was made by the State Water Survey on Sept. 27, 1939, using a temporary pump installation. After three-hours pumping at 165 gpm., followed by 6-hr. additional pumping at 230 gpm., the drawdown was 12 1/4 ft. from a static water level of 49 ft. Complete recovery of the water level occurred in 8 minutes.

The pumping equipment includes a 7-in. American Well Works turbine pump, No. 63043, rated at 170 gpm. against 70 ft. of head at 1735 rpm.; 5-hp., U. S. electric motor, No. 176544. An air line of unknown length is in the well.

Pumping from this well is alternated weekly with pumping from Well No. 2.

Analysis of a sample (Lab. No. 116,781) collected Dec. 17, 1948 after 25-minute pumping showed this water to have a hardness of 29.2 gr. per gal., a residue of 545 ppm., and an iron content of 2.6 ppm.

The water is aerated and filtered.

Well No. 2 was drilled to a depth of 96 ft. by Hayes and Sims and located 30 ft. north and 8 ft. east of Well No. 1. The pumping equipment in Well No. 2 includes a 7-in. American Well Works turbine pump, No. 70779, rated at 170 gpm. against 72 ft. of head; 5-hp., U. S. electric motor. The pumping from Well No. 2 is alternated weekly with the pumping from Well No. 1.

On Dec. 17, 1948, the altitude gauge showed a water level of 11 ft. in Well No. 2 after five days of non-pumping in Well No. 2 and after a 30-minute shutdown of the pump in Well No. 1. After 15-minute pumping at 170 gpm. in Well No. 1 the drawdown in Well No. 2 was one foot.

Pumpage is estimated to average 39,000 gpd. of which an average of 6000 gpd. is used by Consolidated Food Co.

LABORATORY NO. 116,781

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.6		Silica	SiO_2	19.9	
Manganese	Mn	0.1		Fluoride	F	0.1	
Calcium	Ca	116.4	5.82	Chloride	Cl	21.0	0.59
Magnesium	Mg	51.2	4.21	Nitrate	NO_3	0.6	0.01
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	100.4	2.09
Sodium	Na	9.4	0.41	Alkalinity	(as $CaCO_3$)	388.	7.76
Turbidity		18		Hardness	(as $CaCO_3$)	502.	10.03
Color		0		Residue		545.	
Odor		0		Free CO_2	(calc.)	97.	
Temperature		53.5° F.		pH = 7.1			

MALTA
DeKalb County
Oct. 1, 1947

A public water supply was installed by the village of Malta (455) in 1915.

Water is obtained from a well drilled to a depth of 853 ft. by W. L. Thorne Co., Des Plaines, and located about 440 ft. south of the Chicago and North Western Railway and 60 ft. west of Main St. (approximately 2300 ft. S. and 1250 ft. E. of the N. W. corner of Section 23, T. 40 N., R. 3 E.). The elevation at the ground surface is 915± ft.

The well is reported to have an 8-in. casing to an unknown depth. Rock was encountered at a depth of 230 ft. and sandstone was penetrated at the bottom.

In Jan. 1918 a standing water level of 100 ft. below the ground surface was reported with no drawdown when pumping at a rate of 92 gpm.

The existing pump installation was made in 1937: 170 ft. of 4-in. od. column pipe; 6-in., 10-stage Fairbanks-Morse turbine pump, No. 1323, rated at a capacity of 100 gpm. against a head of 204 ft. (at 3600 rpm.); 20 ft. of 4-in. od. suction pipe; 170 ft. of 1/4-in. air line; 15-hp. Fairbanks-Morse electric motor. (200 ft. of column pipe were installed in 1937 but several years later three 10-ft. sections were removed.)

On Oct. 1, 1941 the non-pumping water level was 86 ft. In Aug. and Sept. 1942, it was 82 ft. and the pumping water level was 95 ft. On Sept. 25, 1947, the air line was defective.

Analysis of a sample (Lab. No. 112,032), collected Sept. 25, 1947 from a tap on the pressure tank after 15-min. pumping at 100 gpm. showed this water to have a hardness of 11.2 gr. per gal., a residue of 245 ppm., and an iron content of 0.5 ppm.

Pumpage is estimated to average 16,000 gpd.

LABORATORY NO. 112,032

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.5		Silica	SiO_2	14.7	
Manganese	Mn	Tr.		Fluoride	F	0.5	
Calcium	Ca	39.6	1.98	Chloride	Cl	1.0	0.03
Magnesium	Mg	22.7	1.87	Nitrate	NO_3	1.8	0.03
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	2.5	0.05
Sodium	Na	22.5	0.98	Alkalinity (as $CaCO_3$)		236.	4.72
Turbidity		10		Hardness (as $CaCO_3$)		193.	3.85
Color		5		Residue		245.	
Odor		0		Free CO_2 (calc.)		16.	
Temperature 52.2° F.				pH = 7.6			

MANHATTAN
Will County
July 19, 1949

A public water supply was installed by the village of Manhattan (60i) in 1892.

Water was first obtained from a well located about 240 ft. southeast of First St. and 40 ft. southwest of McClure Ave. (or approximately 1230 ft. S. and 1250 ft. W. of the N. E. corner of Section 20, T. 34 N., R. 11 E.). on a site having a ground surface elevation of 680t ft. The depth of the well when measured in 1923 was 98 ft. It was cased with 6-in. diameter pipe to limestone variously reported at a depth of 30 to 45 ft. and terminates in a water-bearing limestone formation.

No authentic records are available of the productive capacity of the well. On Apr. 7, 1924 the discharge from the well, as determined from tank measurements and allowing for consumption during the period tested, was about 40 gpm. In Oct. 1923 the non-pumping water level was 20 ft. below the ground surface. In June 1949, while the pump was out of the well, the water level was 40 ft. The pump had been delivering at a rate of 32 gpm. and broke suction after 3-min. pumping.

The following pump installation, made in 1939, is still in service: 50 ft. of 3 1/2-in. column pipe; 6-in., 16-stage Deming turbine pump, T. 873, rated at a capacity of 50 gpm. against a total head of 200 ft.; the overall length of the pump is 8 ft. 9 in.; 10 ft. of suction pipe and strainer; 5-hp. U. S. electric motor. (The well-is reported to have a jog below the casing preventing an 80-ft. turbine setting.)

This well was the source of the entire public water supply until about 1939 when a second well was drilled. The well is still in service and furnishes a part of the public water supply.

Analysis of a sample (Lab. No. 94226), collected Oct. 1, 1942 after 1 hr. of pumping at 50 gpm., showed this water to have a hardness of 24."8 gr. per gal., a mineral content of 518 ppm., and an iron content of 0.3 ppm.

Well No. 2 was drilled about 1939 and is located about 107 ft. east of the older well.

It was drilled to a depth of 156 ft. by Dreher & Schorie, Joliet, and was cased with 8-in. pipe to rock at a depth of 35 ft. below which it penetrates water-bearing limestone. Upon completion of the well, the driller pumped water for several hours at a rate of 60 gpm. The drawdown was negligible below the non-pumping water level of 28 ft. below the surface.

The following pump installation, made in 1939, is still in service: 80 ft. of 3 1/2-in. column pipe; 6-in., 16-stage Deming turbine pump (Serial T. 307) rated at a capacity of 80 gpm. against 210 ft. of head; the overall length of the pump is 8 ft. 9 in.; 10 ft. of suction pipe and 3-in. strainer; 7 1/2-hp. U. S. electr ic motor.

This well furnishes the greater part of the public water supply and is normally operated for 6 hr. at 80 gpm.

Analysis of a sample (Lab. No. 107,912) collected Oct. 8, 1946 after 6-hr. pumping at 40 gpm., showed the water to have a hardness of 24.5 gr. per gal., a residue of 469 ppm., and an iron content of 0.4 ppm. This quality is similar to that from Well No. 1 and typical for waters from this depth in this vicinity.

The combined pumpage of both wells is estimated to average 35,000 gpd.

LABORATORY NO. 107,912

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.4		Silica	SiO_2	21.4	
Manganese	Mn	Tr.		Fluoride	F	0.3	
Calcium	Ca	93.0	4.65	Chloride	Cl	4.0	.11
Magnesium	Mg	45.4	3.74	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	0.0	0.00	Sulfate	SO_4	57.6	1.20
Sodium	Na	12.0	0.52	Alkalinity (as $CaCO_3$)		380.	7.60
Turbidity		Tr.		Hardness (as $CaCO_3$)		420.	8.40
Color		0		Residue		469.	
Odor		0		Free CO_2 (calc.)		89.	
Temperature 52° F.				pH = 7.05			

MANITO
Mason County
Feb. 11, 1948

A public water supply for the village of Manito (776) was installed in 1937.

Water is obtained from a well completed in July 1937 to a depth of 81 ft. by Chris Ebert, Washington, and located at the southeast corner of Main and Broadway St. about 250 ft. northeast of the Chicago & Illinois Midland R. R. depot (or approximately 2300 ft. N. and 1650 ft. W. of the S. E. corner of Section 21, T. 23 N., R. 6 W.). The ground surface elevation at the well site is 507± ft. The well is cased with 61 ft. of 10-in. pipe below which is 20 ft. of Johnson brass screen. The top 4 ft. and the bottom 9 ft. of the screen has No. 25 slot openings, the other 7 ft. of screen has No. 12 slot openings.

The pumping equipment consists of 30 ft. of 5-in. od. column pipe; 6-in., 7-stage Fairbanks-Morse turbine pump, No. 6920, rated at 120 gpm.; length of air line and length of suction pipe is not known; 7 1/2-hp. Fairbanks-Morse electric motor, No. 332,477, operating at 1740 rpm.

A production test was made by the State Water Survey on July 15-16, 1937. Before the test was started, the water level was 33 1/2 ft. below the top of the casing; and after pumping 24 hr. at 255 gpm., the drawdown was 7 ft. After stopping the pump at the end of the test, the water level returned very quickly to the pre-test level.

On Feb. 11, 1948, before starting the pump the air line gauge reading was 10 ft. and after 40-min. pumping at 120 gpm. the gauge reading was 12 ft. The length of air line was unknown.

Analysis of a sample (Lab. No. 113,466), collected Feb. 11, 1948 after 40-min. pumping at 120 gpm., showed this water to have a hardness of 16.5 gr. per gal., a residue of 349 ppm., and an iron content of 0.1 ppm.

The water is softened. Analysis of a sample (Lab. No. 113,464) collected Feb. 11, 1948 showed the treated water to have a hardness of 0.4 gr. per gal., a mineral content of 342 ppm., and an iron content of 0.1 ppm. Twenty-seven per cent of the raw water is by-passed. A sample (Lab. No. 83303) of blended water collected Apr. 12, 1936, showed this water to have a hardness of 5.6 gr. per gal.

Pumpage is estimated to average 30,000 gpd.

LABORATORY NO. 113,466

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	17.4	
Manganese	Mn	0.1		Fluoride	F	0.1	
Calcium	Ca	71.7	3.59	Chloride	Cl	9.0	0.25
Magnesium	Mg	25.3	2.08	Nitrate	NO_3	19.5	0.31
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	87.0	1.81
Sodium	Na	3.2	0.14	Alkalinity (as $CaCO_3$)		172.	3.44
Turbidity		0		Hardness (as $CaCO_3$)		284.	5.67
Color		0		Residue		349.	
Odor		Tr.		Temperature 56° F.			

Water for the village of Manlius (319) supply, installed in 1926, is obtained from a well drilled by A. J. Pierson, Manlius, and is located in the pumping station near the center of the village on the east side of First St., north of the alley between Maple and Oak St. (or approximately 1180 ft. N. and 1170 ft. W. of the S. E. corner of Section 15, T. 17 N., R. 7 E.). The well is 225 ft. deep below a ground surface elevation of 703± ft. The lower 50 ft. of the well was in a water-bearing sand formation.

The well was cased with 8-in. pipe from the ground surface to a depth of 170 ft. and with 6-in. pipe from 167 to 210 ft. A 6-in., No. 14 Cook screen, 15 ft. long, was set below the 6-in. casing.

The well is equipped with a 2-stroke Cook, No. 2167 pump with a 5 3/4-in. by 18-in. cylinder attached to a 6-in. drop pipe. One length of 6-in. pipe was attached to the bottom of the cylinder. The lower end of the suction pipe was reported in 1928 to be set at 170 ft. Power is furnished by a 10-hp. Century electric motor, No. 713384.

In 1928, the non-pumping water level was reported to be 98 ft., and the pumping rate was 80 gpm. for 5 hr.

The pumpage is estimated at 40,000 gpd., half of which is used by the Kraft Foods Co. The Kraft Foods Co. will have their own water supply when they move their new factory in the west part of Manlius.

Analysis of a sample (Lab. No. 111,478), collected Aug. 12, 1947 after pumping 3 hr., showed this water to have a hardness of 21.5 gr. per gal., a residue of 415 ppm., and an iron content of 4.9 ppm.

The water is not treated.

LABORATORY NO. 111,478

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	4.9		Silica	SiO_2	32.6	
Manganese	Mn	0.2		Fluoride	F	0.3	
Calcium	Ca	89.8	4.49	Chloride	Cl	1.0	.03
Magnesium	Mg	34.7	2.86	Nitrate	NO_3	7.2	.12
Ammonium	NH_4	0.1	.01	Sulfate	SO_4	0.0	0.0
Sodium	Na	9.0	.39	Alkalinity (as $CaCO_3$)		380.	7.60
Color		15		Hardness (as $CaCO_3$)		368.	7.36
Odor		0		Residue		415.	
Turbidity		50		Temperature 56° F.			

MANSFIELD
Piatt County
Sept. 10, 1948

The public water supply for the village of Mansfield (693) was installed in 1939.

Well No. 1 was completed to a depth of 215 ft. in 1938 by Woollen Bros., Wapella, and located on Short St. between Park and West St. (or approximately 750 ft. S. and 2250 ft. W. of the N. E. corner of Section 10, T. 20 N., R. 6 E.). The well was finished at the site of Test Well No. 1. The ground surface elevation at the well-site is 730± ft.

Sample-study log of Well No. 1 furnished by the State Geological Survey:

Formation	Thickness ft.	Thickness in.	Depth ft.	Depth in.
Pleistocene system				
Till	40		40	
Gravel, some sand and silt, "no water"	2	6	42	6
Till	47	6	90	
Gravel, with sand and silt	6		96	
Till	54		150	
Gravel, with sand and silt	5		155	
Till and silt	43		198	
Sand, some gravel	10		208	
Gravel, clean	6	6	214	6
Pennsylvanian system				
Sandstone, compact		6	215	

Well No. 1 was cased with 6-in. pipe to a depth of 211 ft. and with 4 ft. of screen, having No. 40 slot openings.

A production test was made by the State Water Survey on June 13, 1938. Before the test, the water level was 50 ft. below the top of the casing. When pumping at 195 gpm. the drawdown was 50 ft. In June 1946 the non-pumping water level was 50 ft.

The pump assembly, installed about Sept. 1938, was recently pulled for repairs by Hayes and Sims, Champaign. The assembly was reinstalled on Aug. 17, 1948 and includes a 6-in., 16-stage Peerless turbine pump, No. 8444, and 15-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 115,724) collected Sept. 1, 1948 after 20-minutes pumping at an estimated rate of 180 gpm., showed this water to have a hardness of 17.1 gr. per gal., a residue of 392 ppm., and an iron content of 1.2 ppm. Methane gas was found to be present in a concentration of 1.35 cu. ft. per 1000 gal.

Pumpage is estimated to average 50,000 gpd.

The village supplies water to the Wabash R.R. in return for a 10-year lease given to the village for use of a Railroad well as an emergency supply unit. The Railroad well is reported to be gravel-packed and about the same depth as the village well. It is equipped with a Layne turbine pump, No. 3496, having a reported discharge rate of 225 gpm. against a pressure of 55 psi. The pump is maintained by the village and was in service from July 27 to Aug. 17, 1948 when the village well was being repaired.

LABORATORY NO. 115,724

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.2		Silica	SiO_2	24.9	
Manganese	Mn	Tr.		Fluoride	F	0.3	
Calcium	Ca	70.2	3.51	Chloride	Cl	11.0	0.31
Magnesium	Mg	28.5	2.34	Nitrate	NO_3	0.2	Tr.
Ammonium	NH_4	1.6	0.09	Sulfate	SO_4	3.9	0.08
Sodium	Na	39.8	1.73	Alkalinity	(as $CaCO_3$)	364.	7.28
Turbidity		10		Hardness	(as $CaCO_3$)	293.	5.85
Color		10		Residue		392.	
Odor		0		Temperature	54.5° F.		

The village of Manteno (1537) installed a public water supply in 1897.

Well No. 1 was drilled in 1897 and was located at the rear of the village hall about 100 ft. south of Third St. North and 140 ft. west of Chestnut St. (or approximately 1000 ft. N. and 1000 ft. E. of the S. W. corner of Section 15, T.32 N., R. 12 E.). The surface elevation is 695± ft. The well was drilled to a depth of 97 ft. and was 6 in. in diameter at the top and 3 1/2 in. in diameter at the bottom. After a few years, this well did not supply sufficient water for the village and was abandoned and sealed with concrete about 10 ft. below the top.

Well No. 2 was drilled to a depth of 310 ft. and located about 10 ft. north of Well No. 1. The well is 10 in. in diameter at the top, and 8 in. at the bottom and was equipped with a 5 3/4-in. by 24-in. Gould deep-well pump placed at a depth of 192 ft. with a suction pipe extending to a depth of 215 ft. The non-pumping water level in 1914 was reported to be 40 ft. below the top. In 1923 the well produced 44 gpm. when tested by the State Water Survey. In 1934 it was reported that this Well No. 2 was seldom used.

Analysis of a sample (Lab. No. 52524), collected Sept. 29, 1924, showed the water to have a hardness of 32.8 gr. per gal., a residue of 704.6 ppm., and an iron content of 0.1 ppm.

Well No. 2 has been abandoned and is sealed with concrete about 10 ft. below the top.

Well No. 3 was drilled to a depth of 426 ft. and located about 10 ft. north and 60 ft. east of Well No. 1.

The hole record of this well is as follows: 10-in. diameter from the surface to 17 ft.; 8-in. from 17 to 300 ft.; and 6-in. from 300 to 426 ft. A tunnel connection was made between Well No. 3 and Well No. 4 at a depth of 60 ft.

Well No. 3 was equipped with a 5 3/4-in. by 36-in. Gould cylinder pump placed at the bottom of the well.

The non-pumping water level in 1914 was reported to be 40 ft. below the top of the well. In 1934 it was reported that this well was seldom used and was last used in 1938.

The well has been abandoned and is sealed with concrete 10 ft. below the top.

Well No. 4 was dug 15 ft. in diameter and 60 ft. deep in 1913, and located about 10 ft. north and 75 ft. east of Well No. 1. It is walled with concrete to a depth of 20 ft. There was a tunnel connection with Well No. 3 at a depth of 60 ft. so that this well served as a reservoir for Well No. 3.

The well was originally equipped with a 4-in., 2-stage American Well Works centrifugal pump rated at 600,000 gpd., and driven by a 50-hp. Lincoln motor.

In 1914 this well was furnishing practically all of the village supply. At that time the water level was reported to be 40 ft. below the top of the wells and after pumping 2 hr., the water level was lowered to the bottom of the well.

Well No. 4 was deepened to a depth of 1292 ft. by the Ohio Well Drilling Co., Massillon, Ohio, in 1926.

The hole and casing record is shown in Table 1.

TABLE 1

Hole Record

12-in. from 0 to 330 ft.
10-in. from 330 to 625 ft.
8-in. from 625 to 1292 ft.

Casing Record

12-in. casing from 0 to 330 ft.
10-in. casing from 0 to 625 ft.

The 10-in. casing was pulled, but the 12-in. casing is still in place.

After deepening, Well No. 4 was equipped with a 7 1/2-in. by 24-in. American Well Works cylinder pump placed at a depth of 290 ft. and driven by a 20-hp. electric motor. The well then furnished the entire village supply and was reported to be producing 70 gpm.

In 1933 the well was equipped as follows: 300 ft. of 5-in. od. column pipe; 10-in., 8-stage Pomona turbine pump, No. K-811, rated at 150 gpm. against 290 ft. of head operating at 1760 gpm.; 20-hp. Westinghouse electric motor, No. 3 - I P 942, directly connected to the pump. Part of this unit was installed later in South Well No. 2.

It was reported in 1934 that, after pumping for 5 min. at 125 gpm., the drawdown was 125 ft. below a non-pumping water level of 175 ft.

Analysis of a sample (Lab. No. 56833), collected June 26, 1926, showed the water to have a hardness of 35.0 gr. per gal., a residue of 838 ppm., and an iron content of 0.1 ppm.

This well was abandoned about 1938. In 1943 the water level was reported to be 37 ft. The pump has been removed.

In 1918 Lew Kahler, Manteno, drilled a 4-in. test-well to a depth of 87 ft. at a location about 150 ft. north of Well No. 1. It was reported that hard yellow rock was encountered at a depth of 13 ft., hard blue limestone at 22 ft., a light vein of water at 50 ft., and a strong vein at 73 ft. This test-well was not equipped for pumping.

A well, known as the South Well No. 1, was drilled in 1936 to a depth of 100 ft. by Thomas Kramer & Sons, Harvey, and located about 125 ft. west of the Illinois Central R. R. right-of-way and 385 ft. south of Fourth St. South (or approximately 2700 ft. N. and 50 ft. E. of the S. W. corner of Section 22). The well was drilled as a 30-in. hole to a depth of 20 ft. below which it was 12-in. in diameter. It was cased from the surface to a depth of 20 ft. with 12-in. pipe, and the annular space outside of the casing was cement grouted. The well was reported to have penetrated limestone at 4 ft. below the surface. The upper part of the limestone was broken. The surface elevation is 675± ft.

The pump installation, made in 1936, was pulled in 1940 and the installation now is: 60 ft. of 6-in. column pipe; 8-in., 9-stage Pomona turbine pump, No. N-1206, having an overall length of 5 ft. 6 in., and a rated capacity of 250 gpm. against a head of 170 ft., operating at 1750 rpm.; 10 ft. of 5-in. suction pipe; no air line; 15-hp. General Electric motor and a Johnson spiral, right-angle drive gear powered by a 40-hp. Buda gasoline engine.

In 1936, the non-pumping water level was reported to be 17 ft. below the ground surface and when tested at that time, the well produced 450 gpm. (free discharge at ground level) with a drawdown of over 25 ft.

In 1939 the non-pumping water level was reported to be 24 ft. below the pump base, and the average discharge of the well was reported to be 210 gpm. with a drawdown of 25 ft. On Nov. 27, 1940 the distance to water was 17 ft. below the pump base after a 3-hr. non-pumping period.

Pump operations are alternated with South Well No. 2 twice a week.

Analysis of a sample (Lab. No. 86822), collected Nov. 29, 1939, showed the water to have a hardness of 26.9 gr. per gal., a, residue of 560 ppm., and no iron content.

In Jan. 1941, Thomas Kramer & Sons drilled a well known as the South Well No. 2, at a location 260 ft; north of South Well No. 1. This well is 120 ft. deep below a ground surface elevation of 680± ft.

Correlated driller's log of South Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Loam	5	5
Silurian system		
Niagaran-Alexandrian series		
Soft, weathered limestone rock	7	12
Limestone, varying degrees of hardness	108	120

The well was drilled 30 in. in diameter to a depth of 23 ft. and cased with 12-in. pipe to that depth below which the hole is 12-in. diameter. The annular space outside the casing was filled with concrete to a depth of 23 ft.

A production test was made by the driller using a Pomona turbine pump placed at a depth of 97 ft. The non-pumping water level was 28.3 ft. below the ground surface and when pumping at 285 gpm. the drawdown was 18 ft. When pumping at 375 gpm. the drawdown was 36 ft.

The water level returned to within a few inches of the pre-test level in 7 min. It was reported that there was considerable interference between this well and the South Well No. 1.

The existing pump installation is 80 ft. of 6-in. extra heavy bitumastic-coated column pipe; 8-in., 8-stage Pomona turbine pump No. K 811 and SA 1357 having a rated capacity of 305 gpm. against 200 ft. of head; 20-hp. Westinghouse electric motor. Pump operations are alternated twice a week with South Well No. 1.

Three hours after the pump was out, on Nov. 26, 1943, the distance to water was 21 ft. below the pump base.

Analysis of a sample (Lab. No. 112,779), collected Dec. 3, 1947 after 15-min. pumping at 300 gpm. showed this water to have a hardness of 27.8 gr. per gal., a residue of 566 ppm., and an iron content of 0.2 ppm.

The water is chlorinated at each pumping station.

In 1947 pumpage was estimated at 150,000 gpd.

LABORATORY NO. 112,779

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.22		Silica	SiO_2	13.4	
Manganese	Mn	0.2		Fluoride	F	0.1	
Calcium	Ca	106.6	5.33	Chloride	Cl	14.0	0.39
Magnesium	Mg	50.8	4.18	Nitrate	NO_3	8.7	0.14
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	165.0	3.43
Sodium	Na	15.9	0.69	Alkalinity	(as $CaCO_3$)	312.	6.24
Turbidity		Tr.		Hardness	(as $CaCO_3$)	476.	9.51
Color		0		Residue		566.	
Odor		0		Free CO_2	(calc.)	52.	
Temperature		52.5° F.		pH = 7.2			

MANTENO STATE HOSPITAL
Kankakee County
Dec. 17, 1947

The Illinois State Hospital for the Insane at Manteno has had 5 wells.

Well No. 1 was drilled in 1930 by the J. P. Miller Artesian Well Co., Brookfield, and is located approximately 790 ft. S. and 2000 ft. E. of the N. W. corner of Section 26, T. 32 N., R. 12 E. This well is 1760 ft. deep below a surface elevation of 680± ft.

Sample-study log of Well No. 1 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Glacial drift"	63	63
Silurian system		
Niagaran - Alexandrian series		
"Limestone"	197	260
Dolomite	57	317
Shale	23	340
Ordovician system		
Maquoketa shale and dolomite	205	545
Galena - Platteville dolomites	340	885
St. Peter formation		
Sandstone	165	1050
Conglomerate of sandstone, shale, and chert	20	1070
Oneota dolomite	320	1390
Cambrian system		
Trempealeau dolomite	220	1610
Franconia sandstone and dolomite	150	1760

The hole and casing record is shown in Table 1.

TABLE 1

Hole Record

23-in. from surface to 63 ft.
19 1/2-in. from 63 to 482 ft.
15-in. from 482 to 1085 ft.

Casing Record

23-in. od. casing from surface to 63 ft.
16-in. od. liner from 303 to 482 ft.
12 1/2-in. od. liner from 995 to 1085 ft.

In 1934 it was reported that when pumping at a rate of 500 gpm., the drawdown was 266 1/2 ft. below a non-pumping water level of 34 1/2 ft.

Analysis of a sample (Lab. No. 66932), collected July 16, 1930, showed the water to have a hardness of 18.2 gr. per gal., a residue of 330 ppm., and an iron content of 0.6 ppm.

This well has been abandoned, and part of the casing has been pulled.

Well No. 2 was drilled in 1934 to a depth of 156 ft. by William Reed, Manteno, and is located 575 ft. south and 125 ft. east of Well No. 1. It is cased with 6-in. od. pipe to rock at a depth of 17 ft. below which the hole is 6-in. diameter.

This well is equipped with an air lift having a 4-in, eductor pipe extending to a depth of 154 ft. In 1934 the well was reported to produce 205 gpm.

The non-pumping water level in 1938 was 27 ft. below the pump base.

Analysis of a sample (Lab. No. 75465), collected Dec. 12, 1934, showed the water to have a hardness of 26.4 gr. per gal., a residue of 497 ppm., and no iron content.

This well has not been in service since 1941. It is still equipped for pumping and available for service.

Well No. 3 was drilled in 1935 to a depth of 227 ft. by W. L. Thorne & Co., Des Plaines, and located 915 ft. south of Well No. 1. Rock was encountered at a depth of 15 ft.

The hole and casing record is shown in Table 2.

TABLE 2

Hole Record

14-in. from surface to 120 ft.
12-in. from 120 to 227 ft.

Casing Record

14-in. od. drive pipe from surface
12-in. od. from 63 to 120 ft.

The well was originally equipped with an air lift having 220 ft. of 6-in. eductor pice.

A production test was made by the State Water Survey on June 19, 1935. Water levels were measured by 200 ft. of 1/4-in. air line. The non-pumping water level was 10 ft. below the ground

surface. After 7-hr. pumping at a rate of 268 gpm., the drawdown was 88 ft.

The non-pumping water level in 1938 was reported to be 21.3 ft.

In 1938 the well had been equipped as follows: 200 ft. of 7"-in. column pipe; 10-in., 5-stage Sterling deep-well turbine pump, No. 3107; 40-hp. electric motor.

Analysis of a sample (Lab. No. 76212), collected June 19, 1935, showed the water to have a hardness of 16.3 gr. per gal., a residue of 292 ppm., and no iron content.

The well has not been in service since 1941. The Sterling turbine pump is still operated occasionally by pumping to waste.

Well No. 4 was drilled in 1938 to a depth of 226 ft. by Milaeger & Smyth, Milwaukee, Wis., and located 510 ft. south and 445 ft. east of Well No. 1 (or approximately 1300 ft. S. and 2450 ft. E. of the N. W. corner of Section 26). The surface elevation is 678± ft. Rock was encountered at a depth of 19 1/2 ft. The 14-in. od. casing extends to a depth of 19 1/2 ft., and the well is 12 in. in diameter from 19 1/2 ft. to 226 ft.

A production test was made by the State Water Survey on Aug. 16, 1938. The test-pump assembly was as follows: 180 ft. of 8-in. column pipe; 13-stage turbine pump, 7 ft. 1 1/2-in. overall length; 20 ft. of suction pipe. The non-pumping water level was 19.7 ft. below the ground level. After 3-hr. pumping at a rate of 615 gpm., the drawdown was 3.8 ft. After 2-hr. pumping at 510 gpm., the drawdown was 3.7 ft.

In 1941 this well had been equipped as follows: 80 ft. of 8-in. column pipe; 12-in., 4-stage Sterling deep-well turbine pump, No. S 2814; 50-hp. electric motor.

Analysis of a sample (Lab. No. 84069), collected Aug. 16, 1938, showed the water to have a hardness of 29.7 gr. per gal., a residue of 619 ppm., and an iron content of 0.1 ppm.

The well has not been in service since 1941. The Sterling turbine pump is operated occasionally by pumping to waste.

Well No. 5 was drilled in 1940 to a depth of 225 ft. by Milaeger & Smyth, and is located about 3000 ft. south of Well No. 1 (or approximately 1600 ft. N. and 2600 ft. W. of the S. E. corner of Section 26). This well is cased with 10 ft. 2 in. of 16-in. drive pipe. The well penetrated 4 ft. 6 in. of glacial drift, and the remaining depth was in dolomite.

A production test was made by the driller in Jan. 1940. It was reported that the well produced 390 gpm. with a drawdown of 121 ft. below a non-pumping water level of 19 ft. In 1941 when the pump was operating at a rate of 500 gpm. for 16 or more hr. per day, the pumping water level was 179 ft.

In 1941 it was reported that Wells No. 1, 2, 3, and 4 together were producing about 500 gpm., or about half the institution's demand, and that Well No. 5 was also producing about 500 gpm.

This well has not been in service since 1941. It is still equipped with a 10-in., 14-stage Sterling turbine pump, No. S436, and 75-hp. electric motor which is operated occasionally by pumping to waste.

Since 1941 all water used at this institution has been obtained from the Kankakee Water Co. The average consumption is 1 mgd. Water used for drinking and sanitation purposes is re-chlorinated. The water is softened for steam production, hot water, and domestic purposes.

The village of Maple Park (398) installed a public water supply in 1894.

The source of the supply was a well reported to be 6-in. diameter and 300 ft. deep. It is located about 20 ft. south of Main St. and 215 ft. east of Liberty St. (approximately 700 ft. S. and 1400 ft. E. of the N. W. corner of Section 31, T. 40 N., R. 6 E.). The elevation of the ground surface is 865± ft.

A production of 40 gpm. was reported in 1915. About 1920 the non-pumping water level was 127 ft. below the pump base. In 1939, the well was found to be bridged at a point 75 ft. above the bottom. When the bridge was removed there was no change in water level but an increase in production. The non-pumping water level was 155 ft. below the pump base.

This well has not been used since Oct. 1946. It is still equipped with a plunger pump and a 5-hp. General Electric motor.

In 1946, a new well was finished at a depth of 134 ft. by the Layne Western Co., Chicago, and located about 80 ft. north of Main St. and 240 ft. west of Liberty St. (approximately 450 ft. S. and 950 ft. E. of the N. W. corner of Section 31). Elevation of the ground surface is 865± ft.

The well was cased with 117 ft. of 10-in. pipe below which was installed a 20-ft. length of 8-in., No. 10 slot screen. The top 3 ft. of the screen was lead seal, the next 15 ft. was slotted and the bottom 2 ft. was blank.

A production test was made by Mr. Clifford Ashley, engineer, on Oct. 1, 1946. After 3-min. pumping at 132 gpm. the drawdown was 85 ft. from a non-pumping water level of 19 ft. below the top of casing. This drawdown remained constant for the remaining 3 1/2-hr. period of the test. Three min. after shut-down the water level was 19 ft.

The following driller's log of a test well drilled at the site was furnished by the State Geological Survey with correlations:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Top soil	2	2
Yellow clay	12	14
Brown sand	4	18
Sand and clay	47	65
Sand, fine clean and loose	5	70
Sand and clay	12	82
Sand	103	185
Sand, cemented, clay boulders	8	193
Ordovician system (?)		
Maquoketa formation (?)		
Rock, bottom of test hole	at	193

The existing pump installation, made on Oct. 7, 1947, is: 110 ft. of 6-in. column pipe; 10-in., 10-stage Layne turbine pump, No. 15823, havin'g a rated capacity of 100 gpm. against 200 ft. of head at 1150 rpm.; the overall length of the pump is 6 ft. 1 in.; 10 ft. of 4-in. suction pipe; 108 ft. 8 in. of 1/4-in. gi. air line; 7 1/2-hp. Westinghouse electric motor.

Analysis of a sample (Lab. No. 111,419) collected Aug. 7, 1947, after 3-hr. pumping at 100 gpm. showed this water to have a hardness of 19.1 gr. per gal., a residue of 351 ppm., and an iron content of 2.4 ppm.

Pumpage is estimated at 30,000 gpd.

LABORATORY NO. 111,419

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.4		Silica	SiO_2	28.3	
Manganese	Mn	0.0		Fluoride	F	0.4	
Calcium	Ca	68.0	3.40	Chloride	Cl	2.0	0.06
Magnesium	Mg	38.2	3.14	Nitrate	NO_3	4.3	0.07
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	0.2	Tr.
Sodium	Na	10.8	0.47	Alkalinity	(as $CaCO_3$)	344.	6.88
Turbidity		20+		Hardness	(as $CaCO_3$)	327.	6.54
Color		0		Residue		351.	
Odor		0					
Temperature		51.3° F.					

MARENGO
McHenry County
July 25, 1947

The city of Marengo (2034) installed a public water supply system in 1893.

The first installation consisted of a shallow dug well 20 ft. in diameter and 15 ft. deep, and located at the northeast corner of Telegraph and State St. (approximately 57 ft. N. and 70 ft. E. of the S.W. corner of Section 25, T. 44 N., R. 5 E.). The ground surface elevation is 810± ft. The entire depth, except 3 ft. of black soil and clay at the surface, is° in a formation of sand and gravel from which the water supply is obtained.

On May 27, 1924 a 10-hr. production test was made by Randolph-Perkins Co., Chicago. The rate of pumping at the start of the test averaged about 160 gpm. and decreased to an average of 150 gpm. during the latter part of the test. The water level in the well was lowered from a depth of 8 ft. 4 in. below the top of the well curb (2 ft. above ground surface) to a depth of 13 ft. after 5 1/2-hr. pumping and at the end of the test, when the pumping rate was slightly less, the water level had raised 2 in.

A second production test of 12-hr. duration was made on Nov. 12, 13, 1924. Ground water conditions were practically the same as during the May 27, 1924 test. The water level after lowering 4 ft. 8 in. remained stationary when pumping at a rate of 150 gpm.

This well continued in service until about 1938 when it was abandoned and filled to the original ground level.

To provide an adequate water supply for domestic purposes and fire protection during intervals of drought a second well was constructed in 1925. This well is located about 70 ft. northeast of the original well (approximately 100 ft. N. and 130 ft. E. of the S. W. corner of Section 25). It has a diameter of 25 ft. and a depth of 21 ft. and was originally connected to the older well by a 4-in. pipe laid about 15 ft. below the ground level.

Since 1938 this well has been the source of the entire public water supply. On July 15, 1947 the following measurements were made below the ground surface: Non-pumping water level, 7 ft. 4 in.; pumping water level, 11 ft. 8 in. after 3-hr. pumping at 150 gpm.; depth of well was 20.6 ft.

The available pumping equipment consists of 3 American Well Works centrifugal pumps. One pump, Fig. S1MD, Size 2, Shop No. 48563, having a rated capacity of 150 gpm. against 85-lb. pressure is powered by a 15-hp. General Electric motor and is in service about 20 hr. daily. Another pump, Fig. S1MD, Size 3, Shop No. 48638, rated at a capacity of 450 gpm. against 85-lb. pressure and powered by a 40-hp. General Electric motor is used for emergency purposes. The other pump, Fig. S1ED, Size 3, Shop No. 45639, has a rated capacity of 450 gpm. against 85-lb. pressure. It is powered by a50-hp.Buda gasoline engine and serves as a standby unit.

In Aug. 1946, following a protracted period of drought, the water level in the well was lowered to the bottom after pumping for an hr. at a rate of 450 gpm. After 15 min. of idle period, the water level rose to its normal standing level.

Analysis of a sample (Lab. No. 111,091), collected July 15, 1947 after 3-hr. pumping at 150 gpm. showed this water to have a hardness of 22.0 gr. per gal., a residue of 412 ppm., and an iron content of 0.2 ppm.

The largest industrial consumers are Arnold Engineering Co., McGill Metal Products Co., and Marengo Foundry Co. The estimated pumpage is 180,000 gpd.

LABORATORY NO. 111,091

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	17.7	
Manganese	Mn	Tr.		Fluoride	F	Tr.	
Calcium	Ca	90.7	4.54	Chloride	Cl	21.0	0.59
Magnesium	Mg	36.7	3.02	Nitrate	NO_3	12.6	0.20
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	69.1	1.44
Sodium	Na	4.4	0.19	Alkalinity (as $CaCO_3$)		276.	5.52
Turbidity		0		Hardness (as $CaCO_3$)		378.	7.56
Color		0		Residue		412.	
Odor		Tr.		Free CO_2 (calc.)		30.	
Temperature		51.0° F.		pH = 7.4			

MAROA
Macon County
Aug. 30, 1948

A public water supply was installed by the city of Maroa (1033) in 1892.

Water was obtained originally from one 8-in. diameter and two 6-in. diameter tubular wells, from 83 to 85 ft. in depth below a ground surface elevation of 720±ft. In 1912 the non-pumping water level was about 42 ft. below the ground surface.

All wells were located at the pumping station, with the 8-in. well at the north end and the two 6-in. wells located 24 ft. east and 25 ft. and 39 ft. south. The 8-in. well, now known as Well No. 1, originally had 10 ft. of 8-in. screen at the bottom and in 1917 was recased with 75 ft. of 6-in. pipe.

In 1920, one of the original 6-in. wells was abandoned and a 10-in. well was drilled by A. D. Cook. Six feet of Cook screen, with No. 12 slot openings, was placed in the bottom of the well. In 1921, the production rate from the three wells was estimated to average 300 gpm. Later all wells were abandoned and filled except Well No. 1.

In 1938, Well No. 1 was reported to be equipped with 70 ft. of 3 1/2-in. column pipe; 6-in., 3-stage Fairbanks-Morse turbine pump, No. 22137, rated at 75 gpm. at 3600 rpm.; 5-hp. Fairbanks-Morse electric motor.

Well No. 1 is maintained as an emergency supply unit and is estimated to yield 90 gpm.

In Jan. 1931, a gravel-packed well, now known as Well No. 2, was completed and located 67 1/2 ft. south and 7 ft. west of Well No. 1 (or approximately 730 ft. N. and 50 ft. E. of the S. W. corner of Section 2, T. 18 N., R. 2 E.).

Correlated driller's log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Cinders	2	2
Pleistocene system		
Loam and clay	52.8	54.8
Sand	13	67.8
Clay	8.3	76.1
Sand and gravel	5	81.1

The outer casing consisted of 24-in. pipe from the surface to 60 ft. and 20-in. pipe from 60 to 76 ft. The inner casing consisted of 12-in. pipe from the surface to 76 ft. and a 5-ft. length of Continental Well screen. A 2-ft. packer was placed at the bottom making the effective screen length 3 ft.

When new, the well produced water at a rate of 250 gpm. with a drawdown of 36 ft. from a water level of 33 ft. below the ground surface. Later the production rate declined to 25 to 35 gpm. with a drawdown of 38 ft. In 1938 the production had been restored to 75 gpm. by backwashing with a fire hose. Methane gas was present in the water from this well in a concentration of 12.8 cu. ft. per 1000 gal.

Well No. 2 has been abandoned. It is reported that a sack of cement was dropped in the casing to seal it. Efforts to clean the screen by acidizing were unsuccessful. The pumping equipment was installed in Well No. 3.

Well No. 3 was drilled to a depth of 288 ft. by M. Ebert Co., Washington, and located 24 ft.

LABORATORY NO. 115,662

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.8		Silica	SiO_2	15.7	
Manganese	Mn	0.0		Fluoride	F	0.3	
Calcium	Ca	63.7	3.19	Chloride	Cl	60.0	1.69
Magnesium	Mg	40.4	3.32	Nitrate	NO_3	0.5	0.01
Ammonium	NH_4	2.9	0.16	Sulfate	SO_4	5.3	0.11
Sodium	Na	74.1	3.22	Alkalinity	(as $CaCO_3$)	404.	8.08
Turbidity		15		Hardness	(as $CaCO_3$)	326.	6.51
Color		0		Residue		522.	
Odor		Tr.		Temperature		55.5° F.	

east of Well No. 2. A test well had been drilled to the same depth. Well No. 3 was cased with 8-in. pipe and with a 22-ft. length of screen.

The pump installation, removed from Well No. 2 and overhauled, consists of 70 ft. of 5-in. column pipe; 7-in., 12-stage Fairbanks-Morse turbine pump, No. 6085, rated at 150 gpm. at 1800 rpm.; 15-hp. 1800 rpm. Fairbanks-Morse electric motor. The pump is operated at a discharge rate of 110 gpm. against a pressure of 40 psi. Well No. 3 is the sole source of supply.

Analysis of a sample (Lab. No. 115,662), collected Aug. 24, 1948 after 4-hr. pumping at 110 gpm. showed this water to have a hardness of 19.0 gr. per gal., a residue of 522 ppm., and an iron content of 0.8 ppm.

All water is aerated and softened. Analysis of a sample (Lab. No. 115,785), collected Aug. 24, 1948 showed the treated water to have a hardness of 3.5 gr. per gal., a mineral content of 371 ppm., and a trace of iron.

Pumpage is estimated to average 46,200 gpd.

LABORATORY NO. 115,785

	ppm.	epm.			ppm.	epm.
Iron (total) Fe	Tr.		Fluoride	F	0.1	
Turbidity	10		Chloride	Cl	61.	1.72
Color	0		Alkalinity	(as $CaCO_3$)	144.	2.88
Odor	0		Hardness	(as $CaCO_3$)	58.	1.16
Temperature 58.5° F.			Total Mineral Content		371.	

MARQUETTE HEIGHTS
Tazewell County
May 19, 1948

A public water supply was installed in 1947-48 for Marquette Heights, an unincorporated town-site development by Byrne-Peoria Communities, Inc.

Well No. 1 was completed to a depth of 125 ft. in Nov. 1947 by M. Ebert Co., Washington, and located at the town-site about 3/4 mile south of Creve Coeur, or approximately 1770 ft. S. and 2050 ft. E. of the N. W. corner of Section 13, T. 25 N., R. 5 W. The ground elevation at the well is 483.8 ft. The driller's log shows a fine sand stratum between 43 and 125 ft. depth. In a 4-in. test hole, 200 ft. north, shale was reported at 127.5 ft.

The well is cased with 12-in. pipe from 1.8 ft. above to 101.8 ft. below ground surface and with 25 ft. of 12-in. Johnson Everdur bronze screen. The upper 15 ft. of the screen has No. 30 slot openings and the lower 10 ft. has No. 20 slot. A production test was made on Nov. 21, 1947 by the driller. The temporary pumping equipment consisted of an 8-in., 3-stage Pomona turbine attached to 86 ft. of 6-in. column pipe. Before, pumping, the water level was 50.2 below the top of the casing. After 2-hr. pumping at 486 gpm. the drawdown was 10.0 ft. The pumping rate was then gradually decelerated to 300 gpm. and at 30 minutes the drawdown was 3.2 ft. The pumping rate was then gradually accelerated to 400 gpm. and after 1 hr.-, the drawdown was 6.2 ft. After stopping the pump, the recovery of the water level to 50.2 ft. was almost instantaneous. During the test, an automatic water level recorder, property of the State Water Survey, was installed in the 4-in. test hole, 300 ft. north of Well No. 1. Before starting the pump for the test, the water level in the test-hole was 0.2 ft. higher than in the well and after 1 hr. 46 min. of the test the water level in the test-hole was lowered 0.05 ft.

Analysis of a sample (Lab. No 112;687) collected Nov. 21, 1947 after pumping 1 hr. 46 min. at 484 gpm., showed this water to have a hardness of 23.8 gr. per gal., a residue of 445 ppm., and an iron content of 0.2 ppm.

Well No. 2 was drilled to a depth of 122 ft. in Jan. 1948 by Ebert and Co. and located 175 ft. north and 65 ft. east of Well No. 1. The elevation of the top of the casing is 485.29 ft. The well is cased with 93 ft. 4 in. of 12-in. steel pipe and 30 ft. exposed of 12-in. Johnson Everdur bronze screen, having No. 20 slot openings.

A production test was made by the driller on Feb. 25, 1948. Before pumping, the water level was 50.5 ft. below the top of the casing and, after 2-hr. pumping at a rate of 467 gpm. the drawdown was 9.8 ft. During the pumping, the water level in Well No. 1 was lowered 0.13 ft. and was lowered 0.10 ft. in test well No. 3, about 200 ft. northerly from Well No. 2.

Well No. 3 was drilled to a depth of 125 ft. in May 1948 by Ebert and Co. and located 315 ft. north and 55 ft. east of Well No. 2. The elevation of the top of the casing is 487.61 ft. Shale was reported at a depth of 125 ft. The well is cased with 12-in. pipe with a 12-in. Johnson Everdur bronze screen at the bottom.

A production test was made by the driller on May 19, 1948. Before pumping, the water level was 49.4 ft. below the top of the casing and after 2-hr. pumping at 495 gpm., the drawdown was 9.5 ft.

LABORATORY NO. 112,687

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	21.8	
Manganese	Mn	Tr.		Fluoride	F	0.1	
Calcium	Ca	98.0	4.90	Chloride	Cl	6.0	0.17
Magnesium	Mg	40.0	3.28	Nitrate	NO_3	8.7	0.14
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	87.0	1.81
Sodium	Na	0.5	0.02	Alkalinity	(as $CaCO_3$)	304.	6.08
Turbidity		Tr.		Hardness	(as $CaCO_3$)	409.	8.18
Color		0		Residue	-	445.	
Odor		0					
Temperature 53° F.							

A public water supply for the city of Marseilles (4455) was installed by a private corporation in 1902. The water works are now owned by the Il-Illinois Power & Light Co.

The first well was located in the west central part of the city between the Illinois River and the Illinois-Michigan Canal, and about 1000 ft. east of the pumping station and the hydro-electric plant. The well is now enclosed in a 8-story building owned by the National Biscuit Co. It was drilled into sandstone at a depth of 600 ft. below a ground surface elevation of 500t ft. The diameter was reported to be 8 in. at the top and 6 in. at the bottom, with casing extending from the surface to 125 or 150 ft. In 1915 the artesian flow was estimated at 67 gpm. In 1919 it became necessary to operate the air lift continuously. In 1920 the National Biscuit Co. acquired possession of the land on which this well was located. The well was cleaned out, re-cased through the St. Peter sandstone with 6-in. pipe, and drilled to a depth of 615 ft. The natural flow was reported to be increased to 45 or 50 gpm.

Analysis of a sample (Lab. No. 42434), collected Jan. 14, 1920 before the well was recased, showed the water to have a hardness of 21.9 gr. per gal., a mineral content of 596 ppm., and an iron content of 0.1 ppm.

Analysis of a sample (Lab. No. 42901), collected May 20, 1920 after cleaning out, deepening, and re-casing the well, showed the water to have a hardness of 17.7 gr.per gal., a mineral content of 482 ppm., and an iron content of 0.3 ppm.

A sandstone well was drilled at the pumping station soon after the 600-ft. well had been constructed. The pumping station and hydro-electric plant is located about 1/2 mile west of Main St. on the bank of the Illinois River. The well was 800 ft. deep and 8 in. in diameter at the top and 6 in. in diameter at the bottom and also about 125 to 150 ft. of casing. In 1915 the free flow of this well was estimated at 45 gpm. and in Feb. 1920 was 25 gpm.

This well has been plugged.

In Feb. 1920, when the National Biscuit Co. acquired the city's 600-ft. well, it had a new well drilled for the city. The well, now called Well No. 2, was located near the pumping station and about 100 ft. distant from the 800-ft. well. The well was drilled by Wm. Cater, Chicago, to a depth of 670 ft. below a ground surface elevation of 485-ft. Around the top of the well, a pit was constructed 6 ft. square and 5 ft. deep.

At about 602-ft. depth the flow of water increased. The drilling was continued in the hope of obtaining a greater flow, but no greater flow was found. When the well was completed the pressure at the ground surface was 141b. and the free flow was 120 gpm.

The hole and casing record is shown in Table 1.

TABLE 1

Hole Record

10-in. from 368 to 670 ft.

Casing Record

12-in. from 0 to 120 ft.
10-in. from 0 to 368 ft.

Water is pumped by air lift which has been used continuously for the past year, prior to which, for about 10 years, the well had been maintained for emergency use only.

Analysis of a sample (Lab. No. 110,854), collected June 26, 1947 from a tap in the pump house, showed the water in Well No. 2 to have a hardness of 22.3 gr. per gal., a residue of 575 ppm., and an iron content of 0.1 ppm.

The analysis indicates the presence of an appreciable proportion of water from the St. Peter sandstone.

The water is chlorinated.

In 1931, Well No. 3 was drilled to a depth of 850 ft. by W. L. Thorne Co., Des Plaines. It is located 100 ft. north of the Rock Island R. R. tracks and 1 1/2 blocks west of Main St. (or approximately 1700 ft. N. and 1400 ft. W. of the S. E. corner of Section 13, T. 33 N., R. 4 E.).

During the construction of the well, the casing was camaged at 180-ft. depth by the whipping of the cable. Repairs were made by removing the top 180 ft. and placing a 12-in. coupling on the bottom of the 180 ft. A 14-in. od. pipe was welded on the outside of the coupling. A short section of 10-in. id. pipe was fastened on the inside of the coupling. The space between the. 10-in. and 14-in. pipes was filled with lead, and the top string of pipe was lowered and driven hard against the lower string of pipe in order to drive the lead

around the top of the lower pipe.

Sample-study log of Well No. 3 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pennsylvanian system		
Siltstone, shale, thin beds of coal and sandstone	67	67
Ordovician system		
Glenwood dolomite and shale	3	70
St. Peter formation		
Sandstone	225	295
Conglomerate of sandstone, chert, shale and dolomite	15	310
Shakopee dolomite	50	360
New Richmond sandstone and thin beds of dolomite and shale	85	445
Oneota dolomite and some sandstone	245	690
Cambrian system		
Trempealeau dolomite	160	850

The hole and casing record is shown in Table 2.

TABLE 2

Hole Record

16-in. from 0 to 365 ft.
12-in. from 365 to 850 ft.

Casing Record

12-in. from 0 to 365 ft.

The well is equipped with an air lift pump and 90 ft. of 6-in. eductor pipe, the lower 5 ft. of which is perforated with 120 holes, each 3/16 in. in diameter. The perforated section is enclosed in a 5-ft. cylindrical drum made of 10-in. pipe and serving as a foot piece. A 1 1/2-in. air pipe is welded into the drum.

During drilling operations when a depth of 500 ft. was reached, water flowed at the surface; when at 795 ft., the flow was 60 gpm. at an elevation 3 ft. above the ground surface; and when the well was completed, the hydrostatic pressure reached approximately 15 ft. above the surface. However, the level at any time, depended on the number of nearby wells which were operating. It was reported to average 3 ft. above the ground surface. A production test was made, and the production rates and drawdowns, when discharging at 3 ft. above the surface, were:

Discharge Rate gpm.	Drawdown ft.
59	5.25
120	18.83
333	34.83
406	34.83

Analysis of a sample (Lab. No. 110,856), collected June 26, 1947, showed the water from Well No. 3 to have a hardness of 17.9 gr. per gal., a residue of 449 ppm., and an iron content of 0.1 ppm. The quality appears to be typical for waters from the New Richmond sandstone.

Pumpage is estimated to average 300,000 gpd.

LABORATORY NO. 110,856

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	11.5	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	70.3	3.52	Chloride	Cl	57.0	1.61
Magnesium	Mg	31.8	2.61	Nitrate	NO_3	2.5	0.04
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	59.4	1.24
Sodium	Na	56.1	2.44	Alkalinity (as $CaCO_3$)		284.	5.68
Color		0		Hardness (as $CaCO_3$)		307.	6.14
Odor		0		Residue		449.	
Turbidity		0					

The city of Marshall (2758) installed a public water supply in 1900.

Water has always been obtained from wells located in the valley of Big Creek, adjacent to U. S. Highway No. 40, about 2.15 mile east of State Highway No. 1.

The first source of supply consisted of six 6-in. wells driven to depths of 16-20 ft. These wells were abandoned prior to 1914.

Five wells were drilled between 1904 and 1914 and located north of the pumping station and between 25 and 45 ft. west of Big Creek (approximately 100 ft. N. and 2200 ft. W. of the S. E. corner of Section 8, T. 11 N., R. 11 W.). The ground surface elevation is 490± ft.

The well's were 10 in. in diameter, and, numbered from 1 to 5, were, 40, 43, 50, 50 and 55 ft. deep, respectively.

Correlated driller's log of Well No. 5 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Sand	8	8
Gravel	2	10
Sand	4	14
Sand and gravel	30	44
Gravel	11	55

Each well was cased with 10-in. pipe, and equipped with 17 ft. of Cook strainer, having No. 14 slot openings.

It was reported that the water level varied with the water level in Big Creek.

These wells furnished the entire supply until 1916, and were held in reserve for emergency use until shortly after 1916. In 1922, the wells were not in use, and the water level in the well nearest Big Creek was reported to be 9.6 ft. below the top of the casing. With the exception of this well, all other of the old 10-in. wells have been filled and completely obliterated. On June 7, 1948 the depth to water from the top of the casing (0.5 ft. above ground) was 9.5 ft. after the pumps in the East and West Wells had been operating 5 hr. at a combined rate of 400 gpm. At that time, the water surface in Big Creek was 0.7 ft. higher than the water level in the well. On June 9, 1948 the depth to water was 9.3 ft. from the top of the casing after 10-hr. pumping in the East and West Wells.

The top of the casing is 11 ft. below the pump base in the West Well. The old 10-in. well is 37 ft. northeast of the East Well and 46 ft. northeast of the West Well.

The East Well was dug in 1916, and located about 11 ft. north of the pumping station. This well is 6 ft. in diameter and is cased with 5-ft. sections of boiler plate, riveted together, extending from 2 1/2 ft. above to 27 1/2 ft. below the ground surface.

The non-pumping water level in 1922 was reported to be 20.4 ft. below the top of the casing. The sand was reported to have been cleaned from the well in 1936. In 1938, it was reported that a 6-in. hole had been drilled in the bottom of the well to a depth of 42 ft., and that 8 radial slotted pipes (1 1/4 to 2 in. in diameter and up to 15 or 20 ft. long) had been jacked out around the well. The well was reported to be 42 ft. deep in 1938.

Analysis of a sample (Lab. No. 38796) collected Jan. 7, 1918, showed the water to have a hardness of 14.1 gr. per gal., a residue of 286 ppm. and no iron content.

The West Well was drilled in 1920, and located 14 ft. (center to center) west of the East Well. The well was reported to have been similar on construction to the East Well. Sand was cleaned from the well in 193 6.

In 1938, it was reported that 6 radial pipes (1 1/4 to 2 in. in diameter, and up to 15 or 20 ft. long) were jacked out around the well, about 4 ft. above the bottom. The well was reported to be35 ft. deep.

Analysis of a sample (Lab. No. 83709) collected June 17, 1938 showed the water to have a hardness of 15.1 gr. per gal.; a residue of 347 ppm., and an iron content of 0.01 ppm.

When the water system was first installed, water was pumped from the well through common suction pipes by a 7-in. by 8-in. Smith Vaile triplex pump, directly connected to a Marinette gasoline engine. In 1906, the pumping station was enlarged, and a boiler and an 11-in. by 17-in., by 8 1/2-in. by 18-in. McGowan plunger pump, having a capacity of 750,000 gpd., was installed. In 1913, 1918 and in 1938 new pumping equipment was installed. In 1942, the 2 wells were connected by a 6-in. pipe placed about 20 ft. below the

tops of the wells, so that water could flow from either well to the other. The pumping equipment then installed in the West Well consisted of 20 ft. of 6-in. column pipe; 7-in. 12-stage Pomona turbine pump No. SB 939, rated at 550 gpm., against 135 psi., operating at 1760 rpm.; 3 ft. of tapered strainer; 60-hp. Westinghouse Electric motor No. 23 EM 1874 operating at 1760 rpm. There is no air line.

The pump base is 7.9 ft. above the cap of the West Well and 7.4 ft. above the cap of the East Well. The normal non-pumping water level is 19.6 ft. below the pump base. The maximum pumping water level is limited by the position of the connecting pipes, 27.9 ft.belowthe pump base. On June 9, 1948 the pumping water level was 25.1 ft. below the pump base after 3/4-hr. pumping at 400 gpm.

Analysis of a sample (Lab. No. 114,961) of water from both wells collected June 7, 1948 after 4 1/2-hr. pumping, showed the water to have a hardness of 17.2 gr. per gal., a residue of 338 ppm. and an iron content of 0.1 ppm.

In 1943, the Pennsylvania R.R., the New York Central R.R., and the Velsicol Corporation were using about 250,000 gpd., or about half of the daily pumpage. In June 1948 the Velsicol Corporation was using water at a rate of 120 gpm. and had requested an additional 150,000 gpd.

Total metered pumpage for the city, from June 7, 1947 to June 7, 1948 averaged 444,000 gpd.

LABORATORY NO. 114,961

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	13.2	
Manganese	Mn	Tr.		Fluoride	F	0.1	
Calcium	Ca	80.7	4.04	Chloride	Cl	8.0	0.23
Magnesium	Mg	22.5	1.85	Nitrate	NO_3	6.0	0.10
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	40.1	0.83
Sodium	Na	1.6	0.07	Alkalinity (as $CaCO_3$)		240.	4.80
Turbidity		Tr.		Hardness (as $CaCO_3$)		295.	5.89
Color		0		Residue		338.	
Odor		0		Free CO_2 (calc.)		24.	
Temperature 56.2° F.				pH = 7.4			

MARTINSVILLE
Clark County
July 28, 1948

The city of Martinsville (1296) installed a public water supply in 1923. The system was completed about 1928.

Water is obtained from wells located in the southwest part of the city in the valley of Little Creek.

Well No. 1 was dug in 1923 and located about 350 ft. west of Union St. and 150 ft. north of Clay St. extended (or approximately 1660 ft. N. and 1440 ft. W. of the S. E. corner of Section 7, T. 10 N., R. 13 W.). The ground surface elevation is 560± ft. The well was drilled to an unknown depth and the top was dug to a diameter of 17 ft. and lined with concrete to serve as a reservoir. The well was equipped with a centrifugal pump driven by a 30-hp. Ideal Electric Motor No. 3001.

In 1927 the non-pumping water level was 13 ft. below the ground surface.

It was reported that the well was not used much in 1927, because of caving.

Well No. 2 was drilled about 1927 by a Mr. Leatherman, Martinsville, and was located 30 ft. south of Well No. 1. The well is about 50 ft. deep and cased with 8-in. pipe to an unknown depth. The size and type of screen are unknown. The well has not been in service for several years and is temporarily maintained for emergency. In July, 1948, after completion of Well No. 4, a production test was made, in Well No. 2, using a temporary pump with the bottom of the suction set at 42 or 43 ft. below ground level. With the pump in Well No. 4 operating, the water level in Well No. 2 was 22.0 ft. below ground level. The pump in Well No. 2 was then operated at a rate slightly below that at which it would break suction. After 1-hr. pumping at 24 gpm., the drawdown in Well No. 2 was about 20 or 21 ft.

Well No. 3 was drilled by Mr. Leatherman about 1927 and was located about 75 ft. southwest of Well No. 1. This well was reported to be 53 ft. deep and cased with 8-in. pipe. In 1927, Well No. 3 produced about 148 gpm. and was in service about 1 1/2 hr. daily. The well furnished the principal supply until Aug. 1948 when it was abandoned and the pump removed and installed in Well No. 4.

In July 1948, the casing and screen had been removed and the hole filled.

Analysis of a sample (Lab. No. 114,963), collected June 5, 1948 after 22-hr. pumping at 65 gpm., showed the water to have a hardness of 18.7 gr. per gal., a residue of 500 ppm., and an iron content of 1.7 ppm.

A testwell is reported to have been drilled to a depth of 90 ft. in 1937, and located on the east side of Randall St. between Bond and Vine St. (or approximately 1700 ft. S. and 1000 ft. W. of the N. E. corner of Section 7). The ground surface elevation is 605± ft.

Correlated driller's log of test well furnishedby the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay, hardpan	60	60
Gravel	15	75
Hardpan	15	90
Gravel	at	90

The hole was abandoned.

In July 1948, a test hole was drilled by Cecil Griffy, Vale, and located 210 ft. northeast of Well No. 4 and 195 ft. from Well No. 2. The drilling was discontinued at a depth of 150 ft., when no water was encountered at or above that depth.

Well No. 4 was completed in July 1948 at a depth of 51 ft. by Cecil Griffy, and located 80 ft. northwest of Well No. 2 (or approximately 1720 ft. N. and 1510 ft. W. of the S. E. corner of Section 7). Fine sand and gravel, grading to medium corase sand and heavy gravel were encountered between depths of 34 and 51 ft.

The well was cased with 8-in. pipe from 3 ft. 8 in. above to 45 ft. below ground level and with 6 ft. exposed length of 7 1/2-in. Cook screen. The screen had No. 20 slot openings and an overall length of 7 ft. 2 in. A lead packer was placed between the casing and the top of the screen.

The pumping assembly consists of 30 ft. of 4-in. column pipe; 19-stage Pomona turbine pump, No. SD317 having an overall length of 8 ft.; 15 ft. of suction pipe; 5-hp. General Electric motor. The bottom of the suction is 53 ft. below the top of the casing or 1 ft. 8 in. above the bottom of the well.

A production test was made by the State Water Survey on July 27, 1948. The pump had been in service, pumping into the distribution system at a rate of 55 to 60 gpm., for several days be-

fore the test, but had been idle for 4 hr. just before the test was started. The water level was then 18.2 ft. below the top of the casing. After 3-hr. 40-min. pumping at 59 1/2 gpm. the drawdown was 18.3 ft., and after a total of 6-hr. pumping at a final rate of 81 gpm. the drawdown was 32.4 ft. During the test of Well No. 4, frequent observations were made of water level in Well No. 2 from which it was calculated that after pumping 24 hr. in Well No. 4 at a rate of 55 to 60 gpm., the interference in Well No. 2 would be 5 ft. or more.

Analysis of a sample (Lab. No. 115,408) collected July 27, 1948 after 5-hr. pumping at 81 gpm. showed the water to have a hardness of 18.9 gpm., a residue of 489 ppm. and an iron content of 4.0 ppm.

All water is chlorinated. The city owns an iron removal and softening plant but it was not in operation.

Metered pumpage from Feb. 8, 1946 to Feb. 8, 1947 averaged 59,000 gpm.

LABORATORY NO. 114,963

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.7		Silica	SiO_2	17.9	
Manganese	Mn	0.0		Fluoride	F	0.5	
Calcium	Ca	73.3	3.67	Chloride	Cl	78.0	2.20
Magnesium	Mg	33.1	2.72	Nitrate	NO_3	0.4	0.01
Ammonium	NH_4	4.3	0.24	Sulfate	SO_4	1.4	0.03
Sodium	Na	68.3	2.97	Alkalinity	(as $CaCO_3$)	368.	7.36
Turbidity		Tr.		Hardness	(as $CaCO_3$)	320.	6.39
Color		0		Residue		500.	
Odor		Tr.		Free CO_2 (calc.)		14.	
Temperature 57.5° F.				pH = 7.1			

A public water supply was installed by Mason City (1984) in 1889.

Water was obtained originally from a well drilled in 1889 by W. Turner & J. W. Fielder, Mason City, and located at the pumping station on the east side of Tonica St. south of High St. The well was 200 ft. deep below a ground surface elevation of 585t ft., and cased with 80 ft. of 10-in. pipe; 55 ft. of 8-in. pipe; 45 ft. of 6-in. pipe; and 16 ft. of 6-in. Cook strainer at the bottom of the well. This well was abandoned about 1928.

A second well was drilled about 1895 by J. D. Mount, Mason City, and located within the pump station about 20 ft. northeast from the first well. The well was reported to be of the same depth and to be cased exactly as the older well. Each well was equipped with a 7 7/16-in. Cook deep-well pump operated at 20 spm. The working barrels were placed at 85 ft.

Correlated driller's log of well drilled about 1895 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Loam	15	15
Sand	1	16
Blue Clay	20	36
Sand	65	101
Sand and gravel	99	200

In Nov. 1914 the water level was about 65 ft. below the ground surface. In 1926 the production from this well was 90 gpm., and the pump was operated 8 to 9 hr. daily. The well has not been in service since about 1934.

A third well, now called the South Well, was drilled in 1916 by C.P. Brant, Indianapolis, Ind., and located 20 ft. southeast of the well drilled in 1895; (or approximately 1340 ft. S. and 310 ft. E. of the N. W. corner of Section 8, T. 20 N., R. 5 W.). The well is 197 1/2 ft. deep, 12 in. in diameter and cased with 12-in. pipe to 185 ft. and with 12 ft. of Cook screen having No. 30 slot openings. The pumping equipment, installed in Mar. 1943, consists of 80 ft. of 6-in. column pipe; 8-in., 8-stage Pomona turbine pump, No. SC 579, rated at 250 gpm. against 184 ft. of head; the overall length of the pump is 55 in.; 80 ft. of 1/4-in. air line; 10 ft. of suction pipe; 15-hp. Westinghouse electric motor operated at 1750 rpm. The pumpis also belt-connected to a Lycoming gasoline motor.

The South Well is maintained for use at peak demand.

Analysis of a sample (Lab. No. 113,474), collected Feb. 16, 1948, after 15-min. pumping, showed this water to have a hardness of 19.7 gr. per gal., a residue of 381 ppm., and an iron content of 0.7 ppm.

In 1928 a fourth well, now called North Well, was drilled by Baureisen Drilling Co., Chicago, and located about 40 ft. northeast of the South Well. The well is 222 ft. deep and cased with 210 ft. of 12-in. pipe and 12 ft. of Cook screen.

The pumping equipment, installed in Aug. 1941, consists of 80 ft. of 6-in. od. column pipe; 8-in., 8-stage Pomona turbine pump, No. SC2346, designed for 250 gpm. against 184 ft. of head; the length of the pump is 55 in.; 10 ft. of 5-in. suction pipe; with 18-in. strainer, 105 ft. of air line;

LABORATORY NO. 113,474

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.7		Silica	SiO_2	15.8	
Manganese	Mn	0.8		Fluoride	F	0.3	
Calcium	Ca	81.2	4.06	Chloride	Cl	13.0	0.37
Magnesium	Mg	32.8	2.69	Nitrate	NO_3	10.0	0.16
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	43.6	0.91
Sodium	Na	12.2	0.53	Alkalinity (as $CaCO_3$)		292.	5.84
Turbidity		Tr.		Hardness (as $CaCO_3$)		338.	6.75
Color		0		Residue		381.	
Odor		0		Temperature 55.2° F.			

15-hp. Westinghouse electric motor operated at 1755 rpm.

On Apr. 13, 1938, the non-pumping water level was 52 ft. below the pump base and on Feb. 16, 1948 the water level was 67 ft.

Analysis of a sample (Lab. No. 83959), collected July 28, 1938, showed the water to have a hardness of 15.5 gr. per gal., a residue of 290 ppm., and an iron content of 0.06 ppm.

The North Well is the principal source of supply.

Pumpage is estimated to average 125,000 gpd.

MATTESON
Cook County
July 13, 1946

A public water supply was installed by the village of Matteson (819) in 1914. Water is obtained from a. limestone well located near the center of the village (approximately 300 ft. S. and 2200 ft. E. of the N. W. corner of Section 26, T. 35 N., R. 13 E.). The elevation of the ground surface is 705± ft. This 10-in. diameter well was drilled in 1914 to a depth of 282 ft. The pumping equipment consists of a 7 3/4-in. by 36-in. double-acting Downey plunger pump. The cylinder is set at a depth of 96 ft. Power is furnished by a 15-hp. Wagner electric motor which operates at 29 spm. When the well was completed, the water level was 14 ft. below the ground surface, and after pumping for about 6 hr. at 200 gpm., the drawdown was 8 ft. Observations of the water level, made in Oct. 1945 when the pump was removed for repairs, did not indicate any change.

Analysis of a sample (Lab. No. 107,032), collected July 11, 1942 after 40-min. pumping at 210 gpm., showed the water to have a hardness of 28.6 gr. per gal., a mineral content of 589 ppm. A previous analysis of a sample collected Sept. 8, 1941 showed the water to have a hardness of 26.6 gr. per gal., a mineral content of 548 ppm., and an iron content of 1.0 ppm. These analyses are typical of the character of limestone water in this vicinity.

The estimated average pumpage is 42,000 gpd, which varies from a summer maximum average of 48,000 gpd. to a winter minimum average of 36,000 gpd.

All water for the public supply is chlorinated (chlorine residual 0.3 ppm.).

LABORATORY NO. 107,032

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.4		Silica	SiO_2	18.5	
Manganese	Mn	0.0					
Calcium	Ca	123.5	6.18	Chloride	Cl	3.0	0.08
Magnesium	Mg	43.8	3.60	Nitrate	NO_3	1.2	0.02
Ammonium	NH_4	0.7	0.04	Sulfate	SO_4	160.7	3.34
Sodium	Na	20.7	0.90	Alkalinity (as $CaCO_3$)		364.	7.28
Color		0		Hardness (as $CaCO_3$)		489.	9.78
Odor		0		Residue		589.	
Turbidity		20		Free CO_2 (calc.)		30.	
Temperature		51.6° F.		pH = 7.5			

A public water supply for the city of Mattoon (15,827) was installed in 1885 by the Mattoon Clear Water Co. This system was purchased by the Central Illinois Public Service Co. on Aug. 1, 1912, and by the city in 1935. In 1908, the city installed a separate water supply with a reservoir southwest of the city as the source. This supply was first used for industrial purposes only but, since 1935, it has been used as a raw water supply for the treatment plant.

The ground water supply was first obtained from three wells known as Wells No. 1, 2, and 3, which were installed in 1885 and located at the Marshall Ave. station about 300 ft. south and 150 ft. west of the intersection of 12th St. and Marshall Ave. (or approximately 100 ft. N. and 2450 ft. W. of the S. E. corner of Section 13, T. 12 N., R. 7 E.). The ground surface elevation is 715± ft.

These wells were dug to a depth of 45 ft. and were drilled 10 in. in diameter to a total depth of 60-65 ft. below the ground surface. Each of the wells was reported to be equipped with 10 ft. of Cook strainer.

The wells were abandoned and filled about 1924.

Additional wells were drilled in the southern part of the city and by 1912, there were 26 wells in service, including Wells No. 1,2, and 3 at the Marshall Station and Wells No. 4 to 26 inclusive at the Kickapoo Station and City Well Field.

The "gauged well" system was located at the Kickapoo Pumping Station, about 1800 ft. south of the Marshall Ave. Station, near the southeast corner of the intersection of 14th St. and the Illinois Central R. R. (or approximately 1400 ft. S. and 2200 ft. E. of the N. W. corner of Section 24). The ground surface elevation is 705± ft. There were 10 wells in this group.

Wells No. 4, 5, and 6 were located in a pit 48 ft. deep inside the pumping station. Two of the wells were cased with 5-in. pipe, and one with 4-in. pipe, and all were about 35 ft. deep below the bottom of the pit (or about 83 ft. below the ground surface), and equipped with 10-ft. Cook strainer. Seven other wells, No. 7 to 13 inclusive, were located in two lines outside the pump station. Six of the wells were 5 in. in diameter and one was 6 in. in diameter. These wells were connected by tunnels to the pit or receiving well in the pumping station.

Water was pumped from the wells by either a Hughes simple duplex steam pump, or by an 8-in. by 8-in. by 10-in. Deane single-acting steam pump. The pumps were set in the pit, about 6 ft. below the surface.

The Kickapoo Station wells were used for emergency purposes, only, after 1913, and were ultimately abandoned about 1928. The wells were filled with concrete.

Analysis of a sample (Lab. No. 21071) collected May 20, 1910, showed the water from the wells at the Kickapoo Pump Station to have a hardness of 23.7 gr. per gal., a residue of 506 ppm., and an iron content of 1.36 ppm.

The City Well Field group, frequently referred to as "South Side Wells" included the following wells: No. 13 to 23 inclusive; No. 26" and 27; New York Central R. R. and Pipe Yard wells.

Well No. 13 was drilled in 1897, but was in service for a short period only. There is no record of Wells No. 14 and 15.

In 1922-1923, many wells in the "South Side" group were replaced by new wells and the same number retained by each new replacement well.

New Well No. 16 was drilled about 1922 as a testhole atthe southwest corner of Maple and 14th St. (or approximately 1000 ft. S. and 1900 ft. E. of the N. W. corner of Section 24). The well is equipped with a Downie No. 52 single-acting plunger pump and 7 1/2-hp. General Electric motor. The average yield is 60 gpm. and the well is in service as a stand-by unit.

The new well No. 17, 9th St. well, was about 150 ft. south of the old No. 17. This well is equipped with a 5 3/4-in.by 17-in. Downie No. 52 single-acting deep-well pump, operating at 26 spm. The average yield is 51 gpm. The pump is operated under 15 in. of vacuum and is maintained as a stand-by unit.

Well No. 19, north of the treatment plant, was moved about 300 ft. east and a little north. The pump has been removed and the well sealed and capped. Plans for rehabilitation are being considered.

Well No. 21 was moved about 40 ft. west. This is a stand-by unit, and is equipped with a Downie single-acting plunger pump and 7 1/2-hp. General Electric motor. The average yield is 32 gpm.

Wells No. 18, located north of the dredge ditch

west of 11th St., and 23, 100 ft. west of 16th St. along dredge ditch, were not moved. Well No. 18 is equipped with a Luitweiler double-acting plunger pump and 7 1/2-hp. General Electric motor. The average yield is 50 gpm. and the well is maintained as a stand-by unit. Well No. 23 is equipped with a Luitweiler double-acting plunger pump and 7 1/2-hp. General Electric motor. The average yield is 28 gpm. from a thin stratum, about 5 ft., of water-bearing material. The well is maintained as a stand-by unit, and is used intermittently.

Well No. 26 was moved about 100 ft. northerly along the east side of the Illinois Central tracks, in line with Walnut Ave. extended west. When tested, the new No. 26 well produced 138 gpm., when water was being pumped from the old No. 26 well at about 30 gpm. The well was abandoned in 1935 because of distance from the treatment plant.

Old Well No. 27 was drilled about 1914 and was located at 3213 W. Marion St. (or approximately 300 ft. N. and 400 ft. E. of the S. W. corner of Section 14).

This well was cased with 10-in. pipe to a depth of 65 ft., and with 8 ft. of Cook screen attached below the casing. The screen had No. 40 slot openings.

Pumping equipment consisted of a Dean single-acting differential plunger pump, gear connected to a 10-hp. General Electric induction motor, operating at 825 rpm.

Analysis of a sample (Lab. No. 39660), collected on June 26, 1918 showed the water from Well No. 27 to have a hardness of 22.1 gr. per gal., a residue of 532 ppm., and an iron content of 3.8 ppm.

Old Well No. 27 was abandoned after the new Well No. 27 was drilled a short distance north on the same log. New Well No. 27 consistently produced 50 gpm. It was abandoned in 1935 because of the remote location from the treatment plant.

Analysis of a sample (Lab. No. 68280), collected Dec. 31, 1930 showed the water from Wells No. 16, 17, 18, 19,21, and 23 to have a hardness of 22.4 gr. per gal., a residue of 440 gpm., and an iron content of 0.6 ppm.

In 1923, the Central Illinois Public Service Co. leased a dug well, owned by the New York Central R. R., located near the northwest corner of Marshall and 33rd St. (or approximately 800 ft. N. and 50 ft. W. of the S.E. corner of Section 15). This well was about 70 ft. deep and equipped with 8 ft. of strainer.

The strainer was badly corroded and admitted little water. The dug well was replaced in 1924 by a 10-in. tubular well, and located just south and east of the dug well. The new well yielded about 100 gpm. and was in service until 1935 when it was abandoned because of. remoteness from the treatment plant.

A Test Well was drilled about 1923 and located on the north side of Marshall St. opposite 35th St. (approximately 780 ft. N. and 770 ft. W. of the S. E. corner of Section 15). The well was about 70 ft. deep, penetrated 5 1/2 ft. of gravel, and was reported to yield about 45 gpm. The well was not used as a source of supply.

Pipe Yard Well, formerly called City Well No. 7, was drilled to a depth of 56 ft. in Oct., 1939, by E. C. Baker, Sigel, and is located about 75 ft. north of the north line at Dakota Ave. extended east of the intersection of the center line of 12th St. extended south (or approximately 1200 ft. S. and 2500 ft. E. of Section 24). This well is cased with 10-in. pipe, with an 8-ft. length (exposed) Johnson Everdur welded screen, having No. 80 slot openings. The total length of the screen and lead packer is 9 ft. 11 in.

A production test was made by the State Water Survey on Nov. 2, 1939. The well produced 40 gpm. with a drawdown of. 7 3/4 ft. from a non-pumping water level of 42 ft. below the ground surface.

Analysis of a sample (Lab. No. 86666), collected Nov. 2, 1939 showed the water to have a hardness of 37.5 gr. per gal., a residue of **813** ppm., and an iron content of 2.6 ppm.

The pump in place is a 6-in. American Well Works turbine pump, No. 63116, having a rated capacity of 50 gpm. against a head of 75 ft. The electric motor and switches have been removed. The well was in service for only a brief period, because of difficulties in pumping against existing pressure in the system.

All of the "South Side Wells" have now been abandoned, except the following: Wells No. 16, 17, 21, 23 and old Well No. 18. These wells are maintained as stand-by units for the Doran's Field Wells, and their combined production is estimated to average about 220 gpm.

Between 1925 and 1928, extensive test drilling was carried out in an effort to locate additional sources of supply. Test wells were drilled in the city, east and west along the New York Central R. R., and north and south along the Illinois Central R. R. The best formation was reported to have been found near Dorans, about 5 1/2 mi. north of Mattoon.

Further test drilling was then carried out covering Sections 25 and 26, T. 13 N., R. 7 E., and Section 30, T. 13 N., R. 8 E. The well field, now known as Dorans Field, is located in Section 30.

Well No. 1 (originally called Test Well No. 30) was constructed about 1928 by J. A. Rue of the Central Illinois Public Service Co. and located west of U. S. Route No. 45, about one mile south of Dorans (or approximately 2300 ft. N. and 2600 ft. E. of the S. W. corner of Section 30). The ground surface elevation at the well-site is 690± ft.

Correlated driller's log of Well No. 1 furnished by the State Geological Survey:

Formation	Thickness ft.	Thickness in.	Depth ft.	Depth in.
Pleistocene system				
Loam and clay	26		26	
Sand and gravel	17		43	
Peat	2		45	
Clay	11	8	56	8
Pennsylvanian system				
Limestone		4	57	

The well is 42 ft. deep and is constructed with 16 ft. of 26-in. id. by 3 6-in. od. Thorpe porous concrete screen at the bottom of the well. A 12-in. casing, welded to a metal plate fastened to the top of the concrete screen, extends to the ground surface.

When completed the static water level was 11 ft. 7 in. below ground level. When tested by the State Water Survey on Dec. 27, 1937 the non-pumping water level was 19 ft. 10 in. and the maximum yield of the well was 107 gpm'. In 1939, the non-pumping water level was reported to be 16 ft. 8 in. below the ground surface. The screen became sand-clogged and the well was abandoned in 1941. The pump house is used for storage of oil.

Well No. 2 is located about 850 ft. south of Well No. 1 and was drilled by J. A. Rue about the same time. The 2 wells were constructed identically. Well No. 2 is equipped with a Dean plunger pump, No. 78454, and a 10-hp. General Electric motor.

When tested by the State Water Survey on Dec. 27, 1937, the non-pumping water level was 19 ft. 10 in. below the ground surface, and the maximum yield of the well was 75 gpm. The average yield is now estimated to be 40 gpm. Well No. 2 is in daily service.

Analysis of a sample (Lab. No. 68281), collected Dec. 31, 1930 showed the water to have a hardness of 20.5 gr. per gal., a residue of 417 ppm., and an iron content of 3.5 ppm.

An old test well located about 140 ft. south and 100 ft. east of Well No. 2 is use'd for observation of water levels. On June 28, 1948 the depth to water was 14.1 ft. below the top of the 6-in. casing. The top of the casing is 1 ft. above a ground elevation of 690± ft.

Well No. 2 and the other 5 Field Wells were in continuous operation.

Well No. 3 is reported to have been drilledbefore 1934 by J. A. Rue and was located approximately 2620 ft. N. and 1350 ft. E.of the S. W. corner of Section 30. The well was similar in construction to Wells No. 1 and 2.

When tested on Dec. 27, 1937, the well produced 65 gpm. The casing sunk after attempting to dislodge some boulders. The well was abandoned in 1941.

Well No. 4 was drilled in 1936 by the W. P. A. and was located approximately 2600 ft. N., and 1930 ft. E. of the S. W. corner of Section 30. The well was 40 ft. deep, and was cased with 10-in. pipe to a depth of 25 ft. when pumping at 150 gpm. the drawdown was 12 1/2 ft. from a non-pumping water level of 15 1/2 ft.

This well was abandoned in 1940, because of low capacity.

In 1938, Wells No. 1 to 10, excluding No. 2, yielded water at the plant containing 1.2 cu. ft. methane per 1000 gal.

Well 1 A was drilled in 1940 to a depth of 42 ft. 9 in. by E. C. Baker, and is located about 225 ft. north and 10 ft. east of Well No. 1 (or approximately 2550 ft. N. and 2610 ft. E.of the S. E. corner of Section 30).

The well was cased with 12-in. pipe from 2 to 18 ft. below the ground surface, and with 28 ft. 6 in. of 10-in. pipe from about 2 ft. above to 26 1/2 ft. below the ground surface. A 20-ft. length of 4 1/2-in. Johnson Everdur wire-wound screen was installed in the well. The top 2 ft. of screenhadNo. 40 slot openings; the next 16 ft. No. 100 slot; and the bottom 2 ft. No. 80 slot. The annular space between the casings was filled with concrete.

A production test was made by the State Water Survey on Jan. 30, 1940. The well produced 150 gpm. with a drawdown of 9 1/2 ft., and 235 gpm. with a drawdown of 16 1/4 ft. from a non-pumping water level of 17 1/2 ft. below the top of the 10-in. casing. Twenty-one minutes after pumping was stopped, the water level had recovered to within 2.25 ft. of the non-pumping level. During the test, water levels were observed in 4 test holes located with respect to the well as follows: Test Hole A, 29 ft. south and 8 ft. west; Test Hole B, 29 ft. south and 32 ft. west; Test Hole C, 71 ft. south and 30 ft. west; Test Hole D, 157 ft. south and 25 ft. west. After 7-hr. 52-min. pumping, the drawdowns in the test holes, were, respectively, 6.75, 6.17, 5.25, and 4.00 ft. Pumping was stopped six minutes later and after nine minutes of recovery the water levels were, respectively: 3.92, 2.42, 2.58, and 2.42 ft. below the original level. On Jan. 31, the water levels in all wells had risen to within 1/4.ft. of the original level.

The well is in daily service and the average yield is estimated to be 55 gpm. The pumping equipment includes a Peerless turbine pump, No. 11435; 3-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 87151), collected Feb. 12, 1940, after 6 1/2-hr. pumping, showed the water to have a hardness of 19.8 gr. per gal., a residue of 364 ppm., and an iron content of 1.4 ppm.

Well 4 A was drilled in May 1940, to a depth of 39 ft. by E. C. Baker, and is located about 30 ft. west of abandoned Well No. 4.

This well is cased with 10-in. pipe and a 15-ft. length of Johnson Silicon red brass welded screen. The upper seven feet portion of screen has No. 40 slot openings and the remainder has No. 100 slots.

A production test was made by the State Water Survey on May 21, 1940. The well yielded 125 gpm. for -6 hr. with a drawdown of 11 1/4 ft. below a non-pumping water level of 13 1/2 ft. During the test, the water level in a test hole 36 ft. southeast of the well was measured and found to have been lowered from 12.3 ft. to 16.5 ft. Fifteen minutes after pumping was stopped, the water level in both the well and test hole had recovered to within about 1 1/2 ft. of the non-pumping level.

The well is in daily service and is estimated to yield an average of 51 gpm.

The pumping equipment includes a Peerless turbine pump, No. 11436, and a 3-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 87988), collected May 21, 1940 after 5-hr. pumping, showed the water to have a hardness of 17.6 gr.per gal., a residue of 348 ppm., and an iron content of 1.8 ppm.

Well No. 5 was reported drilled by the W.P.A. in 1936 and located approximately 2040 ft. N. and 1330 ft. E. of the S. W. corner of Section 30. The well was reported to have a 10-in. casing and screen and to be about the same depth as other wells in Doran's Field.

The pumping equipment includes a 6-in. American Well Works turbine pump, No. 62722, having a rated capacity of 40 gpm. against 153 ft. of head; and a 3-hp.U. S. electric motor No. 201224 rated at 1800 rpm. The well is in daily service and the yield is estimated to average 40 gpm.

Analysis of a sample (Lab. No. 115,070), collected June 22, 1948 after continuous pumping, showed the water to have a hardness of 22.5 gr. per gal., a residue of 440 ppm., and an iron content of 3.8 ppm.

Well No. 6 was drilled in 1940 to a depth of 40 ft. by E. C. Baker, and is located approximately 2040 ft. N. and 2100 ft. E.of the S. W. corner of Section 30.

This well is cased with 10-in. pipe and with a 15-ft. length of Johnson silicon red brass welded screen, having No. 200 slot openings.

A production test was made by the State Water Survey on June 3, 1940. The well produced 145 gpm. for seven hours with a drawdown of 11 3/4 ft. from a non-pumping water level of 15 1/2 ft. below the ground surface. The water level in a test hole 20 ft. west of the well was observed to have been lowered 6 ft. 2 in. during the test. Ten minutes after pumping was stopped, the water

level in the well had recovered to within 2 ft., and in the test hole to within 2 ft. 4 in. of the non-pumping levels.

The well is in daily service. The present yield is not known.

The pumping equipment includes a Peerless turbine pump, No. 11434, and a 3-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 88051), collected June 3, 1940 after seven-hours pumping, showed the water to have a hardness of 18.6 gr. per gal., a residue of 370 ppm., and an iron content of 4.0 ppm.

Well No. 3 A (original No. 7) was drilled in 1940 to a depth of 43 ft. by E. C. Baker, and is located about 15 ft. northwest of Well No. 3 (approximately 2620 ft. N. and 1330 ft. E. of the S. W. corner of Section 30).

Clean, coarse sand was penetrated between the depths of 24 and 39 ft., and finer sand with clay streaks was penetrated between 39 and 43 ft. The 10-in. casing extends from 8 in. above to 30 ft. 4 in. below the ground surface, and a 15-ft. length of Johnson red brass welded screen was installed with the bottom at a depth of 43 ft. The screen has No. 150 slot openings.

A production test was made by the State Water Survey on June 11, 1940. The well produced 130 gpm. for 4 1/2 hr. with a drawdown of 8 3/4 ft., and 150 gpm. for 1 1/2 hr. with a drawdown of 10 1/2 ft. from a non-pumping water level of 16 ft. below the ground surface. The water level in a 1 1/20-in. observation well located 12 1/2 ft. north of Well 3 A was observed to have been lowered 4 ft. 7 in. during the test. Fifteen minutes after pumping was stopped, the water level in the well had recovered to within 1 ft., and in the observation well to within 3 ft. 3 in. of the non-pumping levels. The pump in Well No. 3 was being operated at an estimated rate of 30 gpm., throughout the test.

The well is in daily service and is estimated to yield an average of 67 gpm.

The pumping equipment includes an American Well Works turbine pump, No. 61603, and a 5-hp. Westinghouse electric motor.

Analysis of a sample (Lab. No. 88102), collected June 12, 1940 after 5 1/2-hr. pumping, showed the water to have a hardness of 18.3 gr. per gal., a residue of 363 ppm., and an iron content of 2.5 ppm.

There are 6 wells in service in Doran's Field, those wells being 1 A, 2, 3 *A,* 4 A, 5 and 6. These wells, by continuous operation, furnish a total combined yield rate of 240 gpm. All water is pumped to the booster station at the southeast corner of the field, from where it is pumped to the treatment plant and mixed with the over-treated Lake Mattoon water. Delivery rate from the Doran's Field wells to the treatment plant varies from 160 to 240 gpm.

All water for the public supply is softened and chlorinated.

An electrical earth resistivity survey was conducted in the vicinity of Mattoon in the summe r of 1944 by the State Geological Survey. The area included in the survey was rectangular in shape, about 14 miles from north to south and about 12 miles from east to west, with the city of Mattoon approximately the center of the area. In Oct. 1944, the survey was extended to include Sections 6, 7, 17, and 18, T. 13 N., R. 7 E.

Numerous test holes were drilled in 1944, most of them located southwest of Lake Mattoon. The completed wells in the Southwest Well Field, are hereafter described.

Well No. 45-1 (originally called Well No. 1) was completed at a depth of 37 1/2 ft. in Nov. 1944 by Hayes and Sims, Champaign, and is located at the site of Test Hole 44-14 (approximately 2630 ft. S. and 1190 ft. E. of the N. W. corner of Section 18, T. 11 N., R. 7 E.). The ground surface elevation is 652 ft.

Sample-study log of Well No. 45-1 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Loam	5	5
Gravel and silt	10	15
Gravel, clean	10	25
Sand and granule gravel	10	35
Gravel, partly silty	5	40
Gravel and silt, soil at bottom	3	43

The well was cased with 16-in. od. pipe from 2 1/2 ft. above to 28 ft. below the ground surface. A 15-in. Johnson Armco-iron wire-wound screen

is exposed below the bottom of the casing. The upper 5 ft. of screen has No. 35 slot openings and the lower 5 ft. has No. 60 slots.

For test purposes, a belt-driven deep-well turbine pump was installed with the bottom of the suction pipe near the bottom of the well. The well produced 300 gpm. with a drawdown of 17.9 ft. from a non-pumping water level of 5.2 ft. below the top of the casing. Three sand-point observation wells were driven at distances of 60, 250, and 600 ft. from the well, and water-level observations made during the test. It was reported that infiltration of water, discharged from the well onto the nearby ground surface during the test, was occurring so rapidly that water was being re-circulated through the well, pump, and aquifer.

The pump installation consists of 30 ft. of 6-in. column pipe; 8-in., 2-stage American Well Works turbine pump, No. 71754, having a rated capacity of 250 gpm. against 52 ft. of head; 40 ft. of 1/4-in. air line; 5 ft. of 6-in. suction pipe; 12 in. of tapered strainer; 7 1/2-hp. U. S. electric motor.

Non-pumping water levels in feet below the pump base have been reported as follows:

Nov. 20, 1944	6.0
May 28, 1945	3.5
Aug. 19, 1947	10.0

Well No. 45-2 was drilled to a depth of 40 ft. in May, 1945 by Hayes and Sims and located approximately 2200 ft. S. and 2500 ft. W. of the N.E. corner of Section 18, T. 11 N., R. 7 E. The ground surface elevation is 654t ft.

The well was cased with 16-in. casing, from 2 ft. above to 30 1/2 ft. below ground level. A 10-ft. 1 1/2-in. length of 16-in. (14 1/8 in. id.) Armco-iron screen was installed with 8 ft. 9 in. exposed. The top 4-ft. section has No. 35 slot openings and the lower 5-ft. section has No. 40 slots.

A production test was made by the State Water Survey on Apr. 3, 1946. The well produced 395 gpm. for 2 hr. with a drawdown of 17 1/4 ft. and 257-272 gpm. for 5 hr., with a drawdown of 13 ft. from a non-pumping water level of 5 1/2 ft. During the test water-level observations were made in Test Hole No. 11, 350 ft. South, and in Test Well No. 7, 300 ft. south and 400 ft. west of Well No. 45-2. After 2 1/2-hr. pumping, the water level in Test Hole No. 11 was lowered 0.39 ft.

Analysis of a sample (Lab. No. 106,107), collected Apr. 3, 1946 after 2-hr. pumping at 272 gpm. showed the water to have a hardness of 16.1 gr. per gal., a residue of 24 ppm., and an iron content of 0.7 ppm.

The pumping equipment in Well 45-2 includes an American Well Works turbine pump, No. 71555. The balance of the pump assembly is identical-with that installed in Well 45-1.

Well No. 45-3 was drilled in May, 1945, by Hayes and Sims, and is located about 1200 ft. east of Well No. 45-2 (or approximately 2200 ft. S. and 1300 ft. W. of the N. E. corner of Section 18). The ground surface elevation is 657± ft.

The well is 39 ft. 5 in. deep below ground level, and is cased with 16-in. od. pipe from 2 ft. 7 in. above to 30 ft. 9 in. below ground level. A 10-ft. section of 16-in. (14 1/8-in. id.) screen, having 8 ft. 8 in. exposed, is installed below the casing. The screen has No. 60 slot openings.

A production test was made by the State Water Survey on Apr. 6, 1946. The well produced 500 gpm. with a drawdown of 15 1/2 ft. from a non-pumping water level of 5 1/2 ft. below the ground surface. During the test, water-level observations were made in Test Holes No. 2, 3,4, 6, and 11. The water level in Test Hole No. 3, located about 250 ft. south and 600 ft. west of Well No. 3 was lowered from4.15 to 7.49 ft. after 8-hr. pumping at rates of 300-500 gpm. The water level in Well No. 2 recovered to within 2 ft. of the non-pumping level of 10 ft. after pumping was stopped.

Analysis of a sample (Lab. No. 106,108), collected Apr. 6, 1946 showed the water to have a hardness of 19.7 gr. per gal., a residue of 369 ppm., and an iron content of 1.1 ppm.

The wells in the Southwest Field serve as auxiliary supply to the Lake Mattoon water supply, and are used only when the lake water level is 3 ft. below the spillway. The combined production from the three wells is limited to 500 gpm. when the three pumps are operated simultaneously.

From June 1947 to June 1948 the total pumpage from all the Mattoon wells averaged 370,000 gpd.

In June 1948, the total metered treated water, including ground and surface water, averaged 2.62 mgd.

LABORATORY NO. 115,070

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	3.8		Silica	SiO_2	21.8	
Manganese	Mn	Tr.		Fluoride	F	0.2	
Calcium	Ca	93.6	4.68	Chloride	Cl	4.0	0.11
Magnesium	Mg	37.0	3.04	Nitrate	NO_3	1.6	0.03
Ammonium	NH_4	5.9	0.33	Sulfate	SO_4	58.2	1.21
Sodium	Na	2.3	0.10	Alkalinity	(as $CaCO_3$)	340.	6.80
Turbidity		40		Hardness	(as $CaCO_3$)	386.	7.72
Color		0		Residue		440.	
Odor		0		Free CO_2 (calc.)		34.	
Temperature		55.6° F.		pH = 7.4			

MAZON
Grundy County
Dec. 13, 1947

The public water supply for the village of Mazon (512) was put into service in 1942.

In Oct. and Nov. 1938 an electrical earth resistivity survey was conducted at Mazon by the State Geological Survey. The area covered in the survey extended 1 1/2 miles east and west, and one mile north and south from the town.

InApril, 1940, T. F. Anderson & Son, Morris, drilled a test hole located approximately 35 ft. S. and 760 ft. E. of the N. W. corner of Section 23, T. 32 N., R. 7 E. The hole was drilled to a depth of 45 ft. below a surface elevation of 576± ft., and was cased with 21 ft. of 6-in. pipe and 8 ft. of 6-in. screen, having No. 20 slot openings.

Upon completion of the well, the driller reported that after five-hours pumping at 32 gpm., the drawdown was 5.3 ft. below a non-pumping water level of 9 1/2 ft. Subsequently the test hole was filled and a new well drilled by J. T. Anderson in Apr. 1941 about 50 ft. distant (or approximately 70 ft. S. and 800 ft. E. of the N. W. corner of Section 23).

The well is 26 ft. deep and was cased with 22 ft. 5 in. of 10-in. pipe with the top of the casing 2 ft. 4 in. above ground surface. Seven feet of 10-in. diameter Johnson screen was swedged into the 10-in. casing with screen slot openings as follows: lower four feet of No. 40 slot; next two feet of No. 20 slot; and top one foot of No. 10 slot.

A seven-hour production test was made by the State Water Survey on Apr. 23, 1941. After five-hours pumping at a rate of 38-40 gpm., the drawdown was 13 ft. below a non-pumping water 'level of 8 1/4 ft. below the ground surface.

The existing pump installation, made in 1941, is: Aurora Pump Co. centrifugal pump, No. GG4, B 120879-BF, having a rated capacity of 28 gpm. against 60 ft. of head; 2-hp. General Electric motor.

In 1945 it was reported that the non-pumping water level was 10-12 ft. below the ground surface. The non-pumping water level on Nov. 13, 1947 was 12 ft. below the pump base, and after 20-min. pumping at an estimated rate of 35 gpm., the water level was 24 ft. Non-pumping water levels in 1947 varied from 10 3/4 ft. in the spring to 12 ft. in the fall. Pumping levels remained constant at 24 ft.

Analysis of a sample (Lab. No. 112,585), collected Nov. 13, 1947 after 20-min. pumping at 35 gpm., showed the water to have a hardness of 16.0 gr. per gal., a residue of 324 ppm., and an iron content of 0.2 ppm.

The average metered pumpage is 15,000 gpd.

LABORATORY NO. 112,585

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	16.2	
Manganese	Mn	0.2		Fluoride	F	0.2	
Calcium	Ca	64.1	3.21	Chloride	Cl	2.0	0.06
Magnesium	Mg	27.7	2.28	Nitrate	NO_3	8.0	0.13
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	109.6	2.28
Sodium	Na	2.3	0.10	Alkalinity (as $CaCO_3$)		156.	3.12
Turbidity		10-		Hardness (as $CaCO_3$)		275.	5.49
Color		0		Residue		324.	
Odor		0		Temperature 54.5° F.			

MEDIA
Henderson County
Oct. 17, 1946

The public water supply for the village of Media (187) was installed in 1924.

Water is obtained from a well located 100 ft. east of East St. and 500 ft. south of State Highway 116 (or approximately 1500 ft. S. and 500 ft. E. of the N. W. corner of Section 14, T. 9 N., R. 4 W.). Elevation of the ground surface is 705± ft.

The well was drilled in 1925 by James Brewer, Stronghurst. It is 65 ft. deep, 6-in. diameter casing to rock at 30 ft., and the hole is 5 in. in diameter the remainder of the depth.

The well is equipped with a Meyers Ejecto pump which is operated by a 3/4-hp. General Electric motor. On Oct. 1946 the capacity of the pump was estimated to be 15 gpm. The base of the pump is approximately 3 ft. below ground surface.

In Oct. 1946 the capacity of the pump was estimated to be 15 gpm., and the non-pumping water level about 30 ft. below the pump base. It was reported that the pump was recently operated for an 18-hr. period without lowering the water level.

Analysis of a sample (Lab. No. 107,984), collected Oct. 15, 1946 after pumping 18 hr. at 15 gpm. showed this water to have a hardness of 14.9 gr. per gal., a residue of 290 ppm., and no iron content.

Pumpage is estimated to be 9000 gpd.

LABORATORY NO. 107,984

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.0		Silica	SiO_2	18.3	
Manganese	Mn	0.0		Fluoride	F	0.3	
Calcium	Ca	61.9	3.10	Chloride	Cl	5.0	0.14
Magnesium	Mg	24.5	2.01	Nitrate	NO_3	9.5	0.15
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	49.0	1.02
Sodium	Na	4.6	0.20	Alkalinity	(as $CaCO_3$)	200.	4.00
Color		0		Hardness	(as $CaCO_3$)	256.	5.12
Odor		0		Residue		290.	
Turbidity		10					

MELVIN
Ford County
Oct. 30, 1948

After 2 unsuccessful attempts to drill wells in 1895 and in 1902, a limited water supply was installed for the village of Melvin (470) in 1908.

At that time Well No. 1 was drilled to a depth of 242 ft. and located on village-owned property on the east side of Center St., and just west of the Illinois Central R. R. right-of-way. The ground surface elevation is 808± ft.

The well was 242 ft. deep and water was pumped from the well into 5 storage cisterns, each cistern 10 ft. in diameter and 15 ft. deep. The cisterns were located in various parts of town. Water was withdrawn from the cisterns by hand pumps.

The pumping equipment includes an 18-in. Deming plunger pump, Fig. 1062, No. 21873 belt-driven by a Master electric motor rated at 7 1/2-hp. at 1725 rpm. The pump was overhauled in Aug. 1948 and when re-installed the discharge rate was 25 gpm. Well No. 1 is maintained for emergency service. Water is pumped directly to the distribution system. The old storage tanks have been abandoned and filled.

In 1913 the present water works station was installed on the west side of Center St. opposite the old well. Well No. 2 was drilled at the new station, to a depth of 231 ft. and cased with 8-in. pipe. In 1916 or 1917 the well was deepened to clay at the bottom of a sand stratum at a depth of 245 ft. and a Cook screen, 19 1/2 ft. long, installed at the bottom. The sand stratum was reported to be 19 ft. thick.

In Jan. 1926, Well No. 2 was reported to be dry and was abandoned. A new screen had been installed, but did not improve the yield. The screen could notbe pulled and was lost. The 8-in. casing was pulled.

Well No. 3 was drilled in 1923 to a depth of 243 ft. by E. W. Johnson, Bloomington, and located 10 ft. south of Well No. 2, and 120 ft. west of Well No. 1. In 1926 Johnson deepened the well to 258 ft. penetrating 15 ft. of sand and gravel to clay and using the 8-in. casing from Well No: 2. At the same time a 19-ft. length of 8-in. screen was installed at the bottom. Subsequently, the screen was renewed 3 or 4times,the last one being a 6-in, Johnson screen, 30 ft. long and having No. 10 slot openings. The openings between the 6-in. screen and the 8-in. casing was closed with a tapered brass tube and lead packer.

Considerable sand continued to be drawn into the well and in 1935 the well was repaired by J. Bolliger and Sons, Fairbury. The 6-in. screen was cleaned, repaired and reinstalled with the bottom at 265 ft. A 6-in. casing was installed, within the 8-in. casing, from the surface to the top of the screen at 240 ft.

After the repair work, very little sand was extracted, when pumping at a rate of 35 gpm.

In Apr. 19.38, the static water level was reported to be 156 ft. and on Oct. 22, 1948, when pumping at an estimated rate of 60 gpm., the water level was 196 ft. The pumping equipment installed in Apr. 1938 consists of 220 ft. of column pipe; 6-in., 31-stage Pomona turbine pump, No. N 406, designed for 60 gpm. against a total head of 360 ft.; the overall length of the pump is 11 ft.; 231 ft. of air line; 30 ft. of 3-in. suction pipe; 10-hp., 1760 rpm., Westinghouse electric motor No. 8105051.

The pump has never been pulled for any purpose and in May 1948, the discharge rate was metered at 60 gpm. against a pressure of 50 psi.

Analysis of a sample (Lab. No. 116,241) collected Oct. 22, 1948 after 5-hr. pumping showed this water to have a hardness of 19.5 gr. per gal., a residue of 427 ppm., and an iron content of 0.6 ppm.

Pumpage is estimated to average 30,000 gpd.

LABORATORY NO. 116,241

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.6		Silica	SiO_2	24.4	
Manganese	Mn	0.0		Fluoride	F	0.6	
Calcium	Ca	77.6	3.88	Chloride	Cl	2.0	0.06
Magnesium	Mg	34.3	2.82	Nitrate	NO_3	0.4	0.01
Ammonium	NH_4	2.0	0.11	Sulfate	SO_4	20.6	0.43
Sodium	Na	33.4	1.45	Alkalinity (as $CaCO_3$)		388.	7.76
Turbidity		10		Hardness (as $CaCO_3$)		335.	6.70
Color		0		Residue		427.	
Odor		0		Free CO_2 (calc.)		49.	
Temperature 55° F.				pH = 7.3			

A public water supply was installed by the city of Mendota (4215) in 1887 mainly for fire protection.

Water was obtained from a well located on the south side of Eighth St. between the railroad tracks and a short distance east of the depot. A deep well had been drilled by a company in 1874 at the intersection of Sixth and Main St. It was reported to be 2175 ft. deep, and the city contributed a small part of the expense of drilling.

About 1891 a well was drilled for the city by the J. P. Miller Artesian Well Co., Brookfield, and located in the pump station at the southwest corner of Ninth St. and Sixth Ave. (or approximately 1471 ft. S. and 2180 ft. W. of the N. E. corner of Section 33, T. 36 N., R. 1 E.). The well was 478 ft. deep below a ground surface elevation of 752i ft., and was cased with 10-in. pipe to a depth of 240 ft. The well is equipped with an air lift pump with about 325 ft. of 7-in. eductor pipe. The air nozzle is 5.4 ft. long and attached to 260 ft. of 1 1/2-in. air line.

Well No. 2 is located 50 ft. north and 50 ft. east of Well No. 1 and was drilled by C. A. Harbough to a depth of 990 ft.

The well is cased with 12-in. pipe to a depth of 240 ft. and was equipped with an air lift pump with 300 ft. of 8-in. eductor pipe. In 1929, a turbine pump was installed but was removed and replaced by air lift, due to inability to satisfactorily remove the iron. The pumping equipment, installed in Dec. 1948, now consists of 120 ft. of 6-in. column pipe; 8-in., 9-stage Aurora Pump Co. turbine No. 40490, designed for 350 gpm. against 190 ft. of head, and having bronze impellers and ci. bowls; 120 ft. of 1/8-in. air line; 20 ft. of 6-in. suction pipe, with strainer; 40 hp., 1750 rpm. electric motor; type C-50 Johnson right angle drive-gear head.

Water levels in Well No. 2 have been reported as follows:

Date	Water Level (ft. below surface)
1896	46
1914	66
1926	76
1948	71

A production test was made on Nov. 17, 1948, by the Aurora Pump Co. Before starting the test, it was reported, the water level was 71 ft. and after 5-hr. pumping at rates gradually increased from 91 to 308 gpm., the drawdown was 42 ft. Twenty minutes after stopping the pump the water level was 80 ft. or 9 ft. below the starting level. On June 8, 1949, after 8-hr. pumping at 350 gpm., the water level was 108 ft.

Analysis of a sample (Lab. No. 110,768) collected June 19, 1947, after pumping 1 hr., showed the water from Well No. 2 to have a hardness of 17.0 gr. per gal., a residue of 372 ppm., and an iron content of 0.9 ppm. The character is very similar to that from the No. 3 well.

Wells No. 1 and 2 are maintained for emergency use.

Well No. 3 was completed by Layne-Western Co., Chicago, in Aug. 1945, and is located at the northwest corner of Eleventh St. and Fourth Ave., 1250 ft. northeast of the old wells (or approximately 875 ft. S. and 1750 ft. W. of the N. E. corner of Section 33).

The well was drilled to a depth of 534 ft. below a surface elevation of 760± ft.

The well was cased with 16-in. od. pipe from the surface to 270 ft., and the hole was 15 in. in diameter from the bottom of the casing to the bottom of the well. As the drilling proceeded, the static water levels were:

Drill Depth ft.	Water Level (ft. below surface)
135-150	40
280	56
295	55
350-355	51
355-385	54

After the well was completed, a production test was made by the State Water Survey on Aug. 22-23, 1945. Static water level was 56 ft.; and after pumping 17 hr. at 355 gpm., the drawdown was 127 ft.; and after an additional 8-hr. pumping at 550 gpm., the drawdown was 209 ft. In 1 hr. after stopping the pump, the water level returned to 67 ft.

During the test, observations were made on water levels in the old city wells, 1250 ft. southwest; and no appreciable interference was noticed. The pumps in both wells were discharging in excess of 300 gpm. When those pumps were shut down for 2 hr., only a slight change in the water level in Well No. 3 was noticed. The Burlington R. R. well pump, 1800 ft. southwest was

operated intermittently at 1700 gpm. with no noticeable effect on water level in this well.

Analysis of a sample (Lab. No. 110,767), collected June 19, 1947 after 1-hr. pumping, showed the water from Well No. 3 to have a hardness of 15.4 gr. per gal., a residue of 325 ppm., and an iron content of 1.7. The quality appears to be typical for waters from the sand and gravel just above the bedrock in this vicinity.

Sample-study log of Well No. 3 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Glacial till and soil	107	107
Sand and gravel	38	145
Gravel, very silty	10	155
Glacial till, silt, sand and soil	55	210
Gravel and sand, clean	57	267
Ordovician system		
Platteville dolomite	76	343
Glenwood formation		
Sandstone, some siltstone	82	425
Sandstone, some shale	10	435
St. Peter formation		
Sandstone	96	531
Chert and shale	3	534

Water from this well is aerated, filtered for iron removal, and chlorinated. A sample of treated water was found to have an iron content of 0.12 ppm.

Well No. 3 was not used until the summer of 1947, when the 10-in. turbine pump, having 6-stages, was set at 230 ft. Water was pumped continuously until Feb. 21, 1948, when it was reported that production had been steadily decreasing and on that date, when pumping at a rate of 264 gpm., the water level was 208 ft. below the pump base (2 ft. above ground level) or a drawdown of about 147 ft. In Mar. 1948, the well was cleaned out and the pump replaced after adding one stage and 50 ft. of column pipe.

The pumping installation now consists of 280 ft. of 8-in. column pipe; 10-in., 7-stage American Well Works deep-well turbine pump, No. 71629, rated at 360 gpm. against 274 ft. of head at 1770 rpm.; the overall length of the pump is 6 ft.; 280 ft. of 1/4-in, brass air line; 10 ft. 8-in. suction pipe;40-hp., 1800 rpm. U. S. electric motor, No. 490724.

Before replacing the pump the water level was reported to be 61 ft. below the pump base.

On Mar. 19, 1948, a production test was made under the supervision of the Water Survey. The pump had been operating 5 1/2 hr. prior to starting the discharge measurement, in order to supply the reservoir. Then after 3 hr. pumping at 350 gpm. the water level was 279 ft. or a drawdown of 218 ft. Fifty minutes after stopping the pump, the water level was 66 ft. or 5 ft. below the reported starting level.

On Mar. 1, 1949, when pumping at 360 gpm. the water level was 248 ft. and on June 8, 1949, when pumping at 350 gpm. the water level was 260 ft.

Water is furnished to several industries, the Conco Co., and a locker plant obtaining all their water from the city. Some water is furnished to the J. B. Interrieden Co. and to the Chicago, Burlington & Quincy R. R. These last two consumers have their own wells but are occasionally supplied by the city.

. It is estimated that the average pumpage is 440,000 to 480,000 gpd. when not furnishing water to the Chicago, Burlington, & Quincy R. R. Meter readings of pumpage from the city wells from May 1, 1947, to June 19, 1947, averaged 462,000 gpd. from Dec. 1, 1947 to Apr. 1, 1948 inclusive, the pumpage averaged 407,000 gpd.

LABORATORY NO. 110,767

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.7		Silica	SiO_2	23.8	
Manganese	Mn	Tr.		Fluoride	F	0.4	
Calcium	Ca	69.2	3.46	Chloride	Cl	4.0	0.11
Magnesium	Mg	22.1	1.81	Nitrate	NO_3	3.1	0.05
Ammonium	NH_4	1.3	0.07	Sulfate	SO_4	0.0	0.00
Sodium	Na	24.4	1.06	Alkalinity (as $CaCO_3$)		312.	6.24
Color		0		Hardness (as $CaCO_3$)		264.	4.28
Odor		0		Residue		325.	
Turbidity		10+		Temperature 52.5° F.			

Correlated driller's log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and clay	50	50
Gravel	4	54
Clay, blue	31	85
Sand and gravel	6	91
Clay, blue	40	131
Sand	4	135
Gray boulder clay with streaks of sand and gravel	25	160
Ordovician system		
Galena-Platteville formations		
Limestone	200	360
St. Peter formation		
Sandstone	175	535
Shakopee formation		
Limestone	117	652
New Richmond formation		
Sandstone	60	712
Oneota formation		
Limestone	88	800
Shale, white	50	850
Calciferous group of limestone	16	866
Sandstone	9	875
Limestone	7	882
Sandstone	2	884
Limestone	16	900
Cambrian and Pre-Cambrian systems		
Trempealeau, Franconia, Galesville, Eau Claire, Mt. Simon and Fond du Lac formations		
Calciferous sand rock	90	990
Potsdam group	1140	2130

METAMORA
Woodford County
Mar. 11, 1947

A public water supply was installed by the village of Metamora (896) about 1889.

Water was obtained from a well located in the northeast corner of the public park (or approximately 300 ft. S. and 2000 ft. E. of the N. W. corner of Section 20, T. 27 N., R. 2 W.).

The well was dug to a diameter of eight feet and to a depth of 80 ft. below a ground surface elevation of 820± ft. Water was pumped by a Myers single-acting cylinder pump attached to 65 or 70 ft. of four-inch drop pipe and six feet of suction pipe. Power was furnished by a 5-hp. Century electric motor. In Jan. 1918 the non-pumping water level was reported to be 30 ft. below the surface, and the drawdown was 20 ft. after two-hours pumping at 53 gpm. On June 18, 1924 the non-pumping water level was 34 ft. belowthe surface, and a drawdown of eight feet was reported after three-hours pumping at 23 gpm. At that time the inflow, while pumping, was estimated at five to six gpm. From Mar. 15, 1924 to June 18, 1924 the average water consumption was estimated to be from 2200 to 2500 gpd. This well has been abandoned and filled in.

An analysis of a sample (Lab. No. 3 1615) collected Sept. 23, 1915, showed the water from this well to have a hardness of 23.3 gr. per gal., a total mineral content of 488 ppm., and an iron content of 0.1 ppm.

Anew well was drilled in 1926 by Mike Ebert, Washington, and located behind the high school, about 1/4 mile north of the old well (or approximately 1050 ft. N. and 1750 ft. E. of the S. W. corner of Section 17). The elevation of the ground surface at this location is 804t ft.

The well was drilled to a depth of 122 ft., with 8-in. casing to 106 ft., and an 8-in. Cook screen from 106 to 122 ft. The pumping equipment consists of 110 ft. of 3 1/2-in. column pipe; 6-in., 5-stage Fairbanks-Morse turbine pump, No. 29686, with cast iron, No. 705, impellers, and rated at 40 gpm. against 200 ft. of head; the overall length of the pump is 31 3/4 in.; 5-hp. Fairbanks-Morse, 3440 rpm. electric motor.

This well is now used for emergency only.

Analysis of a sample (Lab. No. 83854), collected July 22, 1938, showed the water from this well to have a hardness of 26.1 gr. per gal., a residue of 542 ppm., and an iron content of 8.0 ppm. A large amount of methane gas was evident.

A production test was made by the State Water Survey on July 8, 1940. The non-pumping water level was 105 ft., and the drawdown was 6 ft. after three-hours pumping at 63 gpm.

In Mar. 1944, four wells were drilled by M. Ebert Co., Washington. They are grouped in a quadrilateral arrangement along the west side of State Highway No. 89. Well No. 1 is approximately 1315 ft. S. and 1400 ft. W. of the N. E. corner of Section 17). Well No. 2 is 43 ft. N. and 53 ft. E. of Well No. 1; Well No. 3 is 83 ft. N. and 30 ft. E. of Well No. 1; Well No. 4 is 118 ft. N. and 83 ft. E. of Well No. 1.

The wells are cased with 6-in. pipe and have identical Armco-iron wire-wound screens with lead packer and bail bottom. The screens are 5 5/8-in. od. and are 6 ft. in length. The slot openings are: top 3 ft. is No. 60; the next foot is No. 40 slot; the next foot is No. 30 slot; and the bottom one foot is No. 20 slot.

Production tests were made of each well by the State Water Survey on Mar. 13, 1944.

The test pumping was done by using the town fire-pumper with a direct suction connection from the top of each well casing. Consequently water levels in the pumped well could not be measured, but during each test-run the levels in the other three wells were measured with a steel tape. The pump was operated against a vacuum of approximately 28 in. of mercury (31 1/2 ft. of water) indicating that, after making some allowance for pipe-friction loss and air leakage, the water level was near the bottom of the well, and the well was being over-pumped.

Preliminary to the tests, the measurements shown in Table 1 were made.

The tabulation given in Table 2 shows the rate of pumping in each well and the drawdowns in the other wells.

Some conclusions from the test were made as follows: The dependable water supply from this well group was about 50 gpm.; considering the spacing and mutual interference of the wells, any two wells would produce but little more water than the best single well; any two wells would furnish nearly as much water as all four wells.

The present pumping installation consists of two Aurora Rotary pumps powered by 5-hp. Westinghouse motors which operate at a speed of 1750 rpm. One pump operates from Wells No. 1

and No. 3, and the other from Wells No. 2 and 4. The pumps are set in a pit about 6 ft. deep. There is an air line to each well. The pumps are operated at 55 gpm. when the tank is empty and 45 gpm. when the tank is full. On Mar. 11, 1947 the non-pumping water level was about nine feet from the top of the well, and the drawdown was about three feet.

Analysis of a sample (Lab. No. 109,510), collected from Wells No. 2 and 4 on Mar. 11, 1947 after pumping 1 1/2 to 2 hr., showed the water to have a hardness of 22.0 gr. per gal., a residue of 396 ppm., and an iron content of 1.3 ppm.

The water is not treated but is chlorinated. The principal industries that use water from the village wells are an abattoir and a creamery.

Pumpage is estimated at 100,000 gpd.

TABLE 1

Well No.	Elevation of Ground Surface MSL. datum	Depth of Well ft.	Exposed Length of Screen ft.	Depth to Water ft.
1	754.5	27.8	4.5	4.8
2	756.1	29.7	6.0	6.4
3	754.7	28.5	5.0	5.2
4	756.0	32.0	6.0	6.2

TABLE 2

Pumping in Well	Pumping Rate gpm.	Drawdown in Well			
		No. 1	No. 2	No. 3	No. 4
No. 4	45	3.2	3.6	3.8	
No. 3	46	3.4	3.9		3.6
No. 2	35	2.6		2.8	2.3
No. 1	No pumping				

LABORATORY NO. 109,510

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.3		Silica	SiO_2	21.8	
Manganese	Mn	0.0		Fluoride	F	0.2	
Calcium	Ca	89.7	4.49	Chloride	Cl	1.0	0.03
Magnesium	Mg	37.2	3.06	Nitrate	NO_3	0.6	0.01
Ammonium	NH_4	0.8	0.04	Sulfate	SO_4	9.7	0.20
Sodium	Na	3.9	0.17	Alkalinity	(as $CaCO_3$)	376.	7.52
Color		0		Hardness	(as $CaCO_3$)	378.	7.56
Odor		0		Residue		396.	
Turbidity		20		Temperature 52° F.			

METROPOLIS
Massac County
Jan. 31, 1948

The city of Metropolis (6287) installed a public water system in 1892.

Water was obtained from the Ohio River from 1892 to 1906, but the supply has been obtained from wells since 1906.

A well, now called the Old Well, was drilled in 1906 and is located about 40 ft. north of the center of Front St. and on the west line of Catherine St. extended southerly (or approximately 650 ft. S. and 900 ft. W. of the N.E. corner of Section 11, T. 16 S., R. 4 E.). The ground surface elevation is 325± ft.

This well is 8 in. in diameter and is probably about 270 ft. deep with 35 or 40 ft. of slotted brass screen.

This well was originally equipped with an airlift.

In 1916, it was reported that the non-pumping water level was about 13 ft. below the ground surface, and that when pumping at 625 gpm., the drawdown was about 7 ft. In 1923, when tested, the well produced about 1200 gpm. for 12 hr., and the water level was lowered to a depth of 25 ft.

In 193 7, the non-pumping and pumping water levels were 11 and 25 ft., respectively, below the ground surface. In 1941, the non-pumping water level was 11 ft. below the ground surface and when the airlift in the new well 50 ft. distant was operated simultaneously, the drawdown was 21 ft. in both wells.

Sometime prior to 1937, the well was equipped as follows: 100 ft. of 6-in. column pipe; 8-in. Worthington deep-well turbine, No. 920323 Size 8-300QA7, rated at 500 gpm.; 10 ft. of 6-in. suction pipe; 25-hp. Westinghouse electric motor.

In Jan., 1948, the pump was operated 24 hr. daily at an estimated rate of 500 gpm.

Analysis of a sample (Lab. No. 113,290), collected Jan. 26, 1948 after 72-hr. pumping at 500 gpm., showed the water to have a hardness of 11.3 gr. per gal., a residue of 235 ppm., and an iron content of 0.3 ppm.

The New Well was drilled in 1924 by Fred M. Luth, St. Louis, Mo., and is located approximately 50 ft. northeast of the Old Well.

Sample-study and driller's log of the New Well furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Soil and clay, yellow"	31	31
Lafayette sand and gravel	26	57
Cretaceous system		
Silt and silty sand	16	73
Sand, clean	10	83
Sand, silty, silt, and "clay"	42	125
Sand, fine, clean	22	147
"Clay and brown sand"	18	165
Sand, clean	30	195
Clay	25	220
"Sand, white, fine"	25	245
"Clay"	2	247
Sand and gravel, slightly silty	21	268
Gravel, coarse, clean	13	281
Mississippian system		
St. Louis and Salem formations		
"Limestone"	139	420

The well was drilled to a depth of 420 ft., but no water was encountered below the top of the limestone bed rock.

A 12 1/2-in. od. casing was installed to a depth of 290 ft., and 6 or 8 slots were ripped in the casing at different elevations between 229 and 290 ft. When the well was completed, the non-pumping water level was reported to be 11 ft. below the ground surface, and the well was estimated to produce 1000 gpm.

The pumping equipment consisted of an airlift, with a 10-in. eductor pipe, and 3-in. airpipe. A Worthington 13-in. by 14-in. compressor is driven by a 75-hp. Westinghouse electric motor. The pump base is about 7 1/2 ft. above ground level.

In 1944, this well was producing 1500 gpm.

Analysis of a sample (Lab. No. 102,153), collected Dec. 22, 1944, showed the water to have a hardness of 11.2 gr. per gal., a residue of 235 ppm., and an iron content of 0.6 ppm.

Pumpage in 1947 was estimated to average 900,000 gpd.

LABORATORY NO. 113,290

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.3		Silica	SiO_2	14.7	
Manganese	Mn	Tr.		Fluoride	F	0.3	
Calcium	Ca	66.9	3.35	Chloride	Cl	5.0	0.14
Magnesium	Mg	6.7	0.55	Nitrate	NO_3	Tr.	Tr.
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	19.1	0.40
Sodium	Na	3.7	0.16	Alkalinity	(as $CaCO_3$)	176.	3.52
Turbidity		Tr.		Hardness	(as $CaCO_3$)	195.	3.90
Color		0		Residue		235.	
Odor		0					
Temperature 60° F.							

MIDDLE TOWN
Logan County
Sept. 22, 1948

A public water supply for the village of Middletown (496) was installed in 1941.

In Feb. 1941 an electrical earth resistivity survey was made by the State Geological Survey. Three test holes had been drilled to rock at about 200 ft. and located within the corporate limits of the village. None of the test holes encountered water-bearing material below a depth of 15 ft. As a result of the resistivity survey, two test holes, No. 4 and 5, were drilled. A permanent well was completed in Apr. 1941 by Hayes and Sims, Champaign, and located at the site of Test Hole No. 5, about 3/4 mile west of the north part of the village, (or approximately 50 ft. S. and 1120 ft. W.of the N. E. corner of Section 13, T. 19 N., R. 5 W.). The well is in Menard County. The elevation of the ground surface is 580t ft.

Sample-study log of well drilled in 1941 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Silt and till	25	25
Sand, dirty	5	30
Till and silt	72	102
Sand, dirty	13	115
Sand and granular gravel	35	150
Sand	5	155

The well was finished at a depth of 155 ft. and was cased with 8-in. pipe from 1 ft. 5 in. above to 144 ft. below ground level. An 8-in. Johnson screen, with No. 20 slot openings, was exposed from 145 to 155 ft.

A production test was made by the State Water Survey on Apr. 14, 1941 using, for test purposes, a 4-stage centrifugal deep-well pump and 100 ft. of column pipe and 10 ft. of suction pipe. The length of the pump was 3 ft. 8 in. and the 1/4 -in. air line was 100 ft. Before the test the water level was 56 1/2 ft. below the top of casing and after 5 3/4-hr. pumping at rates increasing from 101 to 197 gpm.,the final drawdown was 15 1/2 ft. On Sept. 15, 1948, the water level, after 11 1/2-hr. non-pumping, was 26 ft. above the bottom of the air line.

The pumping equipment includes an 8-in. American Well Works turbine pump, No. 65131, rated at 200 gpm. against 95 ft. of head and a 7 1/2-hp. General Electric motor. An air line is in place but the length is not known.

Analysis of a sample (Lab. No. 115,828), collected Sept. 15, 1948, after 20-min. pumping at 200 gpm., showed this water to have a hardness of 15.2 gr. per gal., a residue of 294 ppm., and an iron content of 1.6 ppm.

The water is aerated and filtered.

Analysis of a sample (Lab. No. 116,032), collected Sept. 15, 1948 showed the treated water to have a hardness of 15.4 gr. per gal., a total mineral content of 283 ppm., and an iron content of 0.17 ppm.

Pumpage is estimated to average 18,000 gpd.

LABORATORY NO. 115,828

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.6		Silica	SiO_2	30.9	
Manganese	Mn	0.0		Fluoride	F	0.0	
Calcium	Ca	62.9	3.15	Chloride	Cl	8.0	0.23
Magnesium	Mg	24.8	2.04	Nitrate	NO_3	0.4	Tr.
Ammonium	NH_4	1.3	0.07	Sulfate	SO_4	0.4	0.01
Sodium	Na	11.5	0.50	Alkalinity (as $CaCO_3$)		276.	5.52
Turbidity		20		Hardness (as $CaCO_3$)		260.	5.19
Color		0		Residue		294.	
Odor		0		Free CO_2 (calc.)		28.	
Temperature 55.6° F.				pH = 7.4			

MILAN
Rock Island County
October 15, 1947

The public water supply for the village of Milan (1210) was installed in 1894.

Water was obtained from a well located at Third St. West and First Ave. (or approximately 1500 ft. S. and 800 ft. W. of the N. E. corner of Section 23, T. 17 N., R. 2 W.).

The well was drilled to a depth of 1157ft. below a ground surface elevation of 566± ft.

Correlated driller's log of well drilled in 1894 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Glacial drift	7	7
Devonian and Silurian systems		
Limestone, with some shale	383	390
Ordovician system		
Maquoketa formation		
Shale, with streaks of limestone	215	605
Galena-Platteville formations		
Limestone	325	930
Glenwood formation		
Shale	30	960
St. Peter formation		
Sandstone	90	1050
Limestone (probably chert), sandstone, some shale	45	1095
Sandstone, hard and sharp	20	1115
Marl, red	10	1125
Shakopee formation		
Limestone	32	1157

During drilling operations, a small flow of water was noted in the upper 95 ft. of the Galena dolomite and a flow rate of 200 gpm. was noted in the upper 90 ft. of the St. Peter sandstone.

In 1912, J. P. Miller Artesian Well Co., Brookfield, placed 5-in. diameter galvanized casing to a depth of 658 ft. and cleaned the hole to 5-in. diameter to the bottom at 1157 ft. The pressure at the ground surface was then 12 psi. Casings have been replaced frequently.

When the well was new, the shut-in pressure was 67 ft. and the free flow rate was 350 gpm. In 1916 the free flow at the ground surface was metered at 100 gpm. In 1923 the flow was 90 gpm.

Analysis of a sample (Lab. No. 49838), collected Aug. 1, 1923, showed this water to have a hardness of 10.5 gr. per gal., and a mineral content of 1202 ppm.

In April 1938 the well was being used only in emergency, and later the pump was removed and the well abandoned.

Well No. 2 was drilled in 1937 to a depth of 320 ft. by D. E. Edwards, West Branch, Iowa, and located 55 ft. east of the old well.

A 10-in. drive pipe casing, 10 ft. in length, was set in the limestone, and an 8-in. casing was placed from the surface to 140 ft. A flow of water about 25 gpm., with a strong sulphur odor, was cased out of the shale at 127 to 134 ft.

The water level, when the well was completed, was 14 ft. below the top of the casing; and during a 48-hr. production test by the driller, the drawdown was 71 ft. when pumping at 165 gpm.

The pumping assembly consists of 100 ft. of 6-in. column pipe; 8-in., American Well Works turbine pump, No. 60670, rated at 150 gpm. against 172 ft. of head at 1750 rpm.; 10 ft. of 6-in. suction pipe; 10-hp. electric motor.

Analysis of a sample (Lab. No. 112,244), collected Oct. 15, 1947 after 48-hr. pumping at 165 gpm. showed this water to have a hardness of 21.6 gr. per gal., a residue of 444 ppm., and an iron content of 0.3 ppm.

The water is not treated. Pumpage is estimated at 50,000 gpd.

LABORATORY NO. 112,244

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.3		Silica	SiO_2	17.7	
Manganese	Mn	Tr.		Fluoride	F	0.2	
Calcium	Ca	86.1	4.31	Chloride	Cl	15.0	0.42
Magnesium	Mg	37.5	3.08	Nitrate	NO_3	4.0	0.06
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	48.3	1.01
Sodium	Na	22.5	0.98	Alkalinity	(as $CaCO_3$)	344.	6.88
Turbidity		10		Hardness	(as $CaCO_3$)	370.	7.39
Color		0		Residue		444.	
Odor		0					

A public water supply was installed in 1896 by the village of Milford (1628).

Water was first obtained from 2 tubular wells drilled to a total depth of 65 ft. below a ground surface elevation of 665± ft. The tops of the wells were in a pit 16 ft. in diameter and 20 ft. deep. One of the wells was abandoned and a third well was drilled in 1916by C. S. Cummings, Gardner, and located 16 ft. south from the well in the pit. All of the wells were located on a village-owned lot on the west side of Axtell Ave. midway between Ashford and Lyle St. (or approximately 2050 ft. S. and 250 ft. W. of the N. E. corner of Section 15, T. 25 N., R. 12 W.).

Two additional wells were drilled about 1925. One well was located 6 ft. west of Well No. 3 and is now capped. The other well was located about 50 ft. south and 25 ft. east of Well No. 3, and was cased with 8-in. pipe. Water was pumped by air lift. The air and eductor pipes are still in place, but disconnected. The water level was 25 1/2 ft. below the ground surface on Nov. 16, 1948. All 5 wells have been abandoned.

in 1931, Well No. 6 was drilled by Layne-Western Co., Chicago, and located on the same lot with the old wells, and about 25 ft. south and 10 ft. east of Well No. 3. The well was of the gravel-pack type with a 30-in. outer casing extending from ground level fo 51 ft. 4 in., a 16-in. inner casing from ground level to 50 ft. and a 16-in. Layne shutter screen from 50 to 60 ft. On the bottom of the screen, a 22 by 16-in. cone was set with the bottom at 63 ft. below ground level.

The pumping equipment includes a Layne turbine pump, No. 6547, rated at 65 gpm., and a 5-hp. General Electric motor.

Well No. 6 is maintained as an emergency supply unit. The pump is operated once a week for 30 minutes, discharging to waste.

Analysis of a sample (Lab. No. 87233) collected Feb. 8, 1940 showed this water to have a hardness of 37.9 gr. per gal., a residue of 918 ppm., and an iron content of 0.4 ppm.

In 1940, Well No. 7 was drilled by Layne-Western Co. and located on the south bank of Sugar Creek about 1/4 mile southeast of town and 20 ft. east of the Chicago and Eastern Illinois R. R. right-of-way (or approximately 1028 ft. N. and 480 ft. E.of the S. W. corner of Section 14). The ground surface elevation is 655.5 ft.

The well is of the gravel-pack type, having 58 ft. of 48-in. outer casing, 58 ft. of 26-in. inner casing and 20 ft. of 26-in. Layne shutter screen with the bottom of the screen set at 77 ft. 11 in. below the top of the inner casing which is 1.8 ft. above ground surface.

A production test was made by the State Water Survey on July 12, 1940. The static water level was 24.2 ft. below the top of the inner casing. After 7-hr. pumping at 600 gpm. the drawdown was 10 ft. and after an additional 2-hr. pumping at 700 gpm. the drawdown was 11.9 ft. On Nov. 16, 1948 water levels were observed on the altitude gauge. The length of air line is not known. After several hours of non-pumping, the gauge read 32.3 ft. and after 15-minutes pumping at an estimated rate of 750 gpm., the gauge read 27.7 ft.

Well No. 7 is the sole source of the public supply. The pumping equipment includes a Layne turbine pump, No. 10215 and 20-hp. U. S. elec-

LABORATORY NO. 116,471

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.5		Silica	SiO_2	20.1	
Manganese	Mn	Tr.		Fluoride	F	0.2	
Calcium	Ca	99.1	4.96	Chloride	Cl	7.0	0.20
Magnesium	Mg	47.6	3.92	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	0.8	0.05	Sulfate	SO_4	165.2	3.42
Sodium	Na	23.2	1.01	Alkalinity	(as $CaCO_3$)	316.	6.32
Turbidity		22		Hardness	(as $CaCO_3$)	444.	8.88
Color		0		Residue		575.	
Odor		0		Free CO_2 (calc.)		56.	
Temperature 55° F.				pH = 7.15			

tric motor. A new bowl assembly was installed in the spring of 1947. The pump head is mounted on a concrete base about 3 1/2 ft. below normal ground level.

Analysis of a sample (Lab. No. 116,471) collected Nov. 16, 1948 after 10-minutes pumping showed this water to have a hardness of 25.8 gr. per gal., a residue of 575 ppm., and an iron content of 2.5 ppm.

The water is chlorinated.

Pumpage is estimated to average 112,000 gpd. inclusive of the Locker Plant and Theatre, but exclusive of the Milford Canning Co. During the 1948 canning season, the Milford Canning Co. purchased 16 mg. from the village. Total pumpage for Milford in 1948 averaged 156,000 gpd.

The water supply was installed by the village of Milledgeville (808) in 1897.

The water works was located 1 block west of the business district (or approximately 1200 ft. N. and 1900 ft. E. of the S. W. corner of Section 23, T. 23 N., R. 6 E.). Two wells were drilled 10 ft. apart within the pumping station building. In 1923 the West Well was reported, by a former water superintendent, to be 475 ft. deep and the East Well 518 ft. deep. In 1916 the wells had been reported to be 250 and 300 ft. deep. Both wells were cased with 8-in. pipe to a depth of 15 ft., extending 2 ft. into rock. The ground surface at that point is 759± ft.

Each well was equipped with a Cook double-action deep-well pump with a 4 3/4 by 24-in. cylinder. The West Well cylinder was attached to 200 ft. of 5-in. drop pipe, and the East Well cylinder was attached to 250 ft. of 5-in. drop pipe: In 1936 the east pump was being operated 18 hr. daily and was pumping air. The cylinder was lowered to a depth of 300 ft. The West Well was being used about 3 hr. daily.

In 1939 the East Well had gone dry and was found to contain a string of tools. The well was abandoned; and the Cook cylinder, formerly in the East Well, was installed in the West Well, which was maintained for emergency supply. The West Well was abandoned prior to 1945.

Analysis of a sample (Lab. No. 83698) collected June 7, 1938, showed the water from the East Well to have a hardness of 17.5 gr. per gal., a residue of 338 ppm., and an iron content of 0.6 ppm.

In 1939, Well No. 3 was drilled by Davis & Lingle, Preston, Iowa. It was reported that Mr. Davis had drilled the 2 old wells. Well No. 3 was drilled 10 ft. east of the old east well to a depth of 437 ft.

From the surface there is 20 ft. of outer casing, 12-in. diameter, and also 32 ft. of inner casing, 10-in. diameter, with cement grout between the 2 casings. The hole is 10 in. in diameter from the casings to the bottom of the well. The non-pumping level was reported to be 115 ft. in 1939.

The following pump installation made in Sept. 1939 is still in service: 220 ft. of 5-in. od. asphalt-coated column pipe; 6-in., 25-stage (porcelain enameled bowls) Fairbanks-Morse turbine pump, No. 4572, rated at a capacity of 100 gpm. against 380 ft. of head; the overall length of the pump is 11 ft. 5 in.; 30 ft. of 5-in. od. asphalt-coated suction pipe; 20-hp. Fairbanks-Morse electric motor. The 220-ft. air line, as installed, has since dropped in the well.

Analysis of a sample (Lab. No. 108,672) collected Sept. 19, 1939 after 30-min. pumping at 100 gpm., showed the water in Well No. 3 to have a hardness of 18.5 gr. per gal., a residue of 324 ppm., and an iron content of 0.1 ppm.

Well No. 3 is now maintained as a stand-by unit.

Well No. 4 was drilled to a depth of 1146 ft. in 1948 by C. W. Varner, Dubuque, Iowa, and located 50 ft. east of Well No. 3. The well was cased with 18-in. od. drive pipe from the surface to limestone at 17 ft. and with 12-in. id. pipe from the surface to 374 ft. The hole was finished at 12-in. diameter from 374 to 1015 ft. and 10-in. diameter from 1015 to 1146 ft.

The driller reported a 10-hr. test made on Sept. 23, 1948. Before the test the static water level was 83 ft. below ground level. After the first 3 1/2-hr. pumping at a rate of 200 gpm., and the pump in Well No. 3 operating, the drawdown in Well No. 4 was 24 ft. Pumping was then discontinued in Well No. 3 and after 1 1/2-hr. pumping in Well No. 4 at 200 gpm., the drawdown was 22 ft. The pumping rate was then increased to 400 gpm. and after 1/2 hr., the drawdown was 58 ft. The pump in Well No. 3 was started and after 1 1/2-hr. additional pumping in Well No. 4 at 400 gpm., the drawdown was 74 ft. Pumping was then gradually accelerated in Well No. 4. For the last 1 1/2 hr. of the test, the pump in Well No. 3 was operated and the pumping rate in Well No. 4 was 565 gpm. with a drawdown of 121 ft. After stopr ping the test and with No. 3 pump not operating, the water level returned to within 5 ft. of the starting level, 30 min. after the test.

Analysis of a sample (Lab. No. 116,031) collected Sept. 23, 1948 after 7-hr. pumping at 565 gpm. showed the water to have a hardness of 17.6 gr. per gal., a residue of 309 ppm., and an iron content of 5.1 ppm.

On Mar. 4, 1949, the pumping equipment was reported to consist of 160 ft. of 6-in. column pipe; 9-stage Peerless turbine pump, having bronze impellers and rated at 300 gpm. against 300 ft. of head; 10 ft. of 6-in. suction pipe; 160 ft. of 1/4-in. copper air line; 30-hp. electric motor. On the same date it was reported that Well No. 4 supplies the entire demand.

Pumpage is estimated to average 60,000 gpd.

LABORATORY NO. 108,672

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	14.4	
Manganese	Mn	Tr.		Fluoride	F	0.2	
Calcium	Ca	70.1	3.51	Chloride	Cl	1.0	0.03
Magnesium	Mg	34.4	2.83	Nitrate	NO_3	1.0	0.02
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	21.6	0.45
Sodium	Na	1.6	0.07	Alkalinity	(as $CaCO_3$)	296.	5.92
Color		0		Hardness	(as $CaCO_3$)	317.	6.34
Odor		Tr.		Residue		324.	
Turbidity		10		Free CO_2 (calc.)		38.	
Temperature 53° F.				pH = 7.3			

Correlated driller's log of Well No. 4 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Ordovician system		
Galena and Platteville formations		
Brown and Gray lime	100	100
Shale (probably cavern deposit)	10	110
Lime	236	346
Glenwood formation		
Blue shale	8	354
Sandy shale	14	368
St. Peter formation		
Sandstone	4	372
Sand	63	435
Ordovician and Cambrian systems		
Shakopee, New Richmond, Oneota, and Trempealeau formations		
Lime	478	913
Franconia formation		
Lime, sand, and shale	7	920
Sandy shale	70	990
Galesville formation		
Sand, some lime	5	995
Sand	129	1124
Eau Claire formation		
Coarse sandy lime	6	1130
Blue sandy shale	4	1134
Blue shale	12	1146

A public water supply was installed in 1931 by the village of Millstadt (1290).

Water was obtained from a well drilled in 1895 as a coal test hole and later equipped to supply water for the Millstadt Electric Light Plant. Originally the well was 614 ft. deep and cased with 8-in. pipe to rock. It was reported that later the well was plugged at 300-ft. depth, and cased with 8-in. pipe to 250 ft. and with 6-in. pipe inside the 8-in. casing to the same depth.

In 1931, this well, designated as Well No. 1, was acquired by the village. It was located at the south-west corner of Main and White St. (or approximately 1800 ft. N. and 640 ft. W. of the S. E. corner of Section 9, T. 1 S., R. 9 W.). The elevation of the ground surface at the well-site-is 620± ft.

The pumping equipment, originally installed in Well No. 2 consi sts of: 256 ft. of 3 1/2-in. od. column pipe; 6-in.; 24-stage Pomona water-lubricated turbine pump, No. SU 83, having an overall length of 14 ft.; 28 ft. of suction pipe; 7 1/2-hp., 1750 rpm. Westinghouse electric motor. The bottom of the suction pipe is two feet above the bottom of the well.

In Oct. 1934 the non-pumping water level was 173 ft. below ground level and in Aug. 1936 after the second pump was installed, the water level was 193 ft. In Aug. 1938 the pump was operated 24 hr. daily, but at almost regular intervals no water was discharged, indicating that the water was drawn down to the maximum suction lift of the pump. Water should be discharged only when the bowls were almost completely submerged.

Analysis of a sample (Lab. No. 116,488) collected Nov. 1948, showed this water to have a hardness of 16.6 gr. per gal., a residue of 343 ppm., and an iron content of 0.4 ppm.

Well No. 2 was drilled in 1939 to a depth of 615 ft. by Sewell Well Co., St. Louis, Mo., and was located at the northwest corner of Monroe and Oak St., about 360 ft. south of Well No. 1, (or approximately 1320 ft. N. and 680 ft. W. of the S. E. corner of Section 9.).

The ground elevation at the well-site is 620± ft.

The well is cased with 8-in. pipe to a depth of 250 ft.

The pumping equipment consists of 263 ft. of 3 1/2-in. od. column pipe; 7-in., 17-stage Sterling turbine pump, No. S 2030, rated at 75 gpm. against 325 ft. of head, and having an overall length of 7 ft. 1 1/32 in.; 24 ft. of 3 1/2-in. suction pipe; 15-hp., 1800 rpm. General Electric motor.

The bottom of the suction pipe is 294 ft. below the top of the well.

In the summer of 1944, after pumping at a rate of 25 gpm. for 1 1/2 hr., the discharge stopped. In Feb. 1945 water was pumped continuously for 10 days at a rate of 13 gpm.

Analysis of a sample (Lab. No. 102,458), collected Feb. 6, 1945 showed this water to have a hardness of 16.4 gr. per gal., a mineral content of 362 ppm., and an iron content of 0.4 ppm.

Well No. 3 was drilled in 1946 to a depth of 310 ft. by Braun Drilling Co., Red Bud, and located at the southwest corner of Breese and Harrison St. (or approximately 110 ft. N. and 330 ft. E. of the S. W. corner of Section 10).

The well was "shot" with nitro-glycerine between depths of 287 and 302 ft. and was then cased with 12 1/2-in. pipe from the surface to 61 ft. 7 in., and with 10-in. pipe from the surface to 251 ft. 7 in. The annular space outside the 10-in. casing was filled with grout by pressure. Below the 10'-in. casing the hole was 10 in. in diameter.

Upon completion of the well, the static water level was 185 ft. below a ground surface elevation of 605± ft. A production test was made by the State Water Survey on Aug. 1, 1946. Before the test the water level was 202 ft. below ground level and, after 5 1/4-hr. pumping at 41 gpm., the drawdown was 71 ft.

The pumping equipment consists of 245 ft. of 4-in. column pipe; 6-in., 33-stage Pomona turbine pump, No. SF 2430, rated at 50 gpm. against 450 ft. of head; overall length of the pump is about 15 ft.; 30 ft. of 4-in. suction pipe with strainer; 20-hp., 1750 rpm. General Electric motor, No. TC 6562228. ASterling meter is on the line from this well.

Analysis of a sample (Lab. No. 107,322) collected Aug. 1, 1946 showed this water to have a hardness of 16.4 gr. per gal., a residue of 378 ppm., and an iron content of 3.7 ppm.

Water from Wells No. 1 and 2 is pumped into the storage reservoir.

Water from Well No. 3 is pumped directly into the distribution system.

Pumpage is estimated to average 51,500 gpd.

LABORATORY NO. 116,488

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.4		Silica	SiO_2	14.2	
Manganese	Mn	0.1		Fluoride	F	0.4	
Calcium	Ca	72.0	3.60	Chloride	Cl	4.0	0.11
Magnesium	Mg	25.6	2.10	Nitrate	NO_3	0.3	Tr.
Ammonium	NH_4	2.0	0.11	Sulfate	SO_4	4.5	0.09
Sodium	Na	20.0	0.87	Alkalinity (as $CaCO_3$)		324.	6.48
Turbidity		5		Hardness (as $CaCO_3$)		285.	5.70
Color		0		Residue		343.	
Odor		0		Temperature 58.5° F.			

Sample-study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil, silt and till	40	40
Pennsylvanian system		
Shale, limestone, thin coal bed	50	90
Mississippian system		
Chester series		
Golconda shale and sandstone	25	115
Cypress sandstone, partly incoherent	10	125
Paint Creek shale	42	167
Bethel sandstone, thin shale and siltstone beds	28	195
Renault shale, thin sandstone beds	47	242
Aux Vases formation		
Sandstone, oil show	38	280
Sandstone, incoherent	15	295
Sandstone, siltstone and shale	9	304
Iowa series		
St. Genevieve limestone, thin dolomite bed	51	355
St. Louis limestone, thin dolomite beds	135	490
Salem limestone, thin dolomite bed	125	615

MINIER
Tazewell County
Feb. 7, 1947

A public water supply was installed by the village of Minier (737) in 1891.

At that time a well was drilled to a diameter of 6 in. A pump cylinder and tools were lost, and the well was abandoned in 1912.

In 1910, a second well was drilled to a depth of 138 ft., 8 in. in diameter and located at the pumping station near the center of the village (or approximately 2400 ft. N. and 2500 ft. E. of the S. W. corner of Section 22, T: 23 N., R. 2 W.).

In 1916 the non-pumping water level was reported to be 75 ft. below the ground surface elevation of 633± ft. Water was drawn down to the 6-in. by 36-in. cylinder, placed at 130 ft., when pumping at a rate of 37 spm. This well has been abandoned.

In 1914, Well No. 3, North Well, was drilled 9 ft. from the second well. It was 8 in. in diameter and was originally 143 ft. in depth. In 1929 this well was deepened to 193 ft. and was cased with 160 ft. of 8-in. pipe and 30 ft. of 7-in. pipe and screen with 3 ft. of fittings and plug. The effective screen length is 16 ft., and the Johnson screen has No. 20 slot openings.

The well is equipped with 120 ft. of 4 1/2-in. column pipe; 5 1/2-in. od. 19-stage Pomona turbine pump, No. G-6442, rated at 130 gpm. against a head of 220 ft.; 10 ft. of 3 1/2-in. suction pipe; 10-hp. Westinghouse electric motor.

Analysis of a sample (Lab. No. 109,156), collected Feb. 7, 1947 after pumping 25 min., showed the water from the Well No. 3 to have a hardness of 18.9 gr. per gal., a residue of 352 ppm., and an iron content of 2.4 ppm.

In 1929 Well No. 4, South Well, was drilled to a depth of 193 ft. and located about 20 ft. south of the third well. The well is cased with 179 ft. of 8-in. pipe and with 14 ft. of Cook screen with No. 30 slot openings.

In 1946 the original pump was reduced from 14 stages to 12 stages. The pump assembly now consists of: 120 ft. of 5-in. od. column pipe; 7-in., 12-stage Fairbanks-Morse turbine pump, No. 23238; the overall length of the pump is 5 ft. 10 in.; 10 ft. of 3 1/2-in. suction pipe; 15-hp. Fairbanks-Morse electric motor.

Analysis of a sample (Lab. No. 109,155), collected Feb. 7, 1947 after pumping 15 min., showed the water from the Well No. 4 to have a hardness of 19.4 gr. per gal., a residue of 372 ppm., and an iron content of 4.1 ppm.

The pumps are operated alternately and are started whenever the water drops 2 ft. in the tank. Pumpage is estimated to be 100,000 gpd.

LABORATORY NO. 109,155

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	4.1		Silica	SiO_2	25.1	
Manganese	Mn	0.0		Fluoride	F	0.2	
Calcium	Ca	75.4	3.77	Chloride	Cl	5.0	.14
Magnesium	Mg	35.1	2.88	Nitrate	NO_3	0.9	.01
Ammonium	NH_4	2.5	.14	Sulfate	SO_4	1.4	.03
Sodium	Na	8.1	.35	Alkalinity	(as $CaCO_3$)	348.	6.96
Color		0		Hardness	(as $CaCO_3$)	333.	6.66
Odor		Tr.		Residue		372.	
Turbidity		30±					
Temperature		54.5° F.					

The public water supply was installed by the city of Minonk (1897) about 1887.

Water was obtained first from a dug well, 16 ft. in diameter and 65 ft. deep. In 1893 the old well was replaced by a well drilled to a depth of 1850 ft. and located near the dug well on Lot 16, Block 7, at the southeast corner of West Fifth and Washington St. (or approximately 1700 ft. N. and 2250 ft. E. of the S. W. corner of Section 7, T. 28 N., R. 2 E.).

The well, now called Well No. 1, was 12 in. in diameter at the top and 6 in. in diameter at the bottom. It was cased to a depth of 600 ft. When this well was completed, the dug well was used as a collecting reservoir. The drilled well was equipped with a Keystone Driller Co. 2-stage deep-well pump which was belt-driven from an electric motor. A 5 3/4-in. cylinder was attached to 6-in. drop pipe, and screen, 1 ft. long, attached to the bottom of the cylinder. The bottom of the screen was set at a depth of 366 ft. The pump operated at a rate of 107 gpm.

In 1922 this well was cleaned out by the J. P. Miller Artesian Well Co., Brookfield, to a depth of 1519 ft. It is probable that a considerable part of this work consisted of repairing the casing as the well was still 1850 ft. deep.

In 1938 Well No. 1 was equipped with: 340 ft. of 5-in. column pipe; size 8-S.C., 13-stage American Well Works turbine pump rated at 130 gpm. against a head of 340 ft.; the overall length of the pump is 7 ft. 9 1/2 in.; 20 ft. of 5-in. suction pipe; 15-hp. U. S. electric motor.

In Mar. 1947 the well was not in operation but was expected to be in service as soon as a new pump and assembly could be obtained.

A record of non-pumping water levels below the top of the well is as follows:

Year	Water Level ft.
1893	150
1914	150
1920	200
1921	202
1937	218
1938	218+

Analysis of a sample (Lab. No. 66476) collected Mar. 23, 1922 showed the water to have a hardness of 2 gr. per gal., a residue of 2211 ppm., and an iron content of 0.3 ppm.

The chloride content and hardness has not varied greatly since 1914.

Date	Chloride ppm.	Hardness ppm.	Residue ppm.
1914	1100	52	2337
1922	1040	37	2355
1930	981	35	2211
1945	888	57	2084

The character is not greatly different from that which might be expected for water from a depth of about 660 ft.

In 1921 - 1922 Well No. 2 was drilled by the J. P. Miller Artesian Well Co. to a depth of 2005 ft. and located 28 ft. northeast of the other well. The ground surface elevation is 758t ft.

The well is cased from the ground surface with 208 ft. of 15-in. od. pipe. Twelve-in. casing, sealed to the 15-in. pipe, extends to a depth of 526 ft., and 10-in. casing sealed to the 12-in. is placed between depths of 516 and 660 ft. All pipe is wrought iron. The well is 10 in. in diameter at the bottom. The depth to water in the well was 217 ft. until sandstone was entered when it raised to 202 ft.

In Mar. 1922 Well No. 2 was equipped with a deep-well pump with the cylinder at a depth of 301 ft. The pump was operated by the well rig during a 10-hr. test. During the first 5 hr., the production, as measured in a tank, was between 115 and 120 gpm. at nearly all times. After 8 1/2-hr. pumping, the production declined to 80 gpm. The rate of pumping was then increased, and the maximum possible rate of pumping at the end of 10 hr. was 107 gpm. During the last 7 1/2 hr. of this test, the pump in the well 28 ft. distant was operating. Measurements to water level in the wells could not be made, but it was reported that the water level in the well tested was probably drawn down to the pump cylinder at a depth of 301 ft.

The temperature of the water from the well, 1 hr. after pumping started, was 67.5° F.; and after pumping 8 1/2 hr., it was 71.5° F.

In Apr. 1925 the well was equipped with a Keystone Driller Co. pump with a 6 3/4-in. cylinder.

In 1937 Well No. 2 was equipped with the following pumping equipment, which is still in place:

350 ft. of 5-in. column pipe; size 8-S.C, 14-stage American Well Works turbine pump, No. 68828, rated at 100 gpm. against a head of 355 ft. at 1800 rpm.;(at the present time it is estimated that the pump actually delivers 125 gpm.); the overall length of the pump is 8ft. 3 1/2 in.; 20 ft. of 5-in. suction pipe; 15-hp. U. S. electric motor; an air line is installed but the length is not known.

Non-pumping water levels in Well No. 2, below the top of the well have been reported as follows:

Year	Water Level ft.
1922	202
1937	218
Mar. 1947	325

Well No. 2 is now supplying all the water for Minonk. Well No. 1 will be placed in production as soon as pump and assembly can be obtained.

Analysis of a sample (Lab. No. 109,530), collected Mar. 13, 1947 after pumping about 3 1/2 hr., showed the water from Well No. 2 to have a hardness of 13.9 gr. per gal., a residue of 170.3 ppm., and an iron content of 0.2 ppm. Similar quality was shown by other analyses.

Date	Chlorides ppm.	Hardness ppm.	Residue ppm.
1922	480	285	1492
1930	593	260	1609
1945	625	250	1623
1947	685	239	1703

The increasing chloride content and decreasing hardness indicates an increasing proportion of water from about 660 ft. The analysis made in 1922 appears to be typical for waters from the St. Peter sandstone in this vicinity.

The water is not treated.

Pumpage is estimated at 120,000 gpd.

LABORATORY NO. 66476

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.3		Silica	SiO_2	14.	
Manganese	Mn	0.0		Chloride	Cl	593.	16.69
Calcium	Ca	60.5	3.02	Nitrate	NO_3	0.9	.02
Magnesium	Mg	26.4	2.18	Sulfate	SO_4	216.4	4.45
Ammonium	NH_4	1.5	.08	Alkalinity	(as $CaCO_3$)	276.	5.52
Sodium	Na	495.	21.50	Hardness	(as $CaCO_3$)	260.	5.20
				Residue		1609	

LABORATORY NO. 109,531

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	14.8	
Manganese	Mn	0.0		Fluoride	F	2.4	
Calcium	Ca	59.5	2.98	Chloride	Cl	685.0	19.32
Magnesium	Mg	21.9	1.80	Nitrate	NO_3	0.3	Tr.
Ammonium	NH_4	1.7	0.10	Sulfate	SO_4	202.2	4.21
Sodium	Na	559.6	24.33	Alkalinity	(as $CaCO_3$)	284.	5.68
Color		0		Hardness	(as $CaCO_3$)	239.	4.78
Odor		0		Residue		1703.	
Turbidity		10-		Free CO_2 (calc.)			
Temperature		71.5° F.					

Sample-study and driller's log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil, silt and till	75	75
Till, sand and gravel, clean	65	140
Pennsylvanian system		
Shale, some limestone and sandstone, thin coal beds	515	655
Devonian (?) and Silurian systems		
Dolomite	595	1250
Ordovician system		
Maquoketa shale	100	1350
Maquoketa and Galena-Platteville formations		
"Limestone" (upper part probably shale)	440	1790
Glenwood and St. Peter formations		
Sandstone, some shale and dolomite	60	1850
Sandstone, incoherent	150	2000
Shale and chert	5	2005

MINOOKA
Grundy County
Nov. 27, 1947

A public water supply was installed by the village of Minooka (317) in 1886.

Water was obtained from a well drilled in 1886 to a depth of 2100 ft. The well has not been in service since 1906 although the free flow continued at a diminishing rate until 1941. All available physical and chemical data, prior to 1941, may be found in Bulletin No. 34.

The State Water Survey installed an automatic water level recorder in this well Sept. 1, 1942. Some critical water levels are shown in Table 1.

TABLE 1

Date	Water Level ft. below top of casing
Sept. 1, 1942	35
May 1, 1943	30
June 11, 1944	24
Oct. 15, 1944	28
Apr. 3, 1945	24 1/2

The recorder was removed Apr. 3, 1945.

Well No. 2 was drilled in 1906to a depth of 620 ft. by John Matthews, Joliet, at a location 200 ft. north and 135 ft. east of Well No. 1 about 185 ft. north of the center of Mondamon St. and 90 ft. west of the center of Wabena St. (or approximately 2400 ft. S. and 2500 ft. E. of the N. W. corner of Section 1, T. 34 N., R. 8 E.). All available physical and chemical data prior to 1941 may be found in Bulletin No. 34.

The pump installation in service on Nov. 14, 1947, was: 207 ft. of 5-in. drop pipe; American Well Works two-stroke deep-well cylinder pump, No. J 2867 having a 4 3/4-in. id. and 18-in. stroke and operating at 25 rpm.; the bottom of the 5-in. suctionpipe is at 240 ft.; 20-hp. Fairbanks-Morse electric motor.

The following pumping equipment is available and will be installed soon: 260 ft. of 4-in. gwi. column pipe; 6-in., 26-stage Peerless turbine pump, No. 33903, having all bronze bowls and an overall length of 11 1/2 ft. and a rated capacity of 50 gpm. against 280 ft. of head; 15 ft. of 4-in. suction pipe and strainer; 260 ft. of 1/4-in. brass pipe air line; 10-hp. U. S. electric motor.

The following non-pumping water levels have been reported with depth to water measured from the top of the casing, which has an elevation of 613.14 ft.

Date	Water Level ft.
1912	60
1917	75
Nov. 1919	78
1923	84
1938	92
Apr. 1941	106
July 1941	107
1945	106

On May 3, 1938 the non-pumping water level was reported to be 92 ft.; and when pumping at 70 gpm., the drawdown was 73 ft. In July 1943 the pumping rate had been 45 gpm. for several months, and the drawdown was 74 ft. below a non-pumping water level of 106 ft.

In July 1945 it was necessary for the village officials to take action toward improving the wa-

LABORATORY NO. 112,587

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.6		Silica	SiO_2	16.7	
Manganese	Mn	Tr.		Fluoride	F	0.8	
Calcium	Ca	44.8	2.24	Chloride	Cl	186.0	5.25
Magnesium	Mg	19.5	1.61	Nitrate	NO_3	Tr.	Tr.
Ammonium	NH_4	0.8	0.04	Sulfate	SO_4	41.3	0.86
Sodium	Na	167.0	7.26	Alkalinity	(as $CaCO_3$)	252.	5.04
Turbidity		10-		Hardness	(as $CaCO_3$)	193.	3.85
Color		0		Residue		643.	
Odor (at well)		H_2S		Free CO_2 (calc.)		18.	
Temperature 54.7° F.				pH = 7.55			

ter supply. It had been proposed to ream out Well No. 2 and replace the pump, but Well No. 1 could not be substituted in service before fishing out an old pump which had dropped in that well.

On July 3, 1945, a short production test of Well No. 2 was made by the State Water Survey. Before the test the water level was 110 ft. Pumping was started at 54 gpm. and gradually fell off to 47 gpm. at the end of 4 1/2 hr.

Analysis of a sample (Lab. No. 112,587), collected Nov. 14, 1947 after two-hours pumping at about 50 gpm., showed the water to have a hardness of 11.3 gr. per gal., a residue of 643 ppm., and an iron content of 0.6 ppm.

From Jan. 1,to Sept. 1, 1947 the pumpage was estimated to average 18,100 gpd.

No log is available for the Minooka village wells. An oil test well was drilled in 1902 by J. P. Miller Artesian-Well Co., Brookfield, and located in S. W. corner, N.W. 1/4, Section 32, T. 35 N., R. 9 E., about two miles northeast of Minooka. The ground elevation is 570t ft.

Correlated driller's log of oil test well furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Gravel, sand and clay	44	44
Ordovician system		
Maquoketa formation		
No log	42	86
Galena-Platteville formations		
Limestone	49	135
Shale	23	158
Limestone	282	440
St. Peter formation		
Sandstone	110	550
Shale, gray	30	580
Shakopee - Oneota formations		
Limestone	285	865
Shale and limestone	53	918
Cambrian system		
Trempealeau formation		
Limestone	142	1060
Franconia formation		
Shale, sandy, blue	102	1162

MOKENA
Will County
Oct. 25, 1946

The water works for the village of Mokena (657) was first installed under private ownership and was acquired by the village in 1899.

Water was obtained from a well drilled in 1891 to a depth of 139 ft. and cased with 4-in. pipe having 10 ft. of screen at the bottom.

The well penetrated drift and obtained water from a sand and gravel stratum. It was located on Front St. about 600 ft. northeast of the present well and was the source of the public supply until 1921 when it was abandoned.

In 1920 a well was drilled by John Matthews, Joliet, to a depth of 225 ft. It is located in the municipal building on Front St. about 1750 ft. northeast of the intersection of Wolf Road (or approximately 1750 ft. N. and 1440 ft. E. of the S. W. corner of Section 8, T. 35 N., R. 12 E.). The elevation of the ground surface is 724i ft. The well is 8 in. in diameter and terminates in water bearing limestone.

The village minutes of Sept. 29, 1920 recorded a water level of 67 ft. below the ground surface when the well was drilled. On Sept. 29, 1922 the water level, after 16 hr. of idle time, was 67 ft. below the pump house floor and was lowered a little over a foot when pumped for 3 hr. at 57 gpm.

The following pump installation was made in Jan. 1945: 150 ft. of 4 1/2-in. column pipe; 6-in., 15-stage Deming turbine pump, T 5929, rated at a capacity of 100 gpm. against 247 ft. of head; 150 ft. of airline; 10 ft. of suction pipe and strainer; 10-hp. U. S. electric motor. The depth to water below the pump base was 60 ft. when the pump was installed.

Analysis of a sample (Lab. No. 107,915), collected Oct. 10, 1946 after 15-min. pumping at 100 gpm., showed this water to have a hardness of 28.6 gr. per gal., a residue of 567 ppm., and an iron content of 1.5 ppm.

This well has furnished the entire public water supply since 1920 and the estimated average pumpage is 33,000 gpd.

The water is not treated.

The Mokena Wall Paper Co. (formerly the plant of the Bowman Dairy Co. and later the Mitchell Brewing Co.) has 2 wells located on their property.

One well was drilled in 1911. It is located about 500 ft. north and 200 ft. west of the southeast corner of Section 7). The well was drilled to a depth of 360 ft., terminating-in limestone, and was cased with 8-in. pipe to limestone at a depth of about 90 to 100 ft. A water level of 60 ft. below the floor was reported in Dec. 1921 when the pump was pulled.

In 1921 and 1922 the well supplied a demand of 30,000 to 40,000 gpd. when operated by the dairy company. On July 30, 1943 it was reported that the well was equipped with a Fairbanks-Morse 5-hp. jet pump having a setting of 73 ft. A non-pumping water level of 59 ft. was observed. A test run of several hours averaged a production of 40 gpm.

Water used for boilers is treated. *All* water used for drinking and sanitation purposes is supplied by the village of Mokena.

A smaller well, drilled in 1904, is located about 50 ft. northeast of the large well. It is 6 in. in diameter and 175 ft. deep terminating in limestone. A production of 23 gpm. and a non-pumping water level of 60 ft. below the surface was reported in 1922.

The well has been abandoned and is now covered with a concrete floor.

LABORATORY NO. 107,915

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.5		Silica	SiO_2	23.4	
Manganese	Mn	0.0		Fluoride	F	0.3	
Calcium	Ca	107.7	5.39	Chloride	Cl	2.0	.06
Magnesium	Mg	54.2	4.45	Nitrate	NO_3	1.2	.02
Ammonium	NH_4	0.5	.03	Sulfate	SO_4	117.2	2.44
Sodium	Na	18.6	.81	Alkalinity	(as $CaCO_3$)	408.0	8.16
Turbidity		20+		Hardness	(as $CaCO_3$)	492.	9.84
Color		0		Residue		567.	
Odor		0					
Temperature		51.5° F.					

The city of Momence (2425) installed a public water supply in 1895.

Water was obtained from 2 wells drilled 5 ft. and 35 ft. south of the pumping station which is located about 200 ft. east of the Chicago & Eastern Illinois R. R. and 100 ft. north of the Kankakee River (or approximately 250 ft. N. and 2400 ft. E. of the S. W. corner of Section 18, T. 31 N., R. 14 E.).

Prior to 1913 two additional wells were drilled. One well was located 70 ft. west, and the other, 200 ft. north of the pump/station.

These wells are reported to be 10 in. in diameter and range from 85 to 135 ft. in depth below a ground surface elevation of 622± ft.

Water was pumped from the 2 original wells by 2 steam-powered duplex pumps; but when the other wells were drilled, all 4 wells were connected to a common suction header, and a 10-in. by 10-in. Gould triplex pump, rated at 330 gpm. was installed. Power was furnished by an electric motor.

The non-pumping water level in 1913 was reported to be between 12 and 20 ft. In 1913 the rate of production was about 300 gpm.; and in 1923 it was about 230 gpm. In 1947 it was reported that these wells and pump were available for service, but were seldom used.

In June 1947 the Gould triplex pump was repaired, and some new suction lines were installed and connected to 3 of the 4 wells.

The non-pumping water level in Well No. 3 was 15 ft., and after 15-min. pumping from the 3 wells at a rate of 195 gpm. the drawdown was 1 1/2 ft.

Well No. 1, nearest the river, is 137 ft. deep and is cased with 10-in. pipe. This well was temporarily equipped with a Fairbanks-Morse turbine pump, rated at 400 gpm. and having a total setting of 130 ft. to the bottom of the suction pipe. When pumping at a rate of 95 gpm. with the above unit the pump broke suction in 50 seconds.

When the pump in Well No. 1 was operating at a rate of 95 gpm., the water level in Well No. 2, 30 ft. north, was lowered 7 ft.

Well No. 5 was drilled in 1936 by W.L. Thorne, Des Plaines, at a location about 12 ft. northwest **of** the northeast corner of the pumping station. This well was drilled to a depth of 575 ft.

Sample-study log of Well No. 5 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil	6	6
Silurian system		
Niagaran - Alexandrian series		
Dolomite, shale streak at 140 ft.	199	205
Shale, dolomite, and siltstone	50	255
Dolomite	270	525
Siltstone, shale and dolomite	50	575

The hole and casing record is shown in Table 1.

TABLE 1

Hole Record

15-in. from surface to 60 ft.
12-in. from 60 to 231 ft.
10-in. from 231 to 575 ft.

Casing Record

12-in. id. casing from surface to 62 1/2 ft.
10-in. id. liner from 177 to 231 ft.

When the well was completed, the water level was reported to be 20 ft. The yield was only about 150 gpm., so it was capped and not used.

In 1947 the pump assembly which was first installed in Well No. 1 was temporarily installed in this well as follows: 110 ft. of 6-in. id. column pipe; 10-in., 7-stage Fairbanks-Morse turbine pump having an overall length of 5 ft. 6 in. and a rated capacity of 400 gpm. against 230 ft. of head; 15 ft. of 6-in. id. suction pipe; 130 ft. of 1/4-in. gi. air line; 30-hp. General Electric motor.

On Aug. 31, 1947 when pumping at a rate of 95 gpm. with the above unit the pump broke suction in 55 seconds.

Well No. 6 was drilled in 1936by W.L. Thorne and is located **on** the north bank of the Kankakee River about 110 ft. south of River St. and 40 ft. east **of** Pine St. (or approximately 850 ft. S. and 300 ft. W.of **the** N. E. corner of **Section** 24, T. 31

N., R. 13 E.). This well was drilled to a depth of 125 ft. below a ground surface elevation of 620± ft.

The well was cased to a depth of 20 ft. with 12-in. pipe. When completed, the water level was 8 ft. below the ground surface, and the well produced about 600 gpm.

The existing pump installation, made in 1936, is: 60 ft. of 8-in. column pipe; 10-in., 5-stage Pomona turbine pump, No. N3382, rated at 500 gpm. against 160 ft. of head; overall length of the pump is 4 ft.; 10-ft. of 7-in. suction pipe and strainer; no air line; 30-hp. General Electric motor, No. 5381066.

Because of the distance to the pumping station, this well was used only as an emergency supply for several years. When the production of of the old wells decreased, this well became the main source of supply.

On June 27, 1947 the non-pumping water level was reported to be 2 ft. below the pump base and 3 or 4 ft. above the Kankakee River water level. After 5-hr. pumping at an estimated rate of 450 gpm., the drawdown was 46 ft. It was reported that about a month earlier when the river stage was about 2 ft. higher, the well had flowed when not pumping.

Since Sept. 1, 1947, Well No. 6 has been the source of the entire public supply.

Analysis of a sample (Lab. No. 112,720) collected Nov. 29, 1947 after 30-min. pumping at 400 gpm. showed this water to have a hardness of 17.5 gr. per gal., a residue of 362 ppm., and a trace of iron content.

Well No. 7 was completed about Oct. 15, 1947 by John Bolliger & Sons, Fairbury, at a location about 40 ft. north of the river channel and 90 ft. east of Well No. 6, and is reported similar in construction to Well No. 6.

The existing pump installation, made in Nov. 1947, is: 110 ft. of 6-in. id. column pipe; 10-in., 7-stage Fairbanks-Morse turbine pump, No. A F 46822, having a rated capacity of 400 gpm. against a head of 230 ft.; the overall length of the pump is 5 ft. 6 in.; 15 ft. of 6-in. id. suction pipe and gi. strainer; 130 ft. of 1/4-in. gi. air line; 30-hp. General Electric motor.

It is reported that the well produced 650 gpm. when tested by pumping to the river. Well No. 6 was reported idle during this test.

On Nov. 29, 1947, the non-pumping water level was 27 ft. below the pump base in Well No. 7 after 5-hr. pumping in Well No. 6.

In Dec. 1947 the well had not been placed in service.

Pumpage in 1947 was estimated to average 400,000 gpd.

All water for the public supply is chlorinated.

In a letter from Florence Astle, City Clerk, dated Aug. 28, 1948, it was stated that "Wells No. 1, 2, 3, 4, and 5 have been abandoned. All water is pumped from Wells No. 6 and 7 and these wells were recently numbered No. 1 and No. 2."

LABORATORY NO. 112,720

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	Tr.		Silica	SiO_2	11.7	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	63.5	3.18	Chloride	Cl	6.0	0.17
Magnesium	Mg	34.2	2.81	Nitrate	NO_3	5.1	0.08
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	84.5	1.76
Sodium	Na	13.1	0.57	Alkalinity (as $CaCO_3$)		228.	4.56
Turbidity		Tr.		Hardness (as $CaCO_3$)		300.	5.99
Color		0		Residue		362.	
Odor		E		Free CO_2 (calc.)		42.	
Temperature 54.2° F.				pH = 7.3			

The system of water works at Monee (427) is owned and operated by the village and was installed in 1897.

The initial water supply was obtained from a well located about 80 ft. east of East St. and 210 ft. south of Main St. (or approximately 2030 ft. N. and 2510 ft. E. of the S. W. corner of Section 21, T. 34 N., R. 13 E.) on ground having a surface elevation of 805± ft.

Well No. 1, the original well, was drilled in 1897 to a depth of 166 ft. and was cased with 6-in. pipe to rock at a depth of 90 ft. When completed, the well was tested for 3 days at a rate of 60 gpm. without lowering the water level.

A water level of 70 ft. below the pump base was recorded in 1935 when the pump was pulled for repairs.

This well has not been in service since 1942. The following pumping equipment was pulled for repairs during the latter part of Sept. 1946 and was to be re-installed as a standby pumping unit: 85 ft. of 4-in. drop pipe; a Gould single-acting plunger pump having a 4 1/2-in. diameter cylinder and 16-in. stroke; 25 ft. of suction pipe. This unit was operated at a speed of 35 spm. and had a displacement of 35 gpm.

On Oct. 4, 1946, the measured depth of the well was 157 ft. The distance to water was 73 ft. below the pump base when Well No. 2 was idle and was lowered 2 ft. when the pump in Well No. 2 was discharging 140 gpm.

Well No. 2, located about 30 ft. east of Well No. 1, was drilled in 1913 to a depth of 169 ft. and was cased with 10-in. pipe to rock at a depth of 90 ft. When the well was completed, water was pumped into it at a rate of 50 gpm., but the well filled in a few hours.

A non-pumping water level of 75 ft. below the surface was reported on June 29, 1915. The pump installation in service on Oct. 8, 1946 consisted of: 95 ft. of 7-in. drop pipe; a Keystone Driller Co. double-acting plunger pump having a 6 3/4-in. diameter cylinder and 18-in. stroke; 25 ft. of 7-in. suction pipe; 15-hp. General Electric motor. It was operated at a rate of 32 spm. and had a displacement of 140 gpm.

This well is now used as the sole source of the public water supply, and the average pumpage is estimated to be 20,000 gpd.

Analysis of a sample (Lab. No. 107,911) collected Oct. 8, 1946 after 1-hr. pumping at 128 gpm. showed this water to have a total hardness of 35.8 gr. per gal., a residue of 776 ppm., and an iron content of 0.5 ppm.

A 9-ft. diameter zeolite softening unit, Serial No. 14282, having a rated softening capacity of 250 gpm., was installed on Aug. 28, 1939.

Analysis of a sample of the treated water (Lab. No. 108,816) collected Oct. 8, 1946, showed the water to have a total hardness of 2.3 gr. per gal., and a total mineral content of 852 ppm.

The Cardox Corporation plant is located about 1.9 miles northeast of Monee on the east side of the Illinois Central Railroad and opposite the intersection of highway routes 50 and 54.

Three limestone wells have been drilled at this plant.

The first well was drilled to a depth of 190 ft. By Thos. Kramer & Sons, Harvey, in Nov. and Dec. 1941. It was cased with 8-in. pipe from the surface to a depth of 123 ft. below which the hole was 8 in. in diameter to the bottom.

This well serves the assembly plant and furnishes water for drinking and sanitary purposes. A temporary pump installation is in service which is to be replaced with a turbine pump having a rated capacity of 100 gpm. and powered by a 10-hp. electric motor.

Sample-study log of well drilled in 1945 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay and silty sand	10	10
Till	55	65
Gravel, clean	5	70
Till and gravel	10	80
Gravel, clean	5	85
Till	5	90
Sand and gravel, clean	15	105
Sand and gravel	9	114
Silurian system		
Niagaran-Alexandrian series		
Dolomite, shale	146	260
Dolomite, "water-bearing crevices, 347-352"	148	408

A second well was drilled by J. P. Miller

Artesian Well Co., Brookfield, in Feb. and Apr. 1945. It is located about 500 ft. north of the original well. It is 408 ft. deep and is cased with 20-in.od. pipe from the surface to a depth of 78 ft. and with 18-in. od. pipe from the surface to a depth of 131 ft. Below the casing, the hole was 17 1/4 in. in diameter to the bottom.

A production test of 6-hr. duration was conducted on May 8, 1945 after completion of. the well. At the end of the pumping period, a production of 195 gpm. against a discharge head of 130 ft. was obtained with a drawdown of 43 ft. below a non-pumping water level of 59 ft. below the pump base.

The following pump installation, made in May 1946, is in service: 340 ft. of 8-in. column pipe; 10-in., 13-stage Peerless turbine pump rated at a capacity of 500 gpm. against 500 ft. of head; 340 ft. of air line; 30 ft. of 8-in. suction pipe; 75-hp. U. S. electric motor.

Water levels below the pump base, observed on May 2, 1946, were: a water level of 130 ft. after a long idle period and a pumping level of 190 ft. when pumping at 300 gpm. against 220 pounds pressure.

A third well was drilled by the J. P. Miller Artesian Well Co. in May and June 1946 to a reported depth of 196 ft. It was cased with 14-in. od. pipe from the surface to a depth of 116 ft. below which the hole was 11 1/8 in. in diameter.

This well was planned to serve as an emergency supply unit and was not equipped for pumping on Oct. 24, 1946.

LABORATORY NO. 107,911

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.5		Silica	SiO_2	18.6	
Manganese	Mn	Tr.		Fluoride	F	0.3	
Calcium	Ca	167.3	8.37	Chloride	Cl	2.0	.06
Magnesium	Mg	47.4	3.90	Nitrate	NO_3	1.5	.02
Ammonium	NH_4	0.8	.04	Sulfate	SO_4	310.6	6.46
Sodium	Na	23.7	1.03	Alkalinity (as $CaCO_3$)		340.	6.80
Turbidity		Tr.		Hardness (as $CaCO_3$)		614.	12.28
Color		0		Residue		776.	
Odor		0		Free CO_2 (calc.)		79.9	
Temperature 52° F.				pH = 7.05			

The public water supply for the city of Monmouth (9096) was started in 1886 with the construction of a well on a city-owned lot at the northwest corner of East Clinton and North Sixth St.

The well was cased as follows: 9-in. pipe from surface to 70 1/2 ft.; 6-in. pipe from 70 1/2 to 147 ft.: and 5-in. pipe from 147 to 893 ft.

The elevation of the ground surface is 740± ft.

The air line in the well was 460 ft. long, and the non-pumping water level was reported in 189.6 to be 60 ft. below the ground surface. In 1921 the air line was extended 20 ft. 9 in.

A second well was drilled in 1891 to a depth of 1222 ft. and cased with 10-in. pipe to a depth of 418 ft. In 1923 the well was recased with 600 ft. of 6-in. pipe. This well was located in the same building and about 32 ft. south and 28 ft. east of the first well. The air line was 550 ft. long.

Analysis of a sample (Lab. No. 38284), collected Oct. 13, 1917, showed this water had a hardness of 26.8 gr. per gal., a mineral content of 1685, and an iron content of 0.1 ppm.

A third we 11 was drilled in 1899 to a depth of 1222ft. and located about 112 ft. south and 160 ft. east of the second well. This well was recased about 1915 by sealing a 6-in. water discharge pipe, 678 ft. long, to the surrounding rock. In 1921 the air line was reported to be 558 ft. long.

In 1900 the 3 wells were connected to a central shaft, 10 ft. in diameter by 185 ft. deep, with 1 pump placed over the shaft. At the 185-ft. level, tunnels were made to each of the wells; and within the tunnels, a system of pipes connected the wells and the pump. In 1906 after many difficulties caused by breakage of the pump rods, the system was replaced by air lift equipment. In 1921 the two 1222-ft. wells were producing. The average consumption in 1912 was estimated to be 450,000 gpd. At the same time the non-pumping water level was 85 ft. below the ground surface. In 1910 during a test of No. 2 well, the pumping level was reported at 210 ft. below the surface when pumping at a rate of 22,000 gal. per hr. or 370 gpm.

Operation of the 3 wells was discontinued in Apr. 1925 upon completion of a new well drilled by S. B. Geiger, Chicago, in 1924. The location of the well was on a new site about 4000 ft. southwest of the original pumping station (or approximately 25 ft. N. and 245 ft. E. of the S. W. corner of Section 29, T. 11 N., R. 2 W.).

This well is known as the West Well, and is located in the southwest corner of the pumping station building, which was constructed in 1925. The well was drilled to a depth of 2445 ft.

The original pump installation was an American Well Works deep-well turbine, but this was removed and a Byron Jackson deep-well turbine installed in 1927, which was removed, rebuilt, and re-installed Oct. 1, 1939. At that time the following assembly was installed and is now in service: 246 ft. of 10-in. column pipe; 14-in., 8-stage Byron Jackson turbine pump, No. 99057, rated at 940 gpm. against 230 ft. of head at 1170 rpm.; the overall length of the pump is 10 ft.; 246 ft. of copper tube air line; 24 ft. of 10-in. suction pipe with 6 ft. of strainer; 75-hp. General Electric motor.

Analysis of a sample (Lab. No. 108,093), collected Oct. 25, 1946 after 1-hr. pumping, showed 'this water to have a hardness of 16.4 gr. per gal., a mineral content of 978 ppm., and an iron content of 1.2 ppm.

In 1926, S. B. Geiger drilled a second well, known as the East Well, and located in the southeast corner of the pumping station building about 30 ft. east of the West well. The well is 2445 ft. deep and is reported to be cased as follows: 24-in. drive pipe from 0 to 85 ft.; 19-in. od. cast iron pipe from 0 to 485 ft.; 14-in. od. copper bearing casing from 443 1/2 to 1044 ft.; 10-in. id. liner from 1225 to 1285 ft.

The elevation of the top of the pump foundation is 768.63 ft.

The original pump installation in the East Well was an American Well works deep-well turbine, but was later replaced and the following pump assembly is in place: 250 ft. of 8-in. column pipe; 14-in., 7-stage A. D. Cook turbine pump rated at 850 gpm. against 261 ft. of head at 1160 rpm.; the overall length of the pump is 6 ft. 10 in.; 250 ft. of air line; 30 ft. of 8-in. suction pipe; 75-hp., 1170-rpm. General Electric motor. On May 14, 1949 it was reported that 20 ft. of column pipe would be added, which would make the length of column pipe 270 ft.

No remarks were included in the water level reports as to conditions of pumping or non-pumping in West Well. On May 14, 1949, John E. lessen, Water Supt. reported that, with the pump

out, the water level was 234 ft. below the pump station floor.

Analysis of a sample (Lab. No. 108,092), collected Oct. 25, 1946 after 5-hr. pumping, showed this water to have a hardness of 16.3 gr. per gal., a residue of 1018 ppm., and an iron content of 0.2 ppm.

The water is chlorinated but not treated otherwise.

In Oct. 1946 the pumps were operated alternately for a total pumping period of 15 or 16 hr. daily. The pumpage was estimated at 600,000 gpd.

Water levels (Table 1) have been reported in the East Well with distances to water in feet below the pump base:

TABLE 1

Water Levels

Date	Non-pumping ft.	Pumping ft.
Apr. 16, 1925	183	
Apr. 9, 1932	201	221
Oct. 17, 1939	212 1/2	233 1/2
Mar. 23, 1943	222 1/2	246 1/2
Feb. 9, 1944	224	246

Sample-study log of the West Well furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Glacial drift	95	95
Pennsylvanian system		
Shale, thin coal bed at top	15	110
Mississippian system		
Burlington limestone	80	190
Kinderhook shale	275	465
Devonian system		
Cedar Valley and Wapsipincon Limestones, partly shaly	95	560
Silurian system		
Alexandrian dolomite	40	600
Ordovician system		
Maquoketa shale and dolomite	180	780
Galena-Platteville dolomite and limestone	320	1100
St. Peter formation		
Sandstone, incoherent	150	1250
Shale, sandstone and chert	25	1275
Shakopee dolomite	275	1550
New Richmond sandstone	5	1555
Oneota dolomite, thin shale and sandstone beds in lower part	295	1850
Cambrian system		
Trempealeau dolomite	245	2095
Franconia sandstone, dolomite, thin shale beds	230	2325
Galesville sandstone, partly dolomitic	120	2445

LABORATORY NO. 108,092

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	13.5	
Manganese	Mn	0.0		Fluoride	F	4.0	
Calcium	Ca	63.2	3.16	Chloride	Cl	113.0	3.19
Magnesium	Mg	28.8	2.37	Nitrate	NO_3	Tr.	Tr.
Ammonium	NH_4	1.4	.08	Sulfate	SO_4	411.8	8.57
Sodium	Na	240.8	10.47	Alkalinity	(as $CaCO_3$)	216.	4.32
Color		0		Hardness	(as $CaCO_3$)	277.	5.54
Odor		0		Residue		1018.	
Turbidity		0					
Temperature		70.4° F.					

MONTGOMERY
Kane County
Sept. 4, 1947

The village of Montgomery (607) installed a public water supply in 1928.

Water is obtained from a well drilled to a depth of 175 ft. by B. L. Palmer & Sons, Aurora, and located about 35 ft. south of Clay St. and 70 ft. east of South Railroad St. (or approximately 1850 ft. N. and 1450 ft. W. of the S. E. corner of Section 32, T. 38 N., R. 8 E.). The elevation of the ground surface is 642± ft.

Sample-study log of well drilled in 1928 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Loam top soil"	4	4
"Gravel"	28	32
Silurian system		
Alexandrian series		
Dolomite, cherty, light gray	23	55
Ordovician system		
Maquoketa formation		
Shale, dolomitic, light gray	55	110
Dolomite, gray, brown	20	130
Shale, dolomitic, brown; dolomite, brown	45	175

The well was cased with 10-in. pipe from the surface to a depth of 34 ft., and with 8-in. pipe from the surface to a depth of 85 ft. Between the depths of 40 and 45 ft. the casing was perforated, opposite water-bearing crevices. Below 85 ft. the hole was finished 8 in. in diameter.

During a 6-hr. test, after completion of the well, the production was 100 gpm. with a drawdown of less than 5 ft. On May 8, 1928 the non-pumping water level was 24 ft. below the floor and when pumping at 100 gpm., the drawdown was 10 ft. On Aug. 8, 1947, the water level was 54 ft. after a 4-hr. idle period and after 5-hr. pumping at 100 gpm., the drawdown was 10 ft.

The existing pump installation, made in Mar. 1946, is: 70 ft. of 4-in. column pipe; 6-in., 17-stage Aurora Pump Co. turbine pump, No. 28303, having a rated capacity of 100 gpm. against 220 ft. of head; the overall length of the pump is 6 ft. 2 in.; 10 ft. of 4-in. suction pipe; 90 ft. of 1/4-in. gi. air line; 10-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 111,417), collected Aug. 8, 1947 after 5-hr. pumping at 100 gpm., showed this water to have a hardness of 13.5 gr. per gal., a residue of 5.38 ppm., and an iron content of 0.3 ppm.

In Jan. 1946 the village leased the site and well located at the northwest corner of Mill and Pearl St. (or approximately 2550 ft. N. and 550 ft. W. of the S. E. corner of Section 32) for a period of 3 years with the option to buy. This well was originally owned and operated by Hinckley and Schmitt who sold the water as magnesia spring water.

This well is reported to be 125 ft. deep and located in a pit about 4 ft. below a ground surface elevation of 630± ft. It is cased with 4-in. pipe at the top.

In Feb., 1946 the village installed a Berkeley pump, Model 5, Serial No. *A* 5087, operated at a speed of 3450 rpm. and a 5-hp. General Electric motor. At that time the non-pumping water level was 7 ft. below the ground surface. The well is operated as an auxiliary supply unit.

Analysis of a sample (Lab. No. 111,418), collected Aug. 8, 1947 after 15-min. pumping at an estimated rate of 70 gpm., showed this water to have a hardness of 27.4 gr. per gal., a residue of 577 ppm., and no iron content.

The average combined pumpage for the public supply is estimated to be 30,000 gpd.

LABORATORY NO. 111,417

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.3		Silica	SiO_2	19.0	
Manganese	Mn	Tr.		Fluoride	F	0.9	
Calcium	Ca	49.5	2.48	Chloride	Cl	11.0	0.31
Magnesium	Mg	26.2	2.16	Nitrate	NO_3	2.4	0.04
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	112.3	2.34
Sodium	Na	115.0	5.00	Alkalinity (as $CaCO_3$)		348.	6.96
Turbidity		10-		Hardness (as $CaCO_3$)		232.	4.64
Color		0		Residue		538.	
Odor (at well)		H_2S		Temperature 53° F.			

LABORATORY NO. 111,418

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.0		Silica	SiO_2	18.1	
Manganese	Mn	0.0		Fluoride	F	Tr.	
Calcium	Ca	106.5	5.33	Chloride	Cl	12.0	0.34
Magnesium	Mg	48.4	3.98	Nitrate	NO_3	16.5	0.27
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	175.3	3.65
Sodium	Na	25.3	1.10	Alkalinity (as $CaCO_3$)		308.	6.16
Turbidity		0		Hardness (as $CaCO_3$)		466.	9.31
Color		0		Residue		577.	
Odor		0		Temperature 53.5° F.			

A public water supply was installed by the city of Monticello (2523) in 1892.

Until 1916, water was obtained from 3 wells drilled at different times since 1892. A 6-in. well was 309 ft. deep and the other 2 wells were 212 ft. deep and 8-in. and 10-in. diameter. The wells were located at the pumping station on Hamilton St. just north of the Illinois Central R. R. (or approximately 650 ft. N. and 1350 ft. E. of the S. W. corner of Section 7, T. 18 N., R. 6 E.). The ground elevation is 672± ft.

In 1912 the static water level in the wells was 25 ft. below the surface. The 309-ft. well was abandoned in 1922 and the 8-in. well several years later.

The old 10-in. well, reported to be 194 ft. deep, is still available for service, but has not been in use since 1935. The air compressor and 4-cylinder gasoline engine are in place at the well.

The public supply is now obtained from Wells No. 1 and No. 2.

Well No. 1 was drilled in 1916 to a depth of 209 ft. and located at the pumping station 45 ft. south of the old wells.

Sample-study log of Well No. 1 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and till	28	28
Sand and gravel	12	40
Till	55	95
Sand and fine gravel	15	110
Sand, some clay and gravel	40	150
Sand	15	165
Sand with organic matter	5	170
Sand	5	175
Gravel	34	209

In July 1922 the non-pumping water level was 28 ft. In June 1927, Well No. 1 and the old 10-in. well were reported to be yielding 350 gpm. each.

Well No. 1 is equipped with: 100 ft. of 6-in. column pipe; 10-in., 6-stage Worthington turbine pump, No. 920037, rated at 350 gpm. against 120 ft. of head at 1750 rpm.; the overall length of the pump is 6ft. 4 1/2 in.; 10 ft. of 6-in. suction pipe; 25-hp. General Electric motor.

Analysis of a sample (Lab. No. 115,726) collected Sept. 2, 1948 after 1 1/2-hr. pumping at 400 gpm., showed the water from Well No. 1 to have a hardness of 14.6 gr. per gal., a residue of 341 ppm., and an iron content of 1.7 ppm. Methane gas is present in the water in a concentration of 1.0 cu. ft. per 1000 gal.

All water is aerated, filtered and softened. Analysis of a sample (Lab. No. 115,784) collected Sept. 2, 1948 showed the treated water to have a hardness of 3.9 gr. per gal., a mineral content of 322 ppm., and an iron content of 0.07 ppm.

Well No. 2 was drilled in 1927 to a depth of 212 ft. by Mike Ebert, Washington, and located 60 ft. north and 15 ft. west of Well No. 1. The well was cased with 12-in. pipe to 196 ft. and with a 20-ft. Cook screen having 16 ft. exposed length.

The pumping equipment is identical with that in Well No. 1. The pump is a Worthington turbine, No. 920,036, with same rating as the pump in Well No. 1. The electric motor is also identical.

When Well No. 2 was completed, the non-pumping water level was 27 ft. below the pump base. Well No. 1 and the old 10-in. well were in use at the time. With those wells still in use, water was pumped from Well No. 2 for 8 hr. at a rate of 750 gpm. Then, within 10 minutes after stopping the No. 2 pump the water level in Well No. 2 returned to 27 1/2 ft.

In Apr. 1938 the non-pumping water level was 30 ft. and the pumping water level was 50 ft.

In 1942, the pumps in Wells No. 1 and 2 were pulled and overhauled. At that time the depth of water measured 27 ft. below the pump base.

The pumps in Wells No. 1 and No. 2 are operated simultaneously at a discharge rate of 400 gpm. for each pump. On Sept. 2, 1948, after a 3-hr. non-pumping period in both wells, the altitude gauge reading was 88 1/2 ft. and after 1 1/2 hr. pumping from both wells the drawdown in Well No. 1 was 39 ft.

Pumpage is estimated to average 400,000 gpd.

LABORATORY NO. 115,726

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.7		Silica	SiO_2	17.4	
Manganese	Mn	0.1		Fluoride	F	0.1	
Calcium	Ca	55.5	2.78	Chloride	Cl	8.0	0.23
Magnesium	Mg	26.9	2.21	Nitrate	NO_3	0.4	0.01
Ammonium	NH_4	0.5	0.03	Sulfate	SO_4	2.5	0.05
Sodium	Na	38.4	1.67	Alkalinity (as $CaCO_3$)		320.	6.40
Turbidity		10		Hardness (as $CaCO_3$)		250.	4.99
Color		10		Residue		341.	
Odor		0		Temperature 55° F.			

LABORATORY NO. 115,784

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.07		Fluoride	F	0.1	
				Chloride	Cl	6.0	0.17
Turbidity		0		Alkalinity (as $CaCO_3$)		304.	6.08
Color		0		Hardness (as $CaCO_3$)		66.	1.32
Odor		Tr.		Total Mineral Content		322.	
Temperature 57.3° F.							

A public water supply was installed by the city of Morris (6145) in 1894.

Well No. 1 was drilled in 1894 to a depth of 650 ft. and located at the southwest corner of Wauponsee and Main St. The well has not been used since 1939. All available physical and chemical data, prior to 1941, may be found in Bulletin No. 34. The pump has been removed, and the well is sealed. It is now covered by the concrete floor of the work shop.

Well No. 2 was drilled about 1902 by A. K. Wallen, Morris, to a depth of 728 ft. and located about 30 ft. west of Well No. 1. The well has not been used since 1938. The pump has been removed, and the well is sealed. It is covered by the concrete floor of the work shop. All available physical and chemical data prior to 1941 may be found in Bulletin No. 34.

Well No. 3 was drilled in 1915 by William Cater, Chicago, to a depth of 720 ft. and was deepened to 865 ft. by the Layne Western Co., Chicago, in 1940-41. It is located 100 ft. north of Well No. 1 (or approximately 295 ft. N. and 1045 ft. W. of the S. E. corner of Section 4, T. 33 N., R. 7 E.). All available physical and chemical data prior to 1941 may be found in Bulletin No. 34.

In Oct. 1943 the non-pumping water level was reported to be 61 ft. below the ground surface elevation of 522t ft. The pumping level was 174 ft. below the surface.

The water levels below the pump base on Nov. 12 and 13, 1947, are given in Table 1.

TABLE 1

Nov. 12, 1947, after 14 hr. of idle period - 84 ft.
Nov. 12, 1947, after 2 hr. of idle period following 9 1/2 hr. of pumping at 550 gpm. 95 ft. While pumping the water level was 185 ft.
Nov. 13, 1947, after 18 hr. of idle period - 79 ft.

The existing pump installation, made in Dec. 1941, is: 200 ft. of 8-in. column pipe; 12-in., 3-stage Layne turbine pump, No. 10785, having a rated capacity of 550 gpm. against 183 ft. of head; the overall length of the pump is 3 ft. 11 in.; 30 ft. of 8-in. suction pipe; 210 ft. of 1/4-in. brass pipe air line; 50-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 112,557) collected Nov. 12, 1947 after 7 1/2-hr. pumping at a rate of about 550 gpm. showed this water to have a hardness of 17.3 gr. per gal., a residue of 424 ppm., and an iron content of 0.1 ppm.

In Aug. 1944, with a State Water Survey automatic water level recorder in the Gebhard Brewing Co. well, pumping in city Well No. 3 was reflected on the recorder chart, and pumping in city Well No. 4 did not show on the recorder chart.

Well No.4 was drilled in 1938 by Milaeger and Smyth, Milwaukee, Wis., and located at the southeast corner of Washington and Nettle St. about 1000 ft. west of Well No. 3 (or approximately 55 ft. S. and 1800 ft. W. of the N. E. corner of Section 9).

The elevation of the ground surface is 5 18± ft.

The hole and casing record is shown in Table 2.

TABLE 2

Hole Record

19-in. from 0 to 915 ft.
16-in. from 915 to 1501 ft.

Casing Record

19-in. casing from 0 to 90 ft.
16-in. casing from 0 to 915 ft.

The original pump, installed in Dec. 1938, was pulled and overhauled Sept.-Oct. 1947, and the installation now in service is: 170 ft. of 8-in. column pipe; 12-in., 3-stage Layne turbine pump, No. 9109, all bronze bowls and having a rated capacity of 700 gpm. against 100 ft. of head; the overall length of the pump is 3 ft. 11 in.; 30 ft. of 8-in. suction pipe; 110ft. of 1/4-in. brass pipe air line (defective); 50-hp. U. S. electric motor.

On Aug. 24-25, 1938 a production test was made by J. Albert Robinson, engineer. Before the test was started, the water level was about 16 ft. below the ground surface; and when pumping at 450 gpm., the drawdown was reported to be about 90 ft. On Oct. 16, 1943 the non-pumping level was reported to be at 30 ft., and the drawdown was 104 ft. On Nov. 6, 1945, the water level was 26 ft. 4 in. below the pump base, after the well had been idle 45 days.

Analysis of a sample (Lab. No. 112,558), collected Nov. 12, 1947 after 1 1/2-hr. pumping at 700 gpm. showed this water to have a hardness of 15.5 gr. per gal., a residue of 411 ppm., and an iron content of 1.3 ppm.

The water from both wells is aerated at the reservoir at the plant.

The metered pumpage from Nov. 1, 1946 to Nov. 1, 1947 averaged 619,180 gpd.

Sample-study log of Well No. 4 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Top soil"	4	4
Sand and little gravel, slightly clayey	26	30
Till	15	45
Sand and gravel, clean	5	50
Pennsylvanian system		
Shale, some siltstone	80	130
Sandstone, incoherent	5	135
Ordovician system		
Galena-Platteville dolomite and limestone	180	315
Glenwood dolomite and sandstone	10	325
St. Peter sandstone	578	903
Oneota formation		
Chert	12	915
Sandstone	18	933
Dolomite	37	970
Cambrian system		
Trempealeau dolomite	150	1120
Franconia dolomite, some sandstone	145	1265
Galesville sandstone	190	1455
Eau Claire shale	46	1501

LABORATORY NO. 112,557

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	11.4	
Manganese	Mn	0.0		Fluoride	F	0.3	
Calcium	Ca	65.6	3.28	Chloride	Cl	32.0	0.90
Magnesium	Mg	32.3	2.66	Nitrate	NO_3	0.3	Tr.
Ammonium	NH_4	0.6	0.03	Sulfate	SO_4	52.9	1.10
Sodium	Na	43.0	1.87	Alkalinity (as $CaCO_3$)		292.	5.84
Turbidity		Tr.		Hardness (as $CaCO_3$)		297.	5.94
Color		0		Residue		424.	
Odor (at well)		H_2S		Free CO_2 (calc.)		31.	
Temperature 56.1° F.				pH = 7.35			

LABORATORY NO. 112,558

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.3		Silica	SiO_2	12.7	
Manganese	Mn	0.1		Fluoride	F	0.4	
Calcium	Ca	64.5	3.23	Chloride	Cl	38.0	1.07
Magnesium	Mg	25.4	2.09	Nitrate	NO_3	Tr.	Tr.
Ammonium	NH_4	0.7	0.04	Sulfate	SO_4	34.6	0.72
Sodium	Na	50.4	2.19	Alkalinity (as $CaCO_3$)		288.	5.76
Turbidity		Tr.		Hardness (as $CaCO_3$)		266.	5.32
Color		0		Residue		411.	
Odor		Tr.		Free CO_2 (calc.)		31.	
Temperature 61° F.				pH = 7.35			

The first public water supply was installed by the city of Morrison (3187) prior to 1880.

Water was first obtained from an artesian well, by means of a deep well pump. This supply proved inadequate and in 1881, a spring issuing from limerock, was developed, and the original well was abandoned. The spring is located approximately 1850 ft. N. and 300 ft. E. of the S. W. corner of Section 18, T. 21 N., R. 5 E.

In 1938, the flow was estimated to be 220 gpm. The spring has not been used since Aug. 6, 1948 at which time 70 to 80 gpm. was pumped in 24 hr.

Analysis of a sample (Lab. No. 112,161), collected Oct. 8, 1947, showed water from the spring to have a hardness of 21.8 gr. per gal., a residue of 381 ppm., and an iron content of 0.2 ppm.

Sometime after 1881, four 6-in. tubular wells, from 55 ft. to 80 ft. in depth and terminating in limestone, were drilled near Rock Creek. Due to their distance from the pumping station, these wells were not in use in 1919 and were subsequently abandoned.

The East Well was drilled in 1897 to a depth of 1643 ft. by L. Wilson & Co., Chicago, and located approximately 1850 ft. N. and 320 ft. E. of the S. W. corner of Section 18. The ground elevation is 670 ± ft.

The well was drilled 8-in. in diameter at the top and 6 in. in diameter at the bottom. When sounded in 1909, it had filled to about 900 ft. In 1938, it was reamed and cleaned by C. W. Varner, Dubuque, Iowa, to a depth of 1595 ft. and reported to be cased as follows: 17-in. pipe from surface to 21 ft.; 10-in. pipe from surface to 137 ft.; 8-in. pipe from 137 ft. to 435 ft.

A decrease in yield necessitated new repairs by C. W. Varner in 1940. Bridges were found at 781 ft. and 805 ft. To prevent future caving, a 6-in. liner was set in 15 or 20 ft. of cement grout, from 751 ft. to 815 ft. The well was then cleaned to the bottom. After the repairs, a production of 350 gpm. was reported with a drawdown of 76 ft. from a non-pumping level of 14 ft. below ground surface.

Originally, water was pumped with an air lift. The pump assembly, made in Jan. 1941, consisted of 120 ft. of 6-in. column pipe; 8-in., 7-stage Pomona turbine pump, No. 159 rated at 425 gpm. against 136 ft. of head at 1760 rpm.; 120 ft. of air line; 20-hp. Westinghouse motor. On Feb. 2, 1949, Harry E. Traum, Water Supt., reported that the column pipe "is now 200 ft. long; 3 stages added to the pump and a 30-hp. A. O. Smith electric motor. We are pumping around 400 gpm. with j 75 ft. drawdown from a non-pumping level of 105 ft."

In 1938, analysis of a sample (Lab. No. 84056) showed water from the East Well to have a hardness of 20.2 gr. per gal., a residue of 375.0 ppm., and an iron content of 0.4 ppm.

A series of samples collected on July 12, 1947 showed the temperature of the water from this well to be 60° F. after 40 min. of pumping.

The West Well was drilled to a depth of 2048 ft. by H. W. Hambrecht, Sterling, in 1912 and located 31 ft. southwest of the East Well (or approximately 1820 ft. N. and 300 ft. E. of the S. W. corner of Section 18).

The hole and casing record is shown in Table 1.

TABLE 1

Hole Record

7-in. from 437 to 751 ft.
6-in. from 916 to 2048 ft.

Casing Record

12-in. casing from surface to 112 ft.
8-in. casing from 112 to 437 ft.
7-in. liner from 751 to 916 ft.

In 1914, the well had a natural flow of about 88 gpm., and, equipped with an air lift with 175 ft. 3 in. of 2-in. air pipe, yielded an estimated 750 to 800 gpm.

In 1938, the non-pumping water level was 6 1/2 ft.

In 1947, the non-pumping water level was 50 ft. below pump base and the drawdown was 40 ft. when pumping at about 400 gpm.

In 1941, a Pomona turbine pump, No. 160, was installed. The pump and assembly were reported to be identical with that in the East Well. In Feb. 1949, Mr. Traum also reported "the West Well is now pumping down below the air line. This still has 120 ft. of column pipe and air line, with 10 ft. of tail pipe and bowl section. The recovery as far as we can tell on the air line is very slow. The

last check we were still pumping around 400 gpm. from this well also, the non-pumping level is 115 ft. The drawdown is below the air line."

Analysis of a sample (Lab. No. 112,154), collected Oct. 8, 1947 after 1-hr. pumping at 400 gpm., showed the water from the West Well to have a hardness of 17.3 gr. per gal., a residue of 292 ppm., and an iron content of 0.5 ppm.

The water is not treated.

Pumpage is estimated to average 319,000 gpd.

LABORATORY NO. 112,161

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	27.1	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	82.2	4.11	Chloride	Cl	7.0	0.20
Magnesium	Mg	40.8	3.36	Nitrate	NO_3	8.5	0.14
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	26.1	0.54
Sodium	Na	1.2	0.05	Alkalinity	(as $CaCO_3$)	332.	6.64
Turbidity		Tr.		Hardness	(as $CaCO_3$)	374.	7.47
Color		0		Residue		381.	
Odor		0					

Sample-study log of the East Well furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Sand and granule gravel, silty	15	15
Silurian system		
Niagaran-Alexandrian dolomites	210	225
Ordovician system		
Maquoketa shale and dolomite	203	428
Galena-Platteville dolomites	322	750
Glenwood shale, and sandstone	20	770
St. Peter formation		
Sandstone, incoherent	100	870
Sandstone, shale and chert	33	903
Shakopee dolomite	52	955
New Richmond sandstone and dolomite	20	975
Oneota dolomite	150	1125
Ordovician and Cambrian systems		
Oneota and Trempealeau formations		
No record	200	1325
Cambrian system		
Trempealeau dolomite	37	1362
Franconia shale and thin sandstone beds	123	1485
Galesville sandstone	160	1645

LABORATORY NO. 112,154

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.5		Silica	SiO_2	13.5	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	64.6	3.23	Chloride	Cl	8.0	0.22
Magnesium	Mg	32.7	2.69	Nitrate	NO_3	0.8	0.01
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	23.2	0.48
Sodium	Na	1.6	0.07	Alkalinity (as $CaCO_3$)		264.	5.28
Turbidity		Tr.		Hardness (as $CaCO_3$)		296.	5.92
Color		0		Residue		292.	
Odor		0		Temperature 65° F.			

A public water supply was installed by the village of Morrisonville (1206) in 1888.

Water was obtained originally from a dug well located across from the Wabash R. R. station, about 200 ft. southeast of the center line of the tracks. The well was 16 ft. in diameter and walled with brick, with cement mortar, to a depth of 35 ft. A second well was dug in 1895 and located 45 ft. south and 40 ft. east of the village hall. The dimensions of the well were the same as for the first well. The ground elevation is 625± ft. A third well, drilled to a depth of 100 ft., did not produce much water and was abandoned.

In 1923, the two dug wells were in use, but additional water was being purchased from the Southern Illinois Light and Power Co., who operated the village-owned water system. In 1923, the non-pumping water level in the older dug well was 18 ft. After 3-hr. pumping, the drawdown was 7 ft. A 21-hr. idle period was required for the water to return to its starting level. Pumpage from the dug well near the station was about 4000 gpd. The other village well was used only occasionally. On Nov. 30, 1940, there was 2 ft. of water in the well.

Analysis of a sample (Lab. No. 49,726) showed the water from the dug wells to have a hardness of 38.5 gr. gal., a residue of 974 ppm., and no iron.

Neither of the dug wells is in service. The older well is not equipped for pumping but is available. On July 26, 1948, the depth to water measured 13.6 ft. from the top of the curb (3 ft. above ground). The other well, near the village hall, has not been in service for several years. The well is equipped with a Myers pump and 5-hp. Century electric motor. On July 26, 1948 the depth to water measured 14 1/2 ft. below the concrete cap (3 ft. above ground level).

In 1928, the village purchased the spring-well of the Southern Illinois Light and Power Co. and located about 1 mile northwest of the village wells (or approximately 1300 ft. S. and 2300 ft. E. of the N. W. corner of Section6, T. 11 N., R. 3 W.). The well was rebuilt by the village in 1934. A brick curb was constructed with the top at 6 ft. above normal ground level and the bottom at 14 ft. below ground level. The surrounding ground level was then raised to the top of the curb. The well was 10 ft. in diameter and water entered at the bottom of the well.

On June 16, 1938, the water level was 8 to 10 ft. below the top of the well curb. When pumping in dry seasons, the water level was pulled down to near the bottom of the well. The capacity of the well became considerably reduced about 1935 but was restored by loosening the sand in the bottom of the well. On Jan. 11, 1939, the water level was 17.1 ft. below the top of the curb and the well was reported to be 17.7 ft. deep.

This well, maintained as an emergency supply unit, has been out of service since Feb. 1948. The pumping equipment, located in a pit about 10 ft. below ground level, was under 5 ft. of water caused by failure of the sump pump. The 5-hp. Fairbanks-Morse motor has been removed and will be replaced. The Fairbanks-Morse duplex piston-type pump, No. 279617, rated at 100 gpm. is still in place. On July 26, 1948, the water level was 5 ft. below the top of the well opening (5 ft. above normal ground level). The depth of the well was measured 16.4 ft. The present capacity of the well is about 40,000 gpd.

Due to the gravity of the water supply situation, an electrical earth resistivity survey was made by the State Geological Survey in Feb. 1939. As a result in Sept. 1940, two test holes were drilled to depths of 25 and 35 ft. by L. R. Burt, Decatur, and located 33 ft. west and 90 ft. northwest of the village dug well near the village hall. Water in suitable quantity was not encountered. A third test hole was drilled about 40 ft. north of the village well, with no more favorable results. In Nov. 1940, Test Hole No. 4 was constructed by J. M. Kerns, Taylorville, by setting a 24-in. casing in the village dug well from 18 to 25 ft. In Sept. 1941, Test Hole No. 5 was drilled by J. M. Kerns to a depth of 36 ft. and located about 100 ft. north of Test Hole No. 4. Additional resistivity surveys were made in July 1942 and five test holes were drilled by Hayes and Sims, Champaign.

Well No. 4, sometimes called Timmon's Well, was completed in June 1944 by Hayes and Sims and located 10 ft. north of Hayes and Sims Test Hole No. 5 (or approximately 88 ft. N. and 1570 ft. W. of the S. E. corner of Section 8). This is about 5500 ft. southeast of the old village dug well.

The well is 44 ft. deep, below the top of the pump base, penetrating sand and gravel from 26 to 39 ft., and is cased with 35 ft. 7 in. of 8-in. id. steel pipe from 3 ft. 7 in. above ground level to 32 ft. below ground level. A 7 1/2-i'n. od. Johnson Everdur screen, having No. 60 slot openings, was set with the bottom at 43 ft. 9 in.

The pump installation, made in Feb. 1947, con-

sists of 40 ft. of 5-in. column pipe; 7-in., 3-stage American Well Works turbine pump, No. 73582, having an overall length of 33 1/2 in. and a rated capacity of 150 gpm. against 61 ft. of head; 5-hp. electric motor. An unknown length of air line is in place.

On June 5, 1944, a production test was made by the State Water Survey with temporary pumping equipment. Before pumping, the water level was 5 ft. 7 in. below the top of the casing and after 7-hr. pumping at 185 gpm., the drawdown was 10 ft. 11 in. Thirty min. after the test, the water level had returned to 6 ft. 7 in. On July 26, 1948 the air line altitude gauge read 17 ft. after 2-hr. pumping at an estimated rate of 125 gpm., and 2 1/2 ft. after a 3-min. shutdown.

Analysis of a sample (Lab. No. 115,383) collected July 26, 1948 after 1/2-hr. pumping at 125 gpm., showed this water to have a hardness of 14.4 gr. per gal., a residue of 336 ppm., and an iron content of 1.7 ppm.

All water is aerated and filtered for iron removal. Analysis of a sample (Lab. No. 115,515) collected July 26, 1948 showed the treated water to have a hardness of 14.2 gr.per gal., a mineral content of 295 ppm., and an iron content of 0.16 ppm.

Pumpage is estimated to average 60,000 gpd.

LABORATORY NO. 115,383

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.7		Silica	SiO_2	20.6	
Manganese	Mn	0.1		Fluoride	F	0.2	
Calcium	Ca	65.0	3.25	Chloride	Cl	8.0	0.23
Magnesium	Mg	20.5	1.69	Nitrate	NO_3	1.9	0.03
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	40.7	0.85
Sodium	Na	20.2	0.88	Alkalinity	(as $CaCO_3$)	236.	4.72
Turbidity		10		Hardness	(as $CaCO_3$)	247.	4.94
Color		0		Residue		336.	
Odor		0		Free CO_2	(calc.)	42.	
Temperature		54.5° F.		pH = 7.15			

MORTON
Tazewell County
Feb. 13, 1947

The public water supply was installed by the village of Morton (2241) about 1895.

Water was purchased from a local utility company until 1913. Since then water has been obtained from 2 wells owned by the village. Well No. 1, South Well, was drilled in 1911 to a depth of 230 ft. and located near the business district (or approximately 650 ft. S. and 1000 ft. W. of the N. E. corner of Section 20, T. 25 N., R. 3 W.). No log is available, but it was reported that a gravel stratum, about 10 ft. in thickness, was encountered at a depth of 220 ft. The well was cased with 214 ft. of 8-in. pipe below which was a Cook screen, 16 ft. in length. In 1915 the non-pumping water level was reported to be at 190 ft. below a ground surface elevation of 710± ft. At the present time, the non-pumping water level is 194 ft. below the ground surface.

Well No. 1 is equipped with: 210 ft. of column pipe; 8-stage American Well Works turbine pump, No. 56188, rated at 200 gpm. against a head of 225 ft. at 1750 rpm.; 210 ft. of airline; there is a screen but no suction pipe below the pump; 20-hp. U. S. electric motor.

Well No. 2, North Well, was drilled in 1913 with the same casing and screen diameter as the South Well. It is 45 ft. from the South Well. In 1938, the North Well was repaired by Chris Ebert, Washington. The old screen was replaced by a new Johnson welded screen, with 18 ft. of slot openings. An. undetermined length in the lower portion has No. 25 slot openings, and the upper portion has No. 16 openings. The well was also deepened to 232 ft., and the amount of the deepening was reported to be 8 ft.

After repairs had been completed, a production test was made of the North Well Dec. 13 - 14, 1938 under the supervision of the State Water Survey. Before the test, the water level was 184 ft. below the pump house floor; and after pumping for 21 hr. at 395 gpm., the drawdown was more than 12 ft. After 24-hr. pumping at 300 gpm., the drawdown was 10 ft.

During part of the test, the pump in the South Well was being operated at 200 gpm. with only slight interference in water levels in Well No. 2.

The pumping assembly, installed in 1938, consists of: 210 ft. of column pipe; American Well Works turbine pump, No. 61889, rated at 200 gpm. against a head of 125 ft.; 210 ft. of air-line; 15-hp. Westinghouse motor. There is a screen below the pump but no suction pipe.

Non-pumping water level in 1946 was 194 ft. below the pump house floor.

Analysis of a sample (Lab. No. 109,234), collected Feb. 13, 1947, showed the untreated water from Well No. 1, South Well, to have a hardness of 20.2 gr. per gal., a residue of 443 ppm., and an iron content of 2.9 ppm.

The water is aerated, filtered, and softened.

Analysis of a sample (Lab. No. 109,236), collected Feb. 13, 1947 showed the treated water to have a hardness of 3.4 gr. per gal., a mineral content of 466 ppm. and an iron content of 0.59 ppm.

The 2 wells are operated a total of 19 to 20 hr. per day. Consumption in Jan. 1947 was 230,000 gpd.

LABORATORY NO. 109,234

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.9		Silica	SiO_2	21.8	
Manganese	Mn	0.0		Fluoride	F	0.2	
Calcium	Ca	76.1	3.81	Chloride	Cl	12.0	0.34
Magnesium	Mg	37.9	3.12	Nitrate	NO_3	0.9	0.01
Ammonium	NH_4	4.0	0.22	Sulfate	SO_4	0.2	Tr.
Sodium	Na	35.0	1.52	Alkalinity	(as $CaCO_3$)	416.	8.32
Color		0		Hardness	(as $CaCO_3$)	347.	6.94
Odor		0		Residue		443.	
Turbidity		10+					
Temperature		54.5° F.					

LABORATORY NO. 109,23 6

	ppm.	epm.			ppm.	epm.
Iron (total) Fe	0.6		Fluoride	F	0.1	
			Chloride	Cl	12.0	.33
Turbidity	10		Alkalinity	(as $CaCO_3$)	420.	8.40
Color	0		Hardness	(as $CaCO_3$)	58.	1.16
Odor	0		Total Mineral Content		466.	

A public water supply system for the city of Mound City (2465) was installed by A. J. Dougherty in 1900. The system has been owned and operated by private utilities since about 1915, and at present by the Mound City Water and Light Co.

Water is obtained from a well drilled in 1900 by C. O. Wilson, Cairo, and located just inside the levee on the Ohio River waterfront about 60 ft. north of the center of Merritt Court and 150 ft. east of the center of Commercial Ave. (or approximately 200 ft. N. and 1100 ft. W. of the S. E. corner of Section 25, T. 16 S., R. 1 W.). The well was reported to have been drilled to a depth of 630 ft. below a ground surface elevation of 320± ft., and is cased with 8-in. pipe to a depth of 450 ft.

Correlated driller's log of well drilled in 1900 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene, Eocene, and Cretaceous systems		
Soil	10	10
Sand and gravel	50	60
Sand, water	300	360
Devonian system		
Clear Creek formation		
Crust of rock	20	380
Flint rock, white	250	630

The well was originally equipped with 2 McGowan steam pumps, but in 19 14 these were replaced by three 8 1/2-in. by 10-in. Smith-Vaile double-acting triplex pumps, each rated at 350 gpm. and direct-connected to a 25-hp. electric motor. Two of these pumps are operated alternately, and the other pump is operated by. manual control as an emergency unit.

When the well was completed, it flowed at a rate of 85,000 gpd., but in 1914 it was reported to barely flow over the top. It was reported that production tests showed a maximum yield of between 650,000 and 700,000 gpd.

In 1937 it was reported that water levels in the well changed considerably with the river stages. In Nov. 1947 the well flowed with about 5 ft. of head above ground level from the tap at the well top.

Analysis of a sample (Lab. No. 113,261) collected Jan. 28, 1948 after 1-hr. pumping at 350 gpm., showed the water to have a hardness of 10.2 gr. per gal., a residue of 278 ppm., and an iron content of 1.0 ppm.

The water is chlorinated.

Pumpage for 1947 was estimated to average 148,000 gpd.

The largest consumer of water is the Ladoga Canning Co. and the largest daily pumpage occurs during their canning operations which are seasonal.

LABORATORY NO. 113,261

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.0		Silica	SiO_2	14.1	
Manganese	Mn	Tr.		Fluoride	F	0.5	
Calcium	Ca	48.0	2.40	Chloride	Cl	55.0	1.55
Magnesium	Mg	12.9	1.06	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	0.2	0.01	Sulfate	SO_4	15.0	0.31
Sodium	Na	34.7	1.51	Alkalinity (as $CaCO_3$)		156.	3.12
Turbidity		Tr.		Hardness (as $CaCO_3$)		173.	3.46
Color		0		Residue		278.	
Odor		0		Free CO_2 (calc.)		7.	
Temperature 62° F.				pH = 7.7			

MOUNDS
Pulaski County
Jan. 27, 1948

The public water system for the city of Mounds (2144) was owned and operated by the Central Illinois public Service Co. until Nov. 1941, when the system was acquired by the city.

From 1911 to 1921 water was obtained from 2 wells, each 650 ft. deep and cased to 218 ft. with 10-in. pipe. The wells had been drilled to furnish water for the utility company's plant.

In 1911 the water level in one of the wells was 15 ft. below the ground surface and, in the other well, the water level was 19 ft. Water was pumped by suction by steam pumps. In 1913 the wells flowed when not pumping, and pumpage from the. 2 wells was reported to be about 1000 gpm. Later the wells were equipped with air lifts. In May 1921, the north one of the 2 wells yielded 590 gpm. and the other well yielded 400 gpm. The wells had partly filled at the time. The south well was abandoned some time after 1921.

Water is now obtained from 2 wells known as North and South wells.

The North Well is located about 65 ft. west and 120 ft. south of the north end of the old Illinois Central R. R. Banana Shed. It is believed that this is the north one of the original wells and, in 1927, was reported to be 321 ft. deep. At that time, when pumping by air lift with a jet depth of 182 ft., the non-pumping water level was 47 ft. and the pumping level was 68 ft. below the pump base.

The air lift was removed and replaced by a turbine pump in May 1927. The following pump installation is in place: 98 ft. of 8-in. column pipe; 10-in., 6-stage Layne turbine pump, No. 4312, having an overall length of 4 ft. 9 3/4 in. and a rated capacity of 750 gpm.; 20 ft. of 6-in. suction pipe; 50-hp. Fairbanks-Morse electric motor.

This well is maintained for emergency purposes.

The South Well was drilled to a depth of 595 ft. in 1921 by Meister Bros., Tuscola, and is located about 300 ft. south of the North Well and 20 ft. west of the Banana Shed, (approximately 2770 ft. S. and 2300 ft. W. of the N. E. corner of Section 22, T. 16 S., R. 1 W.).

The ground surface elevation is 323t ft.

Sample-study log of the South Well furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene, Eocene and Cretaceous systems		
Sand and pebbles	55	55
Clay, sandy	75	130
Sand, clayey	25	155
Sand, and small pebbles	7	162
Sand, shaly	28	190
Devonian system		
Clear Creek chert	405	595

The casing record was reported to be: 16-in. pipe from the surface to a depth of 20 ft., 12-in. pipe from the surface to a depth of 57 ft., and 10-in. pipe between the depths of 17 and 323 ft. The lower 87 ft. of the 10-in. casing was perforated.

The hole was "shot" at a depth of 542 ft. with a charge of 14 lb. of 60% dynamite. Upon completion of the well a non-pumping water level of 6 ft. below the surface and a production of 600 gpm. were reported.

Water was pumped by air lift prior to May 1927. The local records indicate a jet depth of 196 ft., a non-pumping water level of 14 ft., and a pumping water level of 36 ft. below the pump base at that time.

The following pump installation is in daily service: 65 ft. 5-in. of 8-in. column pipe; 10-in., 6-stage Layne turbine pump, No. 4311, having an overall length of 4 ft. 9 3/4 in. and a rated capacity of 750 gpm.; 21 ft. 7 in. of 6-in. suction pipe; 50-hp. Fairbanks-Morse electric motor.

Analysis of a sample (Lab. No. 113,262) collected Jan. 23, 1948 after 20-min. pumping at 750 gpm., showed this water to have a hardness of 8.1 gr. per gal., a residue of 267 ppm., and an iron content of 0.1 ppm.

The metered pumpage for the period from Apr. 26, to May 29, 1946 averaged 201,000 gpd.

LABORATORY NO. 113,262

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	12.2	
Manganese	Mn	Tr.		Fluoride	F	0.9	
Calcium	Ca	37.7	1.89	Chloride	Cl	65.0	1.83
Magnesium	Mg	10.7	0.88	Nitrate	NO_3	Tr.	Tr.
Ammonium	NH_4	0.3	0.02	Sulfate	SO_4	14.0	0.29
Sodium	Na	47.2	2.05	Alkalinity	(as $CaCO_3$)	136.	2.72
Turbidity		Tr.		Hardness	(as $CaCO_3$)	139.	2.77
Color		0		Residue		269.	
Odor		0		Free CO_2 (calc.)		10.	
Temperature 63.5° F.				pH = 7.5			

MT. AUBURN
Christian County
Aug. 6, 1948

The village of Mt. Auburn (471) installed a public water supply in 1942.

In the search for a satisfactory source of supply, several test wells were drilled.

A test well, drilled in 1941 by Hayes and Sims, Champaign, was located in the eastern part of the village (or approximately 2400 ft. S. and 200 ft. W. of the N. E. corner of Section 12, T. 15 N., R. 2 W.).

The well was drilled to a depth of 40 ft. below a ground surface elevation of 595t ft., and was cased with 40 ft. of 6-in. pipe. The lower 20 ft. were slotted with 1/8-in. by 12-in. openings.

A production test was made by the State Water Survey on Feb. 10, 1941. A small air lift was installed for test purposes. The well produced 10 gpm.for 5 hr. with a drawdown of 11.1 to 11.5 ft. from a non-pumping water level of 11.5 ft. below the ground surface. Thirty min. after pumping was stopped, the water level was 3 1/2 ft. below the non-pumping level. Water level observations were made on 2 test holes, one located 5 ft. south, and one 200 ft. east of the well. The water level in the far test hole was not affected, but in the nearer test hole, the water level was lowered from 11.5 to 16.75 ft. during the test.

Analysis of a sample (Lab. No. 89,827) collected Feb. 19, 1941, showed the water to have a hardness of 18.1 gr. per gal., a residue of 366 ppm., and an iron content of 60.0 ppm.

The permanent municipal well was drilled to a depth of 70 ft. 2 in. in 1941 by Hayes and Sims and is located near the northwest corner of the intersection of Elm and Dane St. (or approximately 1310 ft. S. and 1500 ft. E. of the N. W. corner of Section 12). The ground surface elevation at the well site is 600± ft.

The well was cased with 8-in. pipe to a depth of 59 ft. Below the casing', an 11-ft. section of 8-in. Johnson screen was exposed. The screen had No. 50 slot openings. The pumping equipmentincluded a 6-in. American Well Works turbine pump, No. 64842, rated at 50 gpm. against 70 ft. of head at 1740 rpm.; 2-hp. U. S. electric motor. A Johnson right-angle gear drive is in place for connection to a gasoline motor, as an emergency power unit.

Correlated driller's log of well drilled in 1941 furnished by the State Geological Survey:

Formation	Thickness ft.	in.	Depth ft.	in.
Pleistocene system				
Soil and clay	44		44	
Sand and gravel, dirty with clay	12		56	
Sand and gravel, moderately clean, some silt	14	2	70	2

A production test was made by the State Water Survey on Apr. 29, 1941. After 6-hr. pumping at 69 gpm., the drawdown was 16 1/2 ft. from a non-pumping water level of 15 1/4 ft. After pumping had been stopped for 30 min., the water level was 12 ft. below the non-pumping level, and about 12 hr. later, the water level was reported to be still 5 ft. below the starting level. On July 28, 1948 the air line altitude gauge read 24 ft. after 25-min. pumping at an estimated rate of 50 gpm.; and 25 1/2 ft. after 20-min. shutdown.

Analysis of a sample (Lab. No. 115,421), collected July 28, 1948 after 25-min. pumping showed the water to have a hardness of 22.0 gr. per gal., a residue of 417 ppm., and an iron content of 2.5 ppm.

The water is aerated filtered, and softened. Analysis of a sample (Lab. No. 115,511) collected July 28, 1948 showed the treated water to have a hardness of 15.5 gr. per gal., a mineral content of 3 76 ppm. and an iron content of 0.1 ppm.

From Dec. 1, 1947 to July 27, 1948, pumpage was estimated to average 11,150 gpd.

LABORATORY NO. 115,511

	ppm.	epm.		ppm.	epm.
Iron (total) Fe	0.1		Fluoride F	0.0	
			Chloride Cl	15.0	0.42
Turbidity	0		Alkalinity (as $CaCO_3$)	304.	6.08
Color	0		Hardness (as $CaCO_3$)	266.	5.32
Odor	0		Total Mineral Content	376.	
Temperature 62° F.			Free CO_2 (calc.)	40.	
			pH = 7.25		

LABORATORY NO. 115,421

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.5		Silica	SiO_2	17.9	
Manganese	Mn	0.3		Fluoride	F	0.3	
Calcium	Ca	96.4	4.82	Chloride	Cl	14.0	0.39
Magnesium	Mg	33.0	2.71	Nitrate	NO_3	0.2	Tr.
Ammonium	NH_4	0.7	0.04	Sulfate	SO_4	36.8	0.77
Sodium	Na	1.6	0.07	Alkalinity (as $CaCO_3$)		324.	6.48
Turbidity		40		Hardness (as $CaCO_3$)		377.	7.53
Color		0		Residue		417.	
Odor		0		Free CO_2 (calc.)		65.	
Temperature 54.6° F.				pH = 7.1			

MOUNT CARROLL
Carroll County
Jan. 22, 1947

A public water supply was installed by the city of Mount Carroll (1845) in 1888.

Water was first obtained from a dug well, 20 ft. in diameter and 20 ft. in depth, and located, with the pumping station building and elevated tank, on city-owned property on South Mill St. (or approximately 450 ft. S. and 1555 ft. W. of the N. E. corner of Section 12, T. 24 N., R. 4 E.). Into the bottom of the dug section were drilled two 6-in. and two 8-in. diameter tubular wells, each to a depth of 80 ft. A brick wall, extending above the ground surface, surrounded the dug portion, in an attempt to prevent possible contamination.

The capacity of the well was 24,000 gpd. with the water rising 10 ft. every 24 hr. The well was pumped once each day in 1913, but the length of pumping time was not recorded. In 1920, the water level was 8 ft. below the ground surface, and it was reported that after pumping 1 1/2 hr. to 2 hr. a day at an estimated rate of 400 gpm., the water was drawn down 10 ft. The well was abandoned in 1920 due to suspicion caused by a typhoid fever epidemic.

In 1895, due to a shortage in the water supply, a 'new well, now called Well No. 1, was drilled by J. P. Miller Artesian Well Co., Brookfield, to a depth of 2500 ft. below a ground surface elevation of 730± ft.

The well is located about 35 ft. south of the old abandoned and filled dug well. The hole was drilled to a diameter of 10 in. for about 90 ft.; 8 in. in diameter from 90 to 140 ft. The top of the casing is about 5 ft. above the ground surface of the old abandoned well and 2 ft. above the pump base of Well No. 2. A concrete reservoir, 25 ft. in diameter and 7 ft. 8 in. in depth, with a capacity of about 28,200 gal., surrounds the well.

During the construction of the well, the water flowed from the well until the drilling reached 1200 ft., after which the water level was at the ground surface. In June 1934, the non-pumping water level was reported to be 62.2 ft.

The pumping equipment consists of 63 ft. of old 5-in. and 185 ft. 7 in. of new 4-in. eduction pipe; 212 ft. of 1 1/2-in. air line to which is attached 5 ft. of 3 3/4-in. diameter brass tube; a Worthington air compressor having a 10-in. cylinder and 10-in. stroke; 40-hp. General Electric motor. This air lift discharges directly into the reservoir; and when operated on Dec. 18, 1946, the air gauge registered a starting pressure of 90 lb. and an operating pressure of 72 lb. while the pump in Well No. 2 was operating at a rate of 430 gpm. After Well No. 2 had been shut down 10 min., the air gauge registered 75 lb. pressure.

On Oct. 15, 1946, a non-pumping water level of 72 ft. below the top of the casing was found after 10 days of idle period. On this date a drop of 20 ft. in the water level was observed after the pump in Well No. 2 had been operating for 2 hr. at 430 gpm.

Analysis of a sample (Lab. No. 108,717), collected Dec. 18, 1946 after 40-min. pumping at an estimated rate of 110 gpm., showed the water from Well No. 1 to have a hardness of 17.8 gr. per gal., a residue of 356 ppm., and an iron content of 67.6 ppm. The water had a reddish color throughout the 40-min. pumping period and was wasted.

Well No. 1 is maintained for emergency use only. Water is pumped for a 20-min. period once a week.

Well No. 2 was drilled to a depth of 1457 ft. in 1935 by C. W. Varner, Dubuque, Iowa, and located about 100 ft. south and 20 ft. east of Well No. 1, (or approximately 500 ft. S. and 1440 ft. W. of the N. E. corner of Section 12).

A test was made by the State Water Survey on May 14-15, 1935, and the non-pumping water level was 52 ft., and the drawdown was 95 ft. after pumping for 22 hr. at 225 gpm.

Due to the low capacity of the well, as revealed in the test in May 1935, charges of dynamite were exploded at 5 different levels as follows:

Depth ft.	Charge lbs.
900	60
950	60
1300	60
1350	80
1400	80

This well has been the source of the public water supply since the installation of the existing pump in 1938, which consists of 150 ft. of 8-in. id. column pipe; 10-in., 3-stage American Well Works turbine pump. No. 61844, rated at a capacity of 500 gpm. against a total head of 126 ft.; the overall length of the pump is 3 ft. 1 13/16 in.; 150 ft. of air line; 20 ft. of 6-in. suction pipe; 25-hp. U. S. electric motor.

On June 10-11, 1935 a second production test was made by the State Water Survey, and in a 24-hr. period the specific capacity was determined to be 6.25 gpm. per ft. of drawdown. The non-pumping water level was 52 ft., and the following drawdowns were observed:

Pumping Rate gpm.	Drawdown ft.
300	48
400	64
500	80
600	100

On Nov. 20, 1946, the non-pumping water level was 57 ft. below the pump base, and the pump discharged 430 gpm. by actual reservoir measurements.

Analysis of a sample (Lab. No. 108,718) collected Dec. 18, 1946 from the end of the discharge pipe in the reservoir (about 100 ft. distant from the well) after 3-hr. pumping at 430 gpm., showed the water in Well No. 2 to have a hardness of 18.8 gr. per gal., a residue of 339 ppm., and an iron content of 0.1 ppm.

In Dec. 1946 pumpage was estimated at 206,000 gpd. The summer pumpage is estimated at 320,000 gpd.

The hole and casing diameter record of Well No. 2 is shown in Table 1.

TABLE 1

Hole Record

15-in. from 367 to 737 ft.
12-in. from 737 to 1457 ft.

Casing Record

20-in. drive pipe from surface to 83 ft.
16-in. casing from surface to 367 ft.
12-in. liner from 637 to 737 ft.

LABORATORY NO. 108,717

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	67.6		Silica	SiO_2	17.4	
Manganese	Mn	0.2		Fluoride	F	0.2	
Calcium	Ca	71.9	3.60	Chloride	Cl	12.0	0.34
Magnesium	Mg	38.8	3.19	Nitrate	NO_3	1.7	0.03
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	38.1	0.79
Sodium	Na	0.9	0.04	Alkalinity (as $CaCO_3$)		284.	5.68
Color		0		Hardness (as $CaCO_3$)		340.	6.80
Odor		Tr.		Residue		356.	
Turbidity		100+		Temperature 57.5° F.			

LABORATORY NO. 108,718

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	13.3	
Manganese	Mn	0.0		Fluoride	F		
Calcium	Ca	66.1	3.31	Chloride	Cl	5.0	0.14
Magnesium	Mg	38.2	3.14	Nitrate	NO_3	1.3	0.02
Ammonium	NH_4	0.2	0.01	Sulfate	SO_4	28.6	0.59
Sodium	Na	1.2	0.02	Alkalinity (as $CaCO_3$)		288.	5.76
Color		0		Hardness (as $CaCO_3$)		323.	6.46
Odor		Tr.		Residue		339.	
Turbidity		10		Temperature 58.7° F.			

Sample-study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Till	60	60
Ordovician system		
Galena-Platteville dolomites	202	262
Glenwood formation		
Shale, dolomite and sandstone	15	277
St. Peter formation		
Sandstone, incoherent	383	660
Shale, sandstone and pebbles	97	757
Cambrian system		
Trempealeau dolomite, some sandstone	43	800
Franconia sandstone, thin shale beds	90	890
Galesville sandstone, partly dolomitic	125	1015
Eau Claire sandstone, dolomite, thin shale beds	360	1375
Mt. Simon sandstone	82	1457

MOUNT MORRIS
Ogle County
Dec. 2, 1947

The village of Mount Morris (2304) established a public water supply in 1894.

Water was originally obtained from a well drilled to a depth of 500 ft. in 1894 and located on the east side of McKendrie St. between East Front St. and Center St. (or approximately 1800 ft. N. and 100 ft. E. of the S. W. corner of Section 26, T. 24 N., R. 9 E.). The ground surface elevation is 932t ft. The hole diameter was: 10-in. from surface to 35 ft.; 8-in. from 35 to 75 ft.; 6-in. from 75 to 500 ft.

During a test in 1920, it was reported that the well produced 48 gpm. with a drawdown of 60 ft. from a non-pumping level of 150 ft. The well was abandoned in 1923.

Analysis of a sample (Lab. No. 27327), collected Mar. 27, 1913, showed water from this well to have a hardness of 23.0 gr. per gal., a residue of 496 ppm., and an iron content of 0.1 ppm.

Well No. 2 was drilled to a depth of 878 ft. in 1920 by P. E. Millis, Byron, and located 27 ft. south of Well No. 1.

The hole and casing record is shown in Table 1.

TABLE 1

Hole Record

12-in. from surface to 150 ft.
10-in. from 150 to 878 ft.

Casing Record

12-in. casing from surface to 30 ft.
10-in. casing from surface to 170 ft.

The well was "shot", and redrilled by P. E. Millis to a depth of 1147 ft. The date of the work is not known.

The existing pump installation made in 1938, is: 260 ft. of 5-in. id. column pipe; 7-in., 13-stage, Fairbanks-Morse turbine pump, No. 21823; the overall length of the pump is 81 1/8 in.; 10 ft. of 5-in. id. suction pipe; 25-hp. Fairbanks-Morse induction motor, No. 257509, operating at 1800 rpm. This well is maintained for emergency only.

Analysis of a sample (Lab. No. 50384), collected Oct. 23, 1923, showed water from this well to have a hardness of 18.5 gr. per gal., a residue of 381 ppm., and no iron content.

Well No. 3 was drilled to a depth of 905 ft. by P. E. Millis in 1926 and located 30 ft. north of First St. and 130 ft. west of McKendrie St. (or approximately 1850 ft. S. and 150 ft. W. of the N.E. corner of Section 27). In 1939, the well was deepened to 1425 ft. by R. E. Milaeger Co., Milwaukee, Wis.

The surface elevation is 910± ft.

The hole and casing record is shown in Table 2.

TABLE 2

Hole Record

10-in. or 12-in. from 175 to 905 ft.

Casing Record

20-in. from surface to 28 ft.
16-in. from surface to 175 ft.

Any alteration in casing size, if any, made by Milaeger is not known.

The existing pump installation, made in 1938, is: 290 ft. of 6-in. column pipe; 8-in. American Well Works turbine pump, No. 62951, rated at 240 gpm. against 390 ft. of head at 1750 rpm.; the overall length of pump is 7 ft. 7 in.; 311 ft. of 1/4-in. air line; 20 ft. of 5-in. suction pipe; 40-hp. U.S. electric motor; No. 113 745.

On Dec. 2, 1947, the non-pumping water level was 273 ft. below the pump base and after 1-hr. pumping at 375 gpm. the drawdown was 18 ft.

Analysis of a sample (Lab. No. 112,798), collected Dec. 2, 1947 after 1/4-hr. pumping at 450 gpm., showed this water to have a hardness of 17.5 gr. per gal., a residue of 317 ppm., and an iron content of 0.1 ppm.

Municipal pumpage is estimated to be 65,000 gpd. and pumpage from industrial wells is estimated to be 300,000 gpd.

Sample-study and driller's log of Well No. 3 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Clay"	19	19
Ordovician system		
Galena-Platteville formations		
"Rock, soft, shelly"	9	28
"Limestone, yellow-crevices"	57	85
"Limestone, gray, blue"	58	143
"Crevices containing blue shale"	2	145
"Limestone, white"	28	173
"Limestone, sandy"	2	175
Glenwood-St. Peter formations		
"Sandstone"	65	240
Ordovician and Cambrian systems		
Shakopee, New Richmond, Oneota and Trempealeau formations		
"Limestone, white"	420	660
Cambrian system		
Franconia formation		
"Limestone, white" (probably sandstone and shale)	37	697
"Sandstone"	50	747
Galesville formation		
"Sandstone"	140	887
Eau Claire formation		
Shale, sandstone, siltstone, and thin dolomite beds	213	1100
Sandstone, incoherent	75	1175
Cambrian and Pre-Cambrian systems		
Mt. Simon and Fond du Lac sandstones, few thin shale beds	250	1425

LABORATORY NO. 112.798

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	14.9	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	61.5	3.08	Chloride	Cl	5.0	0.14
Magnesium	Mg	35.4	2.91	Nitrate	NO_3	3.0	0.05
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	17.9	0.37
Sodium	Na	0.2	0.01	Alkalinity	(as $CaCO_3$)	272.	5.44
Turbidity		Tr.		Hardness	(as $CaCO_3$)	300.	5.99
Color		0		Residue		317.	
Odor		0		Temperature	56° F.		

MOUNT PROSPECT
Cook County
Aug. 15, 1949

A public water supply was installed by the village of Mount Prospect (1720) in Aug. 1923.

Water was obtained from a well located on the village property at the intersection of Evergreen and Maple St. (or approximately 1300 ft. S. and 2000 ft. E. of the N. W. corner of Section 12. T. 41 N., R. 11 E.).

Well No. 1 was drilled by W. L. Thorne Co., Des Plaines, in 1922 to a depth of 200 ft. The elevation of the pump base is 667i ft. The upper 100 ft. is 12 in. in diameter and the lower 100 ft. is 8 in. in diameter. A production test was made after completion of the well in 1922. Before pumping, the depth to water was 35 ft. below the ground surface and after pumping 6 hr. at 150 gpm., the drawdown was 15 ft.

The pumping assembly, installed in Aug. 1937, consists of 140 ft. of 4 1/2-in. column pipe; 6-in., 25-stage Pomona turbine pump designed for a capacity of 160 gpm. against 270 ft. of head and having an overall length of 9 ft. 10 in.; a suction strainer and 140 ft. of air line; 20-hp. Westinghouse electric motor. During a production test of 8-hr. duration immediately after installation, the drawdown was 103 ft. from a non-pumping water level of 36 ft; below the pump base. This well serves as a standby unit since Well No. 3 was placed in service.

Analysis of a sample (Lab. No. 101,221), collected Sept. 5, 1944, after 5 1/2-hr. pumping at 160 gpm., showed this water to have a hardness of 17.2 gr. per gal., a residue of 494 ppm., and an iron content of 0.4 ppm.

Well No. 2 was drilled by Henry Boysen, Jr., Libertyville in 1927 to a depth of 210 ft., at a location about 185 ft. south of Central Ave. and 50 ft. west of Pine St. (approximately 185 ft. S. and 350 ft. E. of the N. W. corner of Section 12). The elevation of the pump base is 672± ft. A 12-in. diameter casing extends from the surface to a depth of. 110 ft. where it is seated in the rock below which, the diameter of the hole is 10 in. The well is equipped with a Keystone 2-stroke pump, belt-driven by a 10-hp. Century electric motor. The bottom of the 7 3/4-in. by 7-ft. cylinder is set at a depth of 140 ft. The pump has been slowed down to a speed of 11 spm. and will deliver 100 gpm. On Mar. 15, 1945, the drawdown was 40 ft. from a non-pumping water level of 45 ft. below the pump base.

The present status of the well is that of a standby unit.

Analysis of a sample (Lab. No. 101,220), collected Sept. 5, 1944 after 1-hr. pumping at 100 gpm., showed this water to have a hardness of 16.9 gr. per gal., a residue of 509 ppm., and an iron content of 0.2 ppm.

Well 1 and 2 furnished the public supply until July 26, 1945 when a third well was placed in service. Water pumped from Wells 1 and 2 is chlorinated.

Well No. 3 was completed to a depth of 1348 ft. in Apr. 1945 by the J. P. Miller Artesian Well Co., Brookfield, and located on Pine. St. and about 85 ft. south of the Well No. 2.

The elevation of the ground surface is 670± ft.

The hole and casing diameter records are shown in Table 1.

TABLE 1

Hole Record

19-in. from 106 to 427 ft. 4 in.
13-in. from 427 ft. 4 in. to 982 ft.
12-in. from 982 to 1348 ft.

Casing Record

20-in. steel pipe from 0 to 106 ft.
14-in. od. steel pipe from 0 to 427 ft. 4 in.
10-in. id. steel liner from 864 to 978 ft.

The annular space between the 20 and 14-in. casings was cement grouted. A production test was made on Apr. 28, 1945. After 11-hr. pumping at 415 gpm. the drawdown was 129 ft. from a non-pumping lwater level of 205 ft. below the top of the casing. The yield of the well was considered adequate for the public water supply and plans for shooting the well were abandoned. The pumping equipment installed on July 26, 1945, consists of 340 ft. of 6-in. column pipe; 10-in., 8-stage Peerless turbine pump having an overall length of 6 ft. 3 in. and a rated capacity of 400 gpm. against 300 ft. of head; 20 ft. of 6-in. suction pipe; 340 ft. of air line 50-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 106,246) collected Apr. 17, 1946, after 40-min. pumping at 360 gpm., showed this water to have a hardness of 18.9 gr. per gal., a residue of 474 ppm., and an iron content of 0.2 ppm.

Water from Well No. 3 is not treated.

Well No. 4 was completed in Aug. 1949, to a depth of 1370 ft. by S.B. Geiger and Co., Chicago, and located near the southeast corner of Waverly Place and Thayer St. (or approximately 1150 ft. N. and 1700 ft. W. of the S. E. corner of Section 33). This is approximately 2 miles northwest of Wells No. 1 and 2. The ground elevation at the well site is 689± ft.

The well was cased with 13 1/4 in. od. pipe from 3 ft. above to 435 ft. below ground level and the casing was pressure-cemented. A production test was made on Aug. 10-11, 1949, under the supervision of the Water Survey. For test purposes, an electrically-driven turbine pump was set at 420 ft. below the pump base (1.0 ft. above the top of the casing). Before the test was started, the water level was 267.5 ft. below the pump base. After 9 hr. pumping at 733 gpm. the drawdown was 81.5 ft. The pumping rate was then gradually decelerated and after an additional 11 hr. pumping at a final rate of 405 gpm., the drawdown was 50.0 ft. Two hr. after stopping the test the water level was 280 ft. or 12.5 ft. below the pre-pumping level.

Analysis of a sample (Lab. No. 119,128) collected Aug. 11, 1949, after 20-hr. pumping showed the water to have a hardness of 18.3 gr. per gal., a residue of 472 ppm. and an iron content of 0.3 ppm.

Pumpage from June 30, 1943 to June 30, 1945 averaged 138,600 gpd.

Sample-study log of Well No. 3 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Soil and hardpan"	18	18
"Quicksand"	10	28
"Shale, sandy"	67	95
Silurian system		
Niagaran-Alexandrian dolomites	108	203
Ordovician system		
Maquoketa dolomite and shale	212	415
Galena-Platteville dolomite, some limestone	325	740
Glenwood sandstone and dolomite	10	750
St. Peter formation		
Sandstone, incoherent, little chert at base	143	893
Shale, some siltstone and dolomite	15	908
Oneota dolomite and sandstone, thin shale beds	78	986
Cambrian system		
Trempealeau dolomite	109	1095
Franconia sandstone, shale and dolomite	65	1160
Galesville sandstone		
Sandstone, partly dolomitic	100	1260
Sandstone, incoherent	35	1295
Sandstone, partly dolomitic	49	1344
Eau Claire dolomite and shale	4	1348

LABORATORY NO. 106,246

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	9.5	
Manganese	Mn	0.1		Fluoride	F	0.9	
Calcium	Ca	89.2	4.46	Chloride	Cl	18.0	0.51
Magnesium	Mg	24.5	2.01	Nitrate	NO_3	1.2	0.02
Ammonium	NH_4	0.5	0.03	Sulfate	SO_4	132.7	2.76
Sodium	Na	40.3	1.75	Alkalinity (as $CaCO_3$)		248.	4.96
Turbidity		0		Hardness (as $CaCO_3$)		324.	6.47
Color		0		Residue		474.	
Odor		0		Temperature 57.5° F.			

MT. PULASKI
Logan County
Sept. 22, 1948

A public water supply was established in 1895 for the city of Mt. Pulaski (1378), principally for fire protection.

Water was obtained from an. 85-ft. well located at the pumping station in the public square at the peak of the hill (or approximately 1500 ft. N. and 2140 ft. E. of the S. W. corner of Section 14, T. 18 N., R. 2 W.). The elevation of the ground surface is 700± ft.

Due to increased population necessitating a more adequate water supply, a water works plant and three dug wells were constructed in 1907 on the lower land near the southwest corner of the city. The plant was located on the south side of the Illinois Central R. R. (Peoria branch) and on the west side of Spring St. opposite Green St. (or approximately 400 ft. N. and 750 ft. E. of the S. W. corner of Section 14). This site was selected because ground water levels were known to be near the surface, and some wells in the vicinity had had free flows for short periods after drilling.

Two of the dug wells were 8 ft. and the other was 10 ft. in diameter. All were 33 ft. deep and walled with stone with the top of the curbing at ground level. A fourth well was acquired, about 1910, from the electric light plant, about two blocks east of the dug wells. This well was dug to 33 ft. and a pipe casing, with a Cook strainer on the bottom, extended to 23 ft. below the bottom of the dug portion.

The wells penetrated 16 to 20 ft. of black mucky soil below which was a water-bearing formation. In 1913, the water level was 8 ft. below the ground surface elevation of 628t ft.

In 1914, all wells were furnishing a total estimated amount of 54,000 gpd. and the supply was lessening either from failure of the supply or from clogged screens. In 1922, the supply of 30,000 gpd. was being obtained from two of the dug wells, one of 10-ft. and the other 8-ft. diameter. The other dug well had caved in due to removal of large quantities of sand from the well and the bored well had been abandoned due to failure in production. In the same year, 24 test holes were drilled in an effort to locate a greater supply.

An 8-in. test well, 50 ft. deep, was drilled one quarter mile southeast of the corporation limits. The lower 11 ft. of the well was in sand. In Sept. 1922, water was pumped for 25 hr. at 75 to 85 gpm. with a drawdown of 3 1 ft. from a non-pumping water level of 14 ft. below a ground surface elevation of 629± ft. In 1923, a 10-in. well was drilled 250 ft. southeast of the 8-in. test well. The well was equipped with a 10-ft. Cook screen, having No. 30 slot openings. In a four-day production test, water was pumped at 127 gpm. with a drawdown of 22 ft. from a non-pumping water level of 12 ft. below the surface. In Mar. 1924, the water level was 5 1/2 ft.

This potential source of supply was abandoned because of distance from the city, and in Jan. 1925 the casings and screens had been removed and sold.

In Feb. 1924, Wells No. 1 and 2 were finished by the Sickel Water Production Co., Aurora, and located on the east side of Marion St., north of Harry St. (or approximately 2140 ft. S. and 1540 ft. E. of the N. W. corner of Section 14).

The dug wells and old pumping station in the southwest part of town were abandoned. The water level in the dug wells, was at the ground surface.

Before drilling Wells 1 and 2, the Sickel Co. drilled a well 120 ft. southeast of the location of Well No. 1. Water was found at a depth of 40 ft. At 60 ft. a boulder was encountered and at 100 ft. the hole was dry. The well was abandoned. Well No. 1 was drilled to a depth of 80 ft. below a ground surface elevation of 660± ft. and cased with 60 ft. of 20-in. steel pipe and 12-in. pipe from 53 to 63 ft. A 12-in. wi. screen was set from 63 to 78 ft. and fine gravel placed around the screen. In a production test Feb. 29-Mar. 1, 1924, after 3 1/2-hr. pumping at 312 gpm. the drawdown was 25 ft. to a pumping level of 42.4 ft. and at the end of 24 hr., when pumping at 240 gpm., the water level was 44.5 ft. The water level in Well No. 2 was lowered from 20 to 27 ft.

The water level in a four-inch well of practically the same depth, located 125 ft. east and 40 ft. north, did not change during the test of Well No. 1. In two wells, 21 ft. deep, one located 140 ft. west and the other 140 ft. west and 75 ft. south, there was 1 ft. of water in each well at 2:30 P.M. on Mar. 1.

The pumping equipment includes an 8-in. American Well Works turbine pump, No. 58869, rated at 125 gpm. against 720 ft. of head; 15-hp. Westinghouse electric motor. The pump discharges 200 gpm. at 50 psi.

Analysis of a sample (Lab. No. 115,792) collected Sept. 11, 1948 after three-hours pumping

at 200 gpm., showed the water to have a hardness of 31.4 gr. per gal., a residue of 809 ppm., and an iron content of 0.1 ppm.

Well No. 2 was drilled 27 ft. east of Well No. 1 and to the same depth, with similar construction of casing and screen. The pumping assembly was the same as in Well No. 1. In Jan. 1925, pumpage was estimated to be 22,000 gpd. The pumps were operated on alternate days for about 1 1/2 hr. daily.

In June 1932, although the wells were furnishing the water needed, the screen in Well No. 2 had become corroded in some places and in others a hard scale or deposit had formed, closing the screen openings. The holes in the screen, caused by corrosion, permitted sand to enter the well and to be pumped out into the distribution system.

Layne North Central Co. repaired both wells by replacing the old 12-in. screen with a new 10-in. wi. screen, 17 ft. in length. The new screen was made up of three sections of 10-in. slotted pipe, each section connected with a 4 5/8-in. wide pipe coupling. A 4 5/8-in. coupling was welded to the top of the screen, into which was screwed new 10-in. casing. Each of the three sections of the screen had 12 rows of slots, 1/8 in. by 1 in., and each row contained 94 slots. The length of the rows of 94 slots was 52 in. On the bottom of the screen was placed a truncated cone-shaped piece, 21 1/2 in. in length and 16 3/4 in. in diameter on the bottom. The cone had 12 rows of 1/8-in. by 1 1/2-in. slots, each row having 32 slots.

From the top of the screen, a 10-in. casing was installed to the floor level of the pump house.

After the well-repair work was completed a production test was made by the driller in Aug. 7, 1932. Little information was obtained about the test. Water was pumped for four hours at 180 gpm. and when pumping at 200 gpm. the water was drawn down to the bottom of the air line, 49 or 50 ft. below floor level, from a static level of 24 ft. 10 in. below floor level.

Well No. 2 is maintained as a stand-by unit. The pumping equipment includes a 10-in. American Well Works turbine pump, No. 57680, having a rated capacity of 200 gpm. against 215 ft. of head and a 20-hp. Westinghouse electric motor. The pump discharges 325 gpm. against a pressure of 50 psi.

Total pumpage for the city of Mt. Pulaski is estimated to average 60,000 gpd.

The private four-inch well located 125 ft. east and 40 ft. north of Well No. 1, is used for water level observations. Some of the observations are:

Date	Depth from ground surface
	ft.
Aug. 1, 1946	24.5
Aug. 1, 1947	24.0
Aug. 30, 1948	24.0

LABORATORY NO. 115,792

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	23.6	
Manganese	Mn	Tr.		Fluoride	F	0.1	
Calcium	Ca	141.5	7.08	Chloride	Cl	59.0	1.66
Magnesium	Mg	65.8	5.41	Nitrate	NO_3	83.5	1.34
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	211.5	4.40
Sodium	Na	26.5	1.15	Alkalinity	(as $CaCO_3$)	312.	6.24
Turbidity		Tr.		Hardness	(as $CaCO_3$)	624.	12.49
Color		0		Residue		809.	
Odor		0		Free CO_2 (calc.)		99.	
Temperature 55° F.				pH = 6.9			

MOWEAQUA
Shelby County
July 23, 1948

The village of Moweaqua (1366) installed a public water supply in 1893.

Water was obtained originally from a dug well located in the eastern part of the village. This supply became inadequate and was abandoned. Two wells, near an abandoned mine shaft located close to the southern limits of the village, were then used as a source of supply.

From 1905 to 1910 all water was obtained from six 2-in. sand points located about 2 mi. north of the center of Moweaqua, in Mason County, (or approximately 200 ft. N., and 200 ft. E. of the S. W. corner of Section 18, T. 14 N., R. 2 E.). The ground surface elevation at the well-site is 600t ft. The sand point wells were replaced in 1910 by six 4-in. wells located about 18 ft. apart in 2 east-west rows, about 14 ft. apart, on the south side of the pumping station. The wells were 18 ft. deep, and each equipped with a sand screen about 9 ft. long.

The well casings are capped about 2 1/2 ft. below the ground surface, and connected just below the cap to the pump suction. Water was pumped by direct suction from the well using a 7-in. by 8-in. Deming triplex pump, rated at 220 gpm. and drivenby a Wagner electric motor, rated at 10-hp. at 1800 rpm. The pump is operated at a rate of 150 gpm., when pumping to the mains.

About 1920, a second 7-in. by 8-in. Deming triplex pump, No. 16070, similar to the original, was installed and the 2 pumps were used alternately every other week, from 3 to 5 hr. per day.

In 1913, the non-pumping water level was reported to be about 4 ft., and the pumping level from 8 to 10 ft. below the ground surface. In 1922, the non-pumping water level in wet weather was reported to be 2-3 ft. below the ground surface. In 1924 the non-pumping water level was reported to be 4-6 ft. below the ground surface. In 1928, one pump was operated at a time, for about 3 1/2 hr. per day.

In 1946, the wells were disconnected, and each well was backwashed. The yield was reported to be much improved for a few months. In backwashing the middle well of the south row, the pressure was apparently too great and an eruption occurred around the casing. The screen and casing were pulled, and after cleaning, the screen and new 4-in. casing were installed in a new well about 15 ft. south of the former location. When this well was completed, it was reported that the maximum yield was about 20 gpm., with the pumping water level near the bottom of the well.

Sometime prior to 1947, a 2-in. Worthington horizontal centrifugal pump, No. 960,612, rated at 150 gpm. and driven by a 5-hp. Delco-electric motor at 1740 rpm. was installed. Water is pumped from the wells by the Worthington pump, discharging over the coke-tray aerator at a rate of 160 gpm.

Analysis of a sample (Lab. No. 110,557), collected June 10, 1947 showed the water from the 6 wells to have a hardness of 19.8 gr. per gal., a residue of 388 ppm., and an iron content of 1.5 ppm.

In Sept. 1947, Cyrus Steven, Findlay, completed 4 new wells, located in a straight line due east from the pump house to about 75 ft. east and 18 ft. north of the north row of the older wells. The 2 west wells are 16 1/2 ft. deep and the 2 east wells are 27 ft. deep. The easternmost well penetrated 3 ft. of top soil, 3 ft. of sand and 3 ft. of white gravel. The 2 west wells are spaced 18 1/2 ft. apart and the 2 east wells are spaced at 21 ft. The second and third wells are 17 ft. apart. Each well was cased with 2 1/2-in. pipe, with 7 ft. of slotted screen section at the bottom.

When completed, the water level in the easternmost well was 5 ft. below ground level, and there were a few inches drawdown when the pumps in the 6 older wells were operating. The combined production from the 4 wells had been reported to be 220 gpm.

From Sept. 1947 to July 1948 pumping operations were alternated every 2 weeks between the 4-well group and the 6-well group.

Analysis of a sample (Lab. No. 115,263), collected July 13, 1948 after 7-min. pumping at 160 gpm. from all 10 wells, showed the water to have a hardness of 22.4 gr. per gal., a residue of 435 ppm., and an iron content of 1.5 ppm.

The water is aerated, filtered and chlorinated. Analysis of a sample (Lab. No. 115,513), collected July 13, 1948 showed the treated water to have a hardness of 22.0 gr. per gal., a mineral content of 392 ppm., and an iron content of 0.07 ppm.

From July 12, 1947 to July 12, 1948 metered pumpage averaged 120,000 gpd.

LABORATORY NO. 115,263

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.5		Silica	SiO_2	14.9	
Manganese	Mn	0.2		Fluoride	F	0.2	
Calcium	Ca	96.5	4.83	Chloride	Cl	5.0	0.14
Magnesium	Mg	34.8	2.86	Nitrate	NO_3	0.4	Tr.
Ammonium	NH_4	0.4	0.02	Sulfate	SO_4	115.2	2.40
Sodium	Na	0.7	0.03	Alkalinity	(as $CaCO_3$)	260.	5.20
Turbidity		10+		Hardness	(as $CaCO_3$)	385.	7.69
Color		0		Residue		435.	
Odor		0		Free CO_2 (calc.)		65.	
Temperature 54.7° F.				pH = 7.0			

LABORATORY NO. 115,513

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.07		Fluoride	F	0.1	
				Chloride	Cl	6.0	0.17
Turbidity		0		Alkalinity	(as $CaCO_3$)	260.	5.20
Color		0		Hardness	(as $CaCO_3$)	377.	7.54
Odor		0		Total Mineral Content		392.	
Temperature 57.5° F.				Free CO_2 (calc.)		25.	
				pH = 7.4			

MULBERRY GROVE
Bond County
Nov. 4, 1948

A public water supply was installed by the village of Mulberry Grove (702) in1941.

A well was drilled to a depth of 40 ft. by Sewell Well Co., St. Louis, and located on the west bank of Hurricane Creek, about 1 mile southeast of town, in Fayette County (or approximately 900 ft. S. and 1900 ft. E. of the N. W. corner of Section 6, T. 5 N., R. 1 W.). The ground elevation is 475± ft.

Correlated driller's log of well drilled in 1941 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Sand, clay, mud	16	16
Sand, muddy	2	18
Clay	10	28
Sand and gravel	12	40

The well was cased with 12-in. pipe from 21 in. above to a depth of 28 ft. below ground level. An 8-in. inner casing extended from 30 in. above to 30 ft. below ground. A 10-ft. exposed length of 8-in. Cook screen having No. 125 slot openings, was screwed to the bottom of the inner casing. Gravel was poured in the annular space outside the screen.

When the well was completed the static water level was 11 ft. 8 in. A production test was made by the State Water Survey on Apr. 7, 1941. After 6-hr. pumping at 40 gpm. the drawdown was 19 1/2 ft. from a static water level of 10 1/4 ft. One hr. after stopping the pump the water level was 15 ft. On Jan. 4, 1946, when pumping at 16 gpm. the drawdown was estimated to be 6 1/2 ft. The loss in production was attributed to loss in pump efficiency. A new pump was installed in 1947 using the old pump head and motor. The air line was removed and not reinstalled. The pumping equipment now consists of 30 ft. of 3 1/2-in. column pipe; 16-stage Cook turbine pump, No. 11368, having an overall length of 5 1/2 ft.; 8 ft. of 3 1/2-in. suction pipe; 3-hp., 1800 rpm., U. S. electric motor, No. 714339. The pump head base is 10 ft. above the ground surface and the bottom end of the suction is approximately 6 1/2 ft. above the bottom of the well.

Analysis of a sample (Lab. No. 116,362), collected Nov. 4, 1948 showed this water to have a hardness of 20.7 gr. per gal., a residue of 486 ppm., and an iron content of 21.5 ppm.

All water is chlorinated and treated for iron removal. Analysis of a sample (Lab. No. 116,364), collected Nov. 4, 1948 showed the treated water to have a hardness of 20.4 gr. per gal., a mineral content of 405 ppm., and an iron content of 0.1 ppm.

Pumpage is estimated to average 17,500 gpd.

LABORATORY NO. 116,362

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	21.5		Silica	SiO_2	25.6	
Manganese	Mn	0.7		Fluoride	F	0.7	
Calcium	Ca	91.4	4.57	Chloride	Cl	8.0	0.23
Magnesium	Mg	30.9	2.54	Nitrate	NO_3	0.4	0.01
Ammonium	NH_4	1.0	0.06	Sulfate	SO_4	181.8	3.78
Sodium	Na	19.6	0.85	Alkalinity	(as $CaCO_3$)	200.	4.00
Turbidity		172.		Hardness	(as $CaCO_3$)	356.	7.11
Color		0		Residue		486.	
Odor		0		Temperature 54.5° F.			

Waterworks were installed by the village of Mundelein (1328) in 1915. The public water supply in Aug., 1946 was obtained from the 2 wells located on the village property fronting on Chicago Ave. at the first alley north of Hawley St. known as lot 13, block 3 of Holcomb's "A". The elevation of the ground surface at these wells is 765t ft.

Well No. 1 (the West Well) was drilled in 1915 to a depth of 242 ft. and is cased to limestone at a depth of 235 ft. with 6-in. pipe, below which the diameter is 6 in. to the bottom. This well is located about 190 ft. N. and 300 ft. E. of the S.W. corner of Section 19, T. 44 N., R. 11 E. At the time of completion of the well, it was pumped for a period of 48 hr. at a rate of 75 gpm. without materially lowering the water level.

In Sept. 1926 when the pump was removed, the non-pumping water level was reported to be 40 ft. below the pump base.

The existing pump installation made in Sept. 1939 consists of: 150 ft. of 4-in. id. column pipe; 6-in., 25-stage Pomona turbine pump, Series No. S. U. 1030, rated at 70 gpm. against 270 ft. of head; 7 1/2-hp. Westinghouse electric motor.

The pump is operated daily and averages 12 hr. a day during the summer months and 9 hr. a day for the balance of the year, or an average pumpage of 42,000 gpd.

Analysis of sample (Lab. No. 107,478), collected Aug. 23, 1946 after 3-hr. pumping at 70 gpm. showed this water to have a hardness of 12.3 gr. per gal., a residue of 444 ppm., and an iron content of 0.1 ppm.

Well No. 2, the East Well, was drilled by Henry R. Luebbe, Mundelein, and completed late in Jan. 1930. It is located about 75 ft. east of the older well and is reported to be 285 ft. deep and to be cased with 12-in. id. wi. pipe from the surface to limestone at a depth of 239 ft., below which the hole is 12 in. in diameter to the bottom. At the completion of the well, tests were reported showing an initial capacity of slightly under 125 gpm. and a drawdown of 57 ft. below a non-pumping water level of 64 ft.

The following pump installation made in 1943 is still in service and consists of: 200 ft. of 6-in. od. column pipe; 8-in., 11-stage Pomona (Series SC 708) turbine pump rated at 200 gpm. against 280 ft. of head; 20-hp. Westinghouse electric motor. The pump is operated during the summer months for an average of 12 hr. per day and for the balance of the year about 9 hr. daily. The average pumpage is 66,000 gpd.

Analysis of sample (Lab. No. 107,479), collected Aug. 23, 1946 after 3-hr. pumping at 125 gpm. showed this water to be of quality similar to that of the water in the West Well.

Due to increasing residential demands created by the growth in population, a new well was drilled by Fred Kiene & Sons, Mundelein, and completed in July, 1946. It is located back of the village hall (or approximately 120 ft. N. and 1300 ft. E. of the S. E. corner of Section 19). The elevation of the top of the casing is 765t ft.

The well was first drilled to a depth of 210 ft. and cased with 10-in. id. pipe. It was planned to extend the depth of the well an additional 10 ft. and set a screen, but bedrock was encountered within 3 ft., and the depth of the well terminated at 213 ft. and no screen was installed. A 6-hr. production test was made after completion of the well. When pumping at 125 gpm., the drawdown was 60 ft. below a non-pumping water level of 90 ft. below the top of the casing.

The following pumping equipment was on order Aug. 24, 1946: 170 ft. of 4-in. id. column pipe; Pomona turbine pump to have a rated capacity of 125 gpm. against 305 ft. of head; 15-hp. General Electric motor.

LABORATORY NO. 107,478

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	21.8	
Manganese	Mn	0.0		Fluoride	F	.6	
Calcium	Ca	40.9	2.05	Chloride	Cl	7.0	0.20
Magnesium	Mg	26.6	2.19	Nitrate	NO_3	1.5	0.02
Ammonium	NH_4	0.4	0.02	Sulfate	SO_4	181.6	3.78
Sodium	Na	67.6	2.94	Alkalinity (as $CaCO_3$)		160.	3.20
Turbidity		10-		Hardness		212.	4.24
Color		0		Residue		444.	
Odor		A		Free CO_2 (calc.)		11.	
Temperature 52° F.				pH = 7.6			

A public water supply was installed by the city of Naperville (5272) in 1904.

The initial supply was obtained from a well drilled to a depth of 1425 ft. by the L. Wilson Well Co. and located in the municipal light and water plant about 75 ft. north of Jackson Ave. and 75 ft. east of Webster St. (approximately 850 ft. N. and 900 ft. W. of the S. E. corner of Section 13, T. 38 N., R. 9 E.).

The ground surface elevation is 673t ft. The well was cased with 12-in. pipe from the surface to 10 1/2 ft. followed by 10-in. pipe to a depth of 118 ft. and a 6 1/4-in. liner between depths of 773 and 939 ft. Below the 10-in. casing the well was 8 1/8 in. in diameter to a depth of 939 ft. and finished at 6 1/8-in. diameter to the bottom.

When the well was completed the water level was 45 ft. and when pumping at 79 gpm. the drawdown was 20 ft. and, when pumping at 108 gpm., the drawdown was 28 ft. The well was equipped with an air lift having 254 ft. of 2 1/2-in. air pipe and discharged 267 gpm. This well furnished the entire public supply until some time in 1913 and was in service until about 1924 when it was abandoned, sealed and covered by the concrete floor of the plant.

A second well, now called Well No. 1, was drilled to a depth of 1375 ft. in 1913 and located about 25 ft. south and 50 ft. east of the old well. The floor level elevation is 673.4 ft. The 12-in. casing extends from the surface to bed rock and the hole was finished 8-in. diameter to the bottom. A considerable flow from a limestone crevice at a depth of 45 ft. was reported when the well was drilled. The water level was 14 ft. below the surface.

This well was the principal source of the public supply from 1913 to 1923. In the spring of 1922, the non-pumping water level was 26 1/2 ft. below the surface, and the production was 180 gpm. The well was used occasionally in 1924 but on May 2, 1928 was contributing about 1/3 of the public supply. At that time water was pumped by air lift having 180 ft. of air pipe and discharging about 100 gpm. On June 8, 1944 the water level was 11 ft. after a 28-hr. idle period. The well was maintained for service and water was pumped occasionally until May 5, 1947. The air lift is still in place and the well maintained for emergency usage.

Two limestone wells were drilled in 1923 for the city at their plant site north of Jackson Ave. by Albert Dieter, Naperville. The first of these wells, now called Well No. 2 is located 65 ft. north and 40 ft. east of Well No. 1. It was reported drilled to a depth of 101 ft. and is 12 in. in diameter. The second well, now called Well No. 3, is located 170 ft. north and 45 ft. east of Well No. 1. It was reported drilled to a depth of 130 ft. and is 12 in. in diameter. Both wells were equipped with air lifts having air pipes extending to within about a foot of the bottoms of the wells. On Oct. 25, 1924 the combined discharge from the 2 wells was 250 gpm. At that time the air lifts were operated about 20 hr. daily. On May 2, 1928 these 2 wells were contributing about 2/3 of the public water supply. Both wells were in active service until 1931.

Well No. 2 was abandoned as a source of supply in 1936 and was capped and sealed with concrete.

Well No. 3 was used as an auxiliary supply unit until May 5, 1947. It is still equipped with air lift and is held for emergency purposes.

Well No. 4 was installed by the American Water Corporation in 1928. It is located in the northern part of the city about 80 ft. east of the center of Eagle St. and 310 ft. south of the center of Eighth Ave. (approximately 550 ft. S. and 1100 ft. W. of the N. E. corner of Section 13). The elevation of the ground surface is 695± ft. The well was reported drilled to a depth of 178 ft. and cased with 30-in. pipe to limestone at a depth of 44 ft. below which the hole was finished 24-in. diameter to the bottom. This casing was originally perforated between depths of 6 and 16 ft. to permit access of water from a water bearing gravel formation.

After the completion of the well a test was made on May 20, 1928. When pumping at 570 gpm. the drawdown was 8 ft. from a non-pumping water level of 8 1/2 ft. below the pump base.

Beginning in Sept. 1929, the pumping rate gradually decreased to 390 gpm. on Feb. 1930 and to 345 gpm. on Jan. 1, 1931 when pumping was discontinued. About May 1, 1931 pumping was resumed at a rate of 350 gpm. but dropped to 270 gpm. by Oct. 1, 1931. At that time the perforations in the casing were sealed with cement and the production declined to 250 gpm. with a drawdown of 48 ft. from a non-pumping water level of 14 ft. below the pump base. On Apr. 6, 1932 while pumping at 348 gpm. the water level was 51 ft. below the pump base.

After the water treatment plant was placed in operation in 1936, Well No. 4 was not used because the water contained too much iron. On Nov. 5, 1942 the depth of the well was found to be 179 ft. 5 in. below the top of the pump base. At that time when pumping at 250 gpm. the drawdown was 60 ft. from a non-pumping water level of 10 ft.

The well was rehabilitated in Dec. 1943 by acidizing with 15% hydrochloric acid and on Dec. 15, 1943 a production test (Table 1) showed the results of the acidizing:

TABLE 1

Rate of Pumping gpm.	Drawdown ft.	Specific Capacity
1000	23.0	43.5
840	18.0	46.6
700	14.0	50.0
620	11.5	54.0

Before the test the standing water level was 11.0 ft. below the pump house floor.

The pump, removed from the well in Dec. 1943, was rebuilt for an overflow discharge and the existing installation, made in Dec, 1945, is: 50 ft. of 8-in. column pipe; 12-in., 8-stage American Well Works turbine pump, Shop No. 69990, having a rated capacity of 400 gpm. against 210 ft. of head; the overall length of the pump is 10 ft.; 20 ft. of 8-in. suction pipe; 60 ft. of 1/4-in. gi. air line; 40-hp. General Electric motor.

Well No. 4 was in service, alternating with Well No. 5 to furnish the public supply, from Aug. 15, 1946 to May 5, 1947. Since then the well has been idle but is maintained as an emergency supply unit.

Well No. 5 was drilled in 1930 to a depth of 189 1/2 ft. by the Layne-Western Co., Chicago, and located about 50 ft. south of the center of School Ave. and 250 ft. east of Huffman St. (approximately 2550 ft. N. and 1400 ft. W. of the S.E. corner of Section 18, T. 38 N., R. 10 E.). The elevation of the top of the pump base is 695.1 ft.

The well is cased with 30-in. wi. pipe to a depth of 3 1 1/2 ft. below which the hole is 24-in. diameter to the bottom. On Jan. 7, 1931 when pumping at an average rate of 630 gpm. against a pressure of 46 psi. the drawdown was 43 ft. from a non-pumping water level of *6* ft. below floor level (about 1 ft. above the g round surface).

By 1937 the production had decreased to 460 gpm. with a drawdown of 96 1/2 ft. from a non-pumping water level of 10 ft.

A capacity test was conducted on Apr. 1, 1942 pumping to waste at ground level. Before the test the standing water level was 7 ft. 3 in. below the floor and when pumping at a greater rate than 390 gpm. the water was drawn down below the suction screen, or 112 ft. below the pump base. Following this test the pump assembly was removed and cleaned after an immersion in hydrochloric acid. On Apr. 6, 1942 the well was acidized with 15% Hydrochloric Acid. The acid was allowed to remain in the well overnight and on Apr. 7, 1942 a test was made, pumping to waste. Before the test the water level was 3 ft. 9 in. below the floor, indicating that either there was some remaining pressure from the acid or that the water level had risen. Table 2 shows the rates of pumping and the respective drawdowns:

TABLE 2

Rate of Pumping gpm.	Drawdown ft.	Remarks
650	23	Well No. 6 idle
700	26	Well No. 6 idle
700	29	Well No. 6 operating
825	41	Well No. 6 operating

The existing pump assembly, reinstalled on Apr. 7, 1942, is: 79 ft. of 8-in. column pipe; 15-in., 10-stage Layne turbine pump, No. 5692, having a rated capacity of 600 gpm. against 170 ft. of head; the overall length of the pump is 7 ft. 9 in.; 20 ft. 4 in. of 6-in. suction pipe; 5 ft. 8 in. of suction screen; 104 ft. of 1/4-in. brass air line; 60-hp. General Electric motor.

Water level observations made throughout 1944 showed a uniform non-pumping level of 11 1/2 ft. below the pump base and a pumping level of 38 to 39 ft. when Well No. 6 was idle. On June 4, 1947 the pumping water level was 52 ft.

This well has been the principal source of the public supply since it was placed in service in Jan., 1931. It has furnished the entire supply since the water softening plant was placed in operation on May 5, 1947.

Analysis of a sample (Lab. No. 110,530) collected June 4, 1947 after 30 days of continuous pumping at 560 gpm. showed this water to have a hardness of 26.5 gr. per gal., a residue of 513 ppm., and an iron content of 0.2 ppm.

Well No. 6 was drilled in Aug. 1937 to a depth of 202 ft. by the Layne-Western Co. The wellis located about 160 ft. southwest of Well No. 5, and was cased with 27-in. pipe through the unconsolidated formation to a depth of 30 ft. below which the hole was 24-in. diameter through limestone formation to the bottom. On Aug. 12-13, 1937, while pumping at 400 gpm.the drawdown was 143 ft. from a non-pumping water level of 10 ft. below the top of casing:

The existing pump installation, made in 1937, is: 160 ft. of 8-in. column pipe; 10-in., 5-stage Layne turbine pump having a rated capacity of 400 gpm. against 165 ft. of head; the overall length of the pump is 4 ft. 6 in.; 15 ft. of 8-in. suction pipe; 25-hp. General Electric motor.

The well was used as an auxiliary source of supply until 1939 and then maintained as an emergency supply unit. In Oct., 1943, when Well No. 5 was out of service, a production of 370 gpm. was obtained. On Feb. 17, 1947, the standing water level was 13 ft. below the pump base. Pumping was started at a rate of 450 gpm. and after 30 min., the pump broke suction. The pumping rate was decreased to 350 gpm. and finally to 285 gpm. at which rate the water level was 179 ft. below the pump base.

This well has not been in service since 1945 but is equipped and maintained for emergency use.

An iron removal plant, installed in 1936, was removed Dec. 1, 1946. Since May 5, 1947, 80% of the water has been softened by Zeolite and blended with 20% untreated water. Analysis of a sample (Lab. No. 110,889), collected June 4, 1947 showed the treated water to have a hardness of 7.9 gr. per gal., a mineral content of 504 ppm., and an iron content of 0.2 ppm. All water is chlorinated to a residual of 0.2 ppm.

From Aug. 1, 1943 to Aug. 1, 1945 the combined metered pumpage averaged 525,000 gpd. which varied from a winter minimum average of 495,000 gpd. to a summer maximum average of 570,000 gpd.

Correlated driller's log of well drilled in 1904 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Loam and Loose rock	20	20
Silurian system		
Niagaran and Alexandrian series		
Limestone	95	115
Ordovician system		
Maquoketa formation		
Limestone streaked with shale	190	305
Galena-Platteville formations		
Limestone	341	646
St. Peter formation		
Sandstone	129	775
Limestone streaked with shale	61	836
Oneota formation		
Limestone	100	936
Shale and limestone	9	945
Sandstone	5	950
Cambrian system		
Trempealeau - Franconia formations		
Limestone	315	1265
Galesville sandstone		
Sandstone	160	1425

LABORATORY NO. 110,530

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	17.3	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	101.2	5.06	Chloride	Cl	7.0	0.20
Magnesium	Mg	49.2	4.04	Nitrate	NO_3	0.5	0.01
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	160.9	3.35
Sodium	Na	4.1	0.18	Alkalinity	(as $CaCO_3$)	286.	5.72
Turbidity		Tr.		Hardness	(as $CaCO_3$)	455	9.10
Color		0		Residue		513	
Odor		0					
Temperature		51.5° F.					

The city of Neoga (1062) installed a public water supply in 1915.

Water was obtained originally from a well called the South, or East Well, dug about 1915, and located east of East Pine St. in the alley between Main St. and the Toledo Road (or approximately 190 ft. N. and 2300 ft. E. of the S. W. corner of Section 8, T. 10 N., R. 7 E.). The ground surface elevation is 655± ft.

The well is 15 ft. in diameter, 16 ft. deep, and is reported to have penetrated clay to a depth of 11 1/2 ft., and coarse gravel below that depth. The well walls were lined with brick and arched to a smaller diameter at the top. The bottom of the well is cupped out and is about 17 1/2 ft. below the cover. (Some time later a test hole was drilled in the bottom to a total depth of 55 ft. by E. C. Baker, Sigel.).

Correlated driller's log of the South Well furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
No record	20	20
Clay	10	30
Pennsylvanian system		
Rock, salt-and-pepper appearance	4	34
Sandstone	21	55

When completed, the well produced 100 gpm. for 12 hr. The non-pumping water level was 12 ft. 4 in. and after the pump had been operating for 15 min., the water level was 13 ft. 5 in. Other wells in the vicinity were reported to have gone dry during this test.

Pumping equipment consisted of a 5 1/2-in. by 8-in. Deming triplex pump driven by a 7 1/2-hp. General Electric motor.

In 1923, it was reported that sand and gravel had been taken out of the center, and that a brick curb, 4 ft. high and about 4 ft. in diameter had been placed in the bottom of the well. In 1923, it was reported that the pump was operated at 37-38 rpm. and that when pumping at an estimated rate of 72 gpm. for 45 min., the drawdown was 2 ft. 2 1/2 in. from a non-pumping water level of 15 ft. 7 in. below the bottom of the cover.

In 1928, it was reported that the well produced about 80 gpm., and that the non-pumping water level was 15.18 ft. In 1931, the well was deepened to 28 ft., with the newly constructed portion 10 ft. in diameter.

The pumping equipment has been removed from the well and on June 4, 1948, the water level was 5 ft. below the well cover.

Analysis of a sample (Lab. No. 83707) collected Aug. 10, 1938, showed the water to have a hardness of 23.1 gr. per gal., a residue of 657 ppm., and an iron content of 1.9 ppm.

In 1918,3 test wells were drilled north of the high school, about 1/2 block east of the eastern limits of the village.

The North Well was dug in 1922 by Mr. Kirk - endall, and is located on the south side of the Nickle Plate R. R. about 1 mile northeast of the center of the village (or approximately 2200 ft. N. and 1950 ft. W. of the S. E. corner of Section 8). The ground surface elevation is 650± ft. This location is about 450 ft. northeast of the northern-most of the test wells, which were drilled before this well.

The well was dug 7 ft. 4 in. in diameter to a depth of 20 ft. and was lined with brick. A test hole was then drilled to a water-bearing sand at a depth of about 30 ft. and cased with 4-in. pipe. In 1923, the lower hole was enlarged and an old screen, 2 ft. in diameter, was placed as a casing.

In 1923, after pumping at a rate of 68 gpm. for 13/4 hr., the drawdown was 8 ft. 8 in. from a non-pumping water level of 11 ft. 1 1/2 in. below the ground surface, and the pump was drawing some air.

This well was first equipped with the 5-in. by 8-in. Deming triplex pump, originally installed in the South Well. The pump is still in place, serving as an emergency unit.

The pump installation, made in Dec. 1946, consists of 24 ft. of 4-in. column pipe; 6-in., 13-stage Deming turbine pump, No. T 7371 having a rated capacity of 100 gpm. against 200 ft. of head; 1 ft. tapered strainer; 7 1/2-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 114,926) collected June 4, 1948 after 4-hr. pumping at 75 gpm. showed the water to have a hardness of 18.0 gr. per gal., a residue of 547 ppm., and an iron content of 1.5 ppm.

All water is treated for iron removal, softened and chlorinated.

Analysis of a sample (Lab. No. 115,177) collected June 4, 1948 showed the treated water to have a hardness of 4.7 gr. per gal., a mineral content of 586 ppm., and an iron content of 0.16 ppm.

In the summer of 1930, E. C. Baker, drilled several test holes at various locations in the village. No additional sources of supply were located. From Mar. 13, 1948 to June 4, 1948, metered pumpage averaged 50,000 gpd.

LABORATORY NO. 114,926

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.5		Silica	SiO_2	26.6	
Manganese	Mn	0.2		Fluoride	F	0.2	
Calcium	Ca	83.7	4.19	Chloride	Cl	117.0	3.30
Magnesium	Mg	23.8	1.96	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	0.3	0.02	Sulfate	SO_4	46.1	0.96
Sodium	Na	88.6	3.85	Alkalinity	(as $CaCO_3$)	288.	5.76
Turbidity		40		Hardness	(as $CaCO_3$)	308.	6.15
Color		0		Residue		547.	
Odor		0		Free CO_2 (calc.)		51.	
Temperature 54.8° F.				pH = 7.15			

LABORATORY NO. 115,177

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.16		Fluoride	F	0.1	
				Chloride	Cl	126.0	3.55
Turbidity		0		Alkalinity	(as $CaCO_3$)	276.	5.52
Color		0		Hardness	(as $CaCO_3$)	81.	1.62
Odor		M		Total Mineral Content		586.	
Temperature 55° F.				Free CO_2 (calc.)		49.	
				pH = 7.15			

About 1890, seven 2-in. wells were drilled in the drift formation for the village of Neponsett (520). The wells were located in various neighborhoods so as to be available to as many people as possible. A few residences had water piped into their homes, but many carried water from the wells.

In 1945, L. E. Swearingen, Neponsett, drilled a well for the grade school, located 500 ft. N. and 1300 ft. E. of the S. E. corner of Section 10, T. 15 N., R. 6 E. The well is 181 ft. deep and cased to rock at approximately 48 ft. The water level was 18 ft., and, during a bailer test by the driller when bailing at a rate of 11 1/2 gpm., the drawdown was reported to be 32 ft. This well is no longer used.

In June 1946, an electrical earth resistivity survey was made by the State Geological Survey. The survey extended over an area 3 miles in all directions from the village.

Well No. 1 was completed at a depth of 830 ft. in February 1948 by Peerless Service Co., Orion, and located 15 ft. north of the village hall (or approximately 1240 ft. N. and 2235 ft. E. of the S.W. corner of Section 10). The ground elevation at the well-site is 830± ft.

A production test was made by the State Water Survey on February 3-4, 1948. For test purposes the pumping assembly consisted of 440 ft. of 3-in. column pipe; Peerless Hi-Lift pump and suction pipe. The total length to the bottom of the suction pipe was 450 ft. The 1/4-in. copper tubing air line was 450 ft. long. The static water level was 276 ft. below the surface and after 24-hr. pumping at 193 gpm. the drawdown was 119 ft. Three hours after stopping the pump, the water level returned to the original static level. Pumping was resumed at 18 1/2 gpm. and after 1 3/4-hours pumping the drawdown was 122 ft. Forty-five minutes after stopping the pump the water level returned to 276 ft.

Analysis of a sample (Lab. No. 113,401), collected Feb. 4, 1948 after 20 1/2-hr. pumping showed this water to have a hardness of 8.0 gr. per gal., a residue of 699 ppm., and an iron content of 3.7 ppm.

Sample-study log of Well No. 1 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Loess and till	40	40
Sand and gravel, slightly silty	10	50
Pennsylvanian system		
Shale, thin beds of siltstone, sandstone, limestone and coal	380	430
Sandstone, partly incoherent	30	460
Shale, thin beds of siltstone, sandstone and limestone	93	553
Sandstone, incoherent	47	600
Shale and sandstone	5	605
Silurian system		
Niagaran-Alexandrian dolomites	230	835

The hole and casing diameter record is shown in Table 1.

TABLE 1

Hole Record

14-in. from 0 to 70 ft.
12-in. from 70 to 195 ft.
10-in. from 195 to 453 ft.
8-in. from 453 to 525 ft.
6-in. from 525 to 830 ft.

Casing Record

12-in. from 0 to 70 ft.
10-in. from 0 to 195 ft.
8-in. from 178 to 453 ft.
6-in. from 428 to 608 ft.

LABORATORY NO. 113,401

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	3.7		Silica	SiO_2	11.7	
Manganese	Mn	Tr.		Fluoride	F	0.6	
Calcium	Ca	23.1	1.16	Chloride	Cl	29.0	0.82
Magnesium	Mg	19.1	1.57	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	1.3	0.07	Sulfate	SO_4	106.6	2.22
Sodium	Na	220.8	9.60	Alkalinity	(as $CaCO_3$)	468.	9.36
Turbidity		116		Hardness	(as $CaCO_3$)	137.	2.73
Color		0		Residue		699.	
Odor		0		Temperature	59.6° F.		

NEW BADEN
Clinton County
Apr. 13, 1948 -

The village of New Baden (1176) installed a public water supply in 1911.

Water was obtained originally from a well owned by the New Baden Milling Co., and located about 200 ft. west of the Southern R. R. station and 120 ft. north of the main track (or approximately 2550 ft. S. and 970 ft. E. of the N. W. corner of Section 18, T. 1 N., R. 5 W.). The well was purchasee by the village in 1934 and has sincebeen called Mill Well.

This well was reported to be less than 8 in. in diameter and about 225 ft. original depth.

The pump installation, made in Mar. 1947, consists of: 160 ft. of 3-in. column pipe; 6-in., 21-stage Pomona turbine pump, No. SH 821, rated at 30 gpm. against 300 ft. of head, the overall length of the pumpis 86 3/4 in.; 30 ft. of 3-in. suction pipe; unknown length of air line; 5-hp. General Electric motor.

In Mar. 1947 the water level was 160 ft. below the pump base, after one month of non-pumping. In Apr. 1948, the pump was operated 24 hr. daily at an average metered discharge of 6 1/2 gpm. It was planned to remove some obstructions in the bottom of the well and clean out the well to its original depth. The pump would then be set at a lower level.

Analysis of a sample (Lab. No. 113,937) collected Mar. 24, 1948 showed this water to have a hardness of 0.8 gr. per gal., a residue of 1256 ppm. and an iron content of 0.1 ppm.

A well was drilled for the village in 1921 at a location about 100 ft. north of the Southern R. R. and 700 ft. west of the depot, near the southwestern limits of the village (or approximately 2570 ft. S. and 270 ft. E. of the N. W. corner of Section 18). This well was 217 ft. 10 in. in depth below a ground surface elevation of 458t ft.

The well was 8 in. in diameter, cased to rock at a depth of about 60 ft., and was reported to terminate in a. stratum of sandstone about 20 ft. thick.

It was reported in 1927 that the non-pumping water level was about 100 ft., and that the pump discharged about 7 gpm.

The well was "shot" in 1931 but this did not improve the yield, which later became so small that the well was abandoned in 1934. The well is capped.

Analysis of a sample (Lab. No. 60793) collected Dec. 9, 1927, showed the water to have a hardness of 1.3 gr. per gal., a residue of 1356 ppm., and an iron content of 0.1 ppm.

A well now called New Well was drilled in 1934 to a depth of 279 ft. by C. W. Haverstick, DeSoto, Mo., and located on the lot with the elevated tank about 75 ft. east of Straus St. between Hanover and Main St. (or approximately 1100 ft. S. and 1775 ft. E. of the N. W. corner of Section 18).

The well was measured 240 ft. deep on Nov. 11, 1947 and was cased to rock with 12-in. pipe below which the hole diameter was 8 in. The driller reported that sand rock was encountered between the depths of 96 and 279 ft.

Pumping equipment consists of: A Deming 2 1/2-in. cylinder pump No. 3904A, attached to 240 ft. of drop pipe; the pump has a 14-in. stroke and is operated at 38 spm.; 10-hp. General Electric motor. The pump and motor are set in a pit 4 ft. below the ground surface.

In 1934, the well produced between 15 and 18 gpm. In 1944, the non-pumping water level was reported to be about 100 ft. below the ground surface. In Mar. 1948 the pump was operated 24 hr. daily at a rate of nearly 12 gpm.

Analysis of a sample (Lab. No. 83711) collected June 17, 1938, showed the water to have a hardness of 1.1 gr. per gal., a residue of 1160 ppm., and an iron content of .06 ppm.

Well No. 3, called Baer Well, was drilled in 1947 to a depth of 255 ft. by Charles S. Wise, St. Louis, Mo., at a location about 50 ft. north of the center of Third St. at the north end of Spelser St. (or approximately 150 ft. S. and 375 ft. E. of the N. W. corner of Section 18). The ground surface elevation at the well site surface is 465± ft.

Corre'lated driller's log of Well No. 3 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Surface	35	35
Pennsylvanian system		
Shale	105	140
Sandstone	110	250
Shale	5	255

The well was cased with 13-in. od. steel pipe from the surface to 48 ft., and with 10-in. steel pipe from the surface to 167 ft., below which the hole was 10 in. in diameter. The well was reported to have been "shot", with 20 quarts of nitroglycerine, in the sandstone.

When tested, the well produced 10 gpm. for 4 hr. with a drawdown of 103 ft. from a non-pumping water level of 147 ft. below the ground surface. On Mar. 23, 1948 the water level was 175 ft. below the pump base and after 1-hr. pumping at an average metered rate of 17 gpm. the water was drawn down below the air line.

The pumping equipment consists of 210 ft. of 3-in. column pipe; 6-in. 24-stage Pomona turbine pump, No. S H 3020, rated at 30 gpm. against 254 ft. of head; overall length of pump is 97 5/8-in.; unknown length of air line; 30 ft. of 3-in. suction pipe; 5-hp. General Electric motor.

Analysis of a sample (Lab. No. 113,939) collected Mar. 23, 1948, after 15-min. pumping at 17 gpm., showed this water to have a hardness of 1.3 gr. per gal., a residue of 1091 ppm., and an iron content of 0.1 ppm.

Pumpage for 1948 was estimated to average 35,000 gpd.

LABORATORY NO. 113,937

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	13.4	
Manganese	Mn	Tr.		Fluoride	F	2.5	
Calcium	Ca	3.7	0.19	Chloride	Cl	350.0	9.87
Magnesium	Mg	1.1	0.09	Nitrate	NO_3	Tr.	Tr.
Ammonium	NH_4	0.6	0.03	Sulfate	SO_4	2.7	0.06
Sodium	Na	497.3	21.62	Alkalinity (as $CaCO_3$)		600.	12.00
Turbidity		Tr.		Hardness (as $CaCO_3$)		14.	0.28
Color		0		Residue		1256.	
Odor		0		Free CO_2 (calc.)		3.	
Temperature 59.2° F.				pH = 8.65			

LABORATORY NO. 113,939

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	12.0	
Manganese	Mn	Tr.		Fluoride	F	1.5	
Calcium	Ca	5.9	0.30	Chloride	Cl	315.0	8.88
Magnesium	Mg	1.2	0.10	Nitrate	NO_3	2.5	0.04
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	0.4	0.01
Sodium	Na	442.8	19.25	Alkalinity (as $CaCO_3$)			
Turbidity		Tr.		Hardness (as $CaCO_3$)		20.	0.40
Color		0		Residue		1091.	
Odor		0		Free CO_2 (calc.)		3.	
Temperature 58.2° F.				pH = 8.7			

NEW HAVEN
Gallatin County
Feb. 29, 1948

The village of New Haven (695) installed a public water supply in 1946.

Water is obtained from three gravel wells, owned by the Texas Co., and constructed in 1941 by the Air Made Well Co., Kansas City, Mo. The wells are identical in construction and have an average depth of 60 ft., varying from 58 to 62 ft., according to the topography of the site. The material penetrated was reported as: soil and clay from the surface to a depth of 12 ft. followed by water-bearing gravel to the top of another clay formation. There is no local record available of their productive capacities but it was estimated from partial pumping tests that each well was capable of producing 500 gpm. under simultaneous pumping operations with no appreciable drawdown.

Well No. 1 is located about 2000 ft. N. and 250 ft. E. of the S. W. corner of Section 21, T. 7 S., R. 10 E., and Well No. 2 is located 420 ft. east of Well No. 1; and Well No. 3 is 320 ft. east of Well No. 2.

An outer casing, 40 in. in diameter, was driven to the bottom; an inner steel welded casing 16 in. in diameter with 10 ft. of 12 1/2-in. id. slotted concrete pipe at the bottom was then installed, and the annular space packed with No. 2 gravel. The outer casing was pulled to the clay line and cut off 4 ft. below the ground surface and a concrete pit was constructed. The 16-in. casing extends about 1 ft. above ground surface where a sealed connection is made to a reduced steel column pipe which houses the pump shaft above ground. A Buda gasoline motor and a Johnson right angle gear drive are mounted on a platform supported by a steel tower 30 ft. above ground level, or 3 ft. above the 1937 high water mark.

Each well is equipped with a 32-stage Pomona turbine pump designed to pump against 300 psi.

Water levels in the well fluctuate with the rise and fall of the Wabash River. A non-pumping water level of 16 1/2 ft. below the surface with a 10-ft. drawdown have been observed during low river stage conditions. It was reported that pumping at a rate of 200 gpm. on one occasion failed to show any drawdown.

Difficulties are being experienced with fine sand entering the wells which is decreasing their productive capacities. The concrete perforated pipe in Well No. 3 collapsed when under the compression of flood waters anda series of holes were shot through the bottom of the 16-in. steel casing. The well was then tested by air pressure and was estimated to produce 300 gpm.

Analysis of a sample (Lab. No. 113,566), collected Feb. 21, 1948 from Well No. 2 after 3-hr. pumping at 100 gpm. showed this water to have a hardness of 18.0 gr. per gal., a residue of 335 ppm., and an iron content of 2.6 ppm.

Water is pumped through a 28.-mile pipe line to a storage reservoir at the Texas Co. oil refining plant at Hoodville, where it is treated. Water for New Haven is softened by the village and blended with raw water for consumption.

Analysis of a sample (Lab. No. 114,104), collected Feb. 20, 1948, showed the treated water to have a hardness of 6.9 gr. per gal., a mineral content of 329 ppm., and an iron content of 1.9 ppm.

Total pumpage is estimated to average 144,000 gpd.

The village consumption averages about 7500 gpd.

LABORATORY NO. 113,566

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.6		Silica	SiO_2	23.8	
Manganese	Mn	0.3		Fluoride	F	0.1	
Calcium	Ca	82.3	4.12	Chloride	Cl	4.0	0.11
Magnesium	Mg	25.1	2.06	Nitrate	NO_3	0.4	0.01
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	31.5	0.65
Sodium	Na	6.1	0.27	Alkalinity	(as $CaCO_3$)	284.	5.68
Turbidity		50-		Hardness	(as $CaCO_3$)	309.	6.18
Color		0		Residue		335.	
Odor		0		pH = 7.15			

LABORATORY NO. 114,104

	ppm.	epm.		ppm.	epm.
Iron (total) Fe	1.9		Chloride Cl	5.0	0.14
			Alkalinity (as $CaCO_3$)	280.	5.60
Turbidity	10		Hardness (as $CaCO_3$)	118.	2.36
Color	0		Total Mineral Content	329.	
Odor	0		Free CO_2 (calc.)	49.	
Temperature 46.8° F.			pH = 7.2		

NEW HOLLAND
Logan County
Sept. 22, 1948

A public water supply was installed by the village of New Holland (336) in 1908.

Water was obtained from a well now known as South Well located on Lincoln St., between Vine and Mason St., (or approximately 1000 ft. N. and 600 ft. W. of the S. E. corner of Section 18, T. 20 N., R. 4 W.). The well is 72 ft. deep below a ground elevation of 545t ft., and cased with 6-in. pipe from the surface to 60 ft. and with a Cook screen from 60 to 70 ft. The upper 5 ft. of the screen has No. 14 slot openings and the lower 5 ft. has No. 24 slot openings.

The pumping equipment is identical to that in the North Well.

The well was repaired in 1931, when the well was deepened from 70 to 72 ft. and a screen was installed similar to the screen in the North Well. The water quality is of similar character to that obtained from the North Well.

The North Well was drilled in 1931 to a depth of 74 ft. by Rufus Rush, Stanford, and located 6 ft. north of the South Well. The well was cased with 64 ft. of 6-in. pipe and 10 ft. of screen, the upper 5 ft. of the screen having No. 14 slot openings and the lower 5 ft. having No. 24 slot openings. On Feb. 1, 1931, when the well was completed, the depth to water was 34 ft. below the ground level.

The well is equipped with 54 ft. of 4 1/2-in. column pipe; Gould double-acting 4 1/4-in. id. cylinder pump, 5 ft. long; and having a 24-in. stroke; 14 ft. of 3-in. suction pipe. Both well pumps have a common shaft belt-driven by a 10-hp., 1165 rpm. Century electric motor, No. 143540.

Analysis of a sample (Lab. No. 115,830), collected Sept. 15, 1948 after 25-min. pumping in both wells showed the water from the North Well to have a hardness of 32.6 gr. per gal., a residue of 708 ppm., and an iron content of 0.3 ppm.

From Aug. 14 to 24, 1948, the pumps and strainers, in both wells, were pulled, cleaned and overhauled. Both pumps are now operated at a speed of 16 1/2 spm. and each pump discharges about 40 gpm. The pumps are in daily service.

Pumpage is estimated to average 15,000 gpd.

LABORATORY NO. 115,830

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.3		Silica	SiO_2	30.2	
Manganese	Mn	0.0		Fluoride	F	0.0	
Calcium	Ca	129.4	6.47	Chloride	Cl	33.0	0.93
Magnesium	Mg	59.6	4.90	Nitrate	NO_3	66.0	1.06
Ammonium	NH_4	0.0	0.00	Sulfate	SO_4	135.8	2.82
Sodium	Na	14.7	0.64	Alkalinity (as $CaCO_3$)		360.	7.20
Turbidity		Tr.		Hardness (as $CaCO_3$)		569.	11.37
Color		0		Residue		708.	
Odor		0		Free CO_2 (calc.)		143.	
Temperature 55° F.				pH = 6.8			

NEW LENOX
Will County
Nov. 22, 1948

New Lenox (Est. 1200) was incorporated as a village on Aug. 20, 1946.

The village does not have a public water supply system. Private wells supply residential and business demands. A survey of these wells, made in 1943, reports a total number of 266 wells in the area. These wells range in depth from 47 to 86 ft. and are 4 to 5 in. in diameter. All wells penetrate water-bearing lime stone and have production capacities of 5 to 10 gpm. Non-pumping water levels vary with the topography of the ground and are about 10 to 38 ft. below the ground surface.

The part of New Lenox located in the north portions of Sections 21 and 22 which is known as the Arthur T. Mcintosh Co. addition, is served by a community water supply system. The source of this water supply is a 378-ft. well drilled in 1932 by Henry Boysen, Jr., Libertyville, for Arthur T. Mcintosh Co. It is leased and operated by the Suburban Water Co. and serves about 140 customers. The well is located about 2600 ft. S. and 270 ft. W. of the N. E. corner of Section 21, T. 35 N., R. 11 W. The elevation of the ground surface is 703± ft.

The following information was furnished by the driller: the well is cased with 12-in. pipe from the surface to a depth of 67 ft. where it is seated in limestone and below which the hole is 12 in. in diameter through the lime stone ending in a layer of fine, black gravel below the limestone at a depth of 378ft. Water-bearing crevices were encountered at depths of 179 and 276 ft., and a thin streak of shale at a depth of 300 ft.

After completion of drilling the distance to water was 41 ft. below the surface, and the well was tested by pumping for 8 hr. at a rate of 60 gpm. The drawdown was not determined. When the pump was pulled and overhauled in 1942, the distance to water was 40.8 ft. below the pump base.

On Jan. 8, 1948, the water level was 42.8 ft. after the pump had been out several days. On Nov. 22, 1948 after 35-min. non-pumping the water level was 53 ft. and after 8-min. pumping the drawdown was 103 ft.

The following pump installation was in service on Oct. 29, 1946: 230 ft. of 4-in. id. screwed column pipe; 6-in., 6-stage American Well Works turbine pump, Shop No. 57629, having a reported delivery of 65 gpm. under existing operating conditions; 230 ft. of air line (180 ft. placed in 1942 and 50 ft. of old line placed in 1937); 20 ft. of 3 1/2-in. id. suction pipe; 15-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 108,175), collected Oct. 29, 1946 after 10-min. pumping at an estimated rate of 65 gpm., showed this water to have a total hardness of 36.4 gr. per gal., a residue of 842 ppm., and an iron content of 1.7 ppm.

The estimated average pumpage is 20,000 gpd.

Water is chlorinated some of the time.

LABORATORY NO. 108,175

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.7		Silica	SiO_2	16.1	
Manganese	Mn	Tr.		Fluoride	F	0.4	
Calcium	Ca	172.8	8.64	Chloride	Cl	1.0	0.03
Magnesium	Mg	46.7	3.84	Nitrate	NO_3	0.8	0.01
Ammonium	NH_4	0.6	0.03	Sulfate	SO_4	384.7	8.00
Sodium	Na	33.4	1.45	Alkalinity	(as $CaCO_3$)	296.	5.92
Turbidity		10		Hardness	(as $CaCO_3$)	624.	12.48
Color		0		Residue		842.	
Odor		0		Free CO_2	(calc.)	96.	
Temperature		53° F.		pH = 6.9			

A public water supply was installed by the city of Newman (1103) in 1934.

Well No. 1 was drilled to a depth of 122 ft. by C. W. McAllister, Chrisman, in 1932 and located at the southeast corner of Broadway and Mather St. (or approximately 2270 ft. N. and 2440 ft. W. of the S. E. corner of Section 31, T. 16 N., R. 14 W.). The well was first cased with 8-in. blank pipe, without any screen, to the bottom of the hole. The top of the casing was surrounded by a surface well, about 20 ft. deep.

A production test was made by the State Water Survey on July 28, 1933. The non-pumping water level was 16 ft. below the sidewalk level. After pumping at 37 gpm. for several hours with considerable fine sand being pumped, the pump was removed. Seven feet of fine sand had collected in the bottom of the well. After removal of the sand, pumping was resumed at 35.4 gpm. with a drawdown of 23 ft. After one-hour pumping, the rate dropped to 30 gpm. but with the same drawdown. The pumping apparatus was removed and it was found that sand had accumulated 7 ft. deep in the bottom of the well. Fine sand had been discharged during the entire pumping period.

In 1934, the well was deepened to 127 ft. and equipped with 9 ft. of 8-in. Cook screen, with No. 30 slot openings. The water level at that time was at 21 ft. and when pumping at 28 gpm., the drawdown was 75 ft.

The well was abandoned.

Analysis of a sample (Lab. No. 75,205) collected Oct. 27, 1934 showed this water to have a hardness of 17.7 gr. per gal., a residue of 1161 ppm., and an iron content of 3.0 ppm.

Well No. 2 was drilled to a depth of 143 ft. in Jan. 1935 by George Meister, Tuscola, and located about 6 blocks west of Well No. 1 (or approximately 2100 ft. N. and 950 ft. E. of the S. W. corner of Section 31). The elevation of the ground surface is 647± ft.

The well was cased with 8-in. pipe from 1 1/2 ft. above to 131 ft. below ground level, and with an 8-in. Cook screen, from 131 to 143 ft. The upper 4 ft. of the screen had No. 20 slot openings and the lower 8 ft. had No. 30 slots.

A production test was made by the State Water Survey on Jan. 18, 1935 using a test turbine pump with the bottom at 112 1/2 ft. and the bottom of the suction pipe at 132 1/2 ft. The non-pumping water level was 34 ft. below the top of the casing. Pumping was started at a rate of 155 gpm. and after 40 minutes, the production rate gradually decreased to 115 gpm. with a pumping water level at 88 ft. 8 in. below the top of the well. The pump then continued operating, but produced no water for about one minute. After several cycles of 15 or 20-minute periods of pumping and non-pumping it was determined that the pump became gas-locked. Any pumping in excess of 75 gpm. was difficult.

Correlated driller's log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Thickness in.	Depth ft.	Depth in.
Pleistocene system				
Loam, clay and hardpan	50		50	
Sand, dry	5		55	
Sand	5		60	
Shale (probably till)	57		117	
Sand	2		119	
Gravel, in mud	2		121	
Gravel and sand	13	6	134	6
No record	8	6	143	

The following pump equipment was installed: 120 ft. of 5-in. column pipe; 7-in., 9-stage Fairbanks-Morse turbine pump, No. 29284, rated at 100 gpm.; 7 1/2-hp. Fairbanks-Morse electric motor; air line of unknown length.

On Oct. 26, 1943, the non-pumping water level, after a five-minute quiet period, was 45 ft. and after 1 1/2-hr. pumping, the drawdown was 26 ft. After 10-hr. pumping, the rate decreased to 5 to 10 gpm. On June 14, 1948 after continuous pumping at an estimated rate of 25 gpm., the water level was 43 ft. above the bottom of the air line.

Analysis of a sample (Lab. No. 118,843) collected July 15, 1949 showed this water to have a hardness of 14.9 gr. per gal., a residue of 1162 ppm., and an iron content of 3.9 ppm. The water has a methane content of 12.3 cu. ft. per 1000 gal.

All water is aerated, softened and chlorinated. Analysis of a sample (Lab. No. 118,848) collected July 15, 1949 showed the treated water to have a hardness of 8.4 gr. per gal., a mineral content of 1110 ppm., and an iron content of 0.6 ppm.

In Mar. 1947, a well was drilled to a depth of 250 ft. by Henry Meister, Tuscola, and located 2020 ft. N. and 100 ft. E. of the S. W. corner of

Section 31. The drilling encountered very fine sand between 130 and 145 ft. and between 200 and 220 ft. The well was cased with 150 ft. of 10-in. pipe and 11 ft. of screen having No. 20 slot openings.

The following morning the well was two-thirds full of sand and no pumping was done. The casing and screen were pulled and the well abandoned.

On June 14, 1948, the water level was 28 ft. below ground level.

Pumpage for the city is estimated to average 36,000 gpd.

LABORATORY NO. 118,843

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	3.9		Silica	SiO_2	23.2	
Manganese	Mn	0.0		Fluoride	F	.3	
Calcium	Ca	62.9	3.15	Chloride	Cl	370.0	10.43
Magnesium	Mg	23.7	1.95	Nitrate	NO_3	3.0	.05
Ammonium	NH_4	16.6	.93	Sulfate	SO_4	0.0	0.0
Sodium	Na	343.4		Alkalinity	(as $CaCO_3$)	524.	10.48
Turbidity		16		Hardness	(as $CaCO_3$)	255.	5.10
Color		25		Residue		1162.	
Odor		0					

LABORATORY NO. 118,848

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.6		Fluoride	F	.1	
				Chloride	Cl	460.0	12.97
				Alkalinity	(as $CaCO_3$)	388.	7.76
Turbidity		9		Hardness	(as $CaCO_3$)	144.	2.88
Color		75		Total Mineral Content		1110.	
Odor		0					

NEW WINDSOR
Mercer County
Nov. 8, 1946

The installation of a public water supply for the village of New Windsor (517) was started in 1924.

A well was drilled by Sewell Well Co., St. Louis, near the northwest corner of Third and Main St. (or approximately 1070 ft. S. and 1225 ft. W. of the N. E. corner of Section 13, T. 14 N., R. 1 W.). The well was drilled to a depth of 546 ft. below a ground elevation of 810± ft., and was cased from the surface with 144 ft. 2 in. of 10-in. pipe of which 66 ft. was wrought iron; and also cased from the surface with 402 ft. of 8-in. Byers wrought iron pipe weighing 24 lb. per ft.

Sample-study log of well drilled in 1924 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
No record	15	15
Till	75	90
Sand, clean	5	95
Till	10	105
Sand and granular gravel, clean	15	120
Pennsylvanian system		
Shale, sandstone, then siltstone beds	215	335
Mississippian system		
Kinderhook shale	10	345
Devonian system		
Cedar Valley dolomite and limestone	76	421
Wapsipinicon limestone, some dolomite	43	464
Silurian system		
Niagaran dolomite	82	546

During drilling operations, no water was encountered below sand and gravel until a depth of 462 ft. was reached. The flow increased, and drilling was stopped at a depth of 546 ft.

When the well was completed, the water level was 236 ft. below the ground surface. The well was tested on April 9 and 10, 1924 with a single-acting deep-well pump which was operated by the walking beam of the pump rig. The 5-in. by 18-in. cylinder was set at a depth of 257 ft. and 22 ft. of suction pipe was attached. The water level before the test was 228 ft. During the first hour, the pumping rate averaged 100 gpm., and afterwards, the rate averaged 85 gpm. No air was drawn into the cylinder. The pump was operated at high speed, and at 22 hr. a broken rod ended the test. In 1934 the non-pumping water level was 309 ft.

In 1942 the full capacity of the pump could be obtained for only 5 min. at a time. The pump cylinder was lowered from a depth of 257 ft. to 311 ft.

The pumping equipment now consists of 311 ft. of 6-in. column pipe; A. D. Cook deep-well double-acting pump, No. 1771, with 18-in. stroke and rated at 75 gpm.; 15 ft. of suction pipe; 15-hp., 860-rpm. Northwestern electric motor.

Analysis of a sample (Lab. No. 108,247), collected Nov. 8, 1946, showed this water to have a hardness of 21.4 gr. per gal., a residue of 444 ppm., and an iron content of 0.5 ppm.

The water is not treated.

Pumpage is estimated at 10,000 gpd.

LABORATORY NO. 108,247

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.5		Silica	SiO_2	33.1	
Manganese	Mn	0.0		Fluoride	F	0.2	
Calcium	Ca	99.6	4.98	Chloride	Cl	3.0	0.08
Magnesium	Mg	28.8	2.37	Nitrate	NO_3	0.8	0.01
Ammonium	NH_4	1.8	0.10	Sulfate	SO_4	7.0	0.15
Sodium	Na	20.0	0.87	Alkalinity	(as $CaCO_3$)	404.	8.08
Color		0		Hardness	(as $CaCO_3$)	368.	7.36
Odor		Tr.		Residue		444.	
Turbidity		10					
Temperature		52.7° F.					

NIANTIC
Macon County
Aug. 28, 1948

A public water supply for the village of Niantic (625) was installed in 1941.

After a resistivity survey was made by the State Geological Survey in 1941, a 4-in. test well was drilled to a depth of 72 ft. by Hayes & Sims, Champaign, and located one-half mile north of town. A production test was made by the State Water Survey and a specific capacity of 64 gpm. per foot of drawdown was determined.

A permanent well was completed in May 1941 to a depth of 47 1/2 ft. and located about 30 ft. southwest of the test well site (or approximately 1580 ft. N. and 40 ft. W. of the S. E. corner of Section 2, T. 16 N., R. 1W.). The elevation of the ground surface is 595i ft.

Correlated driller's log of well completed in 1941 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and clay	20	20
Gravel	5	25
Sand and gravel	19	44
Gravel	3	47
Sand	1	48

The well was cased with 8-in. pipe from 2 ft. 8 in. above to 38 ft. 10 in. below the ground surface. An 8-in. Johnson brass screen, 10 ft. 10 1/2 in. long and having No. 35 slot openings, was placed with the bottom of the screen at 48 ft.

A production test was made on June 2, 1941 by the State Water Survey, using for temporary test pumping a small gasoline motor-driven deep-well centrifugal pump. Before the test the water level was 5 1/2 ft. below ground level. After 2 1/2-hr. pumping at 41 gpm. the drawdown was 2 ft., and after an additional 2-hr. pumping at 59 gpm. the drawdown was 3 ft. and after a further pumping period of 3 1/2 hr. at 90 gpm. the drawdown was 4 1/2 ft. After stopping the pump, the water level returned in 30 seconds to within 4 in. of the starting level.

The pump assembly includes a Fairbanks-Morse turbine pump, No. 13558, and a 2-hp. electric motor.

On Aug. 23, 1948 after several hours of non-pumping, the air line altitude gauge read 30 ft. and after 5-min. pumping, the gauge read 27 ft.

Analysis of a sample (Lab. No. 115,663) collected Aug. 23, 1948 after pumping for 5 min. showed this water to have a hardness of 16.9 gr. per gal., a residue of 349 ppm., and an iron content of 2.7 ppm.

All water is aerated, filtered and softened. Analysis of a sample (Lab. No. 115,788) collected Aug. 23, 1948 showed the treated water to have a hardness of 11.0 gr. per gal., a mineral content of 329 ppm., and an iron content of 0.04 ppm.

From Aug. 1, 1947 to Aug. 1, 1948 the pumpage averaged 18,380 gpd.

LABORATORY NO. 115,663

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.7		Silica	SiO_2	19.6	
Manganese	Mn	0.0		Fluoride	F	0.3	
Calcium	Ca	70.4	3.52	Chloride	Cl	14.0	0.39
Magnesium	Mg	27.5	2.26	Nitrate	NO_3	1.7	0.03
Ammonium	NH_4	2.9	0.16	Sulfate	SO_4	18.3	0.38
Sodium	Na	19.8	0.86	Alkalinity (as $CaCO_3$)		300.	6.00
Turbidity		50		Hardness (as $CaCO_3$)		289.	5.78
Color		0		Residue		349.	
Odor		Tr.		Temperature 53.5° F.			

LABORATORY NO. 115,788

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.04		Fluoride	F	0.1	
Turbidity		0		Chloride	Cl	12.0	0.34
Color		0		Alkalinity (as $CaCO_3$)		272.	5.44
Odor		Tr.		Hardness (as $CaCO_3$)		189.	3.78
Temperature 61.5° F.				Total Mineral Content		329.	

NOBLE
Richland County
May 4, 1948

The village of Noble (855) is installing a public water system.

A test well was drilled in 1941 by Schneider and Gwin, Salem, at a location 80 ft. south of the center of U. S. Highway No. 50, at East Second St. (or approximately 100 ft. S. and 1300 ft. E. of the N. W. corner of Section 16, T. 3 N., R. 9 E.). The ground surface elevation is 471± ft.

The well was cased with 10-in. pipe from the surface to 40 ft. and with 8-in. pipe from 40 to 95 ft., below which the hole was 6 in. in diameter.

The well was first drilled in 105 ft., but a bailer test showed a production of only 6 gpm., so drilling was continued to a total depth of 245 ft.

A production test was made by the State Water Survey on Feb. 17, 1941. For test purposes, the well was equipped with an air lift extending to a depth of 220 ft. The well produced 14 gpm. with a drawdown of 115 ft. below a non-pumping water level of 18 ft. below the ground surface.

Analysis of a sample (Lab. No. 89871) collected after 4-hr. pumping on Feb. 17, 1941, showed the water to have a hardness of 10.7 gr. per gal., a residue of 4140 ppm., and an iron content of 5.6 ppm.

This well was abandoned, because of the high mineral content of the water.

Test Well No. 2 was drilled to a depth of 170 ft. at a location about 300 ft. east of Test Well No. 1.

This well was abandoned because of the high mineral content of the water.

Village Well No. 1 was drilled to a depth of 210 ft. in 1946 by Lee Miller and T. T. Hardman, Terre Haute, Ind., and is located about 2 miles north of U. S. Highway No. 50 and 50 ft. east of the gravel road (or approximately 2110 ft. S. and 100 ft. E. of the N. W. corner of Section 4). The elevation of the ground surface at the well site is 480± ft.

Sample-study log of Well No. 1 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Till	35	35
Pennsylvanian system		
Shale and compact sandstone	30	65
Sandstone, slightly porous to compact	40	105
Sandstone, partly incoherent	15	120
Siltstone	7	127
Sandstone, incoherent, few calcareous streaks	83	210

The well is cased with 6 1/4-in. pipe from 1 ft. above to 81 ft. below the ground surface, and the hole is 6 in. in diameter below the bottom of the casing.

When the well was completed, the driller reported that after 10-hr. pumping at 25-30 gpm. the drawdown was 79 ft. from a non-pumping water level of 21 ft. below the surface.

A production test was made by the State Water Survey on Mar. 21-22, 1947. For test purposes, a gasoline engine-driven deep-well turbine pump was installed with the pump intake at a depth of 203 1/2 ft. The well produced 19 gpm. with a drawdown of 59 ft. below a non-pumping water level of 30 ft. below the pump base. On Apr. 22, 1948 the non-pumping water level was 9.7 ft. below the top of the casing.

A partial analysis of a sample (Lab. No. 109,676) collected after 22-hr. pumping on Mar. 22, 1947, showed the water to have a hardness of 22.3 gr. per gal., a residue of 591 ppm., and an iron content of 0.6 ppm.

LABORATORY NO. 109,676

	ppm.	epm.			ppm.	epm.
Iron (total) Fe	0.6		Fluoride	F		
			Chloride	Cl	11.0	.30
Turbidity	Tr.		Alkalinity (as $CaCO_3$)		488.	9.76
Color	0		Hardness (as $CaCO_3$)		388.	7.76
Odor	0		Total Mineral Content		591.	
Temperature 57.6° F.						

A public water supply was installed by the city of Nokomis (2562) in 1895.

Water was first obtained from 6 drift wells located in the southwest part of town along the south side of the New York Central R. R. right-of-way) or approximately 330 ft. N. and 2100 ft. W. of the S. E. corner of Section 22, T. 10 N., R. 2 W.). The wells were 6 in. in diameter and about 41 ft. deep and arranged in 2 rows of 3 wells each. The wells were about 50 ft. apart and water could be pumped from either set of 3 wells by either of the station pumps.

In 1913, the non-pumping water level was 13 ft. below a ground elevation of 674± ft.

In 1923, three of the wells furnished the entire public demand. The other 3 wells had become filled with fine sand. In the same year an effort was made to augment the water supply. Later all of the 6 wells were abandoned.

Eight test wells were drilled at various locations in the city and, as a result, 4 permanent wells were drilled northeast of Test Well No. 8 and about 0.4 mi. west of the old wells. The wells were drilled by Holmes Bros. and located in a north and south line 350 ft. west of the city limits. The south well is approximately 1700 ft. N. and 1800 ft. W. of the S. E. corner of Section 22. The pumping station is between the 2 center wells. The wells were 40 ft. deep below a ground surface elevation of 674± ft. and the top of each well was in a pit 5 ft. in diameter and 13 ft. in depth. A sand and clay formation was encountered from 0 to 17 ft., gravel from 17 to 40 ft., rock at 40 ft. All wells were cased with 10-in. pipe with a 14-ft. length of Cook screen at the bottom. Three of the screens had No. 70 slot openings and the other screen had No. 25 slot openings in the top 4 ft. and No. 70 slots in the lower 10 ft.

A 5-in. suction pipe extended into each well to a depth of 27 ft. or 37 ft. below the top of the pit, in Wells No. 1, 3 and 4.

Water is pumped from all wells simultaneously by either of 2 Deming 8 by 8-in. single-acting triplex pump set in a pit 10 ft. deep. The 4 wells are connected to the pumps by a common 5-in. suction line, and the pumps are belt-driven by 2 Allis-Chalmers electric motors, each operated at a speed of 1150 rpm. The south motor is rated at 15-hp. and the north motor at 20-hp. A 25-hp. Primm oil engine is in place for emergency.

When the wells were being drilled in Mar. and Apr. 1923, the static water level was 4 1/2 ft. below the ground surface. Before the wells were put in service and while pumping in one well for 10 days at a measured rate of 325 gpm. the water level dropped rapidly to 25 or 30 ft. Within a few minutes after stopping the pump the water level was 7 ft. below the ground surface.

On Nov. 26, 1947, the pumping water level was measured at 20.3 ft. below the pump house floor, or 26.8 ft. below normal ground level. The local water superintendent reported that 10 hr. previous the non-pumping level was 15.7 ft. During the summer of 1947 the water level receded considerably. On July 14, 1948 after a 3 1/2-hr. idle period the water level in Well No. 2 was 15.8 ft. below the concrete floor in the plant basement (6 1/2 ft. below ground level) and after 6 1/2-hr. pumping at an average of 333 gpm. from all 4 wells, the water level was 22.2 ft.

Analysis of a sample (Lab. No. 115,295) collected from all four wells July 14, 1948, after 7 1/2-hr. pumping at 333 gpm. showed the water to have a hardness of 29.1 gr.per gal., a mineral content of 776 ppm., and an iron content of 5.5 ppm.

A water treatment plant was constructed in 1937 and the water is aerated, and softened. All water is chlorinated before entering the distribution system. Analysis of a sample (Lab. No. 115,508) collected July 14, 1945 showed the treated water to have a hardness of 6.5 gr.per gal., a total mineral content of 459 ppm., and an iron content of 0.1 ppm.

From July 13, 1947 to July 13, 1948 metered pumpage averaged 205,975 gpd.

Water is furnished to the village of Coalton and to the New York Central R. R. which for the month of June 1948, required 90,170 and 30,730 gpd. respectively.

LABORATORY NO. 115,295

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	5.5		Silica	SiO_2	24.9	
Manganese	Mn	0.4		Fluoride	F	0.3	
Calcium	Ca	136.0	6.80	Chloride	Cl	60.0	1.69
Magnesium	Mg	38.7	3.18	Nitrate	NO_3	1.8	0.03
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	254.2	5.29
Sodium	Na	65.8	2.86	Alkalinity (as $CaCO_3$)		292.	5.84
Turbidity		15		Hardness (as $CaCO_3$)		499.	9.98
Color		0		Residue		776.	
Odor		Tr.		Free CO_2 (calc.)		184.	
Temperature 55° F.				pH = 6.6			

LABORATORY NO. 115,508

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Fluoride	F	0.2	
				Chloride	Cl	59.0	1.66
Turbidity		0		Alkalinity (as $CaCO_3$)		24.	0.48
Color		0		Hardness (as $CaCO_3$)		111.	2.22
Odor		0		Total Mineral Content		459.	
Temperature 58° F.				pH = 10.35			

NORMAL
McLean County
Oct. 27, 1948

The town of Normal (6983) installed a public water supply in 1898.

Water was obtained originally from two wells located 15 ft. apart in the pumping station near the northeast corner of Ash and Linden St. (or approximately 2500 ft. S. and 250 ft. W. of the N. E. corner of Section 28, T. 24 N., R. 2 E.). The surface elevation is 785t ft. One of these wells was 10 in. and the other 8 in. in diameter. Both wells were 180 ft. deep and had 20 ft. of 8-in. Cook screen placed in the bottom. Each well was equipped with 7 1/2-in. by 24-in. Gould single-acting, triplex deep-well pump with the cylinder placed at a depth of 150 ft., belt driven by a 12-hp. motor.

The non-pumping water level was reported to be 90 ft. in 1912, and 112 ft. in 1918. In 1918 each well was reported to produce 250 gpm.

Analysis of a sample (Lab. No. 23299) collected June 19, 1912, showed the water from these two wells to have a hardness of 12.9 gr.per gal., a residue of 464 ppm., and an iron content of 1.0 ppm.

These wells were reported to have gone dry and were abandoned in 1921. The casings became corroded and the wells caved in.

In 1913, a well was drilled to a depth of 204 ft. and located about 30 ft. northeast of the old wells. This well was 12 in. in diameter. It was reported that water-bearing strata were penetrated at depths of 180 and 195 ft. and the well was equipped with Johnson screens between the depths of 176 and 186ft., and between 192 and 204 ft.

The pumping equipment included an American Well Works turbine pump rated at about 600 gpm. with the bottom of the suction pipe at a depth of 200 ft. Power was furnished by a.40-hp. General Electric motor operating at 1500 rpm.

In 1916 the non-pumping water level was about 133 ft. above the ground surface, and the pump was operated about 12 hr. per day.

In 1918, the non-pumping water level was 135 ft. and pumping was reported to lower the water level about 1 ft. The yield was reported to be 600 gpm.

This well was reported to be seldom used in 1924, and was abandoned in 1931.

Well No. 1 was drilled about 1917, to a depth of 215 ft. and located about 150 ft. northeast of the original wells and about 45 ft. west of Linden St. and 145 ft. north of Ash St. (or approximately 2500 ft. S. and 170 ft. W. of the N. E. corner of Section 28.). This well is 16 in. in diameter with two 13-ft. sections of 12-in. screen installed.

In 1918, the yield was reported to be about 600 gpm., and the non-pumping water level was reported to be 135 ft. In 1920, with the old 12-in. well operating, the non-pumping water level was 158 ft. in Well No. 1. In 1924, the well was reported to produce about 200 gpm. and the non-pumping water level, with pump in Well No. 2 operating, was 178 ft.

Well No. 1 was repaired in 1924 by the Sickel Water Production Co., Aurora. Two 13-ft. sections of 12-in. screen were installed. The water level, with the pump in Well No. 2 operating, was 178 ft. below the ground surface.

The non-pumping water level in 1937 was 78 ft. Methane gas was found to be present in a concentration of 6.5 cu. ft. per 1000 gal.

Prior to 1938, the following pumping equipment was installed: 200 ft. of 6-in. column pipe; 7 5/8-in. od., 10-stage Worthington turbine pump, No. 293041; rated at 210 gpm. against 200 ft. of head at 1750 rpm. and having 8 ft. 3/16-in. overall length; 20-hp. General Electric motor, No. 4827410, operating at 1755 rpm. full load.

The water level, in 1942, was 185 1/2 ft. while pumps in Wells No. 2 and 3 were being operated. In Aug. 1942, the well was reported to produce an average of 54 gpm. and in 1944, 90-95 gpm.

Analysis of a sample (Lab. No. 86869) collected Jan. 12, 1940, showed the water to have a hardness of 13.8 gr. per gal., a residue of 482 ppm., and an iron content of 1.8 ppm.

A dug well has been reported at a location 2600 ft. S. and 330 ft. W. of the N. E. corner of Section 28. This well was reported to be about 20 ft. in diameter and 29.5 ft. deep. The non-pumping water level was reported to be 8 1/2 ft. below the well platform.

Well No. 2 was drilled in 1921 to a depth of 215 ft. by the National Pump and Well Company, Stuttgart, Arkansas, and is located 30 ft. west of Well No. 1. The ground surface elevation is 780± ft.

The well is cased with 18-in. pipe to a depth of 178 ft., and with 12-in. pipe from 176 1/2 to 191 ft., with a lead seal between the casings. A 12-in. brass screen extends from 191 ft. to the bottom of the well.

In 1924, the yield was reported to be 455 gpm.

Sometime prior to 1938, the well was equipped with 199 ft. of 6-in. column pipe; 9 7/16-in. od., 7-stage Layne-Western turbine pump, No. 6173, rated at 330 gpm. against 200-ft. head at 1750 rpm. and having 5 ft. 7 in. overall length; 5 ft. of 6-in. suction pipe; 30-hp. General Electric motor, No. 4826874, operating at 1745 rpm.

The yield was reported to be 204 gpm. from Apr. to July, 1942. In 1944, the well was reported to produce 265 gpm.

Well No. 2 has been out of service for the past few months due to mechanical difficulties resulting from a crooked hole.

Analysis of a sample (Lab. No. 86870) collected Jan. 12, 1940, showed the water to have a hardness of 15.1 gr. per gal., a residue of 497 ppm., and an iron content of 1.2 ppm. Methane gas was found to be present in a concentration of 4.5 cu. ft. per 1000 gal.

Well No. 3 was drilled in 1931 to a depth of 210 ft. by the Layne-North Central Co., Chicago, and is located 60 ft. south and 40 ft. west of Well No. 1. This well is of the gravel-pack type. A 30-in. casing extends to a depth of 185 ft. and the 18-in. screen is 25 ft. long.

When completed, the well produced 500 gpm. for 7-hr. continuous pumping. On Apr. 15, 1931, the non-pumping water level was reported to be 171 ft. below the ground surface.

A short production test was made on Apr. 22, 1931. After pumping at 690 gpm. for 2 hr., the drawdown was 6 ft. from a non-pumping water level of 176 ft.

On Nov. 8, 1944 Well No. 3 was treated with 1000 gal. of 15% hydrochloric acid by the Dowell Co. Before acidizing, the pump broke suction after about 10-minutes operation, and after the treatment, the pump did not break suction when pumping at 455 gpm.

In 1945, the following pump equipment was installed: 206 ft. of 6-in. column pipe; 9 1/2-in., 5-stage American Well Works turbine pump, No. 70828, rated at 500 gpm. against 210 ft. of head and having 4 ft. 6 in. overall length; 210 ft. of 1/4-in. air line; 40-hp. U. S. electric motor.

A production test was made by the American Well Works Co. and the State Water Survey on May 21, 1945. The non-pumping water level was 192 ft. When pumping at 220 gpm. the drawdown was 2 ft., and when pumping at 525 gpm. the drawdown was 6 3/4 ft.

In July or Aug. 1948, the impeller blades were found to be badly worn and holes in the bowls caused from coarse sand or gravel entering the well through a corroded screen. The sand and gravel deposit was bailed out and anew 20-ft. length of Johnson screen was set inside the old screen.

A new bowl assembly was installed and the following assembly is in place: 206 ft. of 6-in. column pipe; 10-in., 5-stage American Well Works turbine pump, having an overall length of 4 1/2 ft.; 210 ft. of 1/4-in. air line; 40-hp. U. S. electric motor.

On Sept. 22, 1948 several short yield tests showed an average discharge of 242 gpm. On Oct. 12, 1948 while pumping at an estimated rate of 240 gpm., the water level was below the bottom of the air line.

Analysis of a sample (Lab. No. 116,140) collected Oct. 12, 1948 after 12 1/2-hr. pumping showed the water to have a hardness of 16.3 gr. per gal., a residue of 452 ppm., and an iron content of 2.3 ppm. Methane gas was found to be present in a concentration of 6.0 cu. ft. per 1000 gal.

In Dec. 1940, Layne-Weatern Co., Chicago, drilled 2 test holes. Test Hole No. 1, located about 100 ft. northeast of the Water Works, was reported to be a good project.

In Feb. 1942, Hayes and Sims, Champaign, drilled 2 test wells. It was reported that Test Hole No. 4, located on the north side of Ch'erry St. between Linden and Oak St., encountered a formation of sand and gravel.

When the hole was completed, the water level was 186 ft. 6 in.

Well No. 4 was drilled in 1942-43 by S. B. Geiger, Chicago at a location about 95 ft. north and 25 ft. east of Test Hole No. 4 (or approximately 1800 ft. S. and 90 ft. E. of the N. W. corner of Section 27). The surface elevation is 785± ft. The

well was originally started 25 ft. west and 65 ft. south of this location, but caving and drilling difficulties caused the hole to be abandoned. The finished well is 216 ft. 8 in. deep.

The hole, casing, and screen record is shown in Table 1.

TABLE 1

Hole Record

48-in. from surface to 100 ft.

Casing and Screen Record

30-in. id. 44-in. od. concrete pipe from 3 to 177 ft.
28-in. steel pipe from 177 to 190 ft.
18-in. wrought iron pipe from 164 to 206 ft.
18-in. Johnson Armco-Iron screen from 206 to 217 ft.

The screen was bailed down, and 17 tons of graded (1/2-in. to 5/8-in.) gravel were used in the envelope around the screen.

A production test was made in cooperation with the State Water Survey on Sept. 15, 1943. For test purposes, the well was equipped with a 6-stage turbine pump with the bottom of the strainer at a depth of 211 ft., and 206 ft. of 1/4-in. air line. The non-pumping water level was 189 ft. below the ground surface and the data in Table 2 were obtained.

TABLE 2

Rate of Production gpm.	Time hr.	Drawdown ft.
200	3	1.7
300	3	2.5
400	3	3.5

The following pumping equipment is in daily service: 210 ft. of 6-in. column pipe; 10-in., 5-stage American Well Works turbine pump, No. 66753, having an over all length of 4 1/2 ft. and a rated capacity of 350 gpm. against 220 ft. of head; 2 ft. of 6-in. tapered strainer; 200 ft. of air line, 30-hp. U. S. electric motor.

In a number of yield tests made Sept. 22, 1948, the, average discharge was 263 gpm. On Oct. 12, 1948, after 13 1/3-hr. pumping at an estimated rate of 250 gpm., the water level was 191 ft. below the pump base.

Analysis of a sample (Lab. No. 115,323) collected July 20, 1948 after 2 1/4-hr. pumping, showed the water to have a hardness of 18.5 gr. per gal., a residue of 505 ppm., and an iron content of 2.2 ppm.

Well No. 5 was completed in July 1947 to a depth of 35 ft. by Hayes and Sims, Champaign, and is located about 120 ft. north of Taylor St. (extended) and 18 ft. west of Beech St. (or approximately 2170 ft. N. and 1300 ft. E. of the S. W. corner of Section 27). The surface elevation is 775± ft. Coarse gravel was encountered from 9 to 34 ft.

The well is cased with 26 1/2 ft. of 16-in. od. pipe. The Johnson Everdur screen is 10-ft. 11-in. overall length with 9 1/2 ft. exposed. The upper 5 ft. of the screen has No. 60 slot openings and the lower 5 ft. has No. 80 slots. The top of the casing extends 15 in. above the ground surface.

A production test was made in cooperation with the State Water Survey on Aug. 1, 1947. For test purposes, the well was equipped with a Dayton-Dowd 4-in. horizontal centrifugal pump, belt-driven by a Hercules gas engine. After 7-hr. pumping the well produced 450 gpm. with a drawdown of 10.26 ft. from a non-pumping water level of 7.28 ft. below the top of the casing. Eight hr. after the start of the test, the water level in rotary test hole No. 1, located 155 ft. west of Well No. 5, was lowered from 7.35 to 8.37 ft.

The permanent pump base is 5 1/2 ft. above normal ground level and the pumping equipment, in place, consists of 6-in. column pipe, 8-in., 3-stage American Well Works turbine pump, No. 73320, having a rated capacity of 300 gpm. against a head of 75 ft.; 10 ft. 8 in. of suction pipe and strainer; defective air line; 10-hp. U. S. electric motor.

The overall length from the pump base to the bottom of the suction is 38 ft. In a number of yield tests made Sept. 22, 1948, the average discharge was 420 gpm. On Oct. 12, 1948 after 4 1/2-hr. pumping at an estimated rate of 300 gpm. (pump throttled) the water level was 26 ft. below the pump base.

Analysis of a sample (Lab. No. 116,141) collected Oct. 12, 1948 after 4 1/2-hr. pumping at 300 gpm. showed the water to have a hardness of 24.9 gr. per gal., a residue of 475 ppm., and an iron content of 1.8 ppm.

All water is aerated, filtered, softened and chlorinated. Analysis of a sample (Lab. No. 116,352), collected Oct. 12, 1948 showed the treated water to have a hardness of 5.5 gr. per gal., a mineral content of 474 ppm., and an iron content of 0.3 ppm.

Pumpage is estimated to average 716,280 gpd.

LABORATORY NO. 116,140

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.3		Silica	SiO_2	27.7	
Manganese	Mn	0.1		Fluoride	F	0.3	
Calcium	Ca	60.4	3.02	Chloride	Cl	8.0	0.23
Magnesium	Mg	30.9	2.54	Nitrate	NO_3	0.5	0.01
Ammonium	NH_4	5.1	0.29	Sulfate	SO_4	2.3	0.05
Sodium	Na	67.2	2.92	Alkalinity (as $CaCO_3$)		424.	8.48
Turbidity		30		Hardness (as $CaCO_3$)		278.	5.56
Color		20		Residue		452.	
Odor		0		Free CO_2 (calc.)		55.	
Temperature 54° F.				pH = 7.3			

Correlated driller's log of Well No. 4 furnished by the State Geological Survey:

Formation	Thickness ft.	Thickness in.	Depth ft.	Depth in.
Pleistocene system				
Soil and clay	26		26	
Sand and gravel, dirty	2		28	
Clay	62		90	
Rock gravel and sand	7		97	
Clay	51		148	
Sand, gray	1		149	
Clay	9		158	
Sand, dirty, rocks	2		160	
Sand, gray, rocks	5		165	
Clay	16		181	
Sand, gray, dry	4		185	
Sand, gravel boulder clay, some water	6		191	
Gravel, coarse, water, gas	11		202	
Sand, hard and clay, seemingly dry	3		205	
Sand and gravel, some clay, water	5		210	
Sand and gravel, very good	7	8	217	8
Clay, boulders	at		217	8

LABORATORY NO. 116.141

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.8		Silica	SiO_2	14.6	
Manganese	Mn	0.2		Fluoride	F	0.3	
Calcium	Ca	109.1	5.46	Chloride	Cl	10.0	0.28
Magnesium	Mg	37.7	3.10	Nitrate	NO_3	0.6	0.01
Ammonium	NH_4	0.3	0.02	Sulfate	SO_4	120.5	2.51
Sodium	Na	6.9	0.30	Alkalinity (as $CaCO_3$)		304.	6.08
Turbidity		20		Hardness (as $CaCO_3$)		428.	8.56
Color		0		Residue		475.	
Odor		0		Free CO_2 (calc.)		98.	
Temperature 54° F.				pH = 6.9			

LABORATORY NO. 116,352

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.3		Fluoride	F	0.5	
				Chloride	Cl	15.0	0.42
Turbidity		4		Alkalinity (as $CaCO_3$)		396.	7.92
Color		0		Hardness (as $CaCO_3$)		94.	1.88
Odor		0		Total Mineral Content		474.	
Temperature 55.5° F.				Free CO_2 (calc.)		20.	
				pH = 7.7			

A public water supply was installed in 1929 for the village of North Aurora (772).

Water was obtained from wells owned by the Exposition Grounds until Sept. 1938, when a well drilled for the village by S. B. Geiger, Chicago, was placed in service. This well is located about 55 ft. south of State St. and 135 ft. east of Stone Ave. (or approximately 1350 ft. S. and 350 ft. E. of the N. W. corner of Section 3, T.38 N., R. 8 E.). The elevation of the ground surface is 700t ft.

Sample-study log of well drilled in 1938 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Dry sand"	37	37
Silurian system		
Niagaran-Alexandrian series		
"Lime"	5	42
"Shale"	6	48
Dolomite	46	94
Ordovician system		
Maquoketa dolomite and shale	146	240
Galena-Platteville limestone and dolomite	336	576
St. Peter sandstone	231	807

The driller reported a 12-in. drive pipe to a depth of 49 ft. and 10-in. casing from the surface to 300 ft. below which the hole was finished 10-in. diameter to the bottom.

A production test was made on Sept. 6-7, 1938. When pumping at 121 gpm. for a period of 9 hr. the drawdown was 83 ft. from a non-pumping water level of 143 ft. below the pump base. On decreasing the pumping rate to 106 gpm. the drawdown was 77 ft. On Aug. 12, 1947 the water level was 181 ft. after an idle period of 12 hr. After 1 1/4-hr. pumping at 100 gpm., the drawdown was 65 ft.

The existing pump installation, made in Sept. 1938, is: 260 ft. of 4 1/2-in. column pipe; 7-in., 15-stage American Well Works turbine pump, No. 61772, having a rated capacity of 100 gpm. against 360 ft. of head; the overall length of the pump is 8 ft. 4 in.; 10 ft. of 5-in. suction pipe; 273 ft. 4 in. of 1/4-in. copper tubing air line; 15-hp. General Electric motor.

Analysis of a sample (Lab. No. 111,525) collected Aug. 12, 1947 after 1 1/4-hr. pumping at 100 gpm., showed this water to have a hardness of 14.8 gr. per gal., a total mineral content of 367 ppm., and an iron content of 0.2 ppm.

Metered pumpage for North Aurora averaged 27,600 gpd. in June 1947.

There are 3 wells located on the Exposition Grounds, exclusive of an old.4-in. abandoned deep well, which was reported to be located at the east end of the race track stands, and originally flowed. It was used as a drinking fountain. Two of these 3 wells, one called North and the other West, are each reported to be 190 ft. deep and to have a combined productive capacity of 50 gpm. The third well which was deepened from 821 ft. to 865 ft. and "shot" by Mr. Morey is the main source of the water supply. This well furnished water to the village of North Aurora until the village owned well was placed in service in Sept. 1938.

The North Well, which is located approximately 1000 ft. N. and 3200 ft. E. of the N. W. corner of Section 4, T. 38 N., R. 8 E., is not in service, but is held as an emergency unit.

The West Well is located approximately 700 ft. N. and 2300 ft. E. of the N. W. corner of Section 4 at a ground elevation of 700t ft. On Aug. 1, 1946, the standing water level was 160 ft. and the well was 190 ft. deep. After pumping 72 hr. at 20 gpm. the drawdown was 2 ft. This well is used to supply Aurora Downs, racing park.

Pumpage, during the racing season, is estimated at 6000 gpd.

Well No. 3 supplies the Exposition Grounds, including the hotel and swimming pool, and is located approximately 750 ft. N. and 2600 ft. E. of the N. W. corner of Section 4. The elevation of the pump base is 700± ft.

The existing pump installation, made in 1939, is: 288 ft. of 8-in. column pipe; 12-in., 22-stage American Well Works turbine pump, No. 51444, rated at a capacity of 400 gpm. against 415 ft. of head at 1150 rpm.; 100-hp. General Electric motor.

A pumping water level of 240 ft. below the pump base was reported in 1936.

Pumpage at the Exposition Grounds is estimated to average 100,000 gpd. during the summer months and 15,000 gpd. during the winter months.

LABORATORY NO. 111,525

	ppm.		ppm.
Iron (total) Fe	0.2	Fluoride F	0.9
Turbidity	0	Chloride Cl	6.0
Color	0	Alkalinity (as $CaCO_3$)	288.
Odor	0	Hardness (as $CaCO_3$)	253.
Temperature 54.0° F.		Total Mineral Content	367.
pH = 7.8		Free CO_2 (calc.)	12.

NORTH CHILLICOTHE
Peoria County
Jan. 16, 1947

A public water supply was installed By the village of North Chillicothe (1216) in 1941.

At that time a well was drilled by Mike Ebert, Washington, and located northwest of the intersection of Wilmot St. and Santa Fe Ave. (or approximately 900 ft. S. and 2300 ft. W. of the N. E. corner of Section 20, T. 11 N., R. 9 E.).

Sample-study log of well drilled in 1941 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Silt and soil	5	5
Sand and gravel, slightly silty	15	20
Gravel, sandy, clean	15	35
Sand, and gravel in part, clean	65	100
Pennsylvanian system		
Limestone, some sandstone	5	105

The ground surface elevation at the well is 523± ft. The well is reported to be 111 ft. deep, measuring from the top of the pump base which is 6 ft. above the ground surface. A 10-in. casing was set from +6 to 92 ft. with 14 ft. of exposed screen between depths of 92 and 106 ft.

The well is equipped with: 80 ft. of 6-in. column pipe; 7 1/2-in., 6-stage Worthington turbine pump, No. T-1923, rated at 200 gpm.; the overall length of the pump is 5 1/2 ft.; 10 ft. of 7-in. suction pipe; 20-hp. General Electric motor.

A short production test was made under the supervision of the State Water Survey on Apr. 8, 1942. The non-pumping water level was 70 1/2 ft. below the pump base, and the drawdown was 11 ft. after pumping 4 1/2 hr. at 271 gpm.

On Jan. 16, 1947 the non-pumping water level showed 8 ft. on the air pressure gauge, and the drawdown was below the bottom of the airline, the length of which was not known.

Analysis of a sample (Lab. No. 108,930), collected Jan., 16, 1947 after pumping 4 1/2 hr. at 271 gpm., showed the water to have a hardness of 17.0 gr. per gal., a residue of 351 ppm., and an iron content of 0.1 ppm.

The amount of water pumped is measured by a Worthington-Gamon turbine meter, and pumpage in Jan. 1947 averaged 45,000 gpd. The pump operates 4 to 5 hr. daily at 185 gpm.

The water mains are connected to the mains in Chillicothe, so that in case of emergency, water can be pumped to, or received from, the water works at Chillicothe.

LABORATORY NO. 108,930

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	17.1	
Manganese	Mn	0.0		Fluoride	F	0.3	
Calcium	Ca	71.7	3.59	Chloride	Cl	15.0	0.42
Magnesium	Mg	27.4	2.25	Nitrate	NO_3	13.8	0.22
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	97.5	2.03
Sodium	Na	7.8	0.34	Alkalinity	(as $CaCO_3$)	176.	3.52
Color		0		Hardness	(as $CaCO_3$)	292.	5.84
Odor		0		Residue		351.	
Turbidity		0					
Temperature 57° F.							

NORTH LAKE VILLAGE
Cook County
Jan. 2, 1947

The community water supply system, installed in 1940, is owned and operated by the North Lake Village, Unincorporated, (750) Water Co. It serves a residential section lying north of North Ave. and east of Wolf Rd. and supplied 407 homes in 1945.

Water is obtained from a well 855 ft. deep, drilled in 1940 by John Iten Co., St. Charles. It. is located about 1 block north of North Ave. at the northeast corner of Roy and Park View Ave. (or approximately 440 ft. N. and 2050 ft. E. of the S. W. corner of Section 32, T. 40 N., R. 12 E'.). The elevation of the ground surface at the well is 640± ft.

Correlated driller's log of well drilled in 1940 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Glacial drift	56	56
Silurian system		
Niagaran-Alexandrian series		
Limestone	264	320
Ordovician system		
Maquoketa and Galena formations		
Shale (probably dolomite in lower portion)	248	568
Galena-Platteville formations		
Limestone	277	845
St. Peter formation		
Sandstone	10	855

(Note: Driller lost 2 sets of drilling tools and stopped at depth of 855 ft.)

The hole and casing diameters were reported as shown in Table 1.

TABLE 1

Hole Record

15-in. from surface to 320 ft.
10-in. from 568 to 855 ft.

Casing Record

16-in. wi. casing from surface to 56 ft.
12-in. liner from 320 to 568 ft.

A 34-hr. production test was made on June 5 and 6, 1941. Before the test, the water level was 75 ft. below the pump base; and after 10-hr. pumping at 100 gpm., the drawdown was 191 ft. 9 in.

The following pump equipment, installed in 1941, is still in place: 320 ft. of 4 1/2-in. column pipe; 6-in., 35-stage Pomona turbine pump rated at 160 gpm. against 440 ft. of head; the overall length of the pump is 13 ft.; 320 ft. of air line; 20-hp. Westinghouse electric motor.

On Feb. 25, 1945 the following water levels below the pump base were reported: 238 ft. after a 12-hr. idle period; 282 ft. after 12-hr. pumping at 100 gpm.

A test well was drilled by S. B. Geiger Co., Chicago, in Dec. 1946. It is located at Fullerton Ave. and Jerome Rd. (or approximately 80 ft. S. and 1400 ft. W. of the N. E. corner of Section 31, T.40 N., R. 12 E.). The well is 316 ft. deep below a ground surface elevation of 645t ft.

The well was cased with 28 ft. of 12-in. galvanized-iron pipe, below which the hole was 12 in. in diameter to the bottom. The top of the pump base was about 3 ft. above ground level.

On Jan. 2, 1947 a production test was made by the State Water Survey with the following pump assembly installed in the well: 253 ft. 9 in. of 6-in. column pipe; 8-in., Sterling turbine pump rated at 400 gpm. at 1700 rpm.; the overall length of the pump was 6 1/2 ft.; 254 ft. 9 in. of 1/4-in. galvanized-iron air line; 20 ft. of 6-in. suction pipe; 45-hp., 4-cylinder Buda gasoline engine rated at 900 rpm.

Before the test, the water level was 19 ft. below the pump base, and after 8-hr. pumping at 133 gpm., the drawdown was 119 ft. After the test, 107 ft. of the drawdown was eliminated within 10 min.

Analysis of a sample (Lab. No 108,814), collected Jan. 2, 1947 after 6 1/2-hr. pumping at 133 gpm., showed this water to have a hardness of 27.6 gr. per gal., a residue of 670 ppm., and an iron content of 1.5 ppm. The temperature and general character of the water is typical for water from this depth in this vicinity.

The pumpage in 1945 was estimated to average 42,000 gpd. Maximum demands of 84,000 gpd. are made only when sprinkling during the summer.

The water is chlorinated.

LABORATORY NO. 108,814

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.5		Silica	SiO_2	19.2	
Manganese	Mn	0.0		Fluoride	F	0.5	
Calcium	Ca	97.9	4.90	Chloride	Cl	6.0	0.17
Magnesium	Mg	55.5	4.56	Nitrate	NO_3	0.9	0.01
Ammonium	NH_4	0.6	0.03	Sulfate	SO_4	278.9	5.80
Sodium	Na	42.6	1.85	Alkalinity	(as $CaCO_3$)	268.	5.36
Color		0		Hardness	(as $CaCO_3$)	473.	9.46
Odor		0		Residue		670.	
Turbidity		100					
Temperature		50.6° F.					

The public water supply was installed by the village of North Utica (1019) about 1883. Until 1918, water was obtained from 5 artesian wells, the locations of which are not definitely known, but were approximately as in Table 1.

The first well was drilled in 1883, and the other 4 were drilled at later dates. All were reported to be from 225 to 350 ft. in depth and cased with 6-in. iron pipe to a depth of about 40 ft.

In each well a 4-in. drop pipe about 140 ft. long was sealed in the casing with a wooden wedge, and the water flowed directly into the distribution system leading from that well. The distribution system from each well was separate, and water flowed by natural pressure and gravity to the houses. Leverett, in "Illinois Glacial Lobe" published in 1889, stated that water raised 50 ft. above the ground surface, and that the strongest flow was estimated to be 150 gpm.

In 1913 the hydrostatic pressure at the ground surface was 20 ft., and in 1918 the pressure became inadequate to supply the existing distribution system.

Water from these wells was found (Lab. No. 23731 and 26696) to have a hardness of 16.9 gr. per gal., a residue of 384 to 388 ppm. and an iron content of 0.5 to 1.3 ppm.

The 5 wells have been abandoned; some of them have been capped.

In 1919 a new well and distribution system were completed. The well was located about 50 ft. west of Mill St. on a line with Grove St. (or approximately 1200 ft. N. and 200 ft. E. of the S. W. corner of Section 9, T. 33 N., R. 2 E.). The well was drilled by Wm. Faulkner, Joliet, to a depth of 618 ft. and was originally cased with 6-in. wrought-iron pipe from the surface to a depth of 400 ft. The hole was 6 in. in diameter below the casing. The ground surface elevation is 480± ft.

The well was cased in 1923, and it is reported that the last time the well was recased in 1925, it was cased with 16-in. cast-iron pipe to a depth of 80 or 85 ft.

Water has been pumped by 3 centrifugal pumps which are: a 3-in. by 2 1/2-in. American Well Works pump, No. 57800, rated at 150 gpm. against 69 ft. of head. The pump is driven by a 5-hp., 1735 rpm. General Electric motor; a Lea Courtenay pump, No. 2908, rated at 250 gpm. against 150 ft. of head. The pump is driven by a 20-hp., 1730 rpm. Wagner Electric motor; a Lea Courtenay pump, No. 908, rated at 250 gpm. against 150 ft. of head.

In June, 1947 the Lea Courtenay pumps were being removed and replaced by 2 Aurora centrifugal pumps with 4-in. intake and 3-in. discharge.

On Dec. 10, 1920 a pressure gauge, set at 2 ft. above the floor of the pump house, indicated 38 ft. Water was flowing into the distribution system at the time. The flow was shut off from the distribution system and turned into the reservoir, when, for a 40-min. period, the flow was estimated to be 325 gpm. On Mar. 3, 1927 the pressure gauge recorded 22 ft. In July 1938 the static water level was at ground surface, and one of the centrifugal pumps was operated continuously to maintain pressure in the system.

Analysis of a sample (Lab. No. 110,852) collected June 27, 1947 after 3-hr. pumping, showed the water from this well to have a hardness of 22.5 gr. per gal., a residue of 627 ppm., and an iron content of 0.2 ppm. A previous analysis (Lab. No. 44314) of a sample collected in 1920 was found to have a similar mineral composition excepting that the iron content was 2.0 ppm.

The water is nottreated.

Pumpage is estimated to average 13,000 gpd.

A well was drilled for Reynolds Quarry Co. in 1916 and located about 1780 ft. east of the village well in North Utica. The ground elevation at the well site is 475± ft.

Correlated driller's log of the Reynolds Quarry Co. well furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene and Pennsylvanian systems		
Blue shale	28	28
Ordovician system		
Shakopee limestone	80	108
New Richmond sandstone	170	278
Oneota dolomite	180	458
Cambrian system		
Jordan sandstone	84	542

TABLE 1

West side of Division St., about 175 ft. north of Lincoln St.
West side of Mill St., about 250 ft. north of Church St.
North side of Church St. at Center St. intersection.
Center of Clark St. at Griffin St. intersection.
Center of Division St. at Johnson St. intersection.

LABORATORY NO. 110,852

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	15.1	
Manganese	Mg	0.0		Fluoride	F	0.5	
Calcium	Ca	98.0	4.90	Chloride	Cl	170.0	4.79
Magnesium	Mg	34.4	2.83	Nitrate	NO_3	1.2	0.02
Ammonium	NH_4	0.5	0.03	Sulfate	SO_4	20.8	0.43
Sodium	Na	91.1	3.96	Alkalinity	(as $CaCO_3$)	324.	6.48
Color		0		Hardness	(as $CaCO_3$)	387.	7.74
Odor		0		Residue		627.	
Turbidity		0		Temperature	55.5° F.		

The Cicero Avenue Subdivision was incorporated as village of Oak Forest (825) in June, 1947 and is located east and west of Cicero Ave. between 151st. and 157th St. The water supply and distribution system was installed in 1927 and is now operated by the Suburban Water Co.

Water is obtained from a well located on Lot 40 of Block 17 (or approximately 1650 ft. S. and 1050 ft. E. of the N. W. corner of Section 15, T. 36 N., R. 13 E.). The elevation of the surface of the ground is 650± ft. This well was reported drilled by a Mr. Palmer in 1927 to a depth of 820 ft. No other data on its construction are available.

The following pump installation is in service: 110 ft. of 4 1/2-in. id. wrought-iron column pipe; 7-in., 8-stage American Well Works turbine pump rated at 85 gpm. against 202 ft. of head; 20 ft. of 5-in. id. suction pipe; 15-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 107,220) collected July 25, 1946 after 10-min. pumping at 85 gpm., showed this water to have a hardness of 27.5 gr. per gal., a residue of 760 ppm., and an iron content of 1.2 ppm. The temperature and general mineral compositions of this water is not unusual for waters from the dolomite below the drift in this vicinity.

A non-pumping water level of 18 ft. below the pump base was reported in 1931 and also in 1941. The pumpage is not metered but is estimated to average 75,000 gpd.

The Cook County Infirmary, since 1935, has obtained Lake Michigan water from the city of Chicago.

LABORATORY NO. 107,220

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.2		Silica	SiO_2	24.0	
Manganese	Mn	0.0		Fluoride	F	0.3	
Calcium	Ca	140.1	7.02	Chloride	Cl	8.0	0.23
Magnesium	Mg	66.0	5.42	Nitrate	NO_3	1.6	0.03
Ammonium	NH_4	0.5	0.02	Sulfate	SO_4	255.5	5.32
Sodium	Na	14.7	0.64	Alkalinity (as $CaCO_3$)		376.	7.52
Color		0.		Hardness (as $CaCO_3$)		472.	9.44
Odor		Tr.		Residue		760.	
Turbidity		40.		Temperature 51.2° F.			

OAKWOOD
Vermillion County
August 11, 1949

A public water supply was installed by the village of Oakwood (555) in 1939.

Water is obtained from a well drilled in Dec. 1938 to a depth of 71 ft. by Layne-Western Co., Chicago, and located in the northeastern part of the village, approximately 600 ft. N. and 2000 ft. W. of the S. E. corner of Section 12, T. 19 N., R. 13 W. The elevation of the ground surface at the well-site is 646± ft.

The well was cased with 15-in. pipe from the surface to 55 ft. and with 7-in. pipe from the surface to 56 ft. below which was placed 15 ft. of 7-in. Layne screen. Gravel was packed between the casings.

A production test was made by the State Water Survey on Dec. 29, 1938. Before the test the static water level was 11 1/2 ft. below the top of the 15-in. casing. After 4-hr. pumping at rates decreasing from 48 to 44 gpm. the drawdown was 49 1/2 ft. and after an additional 4-hr. pumping at rates decreasing from 44 to 37 gpm. the final drawdown was 44 1/2 ft.

The pumping equipment consists of 52 ft. of 3-in. screwed column pipe; 6-in., 11-stage Layne-Bowler turbine pump, No. 9288, having an overall length of 5 ft.; 10 ft. of 3-in. suction pipe; 5-hp. General Electric motor, No. 5429317. The pump has not been out for about 5 yr. and no recent water levels are available. No air line is installed.

Analysis of a sample (Lab. No. 119,115) collected Aug. 11, 1949 after 30-min. pumping at 40 gpm. showed this water to have a hardness of 20.3 gr. per gal., a residue of 465 ppm., and an iron content of 3.1 ppm.

The water is aerated and filtered.

Pumpage is estimated to average 15,000 gpd.

LABORATORY NO. 119,115

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	3.1		Silica	SiO_2	20.9	
Manganese	Mn	Tr.		Fluoride	F	.3	
Calcium	Ca	83.2	4.16	Chloride	Cl	25.0	.71
Magnesium	Mg	34.1	2.80	Nitrate	NO_3	.3	Tr.
Ammonium	NH_4	1.7	.10	Sulfate	SO_4	18.1	.38
Sodium	Na	48.5	2.11	Alkalinity (as $CaCO_3$)		404.	8.08
Turbidity		7		Hardness (as $CaCO_3$)		348.	6.96
Color		0		Residue		465.	
Odor		Tr.		Temperature 55° F.			

The public water supply was installed by the village of Odell (927) about 1898.

At that time a well was drilled to a depth of 1298 ft. and located on Front St. just south of Hamilton St. (or approximately 1400 ft. S. and 970 ft. E. of the N. W. corner of Section 10, T. 29 N., R. 6 E.). The ground surface elevation is 721± ft.

The well was 6 in. in diameter at the top and 4 in. at the bottom, and was reported to be cased to a depth of 1000 ft.

Water level in 1914 was 185 ft. below the ground surface, and in 1923 was 250 ft.

The well was not used to any great extent after 1923 although an air lift pump is still in place to serve in an emergency.

In 1911 a second well was drilled to a depth of 1360 ft. by J. P. Miller Artesian Well Co., Brookfield, and located about 10 ft. north of the old well. The well was placed in service in 1913. The hole and casing record is shown in Table 1.

TABLE 1

Hole Record

12-in.	from	0 to	410 ft.
10-in.	from	410 to	1145 ft.
8-in.	from	1145 to	1360 ft.

Casing Record

12-in.	from	0 to	168 ft.
10-in.	from	164 to	410 ft.
8-in.	from	400 to	1110 ft.
8 1/4-in.	from	1110 to	1145 ft.

Lead seal was placed between the 12 and 10-in. casings and between the 10 and 8-in. casings. The 8-in. casing was wrapped with a Marlin packer where it was sealed into the 8 1/4-in. casing.

Until 1935 water was pumped from this well by air lift. The pumping installation now consists of 320 ft. of 5-in. column pipe; 7 1/2-in., 18-stage Peerless turbine pump, No. 5788, rated at 125 gpm. against 320 ft. of head; the overall length of the pump is 7 ft. 10 in.; 35 ft. of suction pipe; 20-hp., 1800 rpm. U. S. electric motor.

In 1937 the pump was repaired and new oil tubing was installed because the old tubing had several holes. The water level was 180 ft.

In Nov. 1945 a geophysical report on the logging of the well was made by the State Geological Survey. The total depth was reported to be 1341 ft. showing a 19-ft. fill in the bottom of the well. The uncased portion of the well between 1144 ft. and the bottom was found to be in the St. Peter sandstone. The water level was 209 ft. below the surface.

When the pump was placed back in the well, the old oil tubing and bearings and 50 ft. of column pipe were replaced with new material. The non-pumping water level was measured in Nov. 1945 at 209 ft. below the surface. The water at times has been pumped below the bottom of the suction pipe.

Analyses of samples (Lab. No. 104,783-104,791) collected for a quality-source test on Nov. 16, 1945, are shown in Table 2.

The first water removed three minutes after starting the pump was the residual water left in the pump and column pipe from the previous pumping period.

Between four and six minutes after starting operation, the water was obtained from the space, immediately opposite and above the end of the suction pipe. This was water from the lower Pennsylvanian or the upper Silurian formation. This water is shown to be very highly mineralized having a total mineral content greater than 9000 ppm. and having no odor of hydrogen sulfide. A definite leg in the rate of temperature rise is noted at this time.

A second lag in rate of temperature rise is noted just before the end of 20 minutes of operation and at this time a slight but definite rise in the chloride-to-sulfate ratio is noted. This rise is caused by the slight but decided drop in the sulfate concentration at this time.

At this time the water contained a very small proportion of water probably from a leak at the packer between the two casings. It was expected that this change in composition would not be very great since the pump was idle only 15 hours before starting and, therefore, permitted only some 7 or 8 gallons of this colder water from the third source to enter the well. It can be inferred from these data that this third source water is of a low sulfate, low chloride content and moderately low hardness. Such water would be expected *to* be

present in any sand and gravel at the base of the drift at about the point where the packer is placed.

The remaining samples collected after 9 A.M. show a continued decrease in mineral content and a rise in temperature indicating that a greater proportion of the water was coming from the bottom of the well. At the end of 2 1/2 hours it was estimated that about 90 per cent of the water was from the lower portion of the well and approximately 10 per cent of the water was from the lower Pennsylvanian or the top of the Silurian formation. This final mixture had a very strong odor of hydrogen sulfide.

Analysis of a sample (Lab. No. 110,310) collected May 14, 1947 after the pump had been operating three hours, showed the water to have a hardness of 8.7 gr. per gal., a residue of 2389 ppm., and an iron content of 0.4 ppm.

The water is not treated but is sprayed from a pipe leading to the reservoir to remove the hydrogen sulfide.

Pumpage is estimated at 35,000 gpd.

An electrical earth resistivity survey was made in July 1945 by the State Geological Survey. The survey extended for three miles to the north of the village, four miles to the east and to the west, and five and one-half miles south.

Sample-study log of well drilled about 1898 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
No record	168	168
Pennsylvanian system		
Shale, some limestone and thin sandstone beds	222	390
Silurian system		
Niagaran-Alexandrian limestones	60	450
Ordovician system		
Maquoketa shale and limestone	170	620
Galena-Platteville limestone	380	1000
St. Peter sandstone	298	1298

TABLE 2

Time	Temp. °F.	Fe ppm.	Cl ppm.	SO_4 ppm.	Alk. ppm.	Hd. ppm.	Res. ppm.
8:34 AM.		Started pumping					
8:37	61	6.7	3550	78.8	248	439	7352
8:38	61.7	2.5	4500	85.4	304	514	9200
8:40	62	3.1	4600	83.1	296	527	9275
8:41		2.3	2900	59.7	324	352	6000
8:42	63	2.2	2300	50.8	336	270	4935
8:47	63.7	1.4	2050	50.0	332	250	4519
8:51	64	1.2	2000	47.9	328	247	4472
9:10	65.3	0.7	1550	49.6	328	196	3206
11:15	65.5	0.4	1150	49.4	332	162	2814

LABORATORY NO. 110,310

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.4		Silica	SiO_2	12.6	
Manganese	Mn	0.0		Fluoride	F	3.5	
Calcium	Ca	37.4	1.87	Chloride	Cl	1200.0	33.84
Magnesium	Mg	13.4	1.10	Nitrate	NO_3	0.6	0.01
Ammonium	NH_4	1.2	0.07	Sulfate	SO_4	38.7	0.80
Sodium	Na	892.6	38.81	Alkalinity (as $CaCO_3$)		360.	7.20
Color		0		Hardness (as $CaCO_3$)		149.	2.98
Odor (at well)		H_2S		Residue		2389.	
Turbidity		20		Temperature 65° F.			

The public water supply for the city of Oglesby (3938) was started in 1912 and actually installed in 1915-16.

In 1912, some test wells were drilled in an attempt to locate a satisfactory supply. The first test well was located east of town in the bottom land of the Vermilion River. This well was 45 ft. deep with a 12-ft. water-bearing stratum of fine sand overlying clay. Two test wells were drilled south of town. One well was 60 ft. deep, and the other 90 ft., both wells penetrating loam, and red. and blue clay. The prospects were that only a limited supply of water could be obtained from the Vermilion River bottom lands. A test well was drilled in the Illinois River bottoms about 1 1/2 to 2 miles north of town and a short distance from the foot of the bluffs. The drilling penetrated 26 ft. of loam and clay, and 14 ft. of sand and gravel but did not pass through the entire gravel stratum.

Analysis of a sample (Lab. No. 24710) collected Feb. 5, 1913 after pumping four hours by hand pump, showed the water from this test hole to have a hardness of 67 gr. per gal., a mineral content of 1622 ppm., and an iron content of 1.0 ppm.

Water is now obtained from two wells located at the pumping station.

Well No. 1 is located approximately 650 ft. S. and 1600 ft. E. of the N. W. corner of Section 36, T. 33 N., R. 1 E. It was drilled by H. H. Adkins, Sullivan, Ind., in 1915 to a depth of 1645 ft. below a ground surface elevation of 630± ft. The top of the casing is in a pit three feet below the floor of the station. An 18-in. od. casing extends from 3 to 88 ft.; a 15-in. od. casing extends from 3 to 338 ft.; a 10-in. casing from 307 to 567 ft.; and an 8-in. casing from 432 to 880 ft. The hole was 8 in. in diameter below the casing. Packers were placed between the 15 and 10-in. casings and between the 10 and 8-in. casings. Water was found at 815 ft. between depths of 875 and 925 ft. and in the St. Peter sandstone.

The well was originally equipped with a deep-well pump with a 9 1/2-in. cylinder set at 200 ft. During a 13-hr. test, the production was reported to be 350 gpm. Apparently that rate of production did not continue because it became necessary to lower the cylinder to 280 ft., and in 1917 the rate was reported to 175 gpm.

The pump was operated about six hours per day. An air lift was installed in 1921, and in 1925 the production was reported to be 227 gpm.

In Aug. 1931 the well was reported to be in continuous service and was producing 275 gpm., but a test in Dec. 1931 indicated a production of 170 gpm. The air lift was removed, and an obstruction was found at 980 ft. depth.

A new well was finally completed in 1932, and Well No. 1 was used as a standby unit until 1940 when it was repaired by J. P. Miller Artesian Well Co., Brookfield. The repairs were necessary because the water became turbid. Analysis of a sample (Lab. No. 86364) collected Sept. 19, 1939, showed a chloride content of 1455 ppm., a hardness of 10.7 gr. per gal., a mineral content of 2858 ppm., and an iron content of 7.6 ppm. The character is not representative of waters from the St. Peter and the Galesville sandstones.

In cleaning the well, an obstruction was found at 960-ft. depth. A 6 1/4-in. od. liner was installed from 813 to 1259 ft. After the repairs had been made, new pumping equipment was installed as follows: 340 ft. of 6-in. column pipe; 7-stage American Well Works turbine pump, No. 63476, rated at 250 gpm. against 330 ft. of head; the overall length of the pump is 6 ft.; 20 ft. of 6-in. suction pipe; 340 ft. of 1/4-in. air line; 30-hp. U. S. electric motor, No. 187872, rated at 1500 rpm.

A record of the water levels, as measured from the pump base, and the pumping rates, is given in Table 1.

Analysis of a sample (Lab. No. 111,049), collected July 11, 1947 after 7 1/2-hr. pumping, showed the water from Well No. 1 to have a hardness of 13.3 gr.per gal., a residue of 1422 ppm., and an iron content of 0.10 ppm.

Well No. 2 is located about 200 ft. west of No. 1 and was drilled in 1931 by Layne North Central Co., Chicago, to a depth of 1700 ft. Upon completion, the yield rate was 115 gpm. and then diminished to 90 gpm. The contract for a well had specified a production of 350 gpm. The pump was removed, and three cave-ins were found between depths of 975 and 1255 ft. The caved material was cleaned out and the casing replaced. Subsequently the production was 170 gpm. In an effort to increase the supply to at least 350 gpm., the Sewell Well Drilling Co., St. Louis, Mo., deepened the well in 1932-1933 to 2784 ft.

The pumping equipment consists of: 170 ft. of 7-in. column pipe; 7-stage Layne & Bowler turbine pump, No. 6092, rated at 350 gpm. against 205 ft. of head; the overall length of the

pump is 6 ft.; 20 ft. of 6-in. suction pipe; 175 ft. of air line; 50-hp., 1750 rpm. U.S. electric motor.

The hole and casing diameter record is shown in Table 2.

TABLE 2

Hole Record

10-in. from 568 to 1715 ft.
8-in. from 1715 to 2784 ft.

Casing Record

20-in. od. from 0 to 102 ft.
16-in. od. from 57 to 306 ft.
13-in. od. from 289 to 568 ft.
10-in. id. from 541 to 880 ft.
8-in. liner from 906 to 1715 ft.

A record of the water levels, as measured from the pump base, and the pumping rates, is given in Table 3.

While the pumping equipment was out from May 17 to 27, 1946, the State Water Survey installed an automatic recorder in the well. The water level raised steadily from 120.6 on the first day to 119.4 on May 27, and very little interference was recorded from Well No. 1 which was furnishing the city water supply during this period.

Analysis of a sample (Lab. No. 110,979) collected July 8, 1947 after 20-min. pumping, showed the water in Well No. 2 to have a hardness of 18.7 gr. per gal., a residue of 878 ppm., and an iron content of 0.8 ppm.

The water from both wells is aerated and filtered for hydrogen sulfide and iron removal.

A sample (Lab. No. 110,977) of treated water blended with the water from the No. 1 Well was found to have a hardness of 15.4 gr. per gal., a mineral content of 1308 ppm., and an iron content of 0.13 ppm.

Well No. 3 was completed at a depth of 2812 ft. in May 1949 by J. P. Miller Artesian Well Co., Brookfield, and located about 1/2 mile southeast of Well No. 1 (or approximately 1150 ft. N. and 1400 ft. W. of the S. E. corner of Section 36).

Well No. 3 was cased as follows:

30-in. pipe from surface to 105 ft.
24-in. pipe from surface to 568 ft.
20-in. pipe from 568 to 785 ft.
16-in. pipe from surface to 123 7 ft.
12-in. liner from 1662 ft. 5 in. to 1819 ft. 6 in.

Below the liner the hole is 12-in. (?) diameter.

A production test was made on May 19-20, 1949, using State Water Survey calibrated measuring equipment. Before pumping the water level was 135 ft. below the pump base and after 26-hr. pumping at 786 gpm. the drawdown was 165 ft. Temporary test pumping equipment was used in the test.

Analysis of a sample (Lab. No. 118245) collected May 20, 1949 after 24-hr. pumping at 764 gpm. showed this water to have a hardness of 16.7 gr. per gal., a residue of 897 ppm., and an iron content of 0.8 ppm.

Pumpage is estimated to average 245,000 gpd.

TABLE 1

Water Levels

Year	Non-Pumping ft.	Pumping ft.	Pumping Rate gpm.
1915	100		350
1916	Pump cylinder lowered 80 ft.		
1917	100	188	175
1921	Air lift installed		
1926	132	211.5	227
1931			170
1940	New turbine installed		
1943	100	200	175

TABLE 3

Water Levels

Year	Non-pumping ft.	Pumping ft.	Pumping Rate gpm.
	Depth of well, 1700 ft.		
July 1931	139	324	115
Oct. 1932	139	312	153
	Depth of well 2002 ft.		
Dec. 1932	115		
	Depth of well 2240 ft.		
Jan. 1933	115	287 1/2	340
	Depth of well 2784 ft.		
Apr. 1933	103	170	362
May 1946	119.4		
Mar. 1947	133	175	350

Sample-study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Glacial drift"	98	98
Pennsylvanian system		
"Shale, thin beds of limestone, sandstone and coal"	507	605
Silurian system		
Niagaran-Alexandrian series		
"Shale" (?)	163	768
Dolomite, shaly	16	784
"Lime"	221	1005
Ordovician system		
Maquoketa formation		
"Shale"	165	1170
Galena-Platteville formations		
Dolomite	5	1175
"Shale" (?)	57	1232
"Limestone"	213	1445
Dolomite	100	1545
St. Peter sandstone	155	1700
Shakopee dolomite	170	1870
New Richmond sandstone, thin beds of dolomite	130	2000
Oneota formation		
Dolomite	175	2175
Sandstone, some dolomite	20	2195
Cambrian system		
Trempealeau dolomite	255	2450
Franconia dolomite, some sandstone	150	2600
Galesville formation		
Sandstone, thin beds of dolomite	120	2720
Sandstone, incoherent	35	2755
Sandstone, partly dolomitic	25	2780
Eau Claire dolomite	4	2784

LABORATORY NO. 111,049

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	14.9	
Manganese	Mn	0.0		Fluoride	F	1.2	
Calcium	Ca	56.9	2.85	Chloride	Cl	580.0	16.36
Magnesium	Mg	21.0	1.72	Nitrate	NO_3	3.5	0.06
Ammonium	NH_4	0.5	0.03	Sulfate	SO_4	57.2	1.19
Sodium	Na	457.5	19.89	Alkalinity (as $CaCO_3$)		344.	6.88
Color		0		Hardness (as $CaCO_3$)		229.	4.58
Odor		Tr.		Residue		1422.	
Turbidity		0		Temperature 67.5° F.			

LABORATORY NO. 110,979

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.8		Silica	SiO_2	16.4	
Manganese	Mn	0.0		Fluoride	F	0.8	
Calcium	Ca	88.4	4.42	Chloride	Cl	272.0	7.67
Magnesium	Mg	24.1	1.98	Nitrate	NO_3	9.9	0.16
Ammonium	NH_4	1.0	0.06	Sulfate	SO_4	74.9	1.56
Sodium	Na	207.2	9.01	Alkalinity (as $CaCO_3$)		304.	6.08
Color		0		Hardness (as $CaCO_3$)		320.	6.40
Odor (at well)		H_2S		Residue		878.	
Turbidity		10+		Temperature 75° F.			

LABORATORY NO. 110,977

		ppm.	epm.			ppm.	epm.
Iron	Fe	0.13		Fluoride	F	0.9	
Turbidity		0		Chloride	Cl	440.0	12.39
Color		0		Alkalinity (as $CaCO_3$)		312.	6.24
Odor		0		Hardness (as $CaCO_3$)		265.	5.30
				Total Mineral Content		1308.	

A public water supply was installed by the village of Ohio (524) in 1894.

Water was obtained from a well drilled to a depth of 412 ft. by the American Well Works Co. Tools were lost, and the well was subsequently abandoned.

A log of this well, as given in Leverett's "Illinois Glacial Lobe," published in 1899, indicates that the 412 ft. is the top of limestone.

In 1900, a well known as the West Well was drilled by F. C. Albrecht, Ohio, in the west end of the pump station on the north side of Jackson St. between Main and Grove St. (or approximately 1740 ft. N. and 2040 ft. E. of the S. W. corner of Section 9, T. 18 N., R. 9 E.). It is about 30 ft. west and 2 ft. south of the first well.

The well was reported to be 385 ft. deep from a ground surface elevation of 920± ft., and cased with 6-in. pipe to a depth of 361 ft. below which 24 ft. of screen was set.

The pump assembly consists of A. D. Cook deep-well pump operated with an 18-in. stroke at a rate of 21 strokes per min. with a 4-in. cylinder attached to a 4 1/2-in. diameter column pipe. There is 16 ft. of suction pipe below the cylinder. The bottom of the suction pipe is 335 ft. below the top of the well. The pump is operated 8 hr. per day and is estimated to discharge 65 gpm. Power is furnished by a 10-hp., 1140 rpm. Wagner electric motor, No. 131571, belt-connected to the pump.

Analysis of a sample (Lab. No. 111,797) collected Sept. 9, 1947 after pumping 25 min., showed the water in the West Well to have a hardness of 9.9 gr. per gal., a total mineral content of 289 ppm., and an iron content of 2.3 ppm.

The East Well was drilled by F. C. Albrecht about 1912, approximately 38 ft. east of the West Well, and to a depth of 388 ft. It was cased with 6-in. pipe from the top to within 40 ft. of the bottom of the well. A No. 60 gauze wire screen, 34 ft. in length, was set below the casing. Just above the seal between the 6-in. casing and the screen, a 5 1/4-in. pump cylinder became wedged, causing sand to enter the well, wearing out the pump leathers.

In 1916, the water level was 260 ft. below the top of the well while the west pump was operating. The west pump was stopped, and, after 8 min., the water level in the West Well raised 1/2 in.

The East Well was abandoned in 1933.

In 1933, a new well was drilled by Jonah Stultz, Dixon, about 14 ft. north of the West Well. It is 404 ft. deep and cased with 390 ft. of 8-in. pipe below which is 14 ft. of 7 1/2-in. Johnson screen.

The pumping assembly consists of 310 ft. of 4 1/2-in. column pipe; 7 7/16-in., 13-stage Pomona turbine pump, No. L-733, rated at 100 gpm. against 280 ft. of head at 1760 rpm.; the length of the pump is 81 3/4-in.; 20 ft. of 4 1/2-in. suction pipe; 15-hp. Westinghouse motor. The pump is operated 8 hr. per day at an estimated rate of 100 gpm.

On June 6, 1938, the non-pumping water level was 250 ft. below the pump base, and in 1943 the water level was 255 ft.

Analysis of a sample (Lab. No. 111,798) collectedSept. 9, 1947 after pumping 35 min., showed the water in the North Well to have a hardness of 9.6 gr. per gal., a residue of 288 ppm., and an iron content of 2.3 ppm. Methane gas has been reported to be present in the water.

The water is not treated. The entire demand is supplied from the West Well and the North Well. Pumpage is estimated at 79,000 gpd.

LABORATORY NO. 111,797

	ppm.	epm.			ppm.	epm.
Iron (total) Fe	2.3		Fluoride	F	0.6	
Turbidity	10		Chloride	Cl	2.0	
Color	30		Alkalinity	(as $CaCO_3$)	272.	
Odor	Tr.		Hardness	(as $CaCO_3$)	169.	
Temperature 53.5° F.			Total Mineral Content		289.	

LABORATORY NO. 111,798

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.3		Silica	SiO_2	19.3	
Manganese	Mn	0.0		Fluoride	F	0.	
Calcium	Ca	37.2	1.86	Chloride	Cl	1.0	0.03
Magnesium	Mg	17.1	1.41	Nitrate	NO_3	1.6	0.03
Ammonium	NH_4	1.5	0.08	Sulfate	SO_4	0.0	0.00
Sodium	Na	45.8	1.99	Alkalinity (as $CaCO_3$)		264.	5.28
Color		20		Hardness (as $CaCO_3$)		164.	3.28
Odor		0		Residue		288.	
Turbidity		10		Temperature 54° F.			

OKAWVILLE
Washington County
Apr. 1, 1948

The village of Okawville (708) installed a public water supply in 1936.

A test well was drilled early in 1936 and was located about 2 miles north of the city in the flood plain of the Kaskaskia River (or approximately 600 ft. N. and 1300 ft. E. of the S.W. corner of Section 4, T. 1 S, R. 4 W). The surface elevation at the well-site is 415t ft.

The test well was 65 ft. deep, and was reported to have penetrated fine, dirty sand between 16 and 30 ft., and clean medium sized sand between 30 and 65 ft. The well was cased with 8-in. pipe to a depth of 50 ft., and was equipped with a 15-ft. length of 8-in. No. 6 Layne shutter screen.

A production test was made by the State Water Survey on Feb. 12, 1936. After 8-hr. pumping at 20 gpm., the drawdown had decreased from 5 ft. 10 in. to 5 ft. from the non-pumping water level of 16 ft. 6 in. below the ground surface.

Analysis of a sample (Lab. No. 77436) collected Feb. 12, 1936, showed the water to have a hardness of 21.8 gr. per gal., a residue of 496 ppm., and an iron content of 10.0 ppm.

The permanent city well was drilled in 1936 to a reported depth of 69 ft. 9 in. by Layne-Western Co., Chicago, at the site of the test well. This well is of the gravel-wall type, with a 20-in. outer casing extending to a depth of 34 ft. below the ground surface, and a 10-in. inner casing from the surface to a depth of 44 ft. 9 in. A 25-ft. length of 10-in. No. 9 Layne screen extends to the bottom of the well. In Jan. 1947 the well depth was measured 74 ft. 4 in. below the pump base, which was about 10 ft. above ground level.

The non-pumping, water level on Mar. 11, 1936 was reported to be 9 ft. below the ground surface. The water level is reported to vary with the season. A production test was made on Mar. 24, 1936 by the State Water Survey. Water was pumped by an air lift system. After 8-hr. pumping at 42 gpm., the drawdown had increased from 3 1/2 to 4 1/2 ft. from the non-pumping water level of 10 1/2 ft. below the ground surface. In Jan. 1947 the water level after a 48-hr. idle period was 17 1/2 ft. At that time the badly corroded screen was removed but not replaced.

New pumping equipment installed in Jan. 1947 consists of: 60 ft. of 4-in. column pipe; 6-in., 4-stage Layne turbine pump, No. 13 695, rated at 100 gpm. against 60 ft. of head; the overall length of the pump is 2 ft. 5 in.; 10 ft. of 4-in. suction pipe; unknown length of air line; 5-hp. U. S. electric motor.

On Mar. 20, 1948 after a 3-minute idle period, the non-pumping altitude gauge recorded 48 1/2 ft. and after 15-minute pumping at 100 gpm., the drawdown was 30 ft.

Analysis of a sample (Lab. No. 113,887) collected Mar. 20, 1948 after 15-minute pumping showed the water to have a hardness of 28.7 gr. per gal., a residue of 674 ppm., and an iron content of 4.8 ppm.

The water is partially softened.

Analysis of a sample (Lab. No. 114,108) collected Mar. 20, 1948, 40 hr. after backwashing showed the treated water to have a hardness of 15.5 gr. per gal., a mineral content of 467 ppm., and an iron content of 0.5 ppm.

On Apr. 16, 1949 it was reported that Well No. 2 had been completed recently by Thorpe Concrete Well Co., Alton, and located 30 ft. north of Well No. 1. The well was constructed to rock at 72 ft., and cased with 32 ft. of 30-in. id. (40-in. od.) concrete pipe and 40 ft. of porous concrete pipe. A 2-ft. concrete plug was poured in the bottom of the concrete screen.

The top of the casing was sealed by the following construction. A 6-ft. diameter steel casing, 10 ft. in depth, was set around the top of the concrete casing and the annular space between the casings was filled with concrete. The top of the steel casing was at ground level. Before the concrete had set, the 6-ft. steel casing was pulled and a 10-ft. section of 49-in. diameter steel casing, was set 18 in. deep in the moist concrete. The top of the 49-in. casing extended 8 1/2 ft. above the ground level. The 30-in. id. concrete casing was then extended upwards so that the top was level with the top of the 49-in. casing. The annular space between these casings was filled with concrete.

The well is reported to be equipped with 60 ft. of column pipe; 4-stage Fairbanks-Morse Pomona turbine water-lubricated pump rated at 100 gpm. against 75 ft. of head; 5-hp. General Electric motor, operated at 1760 rpm.

Metered pumpage for the 14-mo. period preceding Mar. 1948, averaged 32,200 gpd. for the entire public supply.

LABORATORY NO. 113,887

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	4.8		Silica	SiO_2	26.1	
Manganese	Mn	0.4		Fluoride	F	0.1	
Calcium	Ca	140.4	7.02	Chloride	Cl	19.0	0.54
Magnesium	Mg	34.2	2.81	Nitrate	NO_3	0.2	Tr.
Ammonium	NH_4	0.3	0.02	Sulfate	SO_4	206.1	4.29
Sodium	Na	31.7	1.38	Alkalinity (as $CaCO_3$)		320.	6.40
Turbidity		64		Hardness (as $CaCO_3$)		492.	9.83
Color		0		Residue		674.	
Odor		0		Free CO_2 (calc.)		72.	
Temperature 56.2° F.				pH = 7.05			

LABORATORY NO. 114,108

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.5		Fluoride	F	0.1	
				Chloride	Cl	16.0	0.45
Turbidity		0		Alkalinity (as $CaCO_3$)		184.	3.68
Color		0		Hardness (as $CaCO_3$)		265.	5.30
Odor		0		Total Mineral Content		467.	
Temperature 58° F.				Free CO_2 (calc.)		3.	
				pH = 8.25			

OLMSTED
Pulaski County
Feb. 6, 1948

A public water supply was installed by the village of Olmsted (592) in 1941.

Water is obtained from a well drilled in 1940 by the Case Engineering Co., St. Louis, Mo., and located about 50 ft. north of the center of the highway spur about 1200 ft. east of State Route No. 37 (or approximately 50 ft. N. and 2000 ft. E. of the S.W. corner of Section 22, T. 15 S., R. 1 E.). The well is 1000 ft. deep below a ground surface elevation of 344± ft.

Sample-study log of well drilled in 1940 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
No samples	20	20
Chert and pebbles	3	23
Eocene system		
Clay, sandy and silty	57	80
Cretaceous system		
Silt, sand and clay	55	135
Sand, some thin clay beds	165	300
Sand and pebbles	37	337
Clay and sand	126	463
Mississippian system		
Osage siltstone, chert, thin shale beds	204	667
Kinderhook shale, thin sandstone beds	203	870
Devonian system		
Clear Creek chert, some limestone	130	1000

The outer casing consists of: 10-in. pipe from the surface to 100 ft., 8-in. pipe from 100 to 250 ft., and 6 3/4-in. pipe from 250 to 473 ft. The 5-in. inner casing extends from the surface to 871 ft., below which the hole is 4 3/4 in. in diameter to the bottom of the well.

The non-pumping water level was reported to be 40 to 45 ft. below the ground surface when the well was completed.

The well is equipped as follows: 200 ft. of 3-in. column pipe; 4-in. 13-stage, Cook Turbine pump, No. 4346, having an overall length of 5 ft., and rated at 35 gpm. against 58 ft. of head., when operating at 1750 rpm.; 10 ft. of 3 1/4-in. od. suction pipe; 3-hp., 1800 rpm. U.S. electric motor. No. 217958.

The State Water Survey made production tests on Aug. 1-2, 1940; and Aug. 20-23, 1940. Before the first test, the water level was reported to be 18-20 ft. below the ground surface. Pumping water levels were not measured because no air line was installed. When pumping at a rate of 38 gpm., the water was not drawn below the end of the suction pipe at a depth of 215 ft.

Analysis of a sample (Lab. No. 113337) collected Jan. 28, 1948 after 4-hr. pumping at 35 gpm., showed the water to have a hardness of 8.8 gr. per gal., a residue of 257 ppm., and an iron content of 0.5 ppm.

The water is aerated.

The estimated average pumpage is 17,000 gpd.

There were 150 metered service connections in use in Jan. 1948 and 5 flat rate users, one of which is the Sinclair Oil Co. Fuller's earth plant.

LABORATORY NO. 113,337

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.5		Silica	SiO_2	13.5	
Manganese	Mn	Tr.		Fluoride	F	0.3	
Calcium	Ca	40.3	2.02	Chloride	Cl	52.0	1.47
Magnesium	Mg	11.8	0.97	Nitrate	NO_3	Tr.	Tr.
Ammonium	NH_4	0.2	0.01	Sulfate	SO_4	14.2	0.30
Sodium	Na	30.6	1.33	Alkalinity (as $CaCO_3$)		128.	2.56
Turbidity		Tr.		Hardness (as $CaCO_3$)		150.	2.99
Color		0		Residue		257.	
Odor		0		Free CO_2 (calc.)		6.	
Temperature 66° F.				pH = 7.7			

OLYMPIA FIELDS
Cook County-
July 22, 1946

A public water supply system was installed in 1925 under private ownership of Brown & Hammer, Realtors, to supply the homes in the subdivision development. Olympia Fields (101) was incorporated as a village about 1927, and public ownership of the water supply system was acquired shortly thereafter.

Water is obtained from a well located on the north bank of Butterfield Creek about 25 ft. west of Kedzie Ave. and 300 ft. south of 208th St. (or approximately 300 ft. S. and 50 ft. W. of the N.E. corner of Section 23, T. 35 N., R. 13 E.). The elevation of the ground surfaces at the well is 673± ft.

The well was drilled by P. E. Millis & Co., Byron, in 1924 to a depth of 169 ft. and a diameter of 10 in. The well flowed after completion of the drilling and for a few years during the winter months. It is influenced by the pumping of the Olympia Fields Country Club wells which are frequently operated 24 hr. daily during dry summer periods.

The following pump installation is in service: 60 ft. of 5-in. column pipe; 8-in., 9-stage Pomona turbine pump, rated at 250 gpm. against 200 ft. of head; the overall length of the pump is 6 ft.; 10 ft. of 5-in. suction pipe; 15-hp. Westinghouse electric motor.

Analysis of a sample (Lab. No. 107,162), collected July 19, 1946 after 10-min. pumping at 250 gpm., showed this water to have a hardness of 31.2 gr. per gal., a residue of 681 ppm., and an iron content of 0.2 ppm. This quality is typical for water from this depth in this vicinity.

The pump is operated daily to supply the residential demands of the village, but no pumpage data are available.

All water is now chlorinated.

LABORATORY NO. 107,162

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	14.7	
Manganese	Mn	0.0		Fluoride	F	0.5	
Calcium	Ca	130.6	6.53	Chloride	Cl	1.0	0.03
Magnesium	Mg	50.6	4.16	Nitrate	NO_3	0.9	0.01
Ammonium	NH_4	0.6	0.03	Sulfate	SO_4	244.0	5.08
Sodium	Na	27.6	1.20	Alkalinity	(as $CaCO_3$)	340.	6.80
Color		0		Hardness	(as $CaCO_3$)	535.	10.70
Odor		Tr.		Residue		681.	
Turbidity		Tr.					
Temperature		51.6° F.					

OMAHA
Gallatin County
Feb. 20, 1948

The village of Omaha (413) installed a public water supply in Feb., 1947.

The village owns a well drilled in 1915 at the southeast corner of the intersection of Washington Ave. and Second St. (or approximately 1375 ft. S. and 300 ft. W. of the N.E. corner of Section 27, T. 7 S., R. 8 E.).

The well is 6 in. in diameter and was drilled to a depth of 130 ft., but in 1946 it was reported to have been filled with rocks and mud to a depth of 90 ft. A production test was made on Jan. 28, 1946 by the State Water Survey. When pumping at a rate of 25 gpm., the drawdown was 36 ft. below a non-pumping water level of 7 ft. The well is equipped with a hand pump and is used by some residents when the new well is not in operation. The water level is lowered below the pump setting when the new well pump is in operation.

Analysis of a sample (Lab. No. 105,388), collected Jan. 28, 1946, showed the water to have a hardness of 5.1 gr. per gal., a residue of 1055 ppm., and an iron content of 1.1 ppm.

This well is not part of the public water system which was installed in 1946.

A well was drilled in 1946 to a depth of 130 ft. by Paul Hudgins, Eldorado, and is located about 100 ft. south of Washington Ave., and 35 ft. west of Second St. (or approximately 1575 ft. S. and 450 ft. W. of the N.E. corner of Section 27). The surface elevation is 400t ft.

During drilling operations, water was encountered at a depth of 110 ft.

Correlated driller's log of well drilled in 1946 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Surface fill and clay	28	28
Blue mud	40	68
Shale	27	95
Quicksand	7	102
Pennsylvanian system		
Shell limestone	4	106
Gray slate	6	112
Black slate, water at 114 feet	4	116
Coal	2	118
Fire clay	12	130

The well is cased with 6-in. pipe to a depth of 110 ft., and this pumping equipment consists of: 80 ft. of 4-in. column pipe; 15-stage Fairbanks-Morse vertical turbine pump, No. S.W. 43383; 20 ft. of suction pipe; 5-hp. General Electric motor.

A production test was made by the State Water Survey on May 15, 1946. When pumping at 18 gpm., the drawdown was 54 ft. from a non-pumping water level of 5 ft.

Analysis of a sample (Lab. No. 106,470), collected May 15, 1946, showed the water to have a hardness of 4.4 gr. per gal., a residue of 751 ppm., and an iron content of 0.5 ppm.

The average estimated pumpage is 6000 gpd.

LABORATORY NO. 106,470

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.5		Silica	SiO_2	14.8	
Manganese	Mn	0.0		Chloride	Cl	117.0	3.30
Calcium	Ca	13.9	0.70	Nitrate	NO_3	Tr.	Tr.
Magnesium	Mg	9.8	0.81	Sulfate	SO_4	2.3	0.05
Ammonium	NH_4	3.6	0.20	Alkalinity	(as $CaCO_3$)	516.	10.32
Sodium	Na	275.1	11.96				
Turbidity		10		Hardness	(as $CaCO_3$)	76.	1.51
Color		0		Residue		751.	
Odor		Tr.					
Temperature		58° F.					

ONARGA
Iroquois County
Nov. 18, 1948

A public water supply was installed in 1904 by the village of Onarga (1413).

Water was obtained from three 6-in. wells located at the pumping station at the southwest corner of Wilson Ave. and south Chestnut St. (or approximately 1945 ft. N. and 450 ft. E. of the S. W. corner of Section 19, T. 26 N., R. 11 E.).

One of the wells was 105 ft. deep and the other 2 were 110 ft. The wells were about 20 ft. apart. In Sept. 1913 the non-pumping water level was 11 ft. below a ground surface elevation of 670t ft. and, when pumping, the drawdown was 15 ft.

These wells were capped and abandoned in 1922.

In July 1922, two wells were drilled by O. H. Stiegman, Roberts, and located 25 ft. apart in an east and west direction, and about 35 ft. north of the northernmost of the old wells. Each well was drilled to 156 ft. depth and cased with 6-in. pipe, with the bottom 10 ft. slotted with 3/16-in. open-; ings.

In Sept. 1930, the non-pumping water level was 12 ft. below ground level. Water is pumped by air lift with 1-in. air pipes and 4-in. eductor pipes. The eductor pipes extend to within 10 ft. of the bottom of the well. Both wells are in service and are alternated.

Analysis of a sample (Lab. No. 116,359) collected Nov. 6, 1948 after 1-hr. pumping at an estimated rate of 245 gpm., showed this water to have a hardness of 35.1 gr.per gal., a residue of 891 ppm., and an iron content of 2.0 ppm.

When the pumps have been shut down for a period of as much as one week, all water is then chlorinated.

Pumpage is estimated to average 96,000 gpd. inclusive of water supplied Onarga Nursery and Onarga Military Academy.

Correlated driller's log of well drilled in 1922 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Loam, clay and hardpan	93	93
Water sand, not good	7	100
Hardpan	4	104
Water sand	14	118
Hardpan	3	121
Water sand and gravel	35	156

LABORATORY NO. 116,359

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.0		Silica	SiO_2	20.4	
Manganese	Mn	0.1		Fluoride	F	0.3	
Calcium	Ca	151.0	7.55	Chloride	Cl	8.0	0.23
Magnesium	Mg	55.0	4.53	Nitrate	NO_3	0.5	0.01
Ammonium	NH_4	1.6	0.09	Sulfate	SO_4	397.8	8.28
Sodium	Na	55.9	2.43	Alkalinity	(as $CaCO_3$)	304.	6.08
Turbidity		17		Hardness	(as $CaCO_3$)	604.	12.08
Color		0		Residue		891.	
Odor		0		Free CO_2	(calc.)	35.	
Temperature		54° F.		pH = 7.35			

ONEIDA
Knox County
Mar. 31, 1947

A public water supply was installed by the city of Oneida (556) in 1945.

Water is obtained from a well drilled by Ellis Jones, Burlington, Iowa, and located at the southeast corner of Young American and Sage St. (or approximately 1500 ft. S. and 1860 ft. E. of the N. W. corner of Section 36, T. 13 N., R. 2 E.).

The well was drilled to a depth of 840 ft. below a ground surface elevation of 815t ft.

Sample-study log of well drilled in 1945 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Glacial drift"	37	37
"Sand and gravel"	2	39
Pennsylvanian system		
Shale and sandstone, some limestone and coal	411	450
Mississippian system		
Kinderhook shale	55	505
Devonian system		
Cedar Valley dolomite and limestone	76	581
Wapsipinicon limestone	15	596
Silurian system		
Niagaran - Alexandrian dolomites	242	838
Ordovician system		
Maquoketa formation		
"Lime, shaly"	2	840

The 10-in. casing was cemented in by dropping the plugged casing into neat cement grout and forcing the grout to the surface between the 10-in. and 12-in. casings.

The pumping installation consists of 320ft. of 6-in. column pipe; 6-in. American Well Works turbine pump, No. 71884, rated at 120 gpm. against 312 ft. of head at 1760 rpm.; 320 ft. of air line; 20 ft. of 6-in. suction pipe and strainer; 15-hp., 1755 rpm. U. S. motor, Serial No. 515254.

The hole and casing diameter record is shown in Table 1.

TABLE 1

Hole Record

12-in. from 0 to 79.3 ft.
10-in. from 79.3 to 526 ft.
8-in. from 526 to 840 ft.

Casing Record

12-in. from 0 to 39.5 ft.
10-in. from 0 to 79.3 ft.
8-in. from +1.0 to 526 ft.

When the well was completed, a production test was made by the driller, Miller Engineering Co., and the State Water Survey. For test purposes, the following equipment was used: 385 ft. of 4-in. drop pipe; a 5 3/4-in. cylinder; an air line, 311 ft. in length below the top of the 8-in. casing.

Before the test started, the water level was 277 ft.; and after 3-hr. pumping at 49 gpm., the drawdown was 5 1/2 ft. Due to mechanical troubles, the test was not run for a longer time.

At present there are 45 service connections and an estimated consumption of 7,000 gpd., one-half of which is used by the high school. It is estimated that there will be 160 service connections when the projected improvements to the water system are completed.

Analysis of a sample (Lab. No. 104,729), collected Nov. 9, 1945, showed this water to have a hardness of 3.6 gr. per gal., a mineral content of 842 ppm., and an iron content of 1.0 ppm.

LABORATORY NO. 104,729

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.0		Silica	SiO_2	11.5	
Manganese	Mn	0.0		Fluoride	F	1.8	
Calcium	Ca	11.3	5.65	Chloride	Cl	110.0	3.09
Magnesium	Mg	7.9	.65	Nitrate	NO_3	3.0	1.50
Ammonium	NH_4	0.7	.04	Sulfate	SO_4	49.8	1.03
Sodium	Na	306.6	13.33	Alkalinity	(as $CaCO_3$)	532.	10.64
Color		0		Hardness	(as $CaCO_3$)	61.	1.22
Odor		0		Residue		842.	
Turbidity		10		pH = 7.8			
Temperature 62.2° F.							

A water supply was installed for Ophiem, unincorporated, (100) in 1946. The system is owned by the Ophiem Water system, a non-profit organization of 23 members who drilled the well for their own use. Mr. A. R. Rehn is president and R. H. Ossian is secretary of the water company.

The source of the supply is a well drilled in Oct. 1946 by Carl Larson, Orion, and located approximately 175 ft. N. and 2000 ft. W. of the S.E. corner of Section 28, T. 15 N., R. 1 E. The well is 370 ft. deep below a ground surface elevation of 725± ft.

The well was cased with 8-in. pipe to rock, 6-in. casing from 0 to 207 ft., and a 5 3/16-in. liner from 310 ft. to 330 ft. The 8-in. casing was pulled after the 6-in. casing was set.

A production test was made by the driller upon completion of the well. Before the test started, the water level was 180 ft. below the base of the pump; and after pumping for 3 hours at 50 gpm., the water level was 288 ft. or a drawdown of 108 ft. Recovery of 100 ft. of the drawdown occurred 4 minutes after stopping the pump.

The well is equipped with 300 ft. of 2 1/2-in. column pipe; Peerless High Lift pump rated at 50 gpm.; 10 ft. of 2 1/2-in. suction pipe; 10-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 108,505), collected Dec. 2, 1946 after the pump had been operating about 10 minutes, showed this water to have a hardness of 9.7 gr. per gal., a residue of 517 ppm., and an iron content of 2.4 ppm.

Correlated driller's log of well drilled in 1946 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay	70	70
Pennsylvanian-Mississippian (?) (Kinderhook) systems		
Shale	7	77
Coal	4	81
Shale	114	195
Devonian-Silurian systems		
Limestone	120	315
Shale, green	15	330
Limestone	40	370

LABORATORY NO. 108,505

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.4		Silica	SiO_2	13.6	
Manganese	Mn	Tr.		Fluoride	F	0.8	
Calcium	Ca	36.0	1.80	Chloride	Cl	16.0	.45
Magnesium	Mg	18.6	1.53	Nitrate	NO_3	1.3	.02
Ammonium	NH_4	1.9	.11	Sulfate	SO_4	76.5	1.59
Sodium	Na	139.4	6.06	Alkalinity (as $CaCO_3$)		372.	7.44
Color		0		Hardness (as $CaCO_3$)		167.	3.34
Odor (at well)		H_2S		Residue		517.	
Turbidity		40-		Temperature 54° F.			

OQUAWKA
Henderson County
Nov. 4, 1946

The public water supply for the village of Oquawka (912) was installed in 1900.

Water was obtained from a well which was abandoned the following year, when 4 well points were driven in sand and gravel at the foot of Warren St. near the Mississippi River, (or approximately 1300 ft. S. and 4400 ft. W. of the N. E. corner of Section 22, T. 11 N., R. 5 W.). The elevation of the ground surface is 530± ft.

In 1915 eight wells were driven at the same location by Frank Boden. Each well was cased with 2-in. galvanized pipe to a depth of 29 ft., the bottom 3 ft. being perforated, and with 3 ft. of No. 60 gauze screen inside the perforated pipe. Water was pumped 24 hr. daily, and the consumption was estimated to be 10,000 gpd. In 1922 non-pumping water levels were at a depth of 10 ft., but varied with the river stage.

Between 1923 and 1927 the old well points were replaced by new ones driven 10 ft. deeper in an attempt to avoid rapid clogging.

Water is obtained from 14 well points driven to a depth of 36 ft. and pumped by a 2-piston, double-stroke, 7-in. by 10-in., Fairbanks-Morse, No. 270355, suction pump. Power is furnished by a 15-hp., 875-rpm. General Electric motor.

Analysis of a sample (Lab. No. 108,142), collected Oct. 28, 1946 after 30-min. pumping at 200 gpm., showed this water to have a hardness of 13.0 gr. per gal., a residue of 281 ppm., and no iron.

Pumpage is estimated to be 25,000 gpd.

LABORATORY NO. 108,142

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.0		Silica	SiO_2	34.5	
Manganese	Mn	0.0		Fluoride	F	0.0	
Calcium	Ca	61.6	3.08	Chloride	Cl	8.0	.23
Magnesium	Mg	16.7	1.37	Nitrate	NO_3	43.2	.70
Ammonium	NH_4	0.0	0.0	Sulfate	SO_4	37.8	.79
Sodium	Na	1.6	0.07	Alkalinity (as $CaCO_3$)		140.	2.80
Color		0		Hardness (as $CaCO_3$)		223.	4.46
Odor		0		Residue		281.	
Turbidity		0					
Temperature 55° F.							

ORANGEVILLE
Stephenson County
Nov. 12, 1947

The village of Orangeville (407) installed a public water supply in 1896.

Water was originally obtained from a well, probably drilled by E. Wareham, Freeport, in 1896 and located 1/2 block north of High St. and 20 ft. west of Church St. This well was 142 ft. deep and 8 in. in diameter and was equipped with a Fairbanks-Morse deep-well cylinder-type pump. The well has been plugged, capped, and covered with about 5 ft. of earth, and is under the floor of a room in the pump house.

In 1904, P. E. Millis, Byron, drilled a well located 10 ft. west of the old well on the west side of Highway No. 26 and about 1/2 block north of High St. (or approximately 2380 ft. S. and 2640 ft. E. of the N. W. corner of Section 36, T. 29 N., R. 7 E.).

The well is 12 in. in diameter and from 250 to 300 ft. deep. A Gould triplex pump was set in a pit 21 ft. deep surrounding the well.

About 1932 the casing was extended to the surface, the pit filled, and new pumping equipment was installed. This equipment consists of 90 ft. of 5-in. column pipe; 20 ft. of 5-in. suction pipe; Fairbanks-Morse turbine pump rated at 275 gpm. at 1800 rpm. The pump is directly connected to a 25-hp. Fairbanks-Morse electric motor, No. 265602.

The base of the pump is 2 ft. below ground surface.

Analysis of a sample (Lab. No. 112,576) collected Nov. 11, 1947 after 1-hr. pumping at 284 gpm. showed this water to have a hardness of 19.3 gr. per gal., a residue of 355 ppm., and no iron content.

In Nov. 1947 the non-pumping water level was 18 ft. below the base of the pump after pumping 1 hr. at 284 gpm., and the drawdown was 6 ft.

The water is not treated.

Pumpage is estimated to be 54,000 gpd.

LABORATORY NO. 112,576

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.0		Silica	SiO_2	15.0	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	71.4	3.57	Chloride	Cl	4.0	0.11
Magnesium	Mg	36.8	3.03	Nitrate	NO_3	17.6	0.28
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	27.4	0.57
Sodium	Na	6.4	0.28	Alkalinity (as $CaCO_3$)		296.	5.92
Turbidity		0		Hardness (as $CaCO_3$)		330.	6.60
Color		0		Residue		355.	
Odor		0		Temperature 51° F.			

The city of Oregon (2825) installed a public water supply in 1886.

Originally, water for fire protection was obtained from a shallow well. In 1897, the well was deepened to 1690 ft. This well is located close to the bank of the Rock River in the northeast part of town, near the intersection of 3rd and Illinois St. (or approximately 2300 ft. S. and 1500 ft. E. of the N.W. corner of Section 3, T. 23 N., R. 10 E.). The surface elevation is 672t ft. This well is 10 in. in diameter.

Originally, water flowed from the well into an excavated stone-curbed reservoir surrounding the well. In 1931, the reservoir was abandoned, and the well casing sealed. The suction side of each of the 2 Gould triplex pumps, which previously had pumped water from the reservoir, was connected to the well.

In Sept. 1947, the suction pumps were replaced by the existing pumping equipment: 90 ft. of 6-in. column pipe; 15-stage Fairbanks-Morse Pomona turbine, water lubricated pump, No. SH1260; the overall length of the pump is 10 ft.; 10 ft. of 6-in. suction pipe; 100 ft. of air line; 40-hp., 1745 rpm. General Electric motor, No. 5309746.

When the turbine was installed, water was pumped for 24 hr. at a rate of 450 gpm. On Dec. 2, 1947, the non-pumping water level was reported to be 5 ft. below the top of the well and when pumping at 466 gpm., the drawdown was 60 ft.

Analysis of a sample (Lab. No. 112,800) collected Dec. 2, 1947 after 1-hr. pumping at 466 gpm., showed this water to have a hardness of 17.0 gr. per gal., a residue of 286 ppm., and an iron content of 0.3 ppm.

The reservoir around the top of the well has been filled in and a pump house built over the well. The Gould pumps have not been removed from the pump house located 20 ft. south of the well, but the pumps are disconnected from the well.

Well No. 2 was completed at a depth of 1200 ft. in July, 1948 by Neely and Schimelpfenig, Batavia, and locarted 150 ft. east of Third St. and 150 ft. south of Franklin St. (or approximately 930 ft. S. and 1600 ft. E. of the N. W. corner of Section 3). The ground elevation is 707± ft.

Sample-study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Clay, sandy"	12	12
"Gravel"	131	143
Granule gravel, clean	3	146
Ordovician system		
St. Peter sandstone, chert and clay	26	172
Cambrian system		
Trempealeau dolomite	100	272
Franconia sandstone, some dolomite	88	360
Galesville sandstone		
Sandstone, partly dolomitic	60	420
Sandstone, incoherent	73	493
Eau Claire shale and thin sandstone	447	940
Mt. Simon sandstone	260	1200

The hole and casing record is shown in Table 1.

TABLE 1

Hole Record

12 3/4-in. to 1200 ft.

Casing Record

20-in. od. from +1.0 to 145 ft. below surface.
14-in. od. from +1.0 to 358 ft.
19-in. od. from 133 to 181 ft.

When the drilling had reached 962 ft. a production test was made by the State Water Survey on Apr. 23, 1948, using the following equipment for test purposes: 200 ft. of 7-in. id. column pipe; 11-stage turbine pump having an overall length of 12 ft.; 200 ft. of 1/4-in. air line; electric motor.

Before the test, the water level was 31 ft. from the top of the 20-in. casing. After 3-hr. pumping at 385 gpm., the drawdown was 71 ft. and after an additional 7-hr. pumping at a final rate of 735 gpm., the, drawdown was 149 ft. Thirty min. after stopping the pump, the water level was 53 ft. and 11 hr. later the water level

was 34 ft.

Partial analysis of a sample (Lab. No. 115,403) collected July 16, 1948 after 5 1/4-hr. pumping at 640 gpm., showed this water to have a hardness of 17.2 gr. per gal., a residue of 320 ppm., and an iron content of 1.1 ppm.

Pumpage is estimated to average 265,000

LABORATORY NO. 112,800

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.3		Silica	SiO_2	11.9	
Manganese	Mn	0.0		Fluoride	F	2.0	
Calcium	Ca	60.0	3.00	Chloride	Cl	6.0	0.17
Magnesium	Mg	34.5	2.84	Nitrate	NO_3	Tr.	Tr.
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	15.2	0.32
Sodium	Na	0.0	0.00	Alkalinity (as $CaCO_3$)		268.	5.36
Turbidity		Tr.		Hardness (as $CaCO_3$)		292.	5.84
Color		0		Residue		286.	
Odor		Tr.		Temperature 57.3° F.			

ORIENT
Franklin County
Mar. 2, 1948

The city of Orient (942) installed a public water supply system in 1913.

Water is largely obtained from a water ring located at a depth of 180 ft. in the shaft of the Orient coal mine owned by Chicago, Wilmington and Franklin Coal Co. which furnishes and maintains the public water supply. Water is pumped from a pool in the water ring by a centrifugal pump to the elevated steel storage tank in the city. Since May 1941 when the supply from the water ring became inadequate to supply all demands, an auxiliary supply has been obtained from one of the Company's old rock wells. This well is located about 50 ft. north of the concrete slab in the business district and was reported drilled, about 1916, to a depth of 180 ft. The well is equipped with a plunger pump and 5-hp. Westinghouse electric motor which is now operated about 24 hr. daily discharging at a rate of about 5 to 6 gpm. to the elevated steel storage tank in the city.

Analysis of a sample (Lab. No. 113,652) collected Mar. 1, 1948 from the discharge of the pump, after continuous pumping at an estimated rate of 6 gpm., showed this water to have a hardness of 19.5 gr. per gal., a residue of 518 ppm., and an iron content of 1.1 ppm.

All water is chlorinated.

The total combined supply to the city when checked in Oct. 1947 averaged about 25,000 gpd. of which it is estimated that 70% was obtained from the water ring and the balance from the rock well.

The Coal Company obtains a surface water supply from the Muddy River which is treated and used for a boiler supply. Drinking water is furnished from the city supply.

LABORATORY NO. 113,652

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.1		Silica	SiO_2	20.1	
Manganese	Mn	Tr.		Fluoride	F	0.1	
Calcium	Ca	85.3	4.27	Chloride	Cl	31.0	0.87
Magnesium	Mg	29.4	2.43	Nitrate	NO_3	5.7	0.09
Ammonium	NH_4	2.4	0.13	Sulfate	SO_4	18.3	0.38
Sodium	Na	76.6	3.33	Alkalinity (as $CaCO_3$)		436.	8.72
Turbidity		15		Hardness (as $CaCO_3$)		335.	6.70
Color		0		Residue		518.	
Odor		0		Free CO_2 (calc.)		17.	
Temperature 57.3° F.				pH = 7.8			

A water supply was installed by the village of Orion (715) in 1927.

At that time a well was drilled to a depth of 615 ft. by R. J. Bauereisen, Chicago. The well is located on the south side of Jackson St. between Girard and Bank St. (or approximately 500 ft. S. and 1500 ft. W. of the N.E. corner of Section 28, T. 16 N., R. 1 E.). The elevation of the ground surface at this point is 770± ft.

Sample-study log of well drilled in 1927 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Loess and glacial till	163	163
Gravel and sand	22	185
Till	5	190
Pennsylvanian system		
Shale, gray to black	55	245
Sandstone, gray, compact	31	276
Devonian system		
Limestone, brown to gray	94	370
Shale, sandy, blue	5	375
Silurian system		
Limestone and dolomite	45	420
Dolomite, white and buff, porous	195	615

The well is cased with 10-in. pipe from the top to a depth of 249 ft. 8 in., and with 8-in. pipe between depths of 222 and 405 ft. Below the casing the bore hole is 8 in. in diameter. The well was originally equipped with a No. 33 Downey pump having two 5 3/4-in. plungers and with a cylinder of 5 3/4-in. id. and 7 ft. long attached to 230 ft. of 6-in. drop pipe. On the bottom of the cylinder a section of 22 ft. of 4 1/2-in. suction pipe was attached. The rod and guides became worn through the drop pipe. Sealer dropped off the inside of the column into the cylinder during idle periods and cut up the leathers.

The following pumping equipment, installed in January 1944, is in service; 280 ft. of 4 1/2-in. column pipe; 7-in., 13-stage American Well Works turbine pump, No. 69869, rated at 120 gpm. against a total head of 300 ft.; the overall length of the pump is 9 ft.; 280 ft. of 1/4-in. air line; 20 ft. of 5-in. suction pipe; 15-hp., 1750 rpm. electric motor.

In 1927 the non-pumping water level was 201 ft. On Jan. 28, 1944 the non-pumping water level was 213 ft. after a 4-hr. quiet period, and the water was drawn down 27 ft. after 3-hr. pumping at 115 gpm.

Analysis of a sample (Lab. No. 108,552), collected Dec. 4, 1946 after 15-min. pumping, showed the water in this well to have a hardness of 10.0 gr. per gal., a residue of 447 ppm., and an iron content of 0.2 ppm.

In order to insure an adequate supply of water to the village, Well No. 2 was constructed in Aug. 1944 by the Varner Well Drilling Co., Dubuque, Iowa. It is located at the northeast corner of Jackson and Fourth St. (or approximately 300 ft. S. and 1050 ft. E. of the N.W. corner of Section 27). The well was drilled to a depth of 521 ft. below a ground surface elevation of 780t ft. The well was cased with 20-in. od. pipe from the surface to 204 ft. 7 in. and with a 16-in. liner from 190 to 387 ft. below which the hole is 15 in. in diameter.

During drilling operations, some water levels were reported as follows:

Drilling Depth ft.	Water Level Depth ft.	
431	155	
449	189	
468	213	
520	212	
521	213	Aug. 2, 1944

The well is equipped with 260 ft. of column pipe; Peerless deep-well turbine pump, No. 30474, rated at 175 gpm. against 272-ft. of head; 260 ft. of air line; 20-hp., 1755 rpm. General Electric motor.

On July 10, 1945 the static water level was reported to be 235 ft.

Analysis of a sample (Lab. No. 108,553), collected Dec. 4, 1946 after pumping for 15 min., showedthe water in Well No. 2 to have a hardness of 10.5 gr. per gal., a mineral content of 463 ppm., and an iron content of 0.3 ppm.

The wells are used alternately. Pumpage at present is at a minimum of 15,000 to 18,000 gpd. Pumpage during August and September 1946 was 40,000 to 43,000 gpd.

LABORATORY NO. 108,552

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.2		Silica	SiO_2	13.6	
Manganese	Mn	0.0		Fluoride	F	0.3	
Calcium	Ca	41.5	2.08	Chloride	Cl	2.0	.06
Magnesium	Mg	17.0	1.40	Nitrate	NO_3	0.8	.01
Ammonium	NH_4	3.0	.17	Sulfate	SO_4	23.0	.48
Sodium	Na	109.0	4.74	Alkalinity	(as $CaCO_3$)	392.	7.84
Color		0		Hardness	(as $CaCO_3$)	174.	5.48
Odor (at well)		H_2S		Residue		447.	
Turbidity		20					
Temperature		56.1° F.					

LABORATORY NO. 108,553

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.3		Silica	SiO_2	13.4	
Manganese	Mn	0.0		Fluoride	F	0.4	
Calcium	Ca	43.6	2.18	Chloride	Cl	1.0	.03
Magnesium	Mg	17.1	1.41	Nitrate	NO_3	0.4	.01
Ammonium	NH_4	2.8	.16	Sulfate	SO_4	20.4	.42
Sodium	Na	108.3	4.71	Alkalinity	(as $CaCO_3$)	400.	8.00
Color		0		Hardness	(as $CaCO_3$)	180.	3.60
Odor (at well)		H_2S		Residue		463.	
Turbidity		10					
Temperature		56.5° F.					

A public water supply was installed by the village of Orland Park (631) in 1897. Water is obtained from a well, 329 ft. in depth, which was drilled at that time. It is located about 90 ft. east of Beacon Ave. and 150 ft. south of Oak Ave. (approximately 700 ft. S: and 1325 ft. W. of the N.E. corner of Section 9, T. 36 N., R. 12 E.). The ground surface elevation at this location is 720± ft.

The well is reported to be cased with 6-in. pipe to rock at a depth of about 210 ft., and the bore is 6-in. in diameter to the bottom of the well.

In June 1921, the depth to water when not pumping was 29 ft. below the pump base. It was reported that no material variation in water levels had taken place since the well was drilled.

The well was tested for production on two consecutive daily runs of 8 hours each in July 1938. A rate of 238 gpm. was observed with a drawdown of 8 ft. from a non-pumping water level of 40 ft. below the pump base. Observations of the water levels made by the air line method between July 193 6 and June 1943 did not indicate any marked variation from the previous non-pumping and pumping water level observations.

In June 1943, after the pump was pulled, a 10-ft. section of the 4-in. column pipe was found defective. The following equipment was reinstalled and is still in service: 90 ft. of 4-in. column pipe; 6-in., 9-stage American Well Works turbine pump rated at 150 gpm. against 170 ft. of head; the overall length of the pump is 4 ft. 4 in.; 10 ft. of 3 1/2-in. suction pipe; 15-hp. U.S. electric motor.

Analysis of a sample (Lab. No. 106,884), collected June 25, 1946 from a tap at the pump discharge after 15-min. pumping at a metered discharge rate of 233 gpm., showed the water to have a hardness of 30.1 gr.per gal., a total mineral content of 603 ppm., and a general character which is not unusual for waters from the limestone in this vicinity. A sample collected in 1932 after 30-min; pumping was shown to be of similar quality.

The estimated average pumpage for the public water supply is 38,000 gpd. The water is not treated.

CAPITOL DAIRY COMPANY:

A new well drilled by C. E. Kramer, Harvey, to a depth of 355 ft., was completed in 1943. It is located about 300 ft. S. and 700 ft. W. of the N. E. corner of Section 9, T. 36 N., R. 12 E. and has an elevation at the ground surface of 700± ft.

Correlated driller's log of well drilled in 1943 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Cinder fill	6	6
Pleistocene system		
Clay, with gravel mix in lower part	54	60
Silurian system		
Niagaran-Alexandrian series		
Limestone	270	330
Limestone, crevices, water bearing	10	340
Limestone	15	355

A 6-in. diameter wrought steel casing with forged steel shoe was driven in rock to 153 ft. from the surface, below which the well has a 6-in. diameter. A 12-in. diameter outside pipe extends from the surface through the cinder fill into the clay, and the annular space is filled with clay grout as a protection for the 6-in. wrought steel casing from the cinder fill. After the well was completed, it was pumped for 16 hr. at 100 gpm. without any appreciable drawdown from a water level of 12 ft. below the top of the casing.

The following pump installation is in service: 100 ft. of 4 1/2-in. column pipe; a 6-in., 17-stage Pomona turbine pump rated at 100 gpm. against 195 ft. of head; 10 ft. of 4 1/2-in. suction pipe, and a 7 1/2-hp. Westinghouse electric motor. The pump is operated for an average period of 8 hr. per day at the rated capacity.

Analysis of a sample (Lab. No. 107033), collected July 12, 1946 after 3-hr. pumping at 100 gpm., showed the water in this well to have a hardness of 442, a total mineral content of 503, and a content of iron of 0.9 ppm. Temperature, 51.5° F.; pH, 7.2.

The old 4-in. well located 10 ft. north of the new well has been filled with mud. The well was reported having had a depth of 110 ft. when drilled about 40 years ago. When water was being pumped, it frequently delivered mud, and it is assumed that the casing finally collapsed.

LABORATORY NO. 106,884

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.0		Silica	SiO_2	29.3	
Manganese	Mn	0.0		Fluoride	F	0.6	
Calcium	Ca	101.1	5.05	Chloride	Cl	3.0	0.08
Magnesium	Mg	64.0	5.26	Nitrate	NO_3	2.2	0.04
Ammonium	NH_4	0.8	0.04	Sulfate	SO_4	144.8	3.01
Sodium	Na	14.3	0.62	Alkalinity	(as $CaCO_3$)	392.	7.84
Color		0		Hardness	(as $CaCO_3$)	516.	10.32
Odor		0		Residue		603.	
Turbidity		30		Free CO_2 (calc.)		76.0	
Temperature		51.3° F.		pH = 7.15			

OSCO
Henry County
Dec. 18, 1946

In 1910 a well was drilled south of the Chicago, Rock Island & Pacific R.R. tracks opposite the railroad station (or approximately 2100 ft. S. and 150 ft. W. of the N.E. corner of Section 29, T. 16 N., R. 2 E.). This well was abandoned when the creamery ceased operating. The well was placed in operation a few years ago to furnish water for the high school. Later the Osco Water Co. was formed, and the well is now used for the public water supply of Osco, unincorporated (100).

The well was cleaned and reconditioned in 1945, and a considerable amount of work done on the pump house. The well is 120 ft. deep and is cased with 5-in. pipe to the bottom of the well. The pumping equipment consists of an Aermotor pump with 24-in. cylinder; 12 ft. of 2 1/4-in. suction pipe; 100 ft. of 2 1/4-in. column pipe; 3/4-hp. Wagner electric motor. Non-pumping water level is 18 to 20 ft. below the top of the well. The well can be pumped dry.

Analysis of a sample (Lab. No. 108,555), collected Dec. 4, 1946 after the pump had been operated a few minutes, showed this water to have a hardness of 14.7 gr. per gal., a residue of 479 ppm., and an iron content of 0.1 ppm.

LABORATORY NO. 108,555

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.1		Silica	SiO_2	11.6	
Manganese	Mn	Tr.		Fluoride	F	0.6	
Calcium	Ca	58.6	2.93	Chloride	Cl	1.0	.03
Magnesium	Mg	25.6	2.10	Nitrate	NO_3	2.3	.4
Ammonium	NH_4	0.1	.01	Sulfate	SO_4	22.4	.47
Sodium	Na	87.9	3.82	Alkalinity	(as $CaCO_3$)	416.	8.32
Color		0		Hardness	(as $CaCO_3$)	252.	5.04
Odor		0		Residue		479.	
Turbidity		0					

OSWEGO
Kendall County
Oct. 20, 1947

A public water supply was installed by the village of Oswego (978) in 1895.

The initial supply was obtained from a dug well about 12 or 14 ft. in diameter and 18 ft. deep located about 15 ft. west of Well No. 2. The material penetrated was drift except the lower 4 ft. which was in limestone. The water on Sept. 10, 1917 was 6 or 7 ft. deep in the well and after several hr. pumping the depth was reduced to about 2 ft. The production of the well decreased to a small quantity and for a time water was obtained from a spring which had formerly been used by a creamery. The well was abandoned about 1921 and has been filled.

In 1921 Well No. 1 was drilled to a depth of 680 ft. by B. L. Palmer, Aurora, and is located about 100 ft. south of Washington St. and 21 ft. west of Main St. (approximately 1600 ft. N. and 750 ft. E. of the S. W. corner of Section 17, T. 37 N., R. 8 E.). The ground surface elevation is 620± ft. The pump base is now in a pit about 6 ft. below the surface.

The well was cased from the surface to limestone at a depth of 14 ft. below which the hole was 8-in. in diameter to 200 ft. and 6-in. in diameter to the bottom. On Oct. 25, 1924 the non-pumping water level was 40 ft. below the surface, and a production of 100 gpm. was reported. This well was recased in 1932 with 100 ft. of 6-in. pipe to prevent the entrance of water from the upper limestone formation. On Oct. 8, 1947 the water level was 105 ft. below the pump base after a 17-hr. idle period.

The existing pump installation is: 180 ft. of 4-in. column pipe; 6-in., 20-stage American Well Works turbine pump, No. 72034, rated at 100 gpm. against 270 ft. of head; 10 ft. of 4-in. suction pipe; 180 ft. of 18-in. gi. air line; 15-hp. U. S. electric motor.

This well is in service every night for a period of 1 1/2 to 2 hr. and every other night for 5 hr.

Well No. 2 was drilled in 1932 to a depth of 720 ft. by B. L. Palmer & Sons and located in the southwest corner of the triangular block at the intersection of Washington and Van Buren St. (approximately 950 ft. N. and 1550 ft. E. of the S. W. corner of Section 17). The ground surface elevation is 656± ft.

Upon completion of the well the water level was 90 ft. below the top of the casing. In 1939, the well was recased with 192 ft. of 8-in. pipe using some of the old casing. The non-pumping water level at that time was 90 ft. On Oct. 8, 1947, the water level was 135 ft. below the pump base following a 1 1/2-hr. idle period, and after 30-min. pumping at the rate of 100 gpm., the pumping water level was below the air line.

The existing pump installation, made in 1945, is 190 ft. of 5-in. column pipe; 8-in., 10-stage American Well Works turbine pump, No. 71428, rated at a capacity of 100 gpm. against 260 ft. of head; 20 ft. of 4-in. suction pipe; 190 ft. of 1/4-in. gi. air line; 15-hp. U. S. electric motor. The pump is operated every other day for a period of 5 hr. in the morning.

Analysis of a sample (Lab. No. 112,162), collected Oct. 8, 1947 after 30-min. pumping at 100 gpm. showed this water to have a hardness of 13.9 gr. per gal., a residue of 472 ppm., and no iron content.

Combined pumpage averages 50,000 gpd.

Sample-study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Glacial drift, clay and and coarse gravel"	24	24
Silurian system		
Alexandrian series		
"Limestone"	21	45
Ordovician system		
Maquoketa formation		
"Shale"	137	182
Limestone and shale	10	192
Galena-Platteville limestone and dolomite	353	545
St. Peter sandstone	175	720

The hole and casing record is shown in Table 1.

TABLE 1

Hole Record

12-in.	from	0 to 24 ft.
10 1/2-in.	from	24 to 192 ft.
8-in.	from	192 to 200 ft.
6-in.	from	200 to 720 ft.

Casing Record

12-in.	from	0 to 24 ft.
8-in.	from	0 to 192 ft.

LABORATORY NO. 112,162

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.0		Silica	SiO_2	14.0	
Manganese	Mn	0.0		Fluoride	F	1.1	
Calcium	Ca	51.8	2.59	Chloride	Cl	24.0	0.68
Magnesium	Mg	26.3	2.16	Nitrate	NO_3	4.8	0.08
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	125.3	2.61
Sodium	Na	82.3	3.58	Alkalinity (as $CaCO_3$)		248.	4.96
Turbidity		Tr.		Hardness (as $CaCO_3$)		238.	4.75
Color		0		Residue		472.	
Odor		M		Free CO_2 (calc.)		28.	
Temperature		54.6° F.		pH = 7.4			

The public water supply was installed by the city of Ottawa (16,005) in 1894.

Prior to the installation of the city water works, the public supply was obtained from Caton Springs on the south bluff. Water for industries and houses was obtained from artesian wells. In 1894 water was obtained from artesian wells located in the extreme northeast part of the city at the northwest corner of Norris St. and Dayton Road. The wells were arranged in 2 east-west rows, 300 ft. apart, with about 175-ft. spacing between wells and were drilled to a depth of 350 ft. At first, these wells had a free flow sufficient to provide the city demand.

The flow from the wells became inadequate, and pumps were installed. Then in 1896 it was necessary to supplement the supply. Four of the 6 wells, No. 2, 3, 4 and 5, were deepened to depths of 1150 to 1550 ft., and 6-in. casings were placed in each well to a depth of about 285 ft. It was reported that after the wells were deepened, the water flowed to a height of 30 ft. above the ground surface. In 1911 the free flow from the wells was insufficient to supply the demand at all times. Air lift pumps were operated about 50% of the time during the summer and autumn months. With the aid of the pumps, the wells were reported to produce a total of about 1600 gpm. in 1911, butthe capacity was decreasing slowly.

, One of the 350-ft. wells drilled by J.P. Miller & Co., Chicago, in 1894 was deepened by Gray Bros., in Oct. 1896.

Below the 6-in. casing, the hole was 5 15/16-in. diameter. The water was too salty at 1449 ft., and the bottom 200 ft. of the hole was plugged. The artesian flow continued until 1903 or 1904.

In 1922, No. 6, the northeast well of the old original well group, was deepened from 350 to 1200 ft., the reconstruction being done by Vezain Bros., Ottawa. It was cased with 6-in. pipe to a depth of 285 ft., and the hole below the casing was 6-in. in diameter similar to the other 4 deepened wells. This well was abandoned in 1926 when it was replaced by a new well drilled 30 ft. to the south and known as Well No. 6. It was drilled by J. Otis Heflin, Joliet, to a depth of 1120 ft. It was drilled 12-in. in diameter and cased with 10-in. pipe to. 288 ft., and the hole was 10 in. in diameter from 288 to 1120 ft. The ground surface at this location is 482i ft. In Mar. 1927, while the air lifts in Wells No. 3, 5, and 6 were in operation, the water level in No. 2, southwest well, was 25 ft. below the ground surface.

All of these wells have been abandoned, and the public supply is obtained from Wells No. 7, 8, and 9.

Well No. 7 is located at the water works (or approximately 1200 ft. N. and 1600 ft. E. of the S. W. corner of Section 1, T. 33 N., R. 3 E.). It is about 1000 ft. northeast of the Joliet St. Well No. 8-B. The drilling was started in 1928 by J. C. Schomas, Ottawa, and finished in 1929 by J. Otis Heflin and Frank Belrose, Ottawa.

This was a new well, not an old well rehabilitated.

The elevation of the pump base is 488.67 ft. The well was originally cased with 120 ft. of 16-in. and 154 ft. of 12-in. pipe without any screen. The hole below the casing is 12 in. in diameter. In 1932 the well was recased by Layhe-North Central Co., Chicago, with 228 ft. of 12-in. pipe.

The well was repaired in Nov. 1937 by the J. P. Miller Artesian Well Co. because the production had decreased to 420 gpm. The well was "shot" with nitro-glycerine and cleaned out. The production increased to 1100 gpm.

The pumping installation consists of 180 ft. of 8-in. column pipe; 11 3/8-in. 4-stage Peerless turbine pump, No. 8224, rated at 800 gpm.; the overall length of the pump is 4 1/2 ft.; 160 ft. of 1/4-in. air line; 60-hp. 1800 rpm. U. S. electric motor, No. 159662.

On Mar. 26, 1945 the water level was 52 ft., and after pumping 9 hr. at 990 gpm., the drawdown was 89 ft. On May 25, 1948 the npn-pumping water level was 74 ft. After 5-min. pumping the water level was below the air line - a drawdown ofmore than 86 ft.

Analysis of a sample (Lab. No. 111,050) collected July 11, 1947, showed the water from Well No. 7 to have a hardness of 17.4 gr. per gal., a residue of 429 ppm., and an iron content of 0.1 ppm.

In 1931, a well, then known as 8A or the South Side Well, was drilled by Layne-North Central Co., and was located on the south side of Ottawa on Lot 7, Block 1, Lawndale Addition, at State and Watson St. (or approximately 2600. ft. N. and 600 ft. W.of the S. E. corner of Section 14). The well was drilled to a depth of 1290 ft. below a ground surface elevation of 577± ft.

The well was cased with 282 ft. of 16-in. pipe

and reports indicate that the hole below the casing was 10 in. in diameter. On Mar. 31, 1932, immediately after completion, a production test was made by the driller. The water level was reported at 92 ft., and after 9 1/2-hr. pumping at 922 gpm., the drawdown was 142 ft.

Analysis of a sample (Lab. No. 70636), collected on Mar. 31, 1932 at the end of the production test, showed the water from this well to have a hardness of 77.0 gr. per gal., a total mineral content of 3647.3 ppm., and an iron content of 0.6 ppm.

The water was of such undesirable mineral quality that the well was abandoned in the same year.

Well 8-B, now known as No. 8, was completed in Aug. 1932 by Layne-North Central Co., and is located 36. ft. north of Joliet St. and 160 ft. West of Kendall St. (or approximately 400 ft. N. and 750 ft. E. of the S. W. corner of Section 1).

The well was drilled to a depth of 1180 ft. below a ground surface elevation of 488.6 ft.

The well is cased with 272 ft. of 16-in. od. pipe with the top of the casing set at about 2 1/2 ft. above the ground surface. An outside well packer is set at 167 ft., and a drive shoe at 272 ft. in order to shut out all water behind the casing. Below the casing, the hole is 15 in. in diameter.

The pumping installation consists of 165 ft. 2 in. of column pipe; 8-stage Layne turbine pump, No. 6196, having an overall length of 6 ft. 8 1/2-in.; 20 ft. of suction pipe; 75-hp., 1175 rpm. General Electric motor, No. 5285010.

During drilling operations, water levels were reported as follows:

Drilling Depth ft.	Water Level ft.
100	14 2/3
200	16 1/3
330	13
395	7
520	10 1/3
706	5 1/2
790	7

When the well was completed, the water level was 4 ft. 4 in. below the top of the drive pipe. During a production test by the driller, the drawdown was reported to be 123 ft. when pumping at 1260 gpm.; and when pumping at 1100 gpm., the drawdown was 63 ft.

Analysis of a sample (Lab. No. 102,916), collected Mar. 27, 1945 after 4-hr. pumping at 980 gpm., showed the water from Well No. 8 to have a hardness of 18.8 gr. per gal., a residue of 537 ppm., and an iron content of 0.1 ppm. The quality is very similar to that obtained from Well No. 7.

Well No. 9 was completed in Nov. 1946 by the J. P. Miller Artesian Well Co. It is located on the south side of Ottawa on Lot 4, Block 7 of College Hill Subdivision (or approximately 1045 ft. N. and 2190 ft. W. of the S. E. corner of Section 14).

The depth of the well is 3 15 ft. below a ground surface elevation of 585± ft. The first drilling was to a depth of 427 ft. into sandstone, but an analysis (Lab. No. 108,291 and 108,297) showed very undesirable mineral quality and a very high chloride content (1700 to 2000 ppm.) especially after the pump had been idle. The chloride content was relatively low (680 to 715 ppm.) at lower pumping rates.

The depth of the well was then extended to 516 ft. into dolomite, increasing the production rate from about 200 to 400 gpm. The non-pumping water level was about 11 ft. higher, and the hydrogen sulfide content was lower, but the increase of mineral content (from 1968 to 5081 ppm., Lab. No. 108,425 and 108,431) made the water unfit for normal use.

In Jan. 1947, the well was plugged at a depth of 315 ft., and an analysis (Lab. No. 109,018) after pumping 2 1/4 hr., showed the water to have a chloride content of 830 ppm.

The hole and casing diameter record is shown in Table 1.

TABLE 1

Hole Record

17 1/4-in. from surface to 126 ft. 10 in.
12-in. from 126 ft. 10 in. to 516 ft.
(Hole plugged at 315 ft.)

Casing Record

18-in. od. to 42 ft. 5 in.
12-in. id. from surface to 126 ft. 10 in.

Cement grout was placed outside the 12-in. casing (105 sacks of cement were used.)

During drilling operations, the water level was 137 to 138 ft. below the drill floor.

In July 1947, Well No. 9 was not yet equipped for pumping, and the city supply was being obtained from Wells No. 7 and 8.

The water is not treated.

Pumpage in July 1947 averaged 1,346,000 gpd.

LABORATORY NO. 111,050

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	13.4	
Manganese	Mn	Tr.		Fluoride	F	0.7	
Calcium	Ca	72.9	3.65	Chloride	Cl	76.0	2.14
Magnesium	Mg	28.1	2.31	Nitrate	NO_3	2.9	0.05
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	11.3	0.24
Sodium	Na	42.1	1.83	Alkalinity (as $CaCO_3$)		268.	5.36
Color		0		Hardness (as $CaCO_3$)		298.	5.96
Odor		0		Residue		429.	
Turbidity		0		Temperature 59° F.			

Sample-study log of Well No. 8 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene and Pennsylvanian (?) systems		
No record	10	10
Ordovician system		
St. Peter sandstone	155	165
Shakopee dolomite	130	295
New Richmond formation		
Sandstone and dolomite	10	305
Sandstone, incoherent	45	350
Sandstone, some dolomite	55	405
Oneota formation		
Dolomite, thin beds of sandstone	160	565
Sandstone and dolomite	45	610
Cambrian system		
Trempealeau dolomite	245	855
Franconia sandstone and dolomite	190	1045
Galesville formation		
Sandstone and dolomite	25	1070
Sandstone, incoherent	105	1175

Prior to 1946, when a new rock well was placed in service, the public water supply of Palatine (2222) had been obtained from 4 drift wells located at the northwest corner of Brockway Ave. and Washington St. All of these wells were reported to have tapped water from sand and gravel deposits overlying bedrock at depths of 168 1/2 to 172 ft. The elevation of the ground surface is 740± ft. These wells are located approximately 550 to 610 ft. S. and 720 ft. W. of the N.E. corner of Section 22, T. 42 N., R. 10 E.

Well No. 1, located about 29 ft. north of the north line of Washington St. and 47 ft. west of the west line of Brockway Ave. was drilled in 1891. The diameter was 2 in. and the casing extended to the bottom of the well, without any screen. When drilled, the water level was reported to be 31 ft. above the ground surface. On July 11, 1914 the non-pumping water level was at ground surface and flowed into a reservoir at a rate of 25 gpm. when adjacent wells were not in use. When water was being pumped from the other wells, the water level in this well was lowered 19 ft. below the ground surface. The well was abandoned in 1927.

Well No. 2, located about 17 ft. south and 8 ft. west of No. 1, was drilled in 1904. It was 6 in. in diameter and cased to the bottom at 168 1/2 ft. Water was pumped by air lift, and in July 1914 pumping was reported at a rate of 100 gpm. The pumping water level was 19 ft. below the ground surface. This well was abandoned in 1927.

Well No. 3, located about 16 ft. north and 5 ft. west of Well No. 2, was drilled in 1911. It is 10 in. in diameter and cased to the bottom, at 168 1/2 ft., with solid wrought iron pipe. The water level on July 11, 1914, when pumping at a rate of 85 gpm., was 19 ft. below the ground surface.

In May 1943 new pumping equipment was installed as follows: 100 ft. of 5-in. column pipe; 8-in., 9-stage American Well Works turbine pump rated at 200 gpm. against 211 ft. of head; overall length of pump is 10 ft.; 20 ft. of 5-in. suction pipe with strainer; 100 ft. of galvanized air line; 20-hp. General Electric motor.

Before the new pump was installed the water level was 6 ft. below the pump base, and afterwards the pumping water level was 77 ft. This well has been the principal source of the water supply since it was drilled.

Analysis of sample (Lab. No. 106,282) collected on Apr. 22, 1946 after pumping 18 min. at 200 gpm. after a 20-min. idle period, showed the water from this well to have a hardness of 24.0 gr. per gal., a total mineral content of 723 ppm. and character not unusual for waters from this depth in this vicinity and similar to that from the other city wells. (The iron content of the other wells varies from 0.7 to 2.4 ppm.)

Well No. 4, located approximately 50 ft. northeast of Well No. 3, was drilled in 1925. It is reported to be cased with 12-in. id. perforated pipe.

The pumping equipment consists of 149 ft. of 6-in. column pipe; 8-in., 15-stage Layne turbine pump rated at 250 gpm. against a head of 265 ft.; the overall length of the pump is 11 ft.; 10 ft. of 8-in. suction pipe; 30-hp. General Electric motor.

This well is seldom used. The perforated casing admits fine sand; and the water, when first pumped after a quiet period, is turbid and has a milky color with an odor of sulphur which necessitates pumping to waste until the water clears. The proximity of Wells No. 3 and 4 prevents simultaneous operation. Well No. 3 will run dry due to the deeper setting and the higher capacity of the pump in Well No. 4.

In order to augment the village water supply to accommodate an expanding residential area, a well was drilled in Jan. 1945 by Henry Boysen, Jr., Libertyville. This well is located at the southeast corner of Ashland and Lincoln Ave. (or approximately 1200 ft. N. and 1300 ft. W. of the S. E. corner of Section 14). It was cased with 168 ft. of 12 3/4-in. od. pipe. The hole was 12 in. in diameter from the bottom of the casing to a total depth of 265 ft. The elevation of the ground surface, at this location, is 740± ft. Very little water was encountered during drilling operations. When the well was tested for yield it produced 27 gpm. and ran dry after 5 to 10 min. of pumping. About 120 gal. of muriatic acid were poured into the well. This did not improve the yield. The well was considered a failure and abandoned.

Well No. 5, located approximately 2000 ft. S. and 2000 ft. W. of the N. E. corner of Section 22, was completed for the village in Oct. 1945 by Henry Boysen, Jr. The elevation of the ground surface, at this location, is 740± ft.

The well was drilled to a total depth of 209 ft. and was cased to a depth of 158 ft. with 12-in.

id. pipe below which the hole is 12 in. in diameter.

Sample-study log of Well No. 5 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Till and silt	142	142
Silurian system		
Alexandrian dolomite	54	196
Ordovician system		
Maquoketa shale	13	209

A short production test was made on Oct. 18, 1945. Before pumping, the water level was 2 ft. below the ground surface. After 30-min. pumping at 210 gpm. the water level was lowered to 98 ft. After 4 hr. of continuous pumping at a gradual deceleration of the rate to 185 gpm., the water level was 93 ft. After a shut-down of 20 min., pumping was resumed, and the rate was gradually accelerated to 235 gpm. for 1 hr. The water level dropped below the end of the air line which was 148 ft. in length.

The pumpage is not metered, but is estimated to average 120,000 gpd. The water is not treated.

LABORATORY NO. 106,282

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.2		Silica	SiO_2	17.5	
Manganese	Mn	0.0		Fluoride	F	0.7	
Calcium	Ca	71.4	3.57	Chloride	Cl	5.0	0.14
Magnesium	Mg	56.6	4.65	Nitrate	NO_3	0.4	0.01
Ammonium	NH_4	0.8	0.04	Sulfate	SO_4	400.7	8.34
Sodium	Na	65.1	2.83	Alkalinity	(as $CaCO_3$)	130.	2.6
Color		0		Hardness	(as $CaCO_3$)	411.	8.22
Odor		0		Residue		723.	
Turbidity		Tr.					
Temperature		51.2° F.					

PAW PAW
Lee County
Jan. 9, 1948

A public water supply system was installed by the village of Paw Paw (523) in 1891.

Water was originally obtained from a well drilled by W.C. Green, Lee, in 1891. Water was pumped by a windmill-driven deep-well pump.

In 1895, J. P. Miller & Co., Brookfield, drilled a new well after which the old well was abandoned. The new well is 1018 ft. deep and located 75 ft. north of the center line of the Chicago, Burlington, & Quincy R. R. and 175 ft. west of the center line of Peru St. (or approximately, 750 ft. N. and 1000 ft. W. of the S. E. corner of Section 10, T. 37 N., R. 2 E.). The surface elevation is 928± ft.

Correlated driller's log of well drilled in 1895 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Surface sand and gravel	454	454
Ordovician and Cambrian systems		
Oneota and Trempealeau formations		
Limestone	296	750
Cambrian system		
Franconia formation		
Shale	135	885
Galesville formation		
Sandstone	133	1018
Eau Claire formation		
Limestone	at	1018

The casing record is reported as follows: 10-in. from surface to 133 ft.; 8-in. from 100 to 402 ft.; 6-in. from 345 to 454 ft. 6 in. The 6-in. casing was driven 6 in. into the limestone.

The well was equipped with a steam-head 5 3/4-in. by 36-in. American Well Works deep-well pump operating at about 15 spm. The water cylinder was reported to be placed at a depth of about 250 ft. or about 60 ft. below the non-pumping water level at the time the well was drilled.

In 1922, the non-pumping water level was reported to be about 180 ft., and the discharge rate about 77 gpm. On Jan. 9, 1948, the non-pumping water level was 188 ft. and, after 1-hr. pumping at 80 gpm., the drawdown was 5 ft.

In Feb. 1938, the pump broke off and dropped into the well. After the old pump was fished out, the American Well Works loaned and installed a temporary turbine pump rated at 200 gpm. A report of a production test by the pump company at that time showed that when pumping at 200 gpm., the drawdown was 23 ft. from a non-pumping water level of 202 ft. below the surface.

The existing pump assembly, made in Aug., 1943, is: 240 ft. of 4-in. column pipe; 7-in., 10-stage American Well Works oil lubricated turbine pump No. 68675, rated at 180 gpm. against a head of 237 ft. when operating at 1760 rpm.; 10 ft. of 4-in. suction pipe; 240 ft. of air line; 15-hp. U. S. Electric Co. motor, No. 304148.

Analysis of a sample (Lab. No. 113,131), collected Jan. 9, 1948, after 1-hr. pumping at 80 gpm., showed this water to have a hardness of 11.4 gr. per gal., a residue of 238 ppm., and an iron content of 0.2 ppm.

Pumpage in 1947 averaged 40,000 gpd.

LABORATORY NO. 113,131

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	15.0	
Manganese	Mn	0.0		Fluoride	F	0.4	
Calcium	Ca	40.3	2.02	Chloride	Cl	1.0	0.03
Magnesium	Mg	23.2	1.90	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	0.6	0.03	Sulfate	SO_4	2.3	0.05
Sodium	Na	19.6	0.85	Alkalinity (as $CaCO_3$)		236.	4.72
Turbidity		0		Hardness (as $CaCO_3$)		196.	3.92
Color		0		Residue		238.	
Odor		0		Temperature 54.2° F.			

A public water supply was installed by the city of Paxton (3106) in 1887.

In Aug. 1875 a well was completed at a depth of 2673 1/2 ft. by J. P. Miller Artesian Well Co., Brookfield, and located near the corner of Taft and State St. The water was highly mineralized and not suitable for public usage. From 1887 to 1912 four tubular wells were drilled to depths ranging from 142 to 150 ft. and located at the pumping station in the rear of the city hall at Market and Center St. (or approximately 300 ft. N. and 175 ft. E. of the S. W. corner of Section 8, T. 23 N., R. 10 E.). The ground elevation is 795± ft.

In 1912, three of the wells were furnishing the city supply. The combined yield from the 3 wells was estimated to be 115 gpm.

In 1924 all of these wells had been abandoned except the 8-in. well, now called Well No. 1, and it was reported to yield 67 gpm. On Jan. 24, 1943 a production test showed the yield of the well had decreased to 30 gpm. The screen was jetted and the well treated with calgon. The yield was increased to 65 gpm. while the pump was out. The depth of the well was measured 144 1/2 ft. and the water level was 108 1/2 ft. below the pump base. On Oct. 16, 1948 the water level was 119 ft. after a 3-hr. non-pumping period and 141 ft. after 5-minutes pumping at 65 gpm. The old pump was reinstalled, with new shaft on July 23, 1943. The pumping equipment in Well No. 1 now consists of 130 ft. of 4-in. column pipe; 6-in., 11-stage Fairbanks-Morse turbine pump, Branch Order No. 3092, having an over all length of 5 1/2 ft.; 142 ft. of 1/4-in. gi. air line; 8 ft. of 4-in. suction pipe; 5-hp., 1735 rpm. Fairbanks-Morse electric motor, No. 339784.

Well No. 1 serves as an auxiliary supply unit.

In 1912 a 6-in. well was drilled to a depth of 200 ft. by M. Ebert and Co., Washington, and located at the city hall. No water-bearing formation was encountered below a depth of 150 ft.

An attempt was then made to obtain water by blasting in the upper 400 ft. of the old 2673 1/2-ft. well but without success. The drift was said to be 400 ft. thick.

A well was then drilled by M. Ebert and Co. to a depth of 140 ft. and located on Taft St. south of State, about 100 ft. south of the old deep well and 750 ft. northwest of the city hall wells. The well was cased with 124 ft. of 8-in. pipe and 16 ft. of Cook screen. In 1917 the non-pumping water level was 98 ft. below the ground surface elevation of 792± ft. In Jan. 1924 the depth to water was 100 ft., when pumping in 2 wells nearby. The well was abandoned early in 1924.

In 1917 an 8-in. well was drilled to a depth of 150 ft. by C. A. Musson, Hoopeston, and located east of Taft St., south of State St., and 25 ft. north of the well drilled in 1912. This well was equipped with 14 ft. of screen. The well has been abandoned.

In 1923, an 8-in. well called Well No. 2 was drilled to a depth of 150 ft. by E. W. Johnson and Son, Bloomington and located 33 ft. south of the well drilled in 1917 and 8 ft. south of the well drilled in 1912. This well has been abandoned, and filled. The pump was installed in Well No. 5.

In 1945, when pumping in either Well No. 3 or 4, no water could be obtained from Well No. 2.

In 1921 an 8-in. well now called Well No. 3, was drilled to a depth of 151 ft. by Otto Stiegman, Roberts, and located about 135 ft. south of State St. and 65 ft. east of Taft St.; 14 ft. north of Well No. 2 (or approximately 1000 ft. N. and 25 ft. W. of the S. E. corner of Section 7). A 20-ft. Cook screen, having No. 12 slot openings, was placed at the bottom. Upon completion, the yield was reported to be 60 gpm. On July 29, 1943, the main pumping water level was 107 ft. below the pump base.

The pumping assembly consists of 130 ft. of 4-in. flanged column pipe; 8-in., 12-stage Sterling turbine pump, No. S-3-98, having a discharge of 180 gpm., and an overall length of 20 ft. 9 in.; 10 ft. of 4-in. suction pipe with strainer; 146 ft. 2 in. of air line; 15-hp., 1750 rpm. Westinghouse electric motor, No. 8030758.

Well No. 3 serves as an auxiliary supply unit.

In 1930, Well No. 4 was drilled to a depth of 150 ft. by E. W. Johnson, and located about 400 ft. north of Well No. 3, or 25 ft. east of Taft St., and 10 ft. south of the alley between State and Holmes St. The ground elevation is 793± ft.

The well was cased with 10-in. pipe to 129 ft. and a 10-in. Johnson screen from 129 to 150 ft.

On July 29, 1943, the depth of the well was measured 145 1/2 ft. below the pump base and the non-pumping water level was 110 ft. The

pump discharge rate was 180 gpm. against a pressure of 50 psi. In Jan. 1945 the non-pumping water level was 110 ft. On Oct. 21, 1948, after 7-hr. pumping at an estimated rate of 180 gpm. the water level was 138 ft.

Sample-study log of Well No. 4 furnished by the State Geological Survey:

Formation	Thickness ft.	Thickness in.	Depth ft.	Depth in.
Pleistocene system				
Soil, till and silt	130		130	
Gravel, sandy, clean	17	6	147	6
Silt and clay	2	6	150	

The pumping assembly consists of 130 ft. of 5-in. column pipe; 8-in., 12-stage Pomona turbine pump, having an overall length of 6 ft. 8 in., 8 ft. of 4-in. suction pipe; 143 ft. of air line; 25-hp. General Electric motor.

In Oct. 1945, it was reported that there was considerable interference between Wells No. 3 and 4. If both pumps were started at the same time, the pump in Well No. 4 would break suction in 1 1/2 hr.

Analysis of a sample (Lab. No. 116,219) collected Oct. 21, 1948, after 7-hr. pumping, showed the water from Well No. 4 to have a hardness of 18.7 gr. per gal., a residue of 482 ppm., and ah iron content of 1.0 ppm.

In 1945 due to the insufficiency of water supply from Wells No. 1, 3 and 4 an electrical earth resistivity survey was made by the State Geological Survey.

Well No. 5 was completed to a depth of 149 ft. in Oct. 1945 by Woollen Bros., Wapella, and located at the site of Test Hole 45-2, about 10 ft. north of Pine St. and 110 ft. east of Maple St., (or approximately 2350 ft. N. and 650 ft. W. of the S. E. corner of Section 7.) Gravel and sand were penetrated between 117 and 149 ft. below a ground elevation of 790t ft.

The well was cased with 8-in. pipe from 2 ft. above to 126 ft. below ground level and with 23 ft. of Johnson Armco-iron screen, having No. 40 slot openings.

On Oct. 10, 1945 a production test was made by the State Water Survey. The test was very short because of danger of flooding adjacent property. Before the test, the static water level was 101 ft. below the top of the casing (Elev. 791.5 ft.). When pumping at 275 gpm., maximum capacity of the pump, the drawdown was 25 ft., to the top of the screen. After 1-hr. pumping at 155 gpm. the drawdown was 13 ft. Eight minutes after stopping the pump, the water level returned to 0.75 in. below the starting level. On Oct. 21, 1948 the non-pumping water level was 106 ft.

The pump, removed from Well No. 2, was installed with new bowl assembly and now consists of 120 ft. of 4-in. od. column pipe; 6-in., 9-stage Fairbanks-Morse turbine pump, No. 43278, with bronze impellers and having ah overall length of 5 ft.; 130 ft. of 1/4-in. air line; 14 ft. of 4-in. suction pipe; 10-hp., 3425 rpm. electric motor.

Well No. 5 is in daily service and is generally used at night when Well No. 4 is not in use.

Analysis of a sample (Lab. No. 104,473) collected Oct. 10, 1945 showed this water to have a hardness of 11.3 gr. per gal., a residue of 311 ppm. and an iron content of 1.4 ppm.

Pumpage is estimated to average 242,000 gpd. of which 18,000 gpd. is commercial usage.

LABORATORY NO. 116,219

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.0		Silica	SiO_2	23.8	
Manganese	Mn	0.0		Fluoride	F	0.3	
Calcium	Ca	72.2	3.61	Chloride	Cl	1.0	0.03
Magnesium	Mg	34.3	2.82	Nitrate	NO_3	0.2	Tr.
Ammonium	NH_4	6.0	0.34	Sulfate	SO_4	56.8	1.18
Sodium	Na	48.8	2.12	Alkalinity (as $CaCO_3$)		384.	7.68
Turbidity		10		Hardness (as $CaCO_3$)		322.	6.43
Color		0		Residue		482.	
Odor		0		Free CO_2 (calc.)		38.	
Temperature 54.5° F.				pH = 7.4			

PAYSON
Adams County
Mar. 25, 1948

The village of Payson (456) installed a public water supply in 1910.

Water is obtained from a well drilled about 1910 and located on the west side of Main St. between Edwards and State St. (or approximately 1000 ft. N. and 100 ft. E. of the S. W. corner of Section 8, T. 3 S., R. 7 W.). The ground surface elevation at the well site is 763± ft.

The well is reported to be 330 ft. deep. A 100-ft. length of 5-in. id. casing is reported to extend into the first limestone and the hole is 6 in. in diameter to a depth of 150-160 ft. An unknown amount of 4-in. liner is reported below the bottom of the 6-in. hole.

At some time, a 60-ft. length of 2-in. pump column has been dropped into the well. The non-pumping water level in 1940 was reported to be about 75 ft. below the ground surface.

A production test was made by the State Water Survey on Aug. 7, 1940. The well produced at a rate of 74 gpm. for 7 hr. The non-pumping water level was reported to be 75 ft. below the ground surface. No pumping water level measurements were available, but from the characteristics of the pump, it was estimated that the drawdown was about 67 ft.

The pumping equipment installed in 1940 consists of 170 ft. of 3-in. column pipe; 4-in. 15-stage, Fairbanks-Morse turbine pump No. 8565, having 5 1/2-ft. overall length, and rated at 50 gpm. against 284 ft. of head; 20 ft. of 3-in. column pipe; 7 1/2-hp. Fairbanks-Morse electric motor No. 366940 operating at 3600 rpm. There is no air line. The pump base is about 1 ft. above floor level, which is at ground level.

Analysis of a sample (Lab. No. 113,934) collected Mar. 25, 1948 after 7-hr. pumping at 74 gpm., showed the water to have a hardness of 13.9 gr. per gal., a residue of 296 ppm., and an iron content of 0.1 ppm.

Pumpage is estimated to average 20,000 gpd.

LABORATORY NO. 113,934

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	19.7	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	71.1	3.56	Chloride	Cl	24.0	0.68
Magnesium	Mg	14.6	1.21	Nitrate	NO_3	43.8	0.71
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	24.9	0.52
Sodium	Na	11.5	0.50	Alkalinity	(as $CaCO_3$)	168.	3.36
Turbidity		0		Hardness	(as $CaCO_3$)	239.	4.77
Color		0		Residue		296.	
Odor		0					
Temperature		55.8° F.					

PEARL
Pike County
May 13, 1948

A public water supply was installed for the village of Pearl (539) in 1914. The system was installed by the late Dr. F. M. Thurman, Pearl and presently is owned by his son, W. M. Thurman.

Water is obtained from a spring located on Thurman's farm about 3/4 mile south of the center of the village (or approximately 1500 ft. S. and 1200 ft. E. of the N. W. corner of Section 15, T. 7 S., R. 2 W.).

In 1914, it was reported that the spring flowed at a rate of about 50 gpm. Water flows by gravity to a 1200 gal. capacity concrete tank, 20 ft. distant from the spring, thence is piped to a Rife hydraulic ram, rated at 2600 gal. per hr. capacity. The water is pumped by the ram to a 30,000 gal. reservoir on top of the bluff and thence flows by gravity to the distribution system.

Analysis of a sample (Lab. No. 114,727), collected May 13, 1948 showed the water to have a hardness of 12.0 gr. per gal., a residue of 236 ppm., and no iron.

Pumpage is estimated to average 30,000 gpd.

LABORATORY NO. 114,727

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.0		Silica	SiO_2	31.8	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	62.5	3.13	Chloride	Cl	4.0	0.11
Magnesium	Mg	12.0	0.99	Nitrate	NO_3	9.1	0.15
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	18.7	0.39
Sodium	Na	1.2	0.05	Alkalinity	(as $CaCO_3$)	176.	3.52
Turbidity		Tr.		Hardness	(as $CaCO_3$)	206.	4.12
Color		0		Residue		236.	
Odor		0					
Temperature 54 1/2° F.							

PEARL CITY
Stephenson County
Nov. 13, 1947

The village of Pearl City (447) installed a public water supply about 1896.

Originally water was obtained from a well drilled on high ground in the southwest part of town. The well was abandoned a few years later due to inadequate yield, and water was purchased from a creamery company.

In 1910 a pumping station was built and 2 wells were drilled 10 ft. apart on the north side of North St. and about 220 ft. east of Main St. (or approximately 1400 ft. S. and 220 ft. E. of the N. W.corner of Section 9, T. 26 N., R. 6 E.). The surface elevation is 820± ft.

Both wells were 40 ft. deep, and one well was 6 in. and the other was 8 in. in diameter. Both wells penetrated about 3 ft. of top-soil, clay, and quicksand, and terminated in gravel.

Water was pumped from the 2 wells by a Gould's triplex pump driven by an electric motor. A 3-in. suction pipe extended to a depth of 32 ft. in each well. The pump capacity was 85 gpm.

In 1916 the non-pumping water level in the wells was 15 to 18 ft. below the surface and after pumping several hr. the water level was 28 1/2 ft. below the pump station floor. One well alone could not supply 85 gpm., the capacity of the pump.

Analysis of a sample (Lab. No. 35546), collected Oct. 14, 1916, showed water from the 2 wells to have a hardness of 33.1 gr. per gal., a residue of 796 ppm., and an iron content of 0.6 ppm.

Both wells have been abandoned.

In 1922 a well was drilled 13 ft. west of the 6-in. well. This well was originally drilled to a depth of 322 ft. but in 1925 Gus Nelson, Hayfield, Minn., deepened the well to 428 ft., which was reported to be the base of the sandstone. The well is cased with 8-in. casing to the dolomite at a depth of 40 ft. The g round surface elevation is 815± ft.

The existing pump equipmentis: 230 ft. of4-in. column pipe; 5 1/2-in., 36-stage od. Pomona turbine pump, No. J-1100 rated at 125 gpm.; the overall length of the pump is 12 1/2 ft.; 10 ft. of 4 1/2-in. suction pipe; 20-hp. Westinghouse electric motor, No. 8149854, operating at 1760 rpm.

Analysis of a sample (Lab. No. 112,577) collectedNov. 13. 1947 after 25-min. pumping showed this water to have a hardness of 25.0 gr. per gal., a residue of 472 ppm., and an iron content of 0.6 ppm.

The water is not treated.

Pumpage is estimated to be 14,000 gpd.

The Dean Milk Co. well located 200 ft. east of the town well was drilled in 1937 by P. E. Millis, Byron.

LABORATORY NO. 112,577

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.6		Silica	SiO_2	15.3	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	93.8	4.69	Chloride	Cl	13.0	0.37
Magnesium	Mg	47.3	3.89	Nitrate	NO_3	3.2	0.05
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	58.6	1.22
Sodium	Na	13.3	0.58	Alkalinity (as $CaCO_3$)		376.	7.52
Turbidity		Tr.		Hardness (as $CaCO_3$)		429.	8.58
Color		0		Residue		472.	
Odor		0		Temperature 53.5° F.			

Sample-study log of the Dean Milk Co. well furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and till	30	30
Ordovician system		
Galena-Platteville formations		
Dolomite	190	220
Dolomite, thin shale beds	105	325
Glenwood sandstone, some dolomite, thin shale beds at top	15	340
St. Peter formation		
Sandstone, incoherent	280	620
Shale, some sandstone and chert	95	715
Cambrian system		
Trempealeau formation		
Dolomite	25	740
Shale (cavern fill?)	5	745
Dolomite	75	820
Franconia sandstone and shale	90	910
Galesville sandstone		
Sandstone, incoherent	15	925
Sandstone, partly dolomitic	35	960
Sandstone, incoherent	50	1010
Sandstone, partly dolomitic	20	1030
Eau Claire shale	6	1036

A public water supply was installed for the village of Pecatonica (1302) in 1889.

Water was originally obtained from a well located near the northeast corner of 8th and Main St. (or approximately 1820 ft. N. and 50 ft. E. of the S. W. corner of Section 28, T. 27 N., R. 10 E.). The well was dug and blasted into limestone to a diameter of 18 ft. and to a depth of 20 ft. The ground surface elevation is 760± ft. Water was pumped from the well by either of two 9-in. by 5 1/4-in. by 10-in. Deane duplex pumps, which were driven by a 25-hp. steam boiler.

In 1917, when not pumping for 12 or more hr., the water level was 11 ft., but the well emptied during pumping.

Analysis of a sample (Lab. No. 26343) collected Oct. 20, 1913, showed water from this well to have a total hardness of 330, a residue of 357, and an iron content of 0.1 ppm.

About 1917 a spring located about 900 ft. southwesterly from the well was developed as a public water supply. Water flowed from the spring into the well through a 6-in. pipeline.

This well has not been in service since 1936. In case of emergency, water is pumped from this well by means of a centrifugal pump, belt-connected to a 30-hp. Stover gasoline engine.

In 1936, Paul E. Millis, Byron, drilled a well to a depth of 660 ft. and located 45 ft. north and 10 ft. west of the old well. This well is 10-in. in diameter, and is cased from the surface to 14 ft. with 12-in. pipe, and from the surface to 44 ft. with 10-in. pipe.

On Oct. 19, 1947, the well was equipped with 100 ft. of 6-in. column pipe; 8-in., 4-stage Fairbanks-Morse turbine pump, No. 56675, having an overall length of 4 ft. and a rated capacity of 400 gpm. against 100 ft. of head; 20 ft. of 6-in. suction pipe; 15-hp. General Electric motor.

On Dec. 4, 1946, when pumping at 240 gpm. the drawdown was reported to be 18 ft. below a non-pumping water level of 15 ft.

On Oct. 28, 1947 the distance to water below the pump base was 11.7 ft. after an idle period of 2-hr.

Analysis of a sample (Lab. No. 112,380) collected Oct. 28, 1947 after 1 1/2 hr. of pumping at a rate of 400 gpm., showed this water to have a total hardness of 16.4 gr. per gal., a residue of 306 ppm., and an iron content of 0.1 ppm.

All water is chlorinated at the pumping station.

This well was the source of the entire public water supply since it was placed in service in 1936.

A new well was drilled to a depth of 750 ft. on Mar. 5, 1946 by the C. W. Varner Well Drilling Co., Inc., Dubuque, Iowa, and located about 90 ft. south of Seventh St. and 240 ft. west of Main St. (or approximately 2100 ft. N. and 400 ft. W. of the S. E. corner of Section 29). The ground surface elevation is 785t ft.

The hole and casing record is given in Table 1.

TABLE 1

Hole Record

20-in.	from	0 to	16 ft.
18-in.	from	16 to	145 ft.
12-in.	from	145 to	438 ft.
10-in.	from	438 to	750 ft.

Casing Record

20-in.	od. from	0 to	16 ft.
12 1/2-in.	id. from	0 to	145 ft.

Annular space outside of 12 1/2-in. id. gwi. casing was cement grouted.

Upon completion of the well, the standing water level was reported to be 36 ft. below the top of the casing (2 ft. above ground level). On Sept. 1-3, 1946, when pumping at a. rate of 400 gpm. for 1 1/2 hr. the drawdown was 65 ft. The pumping rate was then reduced to 365 gpm., and at the end of 2 hr., the drawdown was 60 ft. The rate of pumping was then reduced to 350 gpm. for the remainder of a 48-hr. test. The drawdown was 64 ft. after 28 hr. and maintained this level throughout the balance of the period.

The well has not been equipped for service as yet.

Pumpage is estimated to be 90,000 gpd.

LABORATORY NO. 112,380

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	12.8	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	53.2	2.66	Chloride	Cl	5.0	0.14
Magnesium	Mg	36.4	2.98	Nitrate	NO_3	22.6	0.36
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	32.7	0.68
Sodium	Na	0.5	0.02	Alkalinity (as $CaCO_3$)		224.	4.48
Turbidity		Tr.		Hardness (as $CaCO_3$)		282.	5.64
Color		0		Residue		306.	
Odor		0		Free CO_2 (calc.)		23.	
Temperature 53.5° F.				pH = 7.4			

Sample-study log of well drilled in 1946 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and silty sand	5	5
Ordovician system		
Platteville dolomite	110	115
Glenwood dolomite, shale and sandstone	10	125
St. Peter formation		
Sandstone, incoherent	272	397
Sandstone, chert, some shale and quartz	72	469
Cambrian system		
Trempealeau dolomite	26	495
Franconia sandstone, shale, thin dolomite beds	79	574
Galesville formation		
Sandstone, incoherent	35	609
Sandstone and dolomite	14	623
Sandstone, incoherent	67	690
Sandstone, some dolomite	9	699
Eau Claire shale, siltstone, sandstone, dolomite	51	750

PEKIN
Tazewell County
Aug. 11, 1947

The water supplyfor the city of Pekin(19,407) is described in Bulletin No. 33, published in 1940.

All wells, constructed prior to 1927, have not been used for many years.

Well No. 4 was completed in 1946 to a depth of 119 ft. by Kelly Well Co., Grand Island, Neb., and located on the south side of the water works property, near Fayette and Capitol St. (or approximately 240 ft. S. and 1120 ft. W. of the N. E. corner of Section 3, T. 24 N., R. 5 W.).

Correlated driller's log of Well No. 4 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and clay	10	10
Sand and gravel	14	24
Sand, gravel and clay	11	35
Sand and gravel	13	48
Sand, gravel and stones	64	112
Sand, some gravel	7	119

The elevation of the ground surface is 460± ft. An 8-in. concrete plug in the bottom of the well supports a 56-ft. length section of 32-in. od. and 26-in. id. Kelly concrete screen, above which is 64 ft. of plain casing with the top of the casing at 2 ft. above ground surface. An envelope of selected gravel surrounds the screen to give it an effective diameter of 42 in.

The pumping assembly consists of: 50 ft. of 8-in. column pipe; 12-in., 5-stage Aurora Pump Co. deep-well turbine pump rated at 1050 gpm.; 10 ft. of 8-in. suction pipe; 100-hp., 1750-rpm., U.S. electric motor.

On Mar. 22, 1946 the driller reported that, when pumping at 1950 gpm., the drawdown was 8 1/2 ft.

Analysis of a sample (Lab. No. 111,415), collected Aug. 11, 1947, showed the water from Well No. 4 to have a hardness of 20.1 gr. per gal., a residue of 425 ppm., and an iron content of 0.1 ppm.

Pumpage at the Pekin Water Works is estimated to average 1.15 mgd.

LABORATORY NO. 111,415

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.1		Silica	SiO_2	23.0	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	81.7	4.09	Chloride	Cl	10.0	.28
Magnesium	Mg	34.1	2.80	Nitrate	NO_3	18.9	.30
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	99.4	2.07
Sodium	Na	9.2	.40	Alkalinity	(as $CaCO_3$)	232.	4.64
Color		0		Hardness	(as $CaCO_3$)	345.	6.90
Odor		0		Residue		425.	
Turbidity		0					

The water supply for the city of Peoria (105,087) is obtained from wells located in what are now identified as the North, Sankoty, and the Central well fields.

North Field

The main pumping station, Pumping Station No. 2, the Main Well, the reserve well, and Wells No. 2, 3, 4, 5, and 6 are located in the North Field. These facilities are described on pages 61-65 in Bulletin No. 33, published in 1940.

Well No. 2 is out of service, the Sterling deep-well turbine pump, described on page 64 of Bulletin 33, having been removed and installed in Well No. 4 in June 1940.

Well No. 3 is not used.

Well No. 4 is in service. In 1940 the Byron-Jackson 6-in. centrifugal pump and 15-hp. Wagner Electric motor were removed, and the 835 gpm. Sterling deep-well turbine pump from Well No. 2 was substituted.

Well No. 5 is out of service, and the Wagner Electric motor has been removed.

Well No. 6 has never been in service.

The Reserve Well pump No. 1 was removed during Nov. 1948 and retired from service. The old pump has been replaced by Reserve Well pump No. 3, which is a new Byron-Jackson single-stage turbine pump rated at 3 mgd. against 30 ft. of head at 1160 rpm. The 10-in. column pipe is 50 ft. long above the pump. The lower 20 ft. 5 1/2 in. of column pipe, together with the pump, is inside the old 16-in. suction pipe, and the column pipe is sealed to the 16-in. gate valve of the old suction line at 20 ft. 5 1/2 in. above the pump. The new discharge take-off is a short length above the gate valve. Power is furnished to the new pump from a 25-hp. alternating current motor operated at 1160 rpm.

Sankoty Field

In the Sankoty Field the Peoria Water Works Co. has Wells No. 7, 8, 9, 10, 11, 12, and 13. Wells No. 7, 8, 9, and 10 are described in Bulletin No. 33, but their locations have been revised as hereinafter shown. All water from the wells in this field is pumped to the Main Well.

Well No. 7 is 91.2 ft. deep below a ground surface elevation of 470± ft., and is located 1040 ft. S. and 1090 ft. W. of the N. E. corner of Section 15, T. 9 N., R. 8 E. The cylindrical 3/8-in. steel plate, perforated strainer at the bottom of the well is 7 ft. in diameter by 24 ft. high and rests on the bedrock. At the top of this strainer is a bulkhead of steel and concrete, 2 ft. thick, forming the floor of what was formerly the pump pit. Above this bulkhead, the former pump pit, 4 ft. 10 in. id., and constructed of stone masonry, extends 56.8 ft. At this elevation the pit is increased to 6 1/2-ft. square chamber for the 8.4 ft. to the ground surface. There is a manhole through the bulkhead. A 10-in. suction pipe extends through the bulkhead, just above the floor of which, a 10-in. gate valve is flanged to the suction pipe. The turbine pump is direct-connected to the 10-in. valve.

The pump assembly, installed in 1941, consists of 59 ft. 11 3/8 in. of 10-in. column pipe; 16-in., 3-stage Sterling deep-well turbine pump rated at 1150 gpm. against 122 ft. of head; the overall length of the pump is 4 ft. 4 5/8 in.; 75-hp., 1175 rpm. U. S. electric motor. This pump unit replaced the 8-in. Byron-Jackson centrifugal pump and 80-hp. Wagner Electric Co. motor.

Well No. 8 is 89.2 ft. deep below a ground elevation of 465± ft., and is located 660 ft. S. and 740 ft. W. of the N. E. corner of Section 15. A 3/8-in. steel plate, perforated strainer, 7 ft. in diameter, rests on bedrock and extends upward for 24 ft. A steel and concrete bulkhead, 2.2 ft. thick is at the top of this strainer. Above the bulkhead, the former stone masonry pump pit, 4 ft. 10 in. id., extends for 56.8 ft., at which elevation a 6 1/2-ft. square chamber reaches 6.2 ft. to the ground surface. A manhole is built into the bulkhead, and the 10-in. suction pipe extends through it. A 10-in. gate valve is flange-connected to the top of the suction pipe, and the turbine pump is connected to this gate valve.

A 16-in., 3-stage Sterling pump, installed in 1940, is rated at 1150 gpm. against 122-ft. head at 1175 rpm. The motor is a 75-hp. U. S. Electric Co. unit.

Well No. 9 is located 340 ft. S. and 1210 ft. W. of the N. E. corner of Section 15 and otherwise is as reported on page 67 of Bulletin No. 33, except that the pump motor is a General Electric 100-hp. unit operating at 1150 rpm. The ground elevation at the well is 467.5 ft.

Well No. 10 is located 355 ft. N. and 1310 ft. W. of the S. E. corner of Section 10 and is as reported in Bulletin No. 33, page 68, except that

the Kelly concrete screen is 23 ft. 10 in. long, and the blank concrete casing is 68 ft. 8 in. long. The elevation of the top of the casing is 467.74 ft. The original ground elevation is 467.2 ft.

Analysis of a sample (Lab. No. 117,179) collected Jan. 31, 1949 shows the water to have a hardness of 23.0 gr. per gal., a mineral content of 448 ppm., and a trace of iron content. The concentrations vary somewhat from time to time but this analysis is representative of the general character of the waters from this Field.

Wells No. 11, 12, and 13, called the Webb Farm Wells, are located westerly of Galena Road and slightly south of Wells No. 7, 8, 9, and 10.

Well No. 11 was completed to a depth of 125 1/2 ft. below the top of the casing by the Kelly Well Co., Grand Island, Neb., in 1941. The well is located about 2545 ft. S. and 920 ft. W. of the N. E. corner of Section 15.

The elevation of the ground surface is 483.4 ft. and the top of the casing is at elevation 484.48 ft.

A concrete plug, 8 in. thick resting on bedrock at the bottom of the well, supports 39 ft. of Kelly concrete screen and 85 ft. 10 in. of blank concrete casing. Both the screen and casing are 32 in. od. and 25 in. id. A 3-in. envelope of selected, washed gravel surrounds the well.

Upon completion of the well, the static level was reported at 62 ft. 9 in. When pumping at 1810 gpm., the drawdown was 14 1/2 ft.

The pump assembly consists of 120 ft. of 16-in. column pipe; 16-in., 5-stage Sterling deep-well turbine pump rated at 1150 gpm. against a 200-ft. head, at a speed of 1180 rpm.; the overall length of the pump is 5 ft.; 125-hp. U. S. electric motor.

Well No. 12 was completed by the Kelly Well Co. in 1941 and is located about 2545 ft. S. and 1640 ft. W. of the N. E. corner of Section 15. The well is 1.40-ft. deep and is 25 in. id. and 32 in. od. An 8-in. concrete plug rests on bedrock and supports 39 ft. of Kelly concrete screen and 99 ft. 11 in. of blank concrete casing to within 5 in. of the original ground surface. It has a 3-in. envelope of selected, washed gravel. The elevation of the top of the casing is 499.45 ft. and the original ground elevation is 499.9 ft.

The static water level at the time of completion of this well was reported to be 76 ft. below the top of the casing; and when pumping at 1700 gpm., the drawdown was 14 ft. 4 in.

The well is equipped with a 5-stage Sterling deep-well turbine pump, rated at 1150 gpm. against a head of 200 ft. at a speed of 1180 rpm. The pump is direct-connected to a 125-hp. U. S. Electric Co. motor.

Well No. 13 was completed by the Kelly Well Co. in 1942 and is located about 1815 ft. S. and 1415 ft. W. of the N. E. corner of Section 15.

The well is 110 ft. 2 in. deep below ground level and is 25 in. id. and 32 in. od. A 3-in. envelope of selected, washed gravel surrounds the well. An 8-in. concrete plug rests on the bedrock and supports 24 ft. of Kelly concrete screen and 85 1/2 ft. of blank concrete casing. The top of the casing is at elevation 485.33 ft. and the ground elevation is 483.8 ft.

The static water level at the time of completion was reported to be 53 ft. 5 in. below the top of the casing; and when pumping at 1050 gpm., the drawdown was 20 1/2 ft.

The pump assembly consists of 90 ft. of 8-in. column pipe; 12-in., 5-stage American Well Works deep-well turbine pump rated at 750 gpm. against 210 ft. of head at a speed of 1760 rpm.; the overall length of the pump is 5 ft.; 100-hp. U. S. Electric Co. motor.

Central Field

In the Central Field, the Peoria Water Works Co. Dodge St. Well No. 1 was constructed in 1944 by the Kelly Well Co. and located on S. Washington St. at Dodge St. extended (or approximately 865 ft. N. and 755 ft. E. of the S. W. corner of Section 17, T. 8 N., R. 8 E.).

The well is 17-in. id. and 22-in. od. and is 118 1/2 ft. deep below a ground surface elevation of 473.8 ft. Boulders made it impossible to rest the 8-in. plug at the bottom of the well on bedrock, which is 122 1/2 ft. below the surface. The 8-in. plug supports 44 ft. of Kelly concrete screen and 76 ft. of blank concrete casing. An envelope of selected washed gravel surrounds the well. The original ground elevation was 473.8 ft.

The static water level at time of completion was reported to be 63 ft. 3 in.; and when pumping at 1050 gpm., the drawdown was 4 in.; and at 1590 gpm., the drawdown was 6 in.

Correlated driller's log of the Peoria Water Works Co. Dodge St. Well No. 1 furnished by the State Geological Survey:

Formation	Thickness ft.	in.	Depth ft.	in.
Pleistocene system				
Till, sand, gravel and clay	15		15	
Sand, gravel, rocks	41		56	
Sand, gravel, stones, rocks, clay	44		100	
Sand, gravel, and stones	18	6	118	6

The pumping equipment consists of 100 ft. of 10-in. column pipe; 9-stage A. D. Cook deep-well pump rated at 2 mgd. against a head of 260 ft. at 1770 rpm.; the overall length of the pump is 9.0 ft.; 150-hp. General Electric Co. motor.

Dodge St. Well No. 2 was completed by the Kelly Well Co. in 1946 and located 30 ft. easterly of Dodge St. Well No. 1. It is 17-in. id. and 22 in. od. and is 113 ft. 8 in. deep. Boulders made it impossible to reach bedrock. The 8-in. concrete plug at the bottom of the well supports 36 ft. of Kelly concrete screen and 77 ft. of blank concrete casing. An envelope of selected, washed gravel surrounds the well. The original ground elevation was 475.0 ft.

The static water level at time of completion of the well was reported to be 62 ft. below the top of the casing. When pumping at 1390 gpm. with Well No. 1 operating at a rate of 2.3 to 2.4 mgd., the drawdown was 0.25 ft.

The pumping equipment consists of 100 ft. of 10-in. column pipe; 6-stage Worthington deep-well turbine pump rated at 2 mgd. against a 275-ft. 'head at 1760 rpm.; the overall length of the pumpis 6 ft.; 125-hp. General Electric Co. motor.

The quality of the water from these wells varies somewhat from time to time. The general character is exemplified by the analysis of a sample (Lab. No. 108,316) collected Nov. 15, 1946. The water is shown to have a hardness of 26.6 gr. per gal., a mineral content of 583 ppm., and an iron content of 0.7 ppm.

Dodge St. Well No. 3 was completed to a depth of 124 ft. in Mar.- 1948 by Kelly Well Co. and located 4 ft. southerly and 70 ft. westerly of Dodge St. Well No. 1. The well is cased with 84 ft. of 17-in. id. by 22-in. od. of blank concrete pipe, below which is 40 ft. of concrete pipe screen of same dimensions. The elevation of the top of the casing is 478.6 ft. The screen sets on a concrete plug of 8-in. thickness and the bottom of the plug is 9 in. above shale.

From 20 ft. below the top of the casing to the bottom of the well, the annular space between the casing and screen, and the temporary steel casing was filled with washed sand and gravel as the steel casing was withdrawn. At 20 ft. below the top of the casing, a special concrete ring of 8-in. thickness supports an outer concrete casings 27-in. id. by 32-in. od. The annular space between the concrete casings was filled with concrete to the top of the well.

A production test was made by the driller on Apr. 21, 1948. Before the test, the water level was 5.7.87 ft. below the top of the casing. After five-minutes pumping at 1600 gpm., the drawdown was 2 ft. and remained the same throughout the test run of 6 hr. 55 min.

The pumping equipment consists of 92 1/2 ft. of 10-in. column pipe; 4-stage Byron-Jackson turbine pump, rated at 2 mgd. against 275 ft. of head at 1750 rpm.; the pump is 4 ft. 7 1/2 in. long; 125-hp. electric motor.

Total pumpage by the Peoria Water Works Co. averages 15.18 mgd., and all water is chlorinated.

LABORATORY NO. 117,179

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	Tr.		Silica	SiO_2	21.8	
Manganese	Mn	0.4		Fluoride	F	0.3	
Calcium	Ca	91.4	4.57	Chloride	Cl	16.0	0.45
Magnesium	Mg	40.3	3.31	Nitrate	NO_3	0.3	Tr.
Ammonium	NH_4	0.2	0.01	Sulfate	SO_4	51.2	1.07
Sodium	Na	13.6	0.59	Alkalinity (as $CaCO_3$)		348.	6.96
Turbidity		0		Hardness (as $CaCO_3$)		394.	7.88
Color		0		Residue		448.	
Odor		0		Temperature 54° F.			

LABORATORY NO. 108,316

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.7		Silica	SiO_2	26.9	
Manganese	Mn	0.1		Chloride	Cl	24.	0.68
Calcium	Ca	109.7	5.49	Nitrate	NO_3	18.8	0.30
Magnesium	Mg	43.9	3.61	Sulfate	SO_4	144.	3.00
Ammonium	NH_4	Tr.	Tr.	Alkalinity	(as $CaCO_3$)	292.	5.84
Sodium	Na	16.6	0.72	Hardness	(as $CaCO_3$)	455.	9.10
Turbidity		10-		Residue		583.	
Color		0		Odor		M	

The water supply for the village of Peoria Heights (4376) is described in Bulletin No. 33, published in 1940.

Well No. 3 has been capped with a concrete slab, and the pump unit was removed for use in Well No. 4.

Well No. 4 was completed in 1942 by the Layne-Western Co., Chicago, at a depth of 125 ft. below a ground surface elevation of 500t ft., and is located about 1820 ft. N. and 1220 ft. W. of the S.E. corner of Section 15, T. 9 N., R. 8 E.

The well was cased with 107 ft. of 18-in. pipe and 20 ft. of Armco-iron, Layne shutter screen. A 12-in. envelope of selected washed gravel surrounds the well.

When the well was completed, the static water level was reported to be 76 ft. below the top of the casing; and when pumping at 450 gpm., the drawdown was 25 ft.

The pump unit of Well No. 3 was worked over for use in Well No. 4 by removing 2 stages, by re-winding the motor to deliver 90 hp. at an increased rpm., and by lengthening the column pipe and shafting by 10 ft. The pump is a Pomona deep-well turbine rated at 450 gpm.

Partial analysis of a sample (Lab. No. 99099) collected Feb. 4, 1944 showed this water to have a hardness of 12.5 gr. per gal., a mineral content of 458 ppm. and an iron content of 1.5 ppm. This is characteristic for the water from this well, although there is some occasional variation.

Well No. 5 was completed in 1942 by Layne-Western Co. to a depth of 135 ft. and located about 630 ft. north of Well No. 3 (or approximately 2450 ft. N. and 1220 ft. W. of the S.E. corner of Section 15).

The well was cased with 117 ft. of 18-in. pipe and 20 ft. of Armco-iron, Layne shutter screen and is surrounded by a 12-in. envelope of selected washed gravel.

Whenthe well was completed, it produced 1200 gpm. with a 7-ft. drawdown with no other major wells operating in the vicinity; when the Peoria Water Works Co. Wells No. 11 and 12 were operating, the drawdown was 9 ft.

The pump assembly consists of: 100 ft. of 10-in. column pipe; 15-in. 5-stage Layne-Bowler turbine pump rated at 1200 gpm.; the overall length of the pump is 6 ft. 5 in.; 10 ft. of 10-in. suction pipe; 15-hp. electric motor.

The general character of the water from this well is similar to that from the Peoria Sankoty Field wells.

The ground-water supply is pumped from Well No. 5 and No. 4 through a 12-in. main which continues southerly past Wells No. 2 arid No. 1, picking up their production. The main then continues to a 320,000-gal. storage reservoir at the Kingman Ave. Pump Station.

A special line leads from the reservoir to a meter pit south of the station for a gravity feed to the Pabst Brewing Corp.

In 1943 a chlorinator was installed at Well No. 5.

Pumpage is estimated to average 1.2 mgd.

Correlated driller's log of Well No. 5 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay	82	82
Sand	20	102
Gravel	28	130
Sand	5	135

LABORATORY NO. 99099

	ppm.	epm.			ppm.	epm.
Iron (total) Fe	1.5		Fluoride	F		
			Chloride	Cl	25.0	.70
Turbidity	Tr.		Alkalinity	(as $CaCO_3$)	390.	7.80
Color	0		Hardness	(as $CaCO_3$)	214.	4.28
Odor	0		Total Mineral Content		458.	
Temperature 54° F.						

PEOTONE
Will County
Oct. 22, 1946

A public water supply was installed by the village of Peotone (1146) in 1895. Water was first obtained from a small well at the local electric light plant. The plant was sold in 1903 and the village developed another water supply.

In 1904 a well was drilled to a depth of 135 ft. by Martin & Kaler, Manteno. It is located about 135 ft. north of Corning Ave. and 10 ft. west of Third St. (or approximately 2325 ft. S. and 1065 ft. W. of the N. E. corner of Section 24, T. 33 N., R. 12 E.). The elevation of the ground surface is 720± ft. The well is reported to be cased with 10-in. pipe to rock at a depth of 60 ft. A production of 210 gpm. was obtained on May 8, 1913 when pumping for 4 hr.

A non-pumping water level of 22 ft. below the pump base was reported in 1922. At that time the well was equipped with a double-acting plunger pump with a 6 1/2-in. diameter Erb cylinder having a 24-in. stroke set at a depth of 40 ft. to which 20 ft. of suction pipe was attached. The pump was operated at a speed of 26 strokes per min. delivering about 6 1/2 gal. per stroke. On Jan. 20, 1934 the pump was reported to have a cylinder setting of 80 ft. and to be held in condition only for emergency purposes.

The same pump installation consisting of the old Gould power head and Erb cylinder was still in service on Oct. 4, 1946. It is belt-driven by a 20-hp. Burke Electric Co. motor and operated at a rate of 26 strokes per min. This unit was operated once a day during the summer of 1946 to keep the pump in working condition as a stand-by unit.

Another well was drilled for the village (45 ft. W. of Third St. and 25 ft. N. of Well No. 1) in 1930 by J. O. Heflin, Joliet. The well is 135 ft. deep and is reported to be cased with 10-in. pipe from the surface to rock at a depth of 60 ft.

The following pump installation was in service on Oct. 4, 1946: 80 ft. of 6-in. column pipe; 8-in., 10-stage Pomona turbine pump, Serial No. G-7351, rated at a capacity of 300 gpm. against 170 ft. of head; the overall length of the pump is 63 in.; 25-hp. Westinghouse electric motor. The pump was pulled and overhauled in 1941.

Analysis of a sample (Lab. No. 107,858), collected Oct. 4, 1946 after 20-min. pumping at 300 gpm. showed this water to have a total hardness of 26.2 gr. per gal., a residue of 605 ppm., and an iron content of 0.8 ppm.

The estimated average pumpage is 72,000 gpd. The water is not treated.

LABORATORY NO. 107,858

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.8		Silica	SiO_2	15.7	
Manganese	Mn	0.0		Fluoride	F	0.4	
Calcium	Ca	117.5	5.88	Chloride	Cl	2.0	.06
Magnesium	Mg	37.6	3.09	Nitrate	NO_3	0.0	0.00
Ammonium	NH_4	0.6	.04	Sulfate	SO_4	194.4	4.04
Sodium	Na	23.2	1.01	Alkalinity	(as $CaCO_3$)	296.	5.92
Turbidity		Tr.		Hardness	(as $CaCO_3$)	449.	8.98
Color		0		Residue		605.	
Odor		0		Free CO_2 (calc.)		43.	
Temperature		52.5° F.		pH = 7.25			

PERE MARQUETTE
STATE PARK
Jersey County
Oct. 7, 1948

A well was drilled in 1933 for public use in Pere Marquette State Park and located at the C.C.C. Camp near Rosedale, (or approximately 600 ft. N. and 1100 ft. W. of the S.E. corner of Section 9, T. 6 N., R. 13 W.).

Sample study log of well drilled in 1933 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
No record	30	30
Sand	10	40
Mississippian system		
Ste. Gehevieve limestone	20	60
St. Louis formation		
Limestone	60	120
Limestone, dolomite, some sandstone and shale	20	140
Limestone, some dolomite	70	210
Salem and Warsaw formations		
Dolomite	30	240
Dolomite, shaly and shale	155	395
Keokuk-Burlington limestone, some dolomite	85	480

The well was drilled by Ernest Kuhse, Grafton, to a depth of 480 ft. below a ground elevation of 465± ft., and cased with 6-in. pipe from the surface to 42 1/2 ft. below which the hole was 6-in. diameter. When completed, the static water level was reported to be 30 to 35 ft. and when bailing at the rate of 12 to 15 gpm., the drawdown was 145 ft. When the drilling reached a depth of 200 ft. water was bailed out at the rate of 16 gpm. with a drawdown of 160 ft.

In 1939, this well was not producing in sufficient quantity to supply the demand. The well has been abandoned.

Well No. 2 was drilled in 1934 to a depth of 74 ft. by E. W. Johnson, Bloomington, and located about 1000 ft. southwest of Well No. 1. The well was cased with 65 ft. of 6-in. pipe and 9 ft. of exposed screen, having No. 30 slot openings.

On July20, 1939, the non-pumping water level was 12 ft. below a ground elevation of 420± ft. and when pumping at 50 gpm. the drawdown was 2 ft. The pumping equipment includes 60 ft. of 4-in. column pipe; Fairbanks-Morse turbine pump, No. 8720, rated at 50 gpm.; 15-hp. Fairbanks-Morse electric motor. Other data on the pump assembly are not known. The discharge is metered and averages a 75-gpm. rate. Well No. 2 furnished the entire supply.

Analysis of a sample (Lab. No. 116,056) collected Oct. 7, 1948, showed this water to have a hardness of 25.7 gr. per gal., a residue of 684 ppm., and an iron content of 4.0 ppm.

The water is aerated, filtered, softened and chlorinated.

Analysis of a sample (Lab. No. 116,054) collected Oct. 7, 1948 showed the treated water to have a hardness of 4.4 gr. per gal., a mineral content of 465 ppm., and an iron content of 0.1 ppm.

Pumpage is estimated to average 35,000 gpd.

LABORATORY NO. 116,056

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	4.0		Silica	SiO_2	25.3	
Manganese	Mn	0.1		Fluoride	F	0.1	
Calcium	Ca	95.9	4.80	Chloride	Cl	146.	4.12
Magnesium	Mg	48.9	4.02	Nitrate	NO_3	0.3	0.01
Ammonium	NH_4	0.8	0.05	Sulfate	SO_4	54.1	1.13
Sodium	Na	89.9	3.91	Alkalinity (as $CaCO_3$)		376.	7.52
Turbidity		50		Hardness (as $CaCO_3$)		441.	8.82
Color		10		Residue		684.	
Odor		0		Temperature 58° F.			

LABORATORY NO. 116,054

	ppm.	epm.			ppm.	epm.
Iron (total) Fe	0.1		Fluoride	F	0.1	
			Chloride	Cl	149.0	4.20
Turbidity	Tr.		Alkalinity (as $CaCO_3$)		68.	1.36
Color	0		Hardness (as $CaCO_3$)		76.	1.52
Odor	0		Total Mineral Content		465.	

PERCY
Randolph County
Mar. 11, 1948

The village of Percy (958) installed a public water supply in 1935.

Water was obtained from Well No. 1, drilled in 1934 by Sewell Well Co., St. Louis, Mo., and located on the west side of Second St., on the south side of the alley between Pine and Almond St. (or approximately 700 ft. N. and 2250 ft. W. of the S.E. corner of Section 11, T. 6 S., R. 5 W.). This well was drilled to a depth of 423 ft. below a ground surface elevation of 470± ft.

Sample-study log of Well No. 1 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Loess and till	20	20
Pennsylvanian system		
Shale, thin beds of limestone, coal and sandstone	225	245
Sandstone, incoherent	25	270
Shale	35	305
Sandstone, incoherent	30	335
Sandstone, partly argillaceous	20	355
Sandstone, incoherent	70	425

The well was cased with 8-in. pipe to a depth of 312 ft., and the hole was 8 in. in diameter from 312 to 423 ft.

Pumping equipment was installed as follows: 185 ft. of 4-in. column pipe; 8-in., 10-stage Cook turbine pump, 4 ft. 3 1/2 in. in overall length and rated at 100 gpm. against 265 ft. of head; 10 ft. of suction pipe; 191 ft. of air line; 15-hp. U. S. electric motor, No. 118548, operating at 1800 rpm.

A production test was made by the State Water Survey on Jan. 15, 1935. The well produced 107 gpm. with a drawdown of 133 ft. below a non-pumping water level of 58 ft.

In 1940, it was reported that the well was producing 82 gpm. with a pumping water level of 178 1/2 ft. below the pump base.

The pump was removed in 1941 and replaced with a 13-stage, 8-in. Cook turbine, No. 1494, rated at 100 gpm. operating at 1760 rpm. The length of the column pipe was increased to 270 rpm. The water level at that time was 90 ft. below the top of the well.

In 1946, the well was reported to produce 35 gpm. with a drawdown of 230 ft.

The well was cleaned and deepened, as a 6-in. hole, to a total depth of 447 ft. in Sept. 1946 by L. W. Gwin, Chester. The driller reported that sandstone was penetrated between 424 and 447 ft.

After the well was deepened, it was reported that when pumping at a rate of 100 gpm. for 40 hours the drawdown was 260 ft. The pump setting was 276 ft. Well No. 1 has not been in service since Oct. 1947 because of expensive operation. In Apr. 1949, the non-pumping water level was reported to be 90 ft.

Analysis of sample (Lab. No. 100,768) collected July 20, 1944, showed the water to have a hardness of 10.0 gr. per gal., a residue of 309 ppm., and an iron content of 0.3 ppm.

Well No. 2 was drilled for the village in Oct. 1944 by Southwestern Illinois Coal Corporation and is located at the dead end of Holland St., about 280 ft. north of Pine St. (or approximately 1270 ft. N. and 1780 ft. E. of the S.W. corner of Section 11). The ground elevation at the well site is 450.4 ft.

Well No. 2 is 430 ft. deep and is cased with 10-in. pipe from the surface to 57 ft. and with 8-in. pipe from the surface to 295 ft. below which the hole is 8-in. in diameter.

The well is equipped with a Cook turbine pump, No. 6948, which delivers an average of 106 gpm. against 66 psi.; 30 ft. of suction pipe; 20-hp. U. S. electric motor, operating at 1800 rpm.

In 1945, it was reported that this well was furnishing most of the village supply, and since Oct. 1947, has furnished the entire supply.

Analysis of a sample (Lab. No. 113,728), collected Mar. 8, 1948 after 30-min. pumping at 106 gpm., showed the water to have a hardness of 12.4 gr. per gal., a residue of 322 ppm., and an iron content of 0.3 ppm.

Metered pumpage in Feb. and Mar. 1948 averaged 24,000 gpd.

LABORATORY NO. 113,728

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.3		Silica	SiO_2	14.0	
Manganese	Mn	Tr.		Fluoride	F	0.1	
Calcium	Ca	60.5	3.03	Chloride	Cl	18.0	0.51
Magnesium	Mg	14.9	1.22	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	0.4	0.02	Sulfate	SO_4	17.7	0.37
Sodium	Na	39.8	1.73	Alkalinity (as $CaCO_3$)		256.	5.12
Turbidity		Tr.		Hardness (as $CaCO_3$)		213.	4.25
Color		0		Residue		322.	
Odor		0		Free CO_2 (calc.)		39.	
Temperature 61.3° F.				pH = 7.2			

PERU
La Salle County
Aug. 4, 1947

The public water supply for the city of Peru (8983) wasinstalled in 1891 by the Peru Water Co., under a financial arrangement whereby the city ultimately acquired the property. Water was obtained from flowing wells but with increasing demands, it was necessary to drill additional wells and pump from these wells at times of maximum demand;

Well No. 1 was drilled in 1889 by O. K. Walling, Ottawa. It was located in the bottom of the old reservoir on the south side of Brewster St. at Main St. The well was drilled to a depth of about 1365 ft., and the hole and casing record were reported as shown in Table 1.

TABLE 1

Hole Record

14-in.	from	0	to 30	ft. (rock)
10-in.	from	30	to 450	ft.
8-in.	from	450	to 900	ft.
6-in.	from	900	to 1365+	ft.

Casing Record

8-in.	from	surface	to 450	ft.
6-in.	from	surface	to 1000+	ft.

After 1905, water from this well was used only during periods of shortage of supply from other wells. The casing deteriorated, and there was possibility of contamination from surface drainage. The well was abandoned about 1913. The free flow ceased about 1921, and in 1923 a small flow commenced again.

Well No. 2 was drilled by Whitney Well Co., St. Louis, Mo., in 1893. It was located on Water St, at the foot of Putnam St. near the Chicago, Burlington & Quincy R. R. depot, and just west of the north approach to the highway bridge (or approximately 400 ft. S. and 700 ft. W. of the N. E. corner of Section 20, T. 33 N., R. 1 E.).

The well was 1254 ft. deep and cased with 900 ft. of pipe. The hole below the casing was reported to be 5 in. in diameter. When the well was completed, the free flow was 311 gpm., and in 1920 when the air lift pumps had been idle for several hours, the flow was 25 gpm. The well was abandoned about 1933.

Analysis of a sample (Lab. No. 66357) collected Apr. 22, 1930, showed the water from this well to have a hardness of 13.9 gr. per gal., a residue of 835 ppm., and an iron content of 0.1 ppm.

Well No. 3 was drilled in 1905 to a depth of 1255 ft. by Wikon Well Co., Chicago. It is located in the engine room at the pumping station at the foot of Plum St. (or approximately 260 ft. N. and 260 ft. E. of the S. W. corner of Section 16).

The elevation of the ground surface is 460± ft.

The well was cased to rock with 14-in. pipe and to a depth of about 900 ft. with 8-in. pipe. Below the casing the hole was reported to be 6 in. in diameter.

In 1905 the free flow was 200 gpm., and in 1920 when the air lift pumps had not operated for several hours, the flow was 40 gpm. A small flow was reported in 1932.

This well has been abandoned.

Analysis of a sample. (Lab. No. 66358) collected Apr. 22, 1930 showed the water in Well No. 3 to have a hardness of 11.8 gr. per gal., a mineral content of 2249 ppm., and an iron content of 0.3 ppm.

Well No. 4 was drilled in 1913 by H. W. Hambrecht, Sterling. It is located in the eastern part of the pumping station.

The depth of the well is 1505 ft. 9 in. below a ground surface elevation of 460t ft.

Salt water (5078 ppm. mineral content) was encountered at depths of 595 and 700 ft. Fresh water flowed when the drilling reached 996 ft., and the flow increased as the drilling progressed through the limestone. The casing record was:

16-in.	from	surface	to 49 1/2	ft.
12-in.	from	49 1/2	to 212 1/2	ft.
10-in.	from	sur face	to 390 1/3	ft.
8-in.	from	surface	to 625	ft.
6-in.	from	616	to 990	ft.

The top of the 6-in. casing was sealed to the 8-in. with a lead packer to exclude water from above a depth of 990 ft. The hole, below the casing, was 6 in. in diameter.

In 1920 the free flow from this well was 200 gpm., and in 1923 the flow from Wells No. 2, 3, and 4 was estimated to be 400,000 gpd. The flow from No. 4 was estimated to be 8 times that from No. 2 and 3. In 1925 the free flow from the 3 wells was 350,000 gpd.

Water is pumped from Well No. 4 by an air lift with a E-in. air pipe extending into the well to a depth of 200 ft. In Aug. 1947 this well was being used about 2 hr. daily to supply water when Well No. 5 is unable to supply the demand.

Analysis of a sample (Lab. No. 66359) collected Apr. 22, 1930, showed the water from Well No. 4 to have a hardness of 14.3 gr. per gal., a mineral content of 778 ppm., and an iron content of 0.2 ppm.

Well No. 5 was drilled in 1931 by Sewell Well Co., St. Louis, Mo., and located 20 ft. north of Water St. and 20 ft. west of the east line of Peoria St. extended, about 345 ft. west of the north approach to the high-way bridge (or approximately 400 ft. S. and 1000 ft. W. of the N. E. corner of Section 20). The well is about 1300 ft. west of the pumping station and treating plant.

The hole, casing and liner record are given in Table 2 with all measurements taken from the top of the casing elevation 464.7 ft.

TABLE 2

Hole Record

25-in. from top to 459 ft.
19-in. from 459 to 1026 ft.
15-in. from 1026 to 1616 ft.
12-in. from 1616 to 2601 ft.

Casing and Liner Record

26-in. od. casing from top to 73 ft. 9 in.
20-in. od. casing from top to 459 ft.
15 1/2-in. id. casing from top to 1020 ft.
12 1/2-in. liner from 1478 to 1616 ft.

The annular space, outside of the 15-in. casing to a depth of 1026 ft., was cemented in to seal off water which contained more than 4000 ppm. sodium chloride (Lab. No. 69173). The annular space outside of the 20-in. casing to a depth of 459 ft. was also filled with cement grout.

During the drilling operations, water levels were reported at depths below the drill floor, 2 ft. above the ground surface, as given in Table 3.

Water was encountered first at 555 ft. depth and with sufficient artesian pressure to flow over the top of the casing 2 ft. above the ground surface. At 605-ft. depth the static head was about 8 ft. above the ground. The flow became so troublesome to drilling operations that, at 1020-ft. depth, it was necessary to seal off the water. This was done by using 2100 sacks of cement and more than 30 tons of sand and gravel. At 1820 ft. the free flow was measured with a Weir at 200 gpm. The flow increased steadily during the final drilling.

At 2601 ft. it was estimated to be 1000 gpm., and as evidence that the flow was largely from the bottom of the hole, the temperature of the water was 73 1/2° F., a higher temperature than had been recorded at lesser depths.

At 1820-ft. depth a short production test was made by the driller. The free flow was 200 gpm., and on pumping at 550 gpm. the drawdown was 88 ft. below the top of the casing. After completion of the well at 2601 ft., a short production test was run. The free flow was 600 to 700 gpm., and after pumping 1 hr. at 1850 gpm., the drawdown was 34 ft. below the top of the casing.

The pumping equipment, installed in July 1945 by Standard Power & Equipment Co., Chicago, consists of 100 ft. of 8-in. column pipe; 4-stage Pomona turbine pump, No. 2F 1835, rated at 1000 gpm. against a head of 130 ft.; the overall length of the pump is 4 ft.; 104 ft. of air line; 10 ft. of 8-in. suction pipe; 50-hp., 1765 rpm. General Electric motor.

The pump is insulated from the well casing to prevent electrolysis, which has previously caused considerable trouble.

On Aug. 4, 1947 when pumping at 1000 gpm., the water level was 39 ft. below the top of the casing. The pump is operated from 15 to 24 hr. daily.

Analysis of a sample (Lab. No. 111,360) collected Aug. 4, 1947 after 1-hr. pumping, showed the water in Well No. 5 to have a hardness of 14.1 gr. per gal., a residue of 792 ppm., and an iron content of 0.9 ppm.

The water is aerated, softened, and filtered. Analysis of a sample (Lab. No. 110,978) collected Aug. 4, 1947, showed the treated water to have a hardness of 5.8 gr. per gal., a mineral content of 673 ppm., and an iron content of 0.1 ppm.

Pumpage is estimated at 800,000 gpd.

Sample-study log of Well No. 5 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Surface"	5	5
Pennsylvanian system		
Shale, some sandstone and limestone, thin coal beds	385	390
Silurian system		
Niagaran-Alexandrian dolomites, thin shale beds	430	820
Ordovician system		
Maquoketa shale and dolomite	160	980
Galena-Platteville dolomite and limestone	387	1367
Glenwood sandstone	13	1380
St. Peter formation		
Sandstone	120	1500
Conglomerate of sandstone, shale and chert	10	1510
Shakopee dolomite, thin sandstone beds	175	1685
New Richmond sandstone, some dolomite	130	1815
Oneota formation		
Dolomite	160	1975
Shale	2	1977
No record	18	1995
Sandstone, incoherent	15	2010
Cambrian system		
Trempealeau dolomite	235	2245
Franconia dolomite and sandstone	145	2390
Galesville formation		
Sandstone, some dolomite	111	2501
No record	74	2575
Eau Claire shale, sandstone and dolomite	26	2601

TABLE 3

Drilling Depth ft.	Water Level ft.	Rate of Flow gpm.	Water Temperature (°F)
555	Free flow		
977	Free flow		
1020	Free flow shut off		
1070	25 to 55		
1235	14		
1640	6		
1820	Free flow	200	69
1905	Free flow	200	
1970	Free flow	400	
2601	Free flow	1000	73 1/2

LABORATORY NO. 111,360

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.9		Silica	SiO_2	15.3	
Manganese	Mn	0.0		Fluoride	F	0.6	
Calcium	Ca	87.5	4.38	Chloride	Cl	236.0	6.66
Magnesium	Mg	29.7	2.44	Nitrate	NO_3	1.9	0.03
Ammonium	NH_4	0.7	0.04	Sulfate	SO_4	50.2	1.04
Sodium	Na	167.2	7.27	Alkalinity (as $CaCO_3$)		320.	6.40
Color		0		Hardness (as $CaCO_3$)		341.	6.82
Odor		0		Residue		792.	
Turbidity		10		Temperature 74.5° F.			

LABORATORY NO. 110,978

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.07		Fluoride	F	0.5	
Turbidity		0		Chloride	Cl	245.0	6.90
Color		0		Alkalinity (as $CaCO_3$)		110.0	2.20
Odor		0		Hardness (as $CaCO_3$)		100.	2.00
				Total Mineral Content		673.	

PETERSBURG
Menard County
Feb. 24, 1948

The city of Petersburg (2586) installed a public water supply in 1878.

Water was obtained originally from ten 4-in. driven wells which were about 60 ft. deep. The well casings corroded and the wells were abandoned about 1896.

The village supply has since been obtained from a well dug about 1896. and located near the west bank of the Sangamon River near the intersection of East Third and Market St. (or approximately 2600 ft. S. and 100 ft. E. of the N. W. corner of Section 13, T. 18 N., R. 7 W.). The surface elevation is 500± ft. This well is 44 ft. deep, 25 ft. in diameter, and is lined with a 27-in. brick wall set on an iron shoe. The; well extends 1 1/2 ft. above the ground surface and is cemented so that water enters from the bottom. It was reported that the well passed through eight feet of loam and was in sand and gravel for the remaining depth.

The original pumping equipment consisted of two Worthington tandem compound duplex steam pumps, rated at 1,000,000 gpd. each.

In 1912 it was reported that the non-pumping water level varied with river stages and was about the same level as the river. The variation was reported to be as much as 25 ft. with the low level about 38 ft. below the ground surface., A low dam has been constructed on the river in an attempt to control water levels in the: well.

The following; pumping equipment installed in 1945 is in place: 30 ft. of: 6-in. column pipe; 10-in., 6-stage American Well Works turbine pump, No. 70568, rated[1] at 380 gpm. against 240; ft. of head and operating at 1750 rpm.; 30-hp. U. S. electric motor. The length of the suction pipe is not known but is reported to be near the bottom of the well.

In 1945 it was reported that while pumping, the drawdown was 10 ft.

Analysis of a sample (Lab. No. 113,599) collected. Feb. 24, 1948, while pumping, showed the water to have a hardness of 24.9 gr. per gal., a residue of 582 ppm., and an iron content of 0.4 ppm.

The water is. softened and chlorinated. Analysis of a sample (Lab. No. 113,598) collected Feb. 24, 1948 showed the treated water to have a hardness of 2.9 gr. per gal., a mineral content of 626 ppm., and an iron content of 0.1 ppm.

The State Geological Survey made an electrical earth resistivity survey along the river bank at Petersburg in Mar. 193 7. The entire area was reported to be an area of high resistivity, and the. city well was, found to. be in a favorable location.

Later in 1946, a new pump and assembly was installed for emergency use and located a few feet north of the first pump. The pumping equipment is a duplication of the other and consists of 30 ft. of 6-in. column pipe; 10-in., 6-stage American Well Works turbine pump, No. 71980, rated at 380 gpm. against 240 ft. of head and operating at 1750 rpm.; 30-hp., U. S. electric motor. The: length of the suction pipe is not known but is reported to, be near the bottoms of the well.

The pumps are alternated in operation.

Pumpage in Aug. 1947 averaged 201,000 gpd. and for Feb. 1-23, 1948 averaged 127,000 gpd.

LABORATORY NO. 113,599

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.4		Silica	SiO_2	17.6	
Manganese	Mn	0.3		Fluoride	F	0.2	
Calcium	Ca	105.0	5.25	Chloride	Cl	34.0	0.96
Magnesium	Mg	40.0	3.29	Nitrate	NO_3	14.2	0.23
Ammonium	NH_4	0.2	0.01	Sulfate	SO_4	169.3	3.52
Sodium	Na	27.6	1.20	Alkalinity (as $CaCO_3$)		252.	5.04
Turbidity		Tr.		Hardness (as $CaCO_3$)		427.	8.54
Color		0		Residue		582.	
Odor		0		Temperature 59.5° F.			

LABORATORY NO. 113,598

	ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1	Fluoride	F	0.2	
Turbidity		0	Chloride	Cl	41.0	1.16
Color		0	Alkalinity (as $CaCO_3$)		298.	5.96
Odor		0	Hardness (as $CaCO_3$)		50.	1.00
			Total Mineral Content		626.	

A public water supply was installed in 1939 by the village of Philo (510).

Well No. 1 was drilled in 1939 to a depth of 81 ft. by Woollen Bros., Wapella and located about 25 ft. north of Washington St. and 50 ft. east of Harrison St. (or approximately 1300 ft. S. and 1000 ft. E. of the N. W. corner of Section 23, T. 18 N., R. 9 E.). The ground elevation at the well-site is 730± ft.

The well was cased with 76 ft. of 10-in. pipe and 5 ft. of Cook wire-wound screen having No. 50 slot openings. A production test was made by the State Water Survey on Mar. 6, 1939. Static water level, before the test, was 33 ft. below the top of the casing. After 2-hr. pumping at 73 gpm. the drawdown was 31 ft. After an additional 5-hr. pumping at 49 gpm. the drawdown was 32 ft. Pumping was continued at 49 gpm. for an additional two hours but the drawdown could not be measured. It was estimated to be near, 37 ft. Thirty-six hours after pumping was stopped, the water level was 6 ft. below the level before the test started and after 61 hr., the water level was one foot below the starting level.

The original pump installation consisted of a 4-stage bowl section, rated at 75 gpm., which in 1943 was found to be cracked and was replaced by a new bowl section. It was also necessary to throttle the pumping rate to 70 psi. back pressure to prevent breaking suction. In Mar. 1944, the bowl section was reduced from 4 to 2 stages and the back pressure maintained at 30 psi. to prevent breaking suction.

Due to the long continued pumping at full capacity, instead of at a lesser rate, sufficient to supply the demand, more and more of the screen became exposed to the atmosphere. In Apr. 1944, the maximum capacity of the well was reported to be 15 gpm. Because of lack of maintenance of water level records it was not possible to attribute the well failure to a clogged screen or to exhaustion of the aquifer.

As of Apr. 1944, the pumping equipment consisted of 70 ft. of 4-in. column pipe; 6-in., 2-stage American Well Works turbine pump, (reduced from an original 4-stage and an original rating of 75 gpm.); 6 ft. of 4-in. suction pipe.

Well No. 1 is maintained for emergency use.

Analysis of a sample (Lab. No. 99701) collected Apr. 5, 1944 after 15-min. pumping at 15 gpm., showed this water to have a hardness of 18.5 gr. per gal., a mineral content of 379 ppm., and an iron content of 2.8 ppm.

An electrical earth resistivity survey was made by the State Geological Survey in May 1944. As a result, about 10 test holes were drilled in and west of the village.

Well No. 2 was drilled in May 1945 to a depth of 44 ft. by Hayes and Sims, Champaign, and located 60 ft. north of the Wabash R. R., about 1/2 mile west of town, (or approximately 2140 ft. S. and 2040 ft. W. of the N. E. corner of Section 22). The ground surface elevation at the well-site is 710± ft.

Correlated driller's log of well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and clay	25	25
Gravel, dirty, some water	10	35
Gravel, slightly dirty, better	3	38
Gravel and sand, fairly clean, slightly silty	6	44

The well was cased with 8-in. pipe from 2 1/2 ft. above to 3 7 ft. below the surface and with 8 ft. exposed length of Johnson Everdur screen, the lower 5 ft. of screen having No. 30 slot openings and the upper 3 ft. having No. 50 slot openings.

A production test was made by the State Water Survey on May 31, 1945, using temporary pumping equipment. Five days earlier, the static water level was reported to be 7 ft. 11 in. below the top of the casing. Just before the test was started, the water level was 9 1/2 ft. After 4-hr. pumping at 65 gpm. the drawdown was 20 1/2 ft. For the next 4 hr.the pumping rate was accelerated to 79 1/2 gpm. with a final drawdown of 25 1/4 ft. One hour after stopping the pump the water level was 17ft., or 7 1/2 ft. below the level observed just before the start of the test: On Dec. 16, 1948, after 10-min. pumping at 60 gpm., the water level was 15 ft. above the bottom of the air line. Ten minutes after stopping the pump, the water level was 22 ft. and 35 minutes later the water level was 23 1/2 ft.

Well No. 2 is the normal source of the public supply. The pumping equipment, installed Feb. 8, 1946, includes a 6-in. American Well Works

turbine pump, No. 71596, rated at 50 gpm. against 185 ft. of head; 5-hp. General Electric motor.

Analysis of a sample (Lab. No. 116,746) collected Dec. 16, 1948 after 15-min. pumping at 60 gpm. showed this water to have a hardness of 17.1 gr. per gal., a residue of 351 ppm., and an iron content of 1.9 ppm.

An aerator and filter are in place but not yet connected to Well No. 2.

Metered pumpage from July 9, 1947 to Dec. 16, 1948 averaged 18,215 gpd.

LABORATORY NO. 116,746

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.9		Silica	SiO_2	15.6	
Manganese	Mn	0.1		Fluoride	F	0.1	
Calcium	Ca	72.7	3.64	Chloride	Cl	7.0	0.20
Magnesium	Mg	27.2	2.24	Nitrate	NO_3	0.6	0.01
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	81.5	1.69
Sodium	Na	3.9	0.17	Alkalinity (as $CaCO_3$)		208.	4.16
Turbidity		23		Hardness (as $CaCO_3$)		294.	5.88
Color		0		Residue		351.	
Odor		0		Free CO_2 (calc.)		34.	
Temperature 53.7° F.				pH = 7.2			

A public water supply was installed by the village of Piper City (663) in 1914.

Water was obtained from 3 drift wells, each 70 ft. in depth. One well was 8 in. in diameter and located just east of the pumping station. The well is abandoned. A 6-in. well was located 20 ft. north of the 8-in. well, and is now filled in. The third well, 8 in. in diameter, was located 40 ft. west of the 6-in. well. This well is filled in. The first well described was equipped with a screen 12 ft. in length and the last 2 were 8-ft. screens. In 1914 the static water level was at the ground surface (Elev. 678±) and in May 1922, the non-pumping water level was 9 ft. below the surface. It was said that the water level might be higher, but for the long pumping periods required. Private wells, nearby, ceased flowing when the pumps in the village were operating.

In Dec. 1942, two wells were drilled by John Bolliger and Sons, Fairbury.

Well No. 1 was drilled to a depth of 39 ft. and located 6 ft. south of the old 8-in. well, just east of the pumping station, or approximately 1639 ft. S. and 1551 ft. W. of the N. E. corner of Section 9, T. 26 N., R. 9 E.

The well was cased with 30 ft. of 8-in. pipe and 9 ft. of 8-in. Johnson screen, having No. 50 slot openings. When completed, the static water level was 3 ft. below ground level and the drawdown was reported to be 18 ft. when pumping at 60 gpm.

Well No. 2 was drilled to a depth of 79 ft. and located 9 ft. east of the old 6-in. well (or approximately 1618 ft. S. and 1542 ft. W. of the N. E. corner of Section 4).

Sample-study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and till	35	35
Sand and gravel, clean	3	38
Till	22	60
Sand, clean	15	75
Sand, some gravel, clean	4	79

The well was cased with 73 ft. of 8-in. pipe and 6 ft. of 8-in. Johnson screen, having No. 20 slot openings. When completed the static level was 16 in. below ground level and the drawdown was 10 ft. 8 in. when pumping at 40 gpm.

Water was pumped by a Goulds triplex suction pump, Fig. 924, having 6-in. plungers and 8-in. stroke and set in a pit in the pump house with the bottom of the pump about 18 in. below floor or ground level. The pump is connected to each well with a 4-in. suction pipe, and is belt-connected to a General Electric motor.

This pump has not been in service for over a year.

In May 1944, Well No. 3 was drilled to a depth of 78 1/2 ft. by Hayes and Sims, Champaign, and located one block east of the pumping station, (or approximately 1615 ft. S. and 1165 ft. W. of the N. E. corner of Section 4). The well construction was gravel-pack type with a 16-in. outer casing from 2 1/2 ft. above to 66 1/2 ft. below the ground surface and an 8-in. inner casing extending from the 2 1/2 ft. above to 64 ft. 10 1/4 in., below the surface. Below the 8-in. casing was placed a 6 5/8-in. Johnson Everdur screen, having No. 60 slot openings. The annular space outside the screen and between the casings was filled with approximately 5 1/2 cu. yd. of pea gravel.

On May 29, 1944 a production test was made by the State Water Survey. The test pumping equipment, furnished by the contractor, consisted of an air lift assembly with the bottom of a 4-in. eductor pipe set at 3 ft. above the bottom of the well. Before the test the static water level was 3.2 ft. below the top of the casing and after 7-hr. pumping at a final rate of 83 gpm., the drawdown was 12.1 ft. Twenty minutes after stopping the pump, the water level returned to 4 1/2 ft. below the top of the casing. On Oct. 24, 1948, after 6-hr. pumping at 65 gpm. the water level was 5 ft. above the bottom of the air line of unknown length.

Well No. 3 is the source of the entire public supply. The pump installation includes a 7-in. American Well Works turbine pump, No. 70272, having a rated capacity of 100 gpm. against 170 ft. of head; an air line of unknown length; 7 1/2-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 116,250) collected Oct. 24, 1948 after 6-hr. pumping at 65 gpm. showed this water to have a hardness of 23.0 gr. per gal., a residue of 450 ppm., and an iron content of 1.3 ppm.

From July 21, to Oct. 24, 1948 the metered pumpage averaged 73,458 gpd.

LABORATORY NO. 116,250

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.3		Silica	SiO_2	27.4	
Manganese	Mn	0.1		Fluoride	F	0.3	
Calcium	Ca	93.0	4.65	Chloride	Cl	2.0	0.06
Magnesium	Mg	39.4	3.24	Nitrate	NO_3	0.3	0.01
Ammonium	NH_4	4.9	0.27	Sulfate	SO_4	0.8	0.02
Sodium	Na	13.1	0.57	Alkalinity (as $CaCO_3$)		432.	8.64
Turbidity		10		Hardness (as $CaCO_3$)		395.	7.89
Color		0		Residue		450.	
Odor		0		Free CO_2 (calc.)		44.	
Temperature 54° F.				pH = 7.4			

The water works were installed by the village of Plainfield (1485) in 1898.

Water was obtained from a well 104 ft. deep located about 50 ft. south of Lockport St. and 85 ft. west of Des Plaines St. (or approximately 90 ft. S. and 900 ft. W. of the N. E. corner of Section 16, T. 36 N., R. 9 E.).

The well was cased with 9-in. pipe to rock at a depth of 20 ft. below which the 6-in. hole penetrated limestone. Water was pumped at a rate of 100 gpm. and furnished the entire public water supply until about 1915 when it was deepened to 638 ft. The well was cased with 10-in. pipe to 44 ft. and an 8-in. liner was placed between the depths of 135 and 273 ft. The water from the deepened well was very turbid, and it was seldom used. It was abandoned in 1918 and is capped.

The second well was drilled to a depth of 1380 ft. and was completed in 1915. It is located about 150 ft. north of the older well. The elevation of the ground surface is 614± ft. It was cased from the surface to a depth of 60 ft. with 12-in. pipe, and a liner was placed between the depths of 150 and 300 ft. where shale was encountered. The well was finished with an 8-in. diameter at the bottom.

In 1917 a non-pumping water level of 55 ft. below the surface and a pumping rate of 175 gpm. were reported. On Mar. 30, 1927 it was reported that an 8-in. pipe could not be lowered in the well, so the 5 3/4-in. cylinder was attached to 160 ft. of 6-in. drop pipe. The records for the period from Jan. 20, 1927 to Mar. 30, 1927 indicate an average pumping time of 12 1/2 hr. daily at an estimated discharge of 80 gpm.

This well served as the source of the public supply until 1929. The pump was removed in 1938, and the well is now used by the State Water Survey for observation purposes.

Two new wells were constructed by the Layne-Western Co., Chicago in 1929. They are located nearly 3/4 of a mile north of Lockport St. on a strip of land about 50 ft. wide lying between State Highway Route 59 and the Elgin, Joliet, and Eastern R. R.

The east well, known as No. 1, is located approximately 1250 ft. S. and 400 ft. W. of the N. E. corner of Section 9. The elevation at the surface of the ground is 612± ft. It was drilled to a depth of 200 ft. and cased with 26-in. od. casing from the surface to a depth of 30.5 ft. and with 16-in. id. casing from the surface to a depth of 41 ft. 7 in., below which the hole is 15 in. in diameter. The annular space outside of the inner casing was filled with concrete.

A production test of 10 1/4-hr. duration was made on July 7, 1929. The distance to water before the test was 11 ft. 9 in. below the surface. The results of the test are given in Table 1.

TABLE 1

112 gpm.	with a drawdown of 28 ft. 9 in.
150 gpm.	with a drawdown of 40 ft. 9 in.
180 gpm.	with a drawdown of 55 ft. 9 in.
200 gpm.	with a drawdown of 61 ft. 3 in.

The water levels in this well were also observed on Aug. 3, 1929 during the production test conducted at the west well located about 400 ft. west. At the start of the test, the distance to water below the ground level was 12 ft. 1 in.; and after 5-hr. pumping at a rate of 200 gpm., the water level in the east well had lowered to 42 ft. 3 in.

The following pump installation, made in Nov. 1929, is still in service: 119 ft. of 6-in. column pipe; 10-in., 3-stage Layne turbine pump, No. 5257, rated at a capacity of 140 gpm. against a total head of 125 ft.; the overall length of the pump is 2 ft. 9 in.; 139 ft. of air line; 20 ft. of 6-in. suction pipe; 10-hp. Fairbanks-Morse electric motor.

The pump base is approximately 4 ft. below the original ground surface.

A final production test of 10-hr. duration was conducted on Nov'. 12, 1929. The pumps in the east and west wells discharge simultaneously to the concrete reservoir located at the site of the east well from which measurements were made. An average input of 320 gpm. was determined. The water level below the pump base at the east well, determined by air line and gauge, indicated a drawdown of 101 1/2 ft. below a water level of 15 ft. before the test.

Analysis of a sample (Lab. No. 107,951) collected Oct. 14, 1946 from the end of the discharge pipe into the reservoir about 25 ft. from the pump after 15-min. pumping at a rate of 125 gpm., showed the water from the east well to have a total hardness of 21.2 gr. per gal., a residue of 455 ppm., and an iron content of 0.1 ppm.

The west well, known as No. 2, is located 400

ft. west of the east well (or approximately 1250 ft. S. and 800 ft. W. of the N. E. corner of Section 9). The elevation at the ground surface is 610± ft.

Correlated driller's log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay and gravel	27	27
Silurian system		
Niagaran-Alexandrian series		
Limestone, broken	2	29
Limestone	172	201
Ordovician system		
Maquoketa formation		
Shale	below	201

The well was drilled to a depth of 201 ft. and cased with 26-in. od. pipe from the surface to a depth of 30.5 ft. and 16-in. od. pipe from the surface to a depth of 47 ft. 8 in., below which the hole is 15 in. in diameter. The annular space outside of the inner casing was filled with concrete.

The well was completed on Aug. 1, 1929, and a preliminary production test was made on Aug. 3, 1929. After pumping for 5 hr. at a uniform rate of 200 gpm., approximate equilibrium was obtained. The drawdown was 61 1/2 ft. below a water level of 10 ft. 3 in. below the ground level, or a specific capacity of about 3 1/4 gpm. per ft. of drawdown. The east well was idle during this test, but observations indicated a recession of 30 ft. 2 in. in its water level.

The following pump installation, made in Nov". 1929, is still in service: 119 ft. of 6-in. column pipe; 10-in., 3-stage Layne turbine pump, No. 5258, rated at a capacity of 140 gpm. against a total head of 125 ft.; the overall length of the pump is 2 ft. 9 in.; 138 ft. of air line; 20 ft. of 6-in. suction pipe; 10-hp. Fairbanks-Morse electric motor. The pump base is approximately original ground level.

During the final 10-hr. production test, conducted on Nov. 12, 1929 when the pumps in both east and west wells are operating simultaneously at an average combined rate of 320 gpm., the drawdown in the west well was 97 ft. below a water level of 17 ft. below the pump base before the test.

Analysis of a sample (Lab. No. 107,952), collected Oct. 14, 1946 from the end of the discharge pipe into the reservoir about 400 ft. east of the pump after 15-min. pumping at a rate of 125 gpm., showed the water in the west well to have a total hardness of 19.5 gr. per gal., a residue of 448 ppm., and an iron content of 0.3 ppm. The quality was very similar to that obtained from the No. 1 (East) well.

All water for the public supply has been obtained from these 2 wells since they were placed in service. Water is pumped from both wells simultaneously, and the combined meter pumpage averaged 79,360 gpd. during Sept. 1946.

Water pumped to the distribution system has been chlorinated since 1942.

LABORATORY NO. 107,951

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.1		Silica	SiO_2	11.7	
Manganese	Mn	0.0		Fluoride	F	0.5	
Calcium	Ca	78.7	3.94	Chloride	Cl	6.0	.17
Magnesium	Mg	40.4	3.32	Nitrate	NO_3	1.3	.02
Ammonium	NH_4	0.3	.02	Sulfate	SO_4	107.8	2.24
Sodium	Na	24.6	1.07	Alkalinity (as $CaCO_3$)		296.	5.92
Color		0		Hardness (as $CaCO_3$)		363.	7.26
Odor		0		Residue		455.	
Turbidity		0		Free CO_2 (calc.)		31.	
Temperature 51.5° F.				pH = 7.4			

A public water supply was originally installed under private ownership by Mr. Stewart in 1891 and later given to the city of Piano (1938).

The source of supply was a shallow dug well located at the Stewart mill about 65 ft. east from the Rock Creek diversion channel in the eastern end of the city. It was dug 12 ft. in diameter to a depth of 14 ft.; deepened in 1916 to 18 1/2 ft. in 1947 to about 20 1/2 ft. below the curbing which is about 2 ft. above ground level.

The well was walled with boulders as excavation proceeded and later lined with concrete. Water, obtained from a gravel-formation, entered the bottom of the well and had a standing level of 8 ft. below the well curb in Sept. 1917. With long continued pumping a drawdown of-4 ft. was reported at that time. No change in water levels were reported on May 5, 1928. When operating with 2 centrifugal pumps a combined production of 240 gpm. was obtained. The average pumpage was 300,000 gpd. On July 22, 1946 the non-pumping water level was 8 ft. below the well curb and the pumping level 15 ft. 8 in. when pumping continuously at a rate of about 320 gpm. The pumping water level on Oct. 8, 1947 measured 15 ft. below the top of the concrete well cap. The water level rises to 8 ft. below the top during the 4-hr. idle period on Sundays.

This well has to date been the source of the entire public water supply. Water is pumped by a Worthington centrifugal pump belted to a shaft which is driven by a 40-hp. General Electric motor, or water power. The pump is operated 24 hr. daily during the week and 20 hr. on Sunday at a rate of about 320 gpm. At the present time there is also a smaller centrifugal pump in place having 4-in. suction pipe. (Estimated to have a capacity of 150 gpm. when operated.) When both centrifugal pumps were operated simultaneously during peak summer demands, the water level drew down to the bottom of the well.

It is planned to replace the Worthington centrifugal pump with the following pump installation, on hand Oct. 8, 1947, but not completely installed: - 13 ft. of 6-in. column pipe; 8-in., 10-stage Aurora Pump Co. turbine pump, No. 32460, having a rated capacity of 350 gpm. against 220 ft. of head; the overall length of the pump is 5 ft. 8 3/4 in.; 25-hp. U. S. electric motor. A 24-in. by 18-in. length gi. tub is placed at the bottom of the bowls.

Analysis of a sample (Lab. No. 112,159) collected Oct. 8, 1947 from a tap on the discharge pipe 40 ft. from the pump showed this water to have a hardness of 19.7 gr. per gal., a residue of 384 ppm., and a trace of iron content.

Well No. 2 was constructed in 1946 by the Layne Western Co., Chicago, and located approximately 1500 ft. N. and 500 ft. E. of the S. W. corner of Section 23, T. 37 N., R. 6 E.

The well is of the gravel packed type and was constructed to a depth of 40 ft. below the ground surface, penetrating sand and gravel.

The driller's record of casing and screen is given in Table 1.

TABLE 1

20 ft. of 42-in. od. temporary casing.
30 ft. of 38-in. id. outer casing.
30 ft. of 26-in. od. inner casing.
5 ft. of 26-in. od. Layne Type D No. 6 slot stainless steel shutter screen.
5 ft. of 26-in. id. x 38 in. od. concrete screen same as above.

Additional 26-in. and 38-in. pipe sections were later added establishing the pump base 8 ft. above the normal ground surface.

Approximately 12 cu. yd. of selected washed gravel (1/4 in. to 3/8 in. size) was used to gravel pack the screen and fill the annular space between the 26-in. and 38-in. casings.

A production test was made by the State Water Survey on July 22, 1946. After 7-hr. pumping at a uniform rate of 325 gpm. apparent equilibrium was attained with a drawdown of 14 3/4 ft. from a non-pumping level of 5 ft. 3 in. below the top of the temporary casing. After pumping was continued at an increased rate of 50 gpm. for an additional hr. the total drawdown was 17 ft.

Analysis of a sample (Lab. No. 107,198) collected during the test period on July 22, 1946 after 6-hr. pumping at 325 gpm. showed this water to have a hardness of 21.1 gr. per gal., a residue of 386 ppm., and an iron content of 0.2 ppm.

The following pump installation was completed Oct. 1, 1947 but is not yet in service: 30 ft. of 6-in. column pipe; 8-in., 2-stage Aurora Pump Co. turbine pump No. 30384, having a rated capacity of 300 gpm. against 65 ft. of head; 10 ft. of 6-in. tapered strainer; 30 ft. of 1/4-in. gi. pipe air line; 10-hp. U. S. electric motor.

Pumpage for the public supply averages 450,000 gpd. About a dozen large industries are consumers of the city water, 2 of which each average 75,000 gpd.

LABORATORY NO. 112,159

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	Tr.		Silica	SiO_2	22.4	
Manganese	Mn	Tr.		Fluoride	F	0.0	
Calcium	Ca	79.2	3.96	Chloride	Cl	6.0	0.17
Magnesium	Mg	34.3	2.82	Nitrate	NO_3	11.4	0.18
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	61.7	1.28
Sodium	Na	4.8	0.21	Alkalinity (as $CaCO_3$)		268.	5.36
Turbidity		Tr.		Hardness (as $CaCO_3$)		339.	6.78
Color		0		Residue		384.	
Odor		0		Free CO_2 (calc.)		22.	
Temperature 52.2° F.				pH = 7.5			

The village of Pleasant Hill (706) installed a public water supply in 1936.

Water is obtained from a well drilled in 1936 to a depth of 57 ft. by E. W. Franke, Batchtown, and located about 1/4 mile south of the Chicago and Alton Railroad station (or approximately 2000 ft. N. and 500 ft. W. of the S.E. corner of Section 20, T. 7 S., R. 4 W.). The ground surface elevation at the well site is 450± ft.

The formation ranged from fine to coarse sand from the surface to the bottom of the well. The well is cased with 8-in. pipe from 3 ft. above to 47 ft. below the surface, and a 10-ft. length of Cook screen having No. 20 slot openings, is installed below the casing.

A production test was made by the State Water Survey on Apr. 14, 1936. After pumping for 6 hr. at a rate of 170-178 gpm., the drawdown was 5.1 ft. from a non-pumping water level of 11.6 ft. below the ground surface. Another production test was made by the State Water Survey on June 16-17, 1936. After 24-hr. pumping at 173 gpm. the drawdown was 5.2 ft. from a non-pumping water level of 13 ft. below the ground surface.

The pumping equipment consists of: 40 ft. of 4-in. column pipe; 8-in., 3-stage American Well Works turbine pump, No. 59645, having 2 ft. 5 3/4-in. overall length, and rated at 100 gpm. against 60 ft. of head operating at 1750 rpm.; 10 ft. of 5-in. suction pipe, with strainer; 3-hp. U. S. electric motor, No. 142105. There is no air line installed. The pump base is 2 ft. above the floor of the pumping station, which is 1 ft. above ground level. A new pump has been ordered and an air line will be installed.

Analysis of a sample (Lab. No. 114,725) collected May 13, 1948 after 1 1/2-hr. pumping showed the water to have a hardness of 16.0 gr. per gal., a residue of 322 ppm., and an iron content of 0.9 ppm.

The water is aerated and filtered for iron removal. Analysis of a sample (Lab. No. 114,724) collected May 13, 1948 showed the treated water to have a hardness of 14.6 gr. per gal., a mineral content of 291 ppm. and an iron content of 0.12 ppm.

Pumpage is estimated to average 35,000 gpd.

PANHANDLE EASTERN PIPELINE CO.

The Pleasant Hill Pumping Station of the Panhandle Eastern Pipe Line Co. is located 3 mile northwest of Pleasant Hill on State Highway No. 96, (or approximately 1500 ft. S. and 100 ft. E. of the N.W. corner of Section 7, T. 7 S., R. 4 W.). The ground surface elevation at the well site is 460± ft. Four drift wells have been drilled between 1936 and 1944 by Layne-Western Co., Kansas City. The wells are spaced rectangularly and are from 225 to 260 ft. apart.

Correlated driller's log of Well No. 1 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and clay	14	14
Sand	93	107

The data in Table 1 have been made available by the drillers.

It is assumed that the dates are those of production tests made at time of completion of the well. It is not known if other pumps were or were not operating at the time.

Analysis of a sample (Lab. No. 114,819) collected May 24, 1948 after 15-min. pumping showed the water from Well No. 3 to have a hardness of 22.5 gr. per gal., a residue of 484 ppm. and an iron content of 0.3 ppm.

The water is softened. Analysis of a sample (Lab. No. 114,820) collected May 24, 1948 showed the treated water to have a hardness of 0.4 gr. per gal., a mineral content of 511 ppm. and a trace of iron.

In May 1948, the pumps were operated in pairs and alternated from day to day.

Pumpage is estimated to average 140,000 gpd.

LABORATORY NO. 114,725

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.9		Silica	SiO_2	38.8	
Manganese	Mn	1.5		Fluoride	F	0.6	
Calcium	Ca	73.3	3.67	Chloride	Cl	13.0	0.37
Magnesium	Mg	21.8	1.80	Nitrate	NO_3	3.5	0.06
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	35.4	0.74
Sodium	Na	2.3	0.10	Alkalinity	(as $CaCO_3$)	220.	4.40
Turbidity		Tr.		Hardness	(as $CaCO_3$)	274.	5.47
Color		0		Residue		322.	
Odor		0					
Temperature 56.5° F.							

TABLE 1

Well No.	Depth ft.	Date	Static Water Level ft.	Pumping Period hr.	Pumping Rate gpm.	Drawdown ft.
1	107.0	5/15/36	15.5	8	160	1.3
2	106.5		16.0	4	250	3.0
3	79.0	4/27/41	20.3	4	550	8.0
4	61.0	9/23/44	26.0	4	350	7.0

LABORATORY NO. 114,819

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.3		Silica	SiO_2	29.8	
Manganese	Mn	0.2		Fluoride	F	0.1	
Calcium	Ca	92.4	4.62	Chloride	Cl	46.0	1.30
Magnesium	Mg	37.7	3.10	Nitrate	NO_3	4.5	0.07
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	51.8	1.08
Sodium	Na	22.3	0.97	Alkalinity	(as $CaCO_3$)	312.	6.24
Turbidity		Tr.		Hardness	(as $CaCO_3$)	386.	7.72
Color		0		Residue		484.	
Odor		0					
Temperature 56 1/5° F.							

The city of Polo (2071) installed a public water supply in 1891.

Water is obtained from two deep wells located 50 ft. north of the Chicago, Burlington & Quincy R. R. tracks and 50 ft. east of Division St., Highway No. 26, (or approximately 1975 ft. N. and 2750 ft. E. of the S. W. corner of Section 9, T. 23 N., R. 8 E.). The surface elevation is 830± ft.

Well No. 1, called the West Well, was drilled to a depth of 2100 ft. in 1891 by the J. P. Miller Artesian Well Co., Brookfield.

The hole and casing record is shown in Table 1.

TABLE 1

Hole Record

10-in.	from	42 ft. 9 in. to 200 ft.
6 1/4-in.	from	200 to 605 ft.
5 1/4-in.	from	605 to 2100 ft.

Casing Record

10-in. from surface to 42 ft. 9 in.

When the well was completed, the water level was about 70 ft. below the top of the well. Mr. Fred, Water Superintendent, reports that when drilling reached a depth of 1620 ft., the water level was 2 ft. below the top of the well.

In 1913, the non-pumping water level was 114 ft. In 1931, this well was repaired by P. E. Millis & Co., Byron and equipped with an air lift pump with 475 ft. of drop pipe. It was reported that when pumping at 150 gpm., the drawdown was 165 ft. below a non-pumping level of 126 ft. In 1938, the air lift which had formerly been in Well No. 2 was installed in Well No. 1 and is now equipped with 500 ft. of 1-in. air pipe.

Analysis of a sample (Lab. No. 112,657) collected Nov. 21, 1947 after 1-hr. pumping at 150 gpm., showed the water from Well No. 1 to have a hardness of 19.7 gr. per gal., a residue of 337 ppm., and an iron content of 0.2 ppm.

This well is used 4 to 6 hr. daily at 150 gpm. If Well No. 2 is not in operation, it is necessary to conserve use of water and to operate the pump 24 hr. per day.

Well No. 2, the East Well, was drilled to a depth of 1200 ft. in 1901 and located about 50 ft. east of Well No. 1. The top 200 ft. is cased with 15-in. pipe, and the remainder of the hole is 8 in. in diameter.

In 1913, the water level was 114 ft. below the top of the well. In 1931, the well was repaired by P. E. Millis & Co. and "shot" with dynamite at the following levels: 1030 ft.; 930 ft.; 780 ft.; 550 ft.; 440 ft. The well was then cleaned out to a depth of 1165 ft. After the repairs, the well was reported to produce 260 gpm.

In 1938, the well was equipped as follows: 220 ft. of 6-in. od. column pipe; 7 5/8-in., 9-stage American Well Works turbine pump, No. 70054, rated at 250 gpm. against 260 ft. of head; the overall length of the pump is 5 ft. 5 5/16 in.; 220 ft. of 1/4-in. air line; 20 ft. of 5-in. suction pipe; 25-hp. U. S. electric motor, No. 97369, operating at 1800 rpm.

On Nov. 21, 1947, the non-pumping water level was 110 ft. below the pump base and after pumping 10 min. at 250 gpm., the drawdown was 30 ft. The pump in Well No. 1 had been operating for 2 hr.

Analysis of a sample (Lab. No. 112,654) collected Nov. 21, 1947 after 10-min. pumping at 250 gpm., showed the water in Well No. 2 to have a hardness of 17.7 gr. per gal., a residue of 309 ppm., and an iron content of 0.3 ppm.

Pumpage is estimated to average 220,000 gpd.

Industrial pumpage in the area is estimated to average 12,000 gpd.

On Mar. 25, 1948, a new well was being drilled by J. P. Miller Co. and located 100 ft. east of Well No. 2. The drilling had reached 842 ft. and the static water level on that date was 124 to 131 ft. below the derrick floor. The lower level was doubtless caused by pumping in Well No. 2. The well was cased with 53 1/2 ft. of 20-in. od. surface pipe and with 14-in. od. pipe from the surface to 412 ft.

Sample-study log of Well No. 1 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
No record	40	40
Ordovician system		
Galena-Platteville dolomites	343	383
Glenwood shale and dolomite	17	400
St. Peter sandstone	65	465
Shakopee dolomite, thin shale bed near top	105	570
New Richmond sandstone and shale	30	600
Oneota dolomite, some sandstone at base	175	775
Cambrian system		
Trempealeau dolomite	175	950
Franconia shale, some dolomite and sandstone	90	1040
Galesville sandstone		
Sandstone, partly dolomitic	40	1080
Sandstone, incoherent	80	1160
Eau Claire formation		
Shale, dolomite and sandstone	205	1365
Sandstone, incoherent	60	1425
Cambrian and Pre-Cambrian systems		
Mt. Simon and Fond du Lac sandstones and thin shale beds	675	2100

LABORATORY NO. 112,654

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.3		Silica	SiO_2	15.3	
Manganese	Mn	Tr.		Fluoride	F	0.1	
Calcium	Ca	66.4	3.32	Chloride	Cl	1.0	0.03
Magnesium	Mg	33.3	2.74	Nitrate	NO_3	Tr.	Tr.
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	16.9	0.35
Sodium	Na	3.5	0.15	Alkalinity	(as $CaCO_3$)	292.	5.84
Turbidity		0		Hardness	(as $CaCO_3$)	303.	6.06
Color		0		Residue		309.	
Odor		0		Temperature 55° F.			

POPLAR GROVE
Boone County
Dec. 27, 1946

The village of Poplar Grove (353) installed a public water supply in 1915.

Water was first obtained from a well drilled to a depth of 130 ft. by Andrew Warren, Poplar Grove. This well was located in back of the village hall about 65 ft. south of the center line of the Chicago & North Western R. R. track and 40 ft. east of Main St. (or approximately 1800 ft. S. and 65 ft. E. of the N. W. corner of Section 19, T. 45 N., R. 4 E.). The elevation of the ground surface is 892± ft.

The well was drilled into sand and gravel below the bottom of an old dug well and cased with 6-in. pipe. The dug well was then filled to the floor of the pumping station which was about 11 ft. below the ground surface. On account of sand entering the well, a 4-in. diameter screen about 6 ft. in length was driven 4 1/2 ft. below the casing and sealed to the casing.

In 1919 the distance to water level was reported to be 4 ft. below the floor of the pumping station. Water was pumped with a plunger pump having a cylinder setting of 60 ft. and a displacement of 22 gpm. The well was the source of the public water supply until about 1940 when it pumped sand. The pumping equipment has been removed, and a hardwood plug has been driven into the top of the casing.

In June 1940 a new well was drilled to a depth of 184 ft. by C. D. Ackly, Walworth, Wis. It is located about 10 ft. north and 5 ft. west of the old well. The elevation at the pump base is 895± ft., which is nearly 3 ft. above the ground surface. The well terminated in sand and gravel and is cased with 8-in. pipe to a depth of 165 ft. below which is installed 19 ft. of slotted screen exposed to water-bearing sand and gravel.

The following pump installation made in Aug. 1940 is in service: 50 ft. of 5-in. od. column pipe; 7-in., 10-stage Fairbanks-Morse turbine pump rated at 150 gpm. against 190 ft. of head; 50 ft. of air line; 10 ft. of 5-in. od. suction pipe; 10-hp. Fairbanks-Morse electric motor.

A production test was made with this equipment on Aug. 29, 1940. The water level before the test was 12 ft. below the pump base. After pumping at a rate of 150 gpm. against a head of 190 ft., the drawdown was 16 ft.; and after 4 hr. of additional pumping to free discharge at a rate of 200 gpm., the drawdown was 28 ft.

Analysis of a sample (Lab. No. 108,433) collected Nov. 20, 1946 after 5-min. pumping at 150 gpm., showed the water in this well to have a total hardness of 20 gr. per gal., a residue of 360 ppm., and an iron content of 0.5 ppm.

The estimated average pumpage is about 15,000 gpd.

A well was drilled in 1945 by I. B. Null, Winnebago, for the Northern Illinois Processing Co. at Poplar Grove, and located 1600 ft. S. and 330 ft. E. of the N. W. corner of Section 11, T. 45 N., R. 4 E. The ground surface elevation is 892 ft.

Correlated driller's log of well drilled in 1945 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay, yellow and blue	150	150
Clay, blue, and gravel	115	265
Ordovician system		
Galena-Platteville formations		
Lime, brown and blue	125	390
Glenwood formation		
Sand break	35	425
St. Peter formation		
Sandstone	125	550
Chert	20	570

LABORATORY NO. 108,433

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.5		Silica	SiO_2	21.4	
Manganese	Mn	0.0		Fluoride	F	0.2	
Calcium	Ca	80.2	4.01	Chloride	Cl	7.0	0.20
Magnesium	Mg	34.7	2.86	Nitrate	NO_3	1.3	0.02
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	49.0	1.02
Sodium	Na	2.8	0.12	Alkalinity (as $CaCO_3$)		288.	5.76
Color		0		Hardness (as $CaCO_3$)		344.	6.88
Odor		M		Residue		360.	
Turbidity		30		Temperature 50.5° F.			

PORT BYRON
Rock Island County
Oct. 15, 1947

The public water supply for the village of Port Byron (861) was installed in 1934.

Water is obtained from a well located a few feet north of the city hall between Main St. and the Mississippi River (or approximately 2266 ft. S. and 3070 ft. W. of the N.E. corner of Section 25, T. 19 N., R. 1 E.).

The well was completed in June 1943 to a depth of 1597 ft. by Chas.D. Nolan, Cedar Rapids, Iowa. The elevation of the pump base is 584.0 ft.

The hole and casing record is shown in Table 1.

TABLE 1

Hole Record

12-in. from surface to 300 ft.
8-in. from 300 to 558 ft.
6-in. from 558 to 1077 ft.
4 1/2-in. from 1077 to 1579 ft.

Casing and Liner Record

8-in. casing from surface to 300 ft.
6-in. casing from 290 to 558 ft.
4 1/2-in. liner from 975 to 1077 ft.

The annular space outside the 8-in. and 6-in. casings was filled with cement. In June 1943, the driller reported the non-pumping water level was 23.7. ft. below the pump base; and, after pumping 150 hr. at 350 gpm., the drawdown was 36.3 ft. The pump was pulled and repaired in Sept. 1947 by Chas. D. Nolan. The drive shaft couplings were eaten away by corrosion or electrolysis. The column pipe was shortened when replaced. On Sept. 29, 1947 the non-pumping water level was 43 ft. below pump base, and on Oct. 15, 1947 was 60 ft. and, after pumping 25 min. at 250 gpm., the drawdown was 25 ft.

The pumping installation consists of 120 ft. of 5-in. column pipe; 8-in., 12-stage American Well Works turbine pump, No. 68345, rated at 175 gpm. against 370 ft. of head at 1760 rpm.; 120 ft. of air line; 10 ft. of suction pipe; 25-hp. electric motor.

Analysis of a sample (Lab. No. 112,242), collected Oct. 9, 1947 after 75-min. pumping at 236 gpm., showed this water to have a hardness of 36.2 gr. per gal., a residue of 2410 ppm., and an iron content of 1.0 ppm.

The water is not treated. Pumpage in Oct. 1947 averaged 35,000 gpd.

Sample-study log of well completed in June 1943 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Till	20	20
Silurian system		
Niagaran-Alexandrian series		
Dolomite	20	40
Crevice clay	10	50
Dolomite	270	320
Dolomite, siltstone at base	15	335
Ordovician system		
Maquoketa shale and dolomite	195	530
Galena-Platteville dolomites	342	872
Glenwood shale and some sandstone	38	910
St. Peter formation		
Sandstone, incoherent	80	990
Conglomerate of shale, sandstone, dolomite and chert	90	1080
Shakopee dolomite	45	1125
New Richmond sandstone and dolomite	35	1160
Oneota dolomite, sandstone in lower portion	260	1420
Cambrian system		
Trempealeau dolomite	159	1579

PRAIRIE DU ROCHER
Randolph County
March 13, 1948

The village of Prairie duRocher (576) installed a public water supply in 1940.

Water is obtained from a well drilled in 1940 and located about 70 ft. north east of the Missouri Pacific R. R. right-of-way and 430 ft. northwest of the center of Henry St., now Highway Route No. 155. The well is on Lot 15, Block 6 of Bessen's Addition to Prairie du Rocher, Survey No. 32, Claim No. 972, in T. 5 S., R. 9 W.

This well was drilled into fine muddy sand at a depth of 86 ft. below a surface elevation of 376± ft. Clean, coarse sand was encountered between the depths of 60 and 70 ft.

The well was cased with 6-in. pipe to a depth of 61 1/2 ft. and a Cook screen with No. 40 slot openings was installed with the bottom of the screen set at 71 1/2 ft.

For test purposes the well was equipped with a 6-in., 6-stage, Fairbanks-Morse turbine pump, with the bottom of the suction pipe 44 ft. below the top of the casing, which extended about 3 1/2 ft. above the ground surface. A production test was made by the State Water Survey May 8-9, 1940. When pumping at the rate of 80 gpm., the drawdown was 2.1 ft. from a non-pumping water level of 29 ft. below the top of the casing. Pumping in the west well of the Missouri Pacific Railroad, 300 ft. southwest of the city well, caused an additional drawdown of less than 1 ft. The well is equipped with an A.D. Cook turbine pump No. 4269, and a 3-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 113,826) collected after 15-minute pumping at 80 gpm. on Mar. 13, 1948, showed the water to have a hardness of 25.3 gr. per gal., a residue of 497 ppm., and an iron content of 21.5 ppm.

The water is aerated, softened and filtered.

Analysis of a sample (Lab. No. 114,109) collected Mar. 13, 1948, showed the treated water to have a hardness of 3.8 gr. per gal., a total mineral content of 462 ppm. and an iron content of 0.1 ppm.

Metered pumpage from Jan. 3 to Mar. 13, 1948 averaged 18,000 gpd.

LABORATORY NO. 113,826

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	21.5		Silica	SiO_2	66.2	
Manganese	Mn	0.3		Fluoride	F	0.1	
Calcium	Ca	119.4	5.97	Chloride	Cl	3.0	0.08
Magnesium	Mg	32.7	2.69	Nitrate	NO_3	10.0	0.16
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	0.0	0.00
Sodium	Na	8.7	0.38	Alkalinity (as $CaCO_3$)		440.	8.80
Turbidity		209.		Hardness (as $CaCO_3$)		433.	8.66
Color		0		Residue		497.	
Odor		0		Free CO_2 (calc.)		171.	
Temperature 57.5° F.				pH = 6.8			

LABORATORY NO. 114,109

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Phosphate	PO_4	0.1	
				Silica	SiO_2	74.	
Turbidity		0		Fluoride	F	0.2	
Color		0		Chloride	Cl	5.0	0.14
Odor		Tr.		Alkalinity (as $CaCO_3$)		440.	8.80
Temperature 57° F.				Hardness (as $CaCO_3$)		66.	1.32
				Free CO_2 (calc.)		86.	
				pH = 7.1			
				Total Mineral Content		462.	

A public water supply was installed by the city of Princeton (5224) in 1886.

Water was obtained from a deep-rock well located at the pumping station in the northeast corner of Main St. and Central Ave. (or approximately 1100 ft. S. and 1650 ft. E. of the N. W. corner of Section 16, T. 16 N., R. 9 E.).

The original dimensions of this well are not known. In 1914, the well was reported to be 2550 ft. deep and cased with 6-in. and 4-in. pipe. The elevation of the top of the well was 700± ft. Water levels were reported as follows:

Year	Depth from Pump House Floor
1886	60
1899	72
1914	140
1920	115

The well was abandoned about 1918, and air lift pumping equipment was removed. The well was covered sometime later.

Analysis of a sample (Lab. No. 22860) collected Jan. 8, 1912, showed the water from this well to have a hardness of 21.1 gr. per gal., a total mineral content of 428 ppm., and a trace of iron.

Well No. 2 was drilled about 1888 by the J. P. Miller Artesian Well Co., Brookfield, to a depth of 2092 ft. and cased with 6-in. pipe to a depth of 200 ft. below which was 4-in. pipe. It was about 50 ft. distant from Well No. 1. Both wells were equipped with air lifts, and in 1914 both wells were producing about 300 gpm. In Leverett's "Illinois Glacial Lobe," published in 1899, it was stated that Well No. 2 produced about 320 gpm. A temperature of 64° F. has been recorded.

The well was abandoned about 1918.

Well No. 3, known as the East Well, was drilled in 1914 about 20 ft. distant from Well No. 1. It was originally 245 ft. deep and cased with 19 1/4-in. id. pipe to a depth of 225 ft. A No. 3 Johnson strainer, 20 ft. in length and 16 in. in diameter was set below the casing.

In Nov. 1940 this well was deepened by Layne-Western Co., Chicago, to a depth of 260 ft. and was cased with 20-in.od. and 12 1/2-in. id. pipe, each from the surface to a depth of 230 ft. A 35-ft. section of 12 1/2-in. od. Johnson screen, No. 20 slot openings, was placed from a depth of 225 ft. to the bottom of the well. The annular space between the 20-in. casing and the 12 1/2-in. casing was filled with cement grout.

The pumping assembly consists of 200 ft. of 8-in. column pipe; 3-stage Layne-Western turbine pump, rated at 800 gpm. against a head of 195 ft.; the overall length of the pump is 3 ft. 11 in.; 20 ft. of 8-in. suction pipe; the bottom of the suction pipe is 223 ft. 11 in. below the top of the well; 204 ft. 11 in. of air line; 60-hp., 1750 rpm. U. S. electric motor.

Water levels have been reported as given in Table 1.

TABLE 1

Date	Non-pumping Water Level	Pumping Water Level	Pumping Rate
1920	161	165	700
1931*	162	178	600
3/8/41**	162	201	700

* Turbine had been lowered 16 ft.
** Well had been deepened and recased.

Analysis of a sample (Lab. No. 82692) collected Jan. 3, 1938, showed the water from this well to have a hardness of 6.8 gr. per gal., a residue of 202 ppm., and an iron content of 1.1 ppm.

Well No. 4, known as the West Well, and located about 50 ft. from No. 3, was drilled in 1920 by the Kelly Well Co., Grand Island, Neb. It is 267 ft. deep and cased with 18-in. id. concrete pipe to a depth of 240 ft. below which is a 12-in., No. 30 Johnson screen, with No. 30 slot openings and 30 ft. in length; with a 10-in. perforated pipe base. In 1931, because it was supposed that fine sand was being pumped over the top of the 12-in. steel screen, a 12-in. steel casing was set within the concrete casing from the ground surface to the top of the screen. A. J. Pierson, Manlius, made the repairs. Mr. J. E. Everson, Water Works Superintendent, stated that it was believed that a 10-in. casing was installed within the 12-in. casing. After completion of the repairs, the production was 770 gpm.

The well is equipped with 168 ft. of column pipe; 13-stage Cook pump, rated at 700 gpm. at 1800 rpm.; 20 ft. of suction pipe; 60-hp. electric motor.

In Aug. 1922 the pumping rate was 500 gpm.

On July 30, 1923, after the pump had been idle 1 hr. 35 min. following a 12-hr. 20-min. period of pumping, the water level was 162 1/2 ft. below the pump base.

On Aug. 8, 1928, the water level was 159 ft.; and when pumping at 690 gpm. the drawdown was 22 ft.

In Aug. 1947, considerable pump trouble was being caused by a crooked bore.

Analysis of a sample (Lab. No. 82693) collected Jan. 3, 1938, showed the water in this well to have a hardness of 14.5 gr. per gal., a residue of 316 ppm., and an iron content of 9.8 ppm. Methane gas is known to be present in the water from the glacial deposits. A sample of water collected Jan. 3, 1938 from this well was found to contain 3.4 cu. ft. methane per 1000 gal.

Well No. 5 was drilled in 1940 by Layne-Western Co., to a depth of 270 ft. and located at the pumping station.

The well is cased with 233 ft. of 12 1/2-in. pipe with the top 1 1/2 ft. above ground level and below the casing, is 38 ft. 7 in. of 10 5/8-in. Cook wire-wrapped screen, with No. 20 slot openings.

The pump assembly consists of 220 ft. of 7-in. column pipe; A. D. Cook turbine pump, No. 4544, having an overall length of 10 1/2 ft.; 232 ft. 2 in. of air line; 14 ft. 1 1/2-in. od. suction pipe; 50-hp. 1170 rpm. Westinghouse electric motor, No. 2347802.

On Sept. 18, 1940, the water level was 160 ft. below the ground surface, and the driller reported that, after pumping 9 hr. at 610 gpm., the drawdown was 45.8 ft.

Analysis of a sample (Lab. No. 111,592) collected Aug. 18, 1947, after pumping 5 hr., showed the water from Well No. 5 to have a hardness of 13.6 gr. per gal., a residue of 323 ppm., and an iron content of 2.8 ppm.

The water is treated for iron removal and softened.

Analysis of a sample (Lab. No. 111,591) collected Aug. 18, 1947 showed the treated water to have a hardness of 554 gr. per gal., a total mineral content of 182 ppm., and an iron content of 0.22 ppm. The methane content was found on Jan. 3, 1938 to be 1.0 cu. ft. per 1000 gal.

Pumpage is estimated to average 800,000 gpd., with maximum pumpage of 1 mgd.

Sample-study log of Well No. 5 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Till, yellow to gray, sandy at base	45	45
Sand, silty, yellow to gray	100	145
Till, very sandy, yellow, gray, brown	20	165
Gravel, silty, grading to sand	35	200
Sand, gravelly, silty	25	225
Sand, medium to coarse, some gravel, silty	45	270

LABORATORY NO. 111,592

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.8		Silica	SiO_2	24.2	
Manganese	Mn	0.0		Fluoride	F	.5	
Calcium	Ca	53.2	2.66	Chloride	Cl	3.0	.08
Magnesium	Mg	24.2	1.99	Nitrate	NO_3	4.3	.07
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	0.0	0.00
Sodium	Na	32.7	1.42	Alkalinity (as $CaCO_3$)		290.	5.92
Color		0		Hardness (as $CaCO_3$)		233.	4.65
Odor		Tr.		Residue		323.	
Turbidity		20.		Temperature 53.2° F.			

LABORATORY NO. 111,591

	ppm.	epm.			ppm.	epm.
Iron (total)	Fe 0.22		Fluoride	F	0.3	
Turbidity	0.		Chloride	Cl	7.0	
Color	0.		Alkalinity (as $CaCO_3$)		148.	
Odor	0.		Hardness (as $CaCO_3$)		92.	
			Total Mineral Content		182.	

PRINCEVILLE
Peoria County
Jan. 27, 1947

The water supply for the village of Princeville (996) is obtained from 2 wells.

Well No. 1 was drilled in 1914 by Sewell Well Co., St. Louis, Mo., to a depth of 1600 ft. and located on Walnut St., 1/2 block north of Main St. (or approximately 434 ft. N. and 260 ft. W. of the S.E. corner of Section 13, T. 11 N., R. 6 E.). The hole and casing diameter record is shown in Table 1.

TABLE 1

Hole Record

5-in. hole from 1450 to 1600 ft.

Casing Record

10-in. casing from surface to 370 ft.
6-in. casing from 370 to 841 ft.
5 3/8-in. casing from 841 to 1380 ft.
5-in. casing from 1380 to 1450 ft.

The well is equipped with 260 ft. of 6-in. column pipe; 8-stage Fairbanks-Morse deep-well turbine pump having an overall length of 5 1/2 ft.; 20 ft. of suction pipe; 25-hp. electric motor. In Sept. 1921 the non-pumping water level was reported to be 144 ft. below the ground surface, and the drawdown was 70 ft. when pumping at 165 gpm. In 1938 the pump and column pipe dropped in the well, and in 1943 they were retrieved, repaired, and placed into service.

In Oct. 1943, a short production test was made. The non-pumping water level was 196 ft. below the surface, and the drawdown was 31 ft. after pumping 2 hr. at 133 gpm.

In Apr. 1944 while the pump assembly in Well No. 2 was being repaired, the No. 1 well was not producing sufficient water to supply both the village and canning factory.

The water had a hardness of 20.4 gr. per gal., a mineral content of 1628 ppm., and an iron content of 0.7 ppm., as shown in the analysis of a sample (No. 98102), collected Oct. 14, 1943. A temperature of 72° F. was recorded.

Well No. 2 was drilled in 1938 to a depth of 1342 ft. by Thorpe Well Co., Des Moines, Iowa, and located 14 ft. south of Well No. 1, in the pumping station, on Walnut St.

Sample-study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay	30	30
Pennsylvanian system		
Shale, some sandstone and limestone, thin coal bed	332	362
Mississippian system		
Burlington limestone	78	440
Kinderhook shale	215	655
Devonian system		
Cedar Valley dolomite and limestone	45	700
Wapsipinicon limestone	30	730
Silurian system		
Niagaran dolomite, thin shale bed at base	210	940
Alexandrian dolomite, siltstone at base	65	1005
Ordovician system		
Maquoketa shale and dolomite	190	1195
Galena dolomite	145	1340

The well is cased from the surface to a depth of 411 1/2 ft. with 12-in. pipe, and from 385 ft. 1 in. to 1091 1/2 ft. with 10-in. pipe. There is a lead seal at the top of the 10-in. casing.

A production test was made under the supervision of the State Water Survey on Sept. 9, 1938. The non-pumping water level was 194 1/2 ft. below the top of the casing, and the drawdown was 95 ft. after 3-hr. pumping at 320 gpm.

In Feb. 1944 it was necessary to repair the pump and some sections of the column pipe after an accident which occurred while pulling the pump for cleaning. The water level was reported to be 198.8 ft. below the top of the casing. The depth was measured by J. P. Miller Co., Brookfield, and found to be 1359.8 ft. In May 1944, after the repairs had been completed and the pump reinstalled, water was pumped for 93 hr. and then pumping was stopped. Fifteen minutes later the water level was 201 ft. Pumping was resumed and after one-hour pumping at 350 gpm. the drawdown was 12 ft. On Jan. 27, 1947 the non-pumping water level was estimated at 190 ft. below the top of the casing, and the drawdown was 10 ft.

The well is equipped with 9-stage Sterling deep-well turbine pump, No. S-2921, having an overall length of 6 ft. 11 3/4 in.; 280 ft. of 6-in. column pipe; 301 ft. of air line; 10 ft. of 6-in. suction pipe; 30-hp. electric motor.

Analysis of a sample (Lab. No. 109,020) collected Jan. 27, 1947 after 93-hr. pumping at 350 gpm., showed the water in Well No. 2 to have a hardness of 19.8 gr. per gal., a residue of 1604 ppm., and an iron content of 0.7 ppm. A previous sample collected May 24, 1944 showed a similar mineral composition but a temperature of 71.5° F. was recorded.

Pumpage is estimated at 80,000 gpd.

LABORATORY NO. 109,020

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.7		Silica	SiO_2	14.3	
Manganese	Mn	0.0		Fluoride	F	2.4	
Calcium	Ca	82.3	4.12	Chloride	Cl	185.0	5.22
Magnesium	Mg	32.2	2.65	Nitrate	NO_3	2.7	.04
Ammonium	NH_4	1.2	.07	Sulfate	SO_4	730.0	15.19
Sodium	Na	412.4	17.93	Alkalinity	(as $CaCO_3$)	216.	4.32
Color		0		Hardness	(as $CaCO_3$)	339.	6.78
Odor (at well)		slight H_2S		Residue		1604.	
Turbidity		Tr.					
Temperature		68° F.					

The water works was installed by the village of Prophetstown (1469) in 1904.

Water was obtained from 2 dug wells in the northeastern part of town.

Well No. 1 was located near the easterly end of Water St. about 200 ft. from the south bank of the Rock River (or about 250 ft. N., 2600 ft. E. of the S. W. corner of Section 33, T. 20 N., R. 5 E.). The well was dug to a depth of 16 ft. through about 4 ft. of soil and clay into coarse sand and gravel. It was 8 ft. in diameter with a 1-ft. brick wall extending from the bottom to 6 ft. above the ground surface elevation of 598± ft. Clean gravel was placed in the well to prevent the fine sand from being drawn into the pump.

This well was reported to have been deepened in 1933 to 35 ft.

In 1934, five 2-in. well points were driven out radially from the dug portion of the well. The points were about 6 1/2 ft. long and 3 ft. above the bottom of the dug portion.

The water level in the well varied with the river level, but was ordinarily from 6 to 8 ft. below the surface. In dry weather, continued pumping lowered the water level to the bottom of the suction pipe, or about 1 ft. above the bottom of the well. In 1933, the water level was 6 ft. 10 in. below the ground surface.

Well No. 2 was dug prior to 1917 about 50 ft. westerly of Well No. 1. It was 16 ft. in diameter with a 1-ft. brick wall extending from the bottom to 6 ft. 9 in. above the ground. The well was 16 ft. deep penetrating about 4 ft. of soil and clay into fine sand and gravel. Clean gravel was placed in the bottom of the well to prevent the fine sand from being drawn into the pump. Water level and. drawdown were similar to that of Well Nb. 1.

This well was reported to have been deepened to 27 ft. in 1933.

In 1934, five 2-in. well points were driven out radially from the dug portion of the well. These were about 6 1/2 ft. long and 3 ft. above the bottom of the dug portion.

Originally water was pumped by 2 Goulds 7-in. by 8-in. triplet pumps. In 1916, only one of these, operated by a 15-hp. Century Induction electric motor rated at 1155 rpm., was in service. The other pump was operated by a Fairbanks-Morse 25-hp. gasoline engine, connected directly to the pump shaft. In 1934, a 20-hp. General Electric motor was installed to drive the north pump, previously driven by the gasoline engine. This pump was then put into use almost exclusively.

Following the flood of 1938, during which the wells were completely submerged, the brick walls were built up, and a chlorinator was installed.

Analysis of a sample (Lab. No. 73228) collected July 10, 1933, showed the water from Well No. 2 to have a hardness of 16.1 gr. per gal., a residue of 285 ppm., and an iron content of 2.6 ppm.

The pumps and motors have been removed and both wells have been abandoned.

In 1944, a well was drilled by Chas. D. Nolah, Cedar Rapids, Iowa, on High St., 163 ft. northerly at East 2nd St. (or about 200 ft. N. and 2300 ft. E. of the S.'W. corner of Section 33). The well is 10 in. in diameter and 235 ft. deep below a surface elevation of 615± ft. entering limestone at 193 ft.

A 10-in. casing extends entirely through the sand and gravel and a few feet into the limestone.

The pumping installation consists of 80 ft. of 5-in. column pipe; 7 5/8-in., 6-stage American Well Works turbine pump, No. 69871, rated at 250 gpm. against 223 ft. head at 1750 rpm.; the overall length of the pump is 5 ft. 3 in.; 20 ft. of 5-in. suction pipe; 20-hp. U. S. motor, No. 361333. In Oct. 1947 the pump discharge was reported to be 330 gpm.

A production test was made on Mar. 15, 1944 by Howard R. Green Co. It was reported that when pumping at 304 gpm. the drawdown was 26 1/2 ft. from a non-pumping water level of 41.0 ft. below the surface. The water level returned to 41.0 ft. 2 min. after stopping the pump.

Analysis of a sample (Lab. No. 112,155) collected Oct. 9, 1947 showed this water to have a hardness of 16.6 gr. per gal., a residue of 306 ppm., and an iron content of 0.3 ppm.

The water is not treated. Pumpage is estimated to average 110,000 gpd.

Industrial pumpage in the area is estimated to average 10,000 gpd. During the water period industrial pumpage averaged 150,000 gpd. The wells of the Eclipse Lawn Mower Co. are con-

nected to the village mains so that in case of fire, water can be pumped to the mains by both village and Eclipse Lawn Mower Co.

Test Well No. 1 drilled for Eclipse Lawn Mower Co. in 1942 by Neely and Schimelsfenig, Batavia, is located approximately 42 ft. S. and 400 ft. W. of the N. E. corner of Section 5, T. 19 N., R. 5 E. The ground elevation is 622± ft.

Sample-study log of Test Well No. 1 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and silt	10	10
Sand, dirty	28	38
Clay	142	180
Sand, dirty	2	182
Sand, some gravel, fairly clean	6	188
Silurian system		
Niagaran-Alexandrian dolomite, shaly at base	184	372
Ordovician system		
Maquoketa shale, thin dolomite beds	188	560
Galena-Platteville formations		
Dolomite		
Limestone, dolomite, and thin shale beds	250	810
Limestone, thin dolomite bed at base	87	897
Glenwood shale, some sandstone and dolomite	43	940
St. Peter formation		
Sandstone, incoherent	15	955
Sandstone, shale	11	966
Shakopee dolomite, some sandstone, thin shale beds	86	1052

LABORATORY NO. 112,155

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.3		Silica	SiO_2	28.3	
Manganese	Mn	0.3		Fluoride	F	0.1	
Calcium	Ca	70.9	3.55	Chloride	Cl	1.0	0.03
Magnesium	Mg	25.9	2.13	Nitrate	NO_3	1.5	0.02
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	3.1	0.06
Sodium	Na	0.7	0.03	Alkalinity	(as $CaCO_3$)	280.	5.60
Turbidity		Tr.		Hardness	(as $CaCO_3$)	284.	5.68
Color		0		Residue		306.	
Odor		Tr.		Temperature	52° F.		

The village of Ramsey (881) installed a public water supply in 1935.

Water was obtained originally from a well drilled in Oct., 1934 by E. C. Baker, Sigel, and located about 125 ft. north of Main St. and 150 ft. east of Madison St. (or approximately 150 ft. N. and 1050 ft. W. of the S.E. corner of Section 8, T. 8 N., R. 1 E.). The ground surface elevation is 610± ft.

The well was 10 in. in diameter and was reported originally to be 104 ft. deep, with a 10-in. Cook screen set between 84 and 104 ft. The upper 7 ft. section of the screen was reported to have No. 20 slot openings, and the lower 13 ft. section No. 10 slots.

In Feb. 1935, the well was deepened to 135 ft., and cased with 10-in. pipe to a depth of 123 ft., with an 11-ft. exposed length of 10-in. Cook screen installed below the casing. The upper 6 ft. section of screen was reported to have No. 20 slot openings, and the" lower 5 ft. section, No. 10 slots. The deepening work was done in an attempt to increase the capacity.

Sample-study log of well deepened in 1935 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Silt and till	84	84
Sand, clean	20	104
Till	19	123
Sand and gravel, silty	11	134
"Clay"	1	135

A production test was made by the State Water Survey onFeb. 22, 1935. For test purposes, a belt-driven turbine pump with the bottom of the suction pipe set at a depth of 134 ft. was installed in the well. The well produced 25 gpm. with a drawdown of 97 ft. below the non-pumping water level of 26 ft.

Permanent pumping equipment was installed as follows: 110 ft. of 3 1/2-in. od. column pipe; 6-in., 18-stage A.D. Cook deep well turbine pump No. 1660, rated at 25 gpm. against 160 ft. of head; 20 ft. of 3 1/2-in. suction pipe; 5-hp. U.S. electric motor No. 116649, operating at 1800 rpm.

A production test was made by the State Water Survey on Oct. 6, 1936. Tihe well was empty after 1 hr. 35 min. of pumping at an average rate of 5.7 gpm. The non-pumping water level was 114 ft. 5 in. below the floor. In 1937, it was reported that this well was not in use. The non-pumping water level was 94 ft., and the pump broke suction after 4-min. pumping at 35 gpm. In 1939, the pump was operated 15-18 hr. per day at a rate of 5-6 gpm.

Analysis of a sample (Lab. No. 78809) collected Oct. 7, 1936, showed the water to have a hardness of 6.3 gr. per gal., a residue of 620 ppm., and an iron content of 2.4 ppm.

Well No. 1 has been abandoned. The pump was installed in Well No. 2.

Ah electrical earth resistivity survey was made by the State Geological Survey June 21-25, 1937. The survey covered areas in the central, north, and northeast parts of the village, and in the valley of Ramsey Creek, southwest of the village. An extension of this survey, made Aug. 6 and 7, 1937, covered the area within 1/2 mile north, west, and south of the original well.

Test Well No. 3 was drilled in 1937 to a depth of 163 ft. and 6-in. diameter by E. C. Baker, and located about 30 ft. south of Sixth St. and 700 ft. west of the Illinois Central R.R. tracks (or approximately 1170 ft. S. and 2250 ft. E. of the N.W. corner of Section 17). The ground surface elevation is 610± ft.

It was reported that sand was encountered between depths of 149 and 152 ft., and between 159 and 162 ft. A home-made screen, consisting of 45 ft. of 5-in. pipe, slotted with a hacksaw, was installed.

A production test was made by the State Water Survey on Oct. 20, 1937. The well produced 7 gpm. for 3 hr. with a drawdown of 48 ft. from a non-pumping water level of 70 ft. below the ground surface.

Test Well No. 3 was not developed because of insufficient capacity.

Well No. 2 was drilled by E.C. Baker in 1938 and located 12 ft. north of Test Well No. 3. The well is 157 ft. deep and is cased with 22-in. pipe to a depth of 148 ft. An 8-in. casing extends from 137 to 147 ft. and an 8-in. Johnson screen, having No. 60 slot openings extends from 147 to 157 ft. There is no connection between the 8-in. and 22-in. pipes, but the space between them is gravel-packed.

The Cook tur.bine pump, formerly in Well No. 1, was installed in Well No. 2.

A production test was made by the State Water Survey on Oct. 4, 1938. The well produced 13 gpm. with a drawdown of more than 44 ft. from a non-pumping water level of 88 1/2 ft. below the ground surface. In 1939, the well was reported to produce 8-10 gpm., and the pump was operated 10-12 hr. per day.

Analysis of a sample (Lab. No. 84396) collected Oct. 4, 1938, showed the water to have a hardness of 8.7 gr. per gal., a residue of 752 ppm., and an iron content of 2.8 ppm.

Well No. 2 was in service until Well No. 3 was completed. The capacity was insufficient and the well was capped and abandoned.

Test Well No. 4 was drilled by E. C. Baker in 1937, in the valley of Ramsey Creek, about a mile southwest of town (or approximately 1100 ft. N., and 1560 ft. W. of the S.E. corner of Section 18). The well was 37 ft. 3 in. deep, below a ground surface elevation of 530± ft. It was reported that below a depth of 1 ft., increasingly coarse sand and gravel was encountered. The well was cased with 8-in. pipe to the bottom, and no screen was used.

A production test was made by the State Water Survey on Nov. 1, 1937. The well produced 52 gpm. with a drawdown of 7.2 ft., and 75 gpm. with a drawdown of 10.6 ft. from a non-pumping water level of 3.2 ft. below the top of the casing. Another production test was made by the State Water Survey on Mar. 18, 1940. When pumping at a rate of 70 gpm. the drawdown was 9.3 ft. from a non-pumping water level of 2.8 ft. below the top of the casing.

Analysis of a sample (Lab. No. 87480) collected Mar. 18, 1940, showed the water to have a hardness of 33.6 gr. per gal., a residue of 777 ppm., and an iron content of 3.3 ppm.

A well was drilled in Mar., 1940, by E. C. Baker at a location about 300 ft. southeast of Test Hole No. 4. The well was 54 ft. deep and produced no water.

Well No. 3 was drilled in Sept., 1942 to a depth of 38 ft. by Hayes and Sims, Champaign, and is located 14 i/2 ft. southwest of Test Well No. 4, at the Springs site which was used as a source of water supply for 50 years by the Illinois Central R. R.

The well is cased with 8-in. pipe from 3 ft. above to 31 ft. 4 in. below the ground surface, and with a 7 5/8-in. od. Johnson Armco-iron wire-wound screen installed between the depths of 29 ft. 4 in. and 38 ft. The screen has No. 60 slot openings.

A production test was made by the State Water Survey on Sept. 10, 1942. For test purposes, a horizontal centrifugal pump was used, with the bottom of the suction pipe about 31 ft. below the ground surface. Equilibrium conditions were not obtained, but after 7-hr. pumping at 154 gpm. the drawdown was 17.7 ft. from a non-pumping water level of 9 in. below the ground surface. After the pump was stopped, the water level rose to within 1 ft. of the non-pumping level in 6 minutes.

The pumping installation includes a 7-in. od. American Well Works turbine pump, No. 67505, rated at 150 gpm. against a head of 117 ft. at 1720 rpm.; 7 1/2-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 114,758) collected May 17, 1948 after 7-hr. pumping at a rate of 150 gpm. showed the water to have a hardness of 42.0 gr. per gal., a residue of 901 ppm., and an iron content of 1.6 ppm.

The water is aerated and filtered. Analysis of a sample (Lab. No. 114,787) collected May 17, 1948 showed the treated water to have a hardness of 36.4 gr. per gal., a mineral content of 749 ppm., and an iron content of 0.14 ppm.

Pumpage is estimated to average 33,000 gpd.

LABORATORY NO. 114,758

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.6		Silica	SiO_2	20.4	
Manganese	Mn	0.2		Fluoride	F	0.1	
Calcium	Ca	181.1	9.06	Chloride	Cl	17.0	0.48
Magnesium	Mg	65.4	5.38	Nitrate	NO_3	1.4	0.02
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	412.4	8.58
Sodium	Na	14.7	0.64	Alkalinity	(as $CaCO_3$)	300.	6.00
Turbidity		5		Hardness	(as $CaCO_3$)	722.	14.44
Color		0		Residue		901.	
Odor		Tr.		Free CO_2 (calc.)		15.	
Temperature 55.7° F.				pH = 7.7			

RANKIN
Vermilion County
Nov. 27, 1948

A public water supply was installed in 1918 by the village of Rankin (781).

Well No. 1 was drilled in 1916 to a depth of 270 ft. by Omer Kersey, Sullivan, and located at the water works plant, 30 ft. west of Johnson St. and 55 ft. north of Third St. (or approximately 2400 ft. N. and 450 ft. W. of the S.E. corner of Section 11, T. 23 N., R. 14 W.).

The ground elevation at the well site is 712± ft. The well was cased with 8-in. pipe to 254 ft. and 16 ft. of Johnson screen having No. 30 slot openings. During drilling operations water was encountered between depths of 222 and 230 ft. and the water level was 35 ft. below ground level. A yield test was made by the driller with the pump set at 50 ft. Water was drawn down immediately to the pump cylinder. After completion of the well, the static water level was 50 ft. below ground level, and, after 15-hr. pumping at 60 to 70 gpm. the pump broke suction. The bottom of the suction pipe was set at 249 ft.

In 1926, the pumping equipment consisted of: 88 ft. 8 in. of drop pipe and an Erb cylinder pump, operated with 20-in. stroke, on July 1, 1926, after long continued pumping at 74 gpm. the water level was 43 ft. 7 in. below the top of the casing. On stopping the pump in Well No. 1 and starting the pump in Well No. 2, the water level in Well No. 1 raised to 39 1/2 ft. in 4 min. and 1/2 hr. later, the water level was 38 ft. 8 in. Then with both pumps operating, the water level in Well No. 1 was lowered to 45 ft. 3 in.

The existing pumping equipment, made in Dec. 1946, consists of: 85 ft. of 4-in. column pipe; Peerless turbine pump, No. 34040, having a discharge rate of 80 gpm. to the ground reservoir; 85 ft. of 1/4-in. copper air line (defective); 10 ft. of 4-in. id. suction pipe; 3-hp. U.S. electric motor.

In Dec. 1946, the non-pumping water level in Well No. 1 was 50 ft. below the pump base (2 ft. above top of the casing). At the same time, the pump in Well No. 2 was operating at a discharge rate of about 100 gpm.

Well No. 1 is the principal source of the public supply and is in daily service.

Analysis of a sample (Lab. No. 84160) collected Aug. 26, 1938 showed the water in Well No. 1 to have a hardness of 18.7 gr. per gal., a residue of 408 ppm., and an iron content of 1.0 ppm.

Well No. 2 was drilled in 1926, to a depth of 282 1/2 ft. by Chas. Krauss and Sons, Indianapolis, Ind., and located 18 ft. east of Well No. 1. The well terminated in a 20-ft. stratum of water-bearing gravel, and was cased with 265 ft. of 10-in. pipe and 17 ft. of Krauss No. 5 1/2 brass screen. When pumping in Well No. 1, the non-pumping water level in Well No. 2 was 41 ft. below ground level.

The pumping equipment consists of: 90 ft. of 6-in. drop pipe; Downie Keystone Driller Co. double-stroke plunger pump, order No. 1014, pump head No. 33, having a 5 3/4-in. cylinder and 18-in. stroke, and operated at a speed of 31 spm.; 7 1/2-hp. Fairbanks-Morse electric motor.

Well No. 2 is maintained as an auxiliary supply unit and is in use about two or three times weekly.

Analysis of a sample (Lab. No. 116352) collected Nov. 24, 1948 after 20-min. pumping showed the water from Well No. 2 to have a hardness of 17.8 gr. per gal., a residue of 395 ppm., and an iron content of 1.8 ppm.

Pumpage is estimated to average 33,000 gpd.

LABORATORY NO. 116,552

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.8		Silica	SiO_2	20.9	
Manganese	Mn	Tr.		Fluoride	F	Tr.	
Calcium	Ca	71.6	3.58	Chloride	Cl	10.0	0.28
Magnesium	Mg	30.5	2.51	Nitrate	NO_3	0.4	0.01
Ammonium	NH_4	2.3	0.13	Sulfate	SO_4	1.2	0.03
Sodium	Na	35.4	1.54	Alkalinity	(as $CaCO_3$)	372.	7.44
Turbidity		6		Hardness	(as $CaCO_3$)	305.	6.09
Color		0		Residue		395.	
Odor		0		Free CO_2	(calc.)	37.	
Temperature 55° F.				pH = 7.4			

RANSOM
La Salle County
June 26, 1947

The public water supply was installed by the village of Ransom (419) in 1907. The installation included Well No. 1, which was drilled by John Wormley, Ransom, and Charles Johnston, Seneca, and located 6 ft. south of the south line of Thomas St. and 6 ft. west of the west line of the alley between Lincoln and Wormly St. (or approximately 1640 ft. N. and 2100 ft. W. of the S. E. corner of Section 16, T. 31 N., R. 5 E.). The original depth was 284 ft., but in 1938 because of an insufficient supply, the well was deepened to 325 ft. It is cased withl48 ft. of 8-in. pipe.

The pumping equipment, installed in May 1946, consists of 210 ft. of 2-in. column pipe; 1 3/4-in. Gould cylinder pump having an overall length of 36 in.; 21 ft. 1 1/4 in. of suction pipe; 3-hp. Century electric motor.

The pump discharge is 6 to 7 gpm.

The water levels at depths below the top of the casing have been reported as given in Table 1.

During the original construction of the well, water was encountered at 160 to 200 ft. depth; and in the deepening of the well in 1938, water was found at 305 ft. Prior to 1938, gas had been noticed in insufficient quantities to cause any difficulty, but, after the well was deepened, gas emanated from a vein at 302 ft. to such an extent as to cause a reduction in the pump discharge. Gas locking of the pump limited the pumping period to 15 to 20 min. at intervals of 10 to 15 min. This frequency of starting and stopping the pump caused a swaying action, which washed down the shale, making it necessary to clean the reservoir frequently.

The pump is operated 24 hr. daily.

Analysis of a sample (Lab. No. 110,858) collected June 26, 1947 after pumping 24 hr., showed the water from Well No. 1 to have a hardness of 8.3 gr. per gal., a residue of 611 ppm., and an iron content of 0.1 ppm. Inflammable methane gas is present in the water. Analysis on previous occasions indicated an iron content of 1.6 ppm., and of 0.0 ppm.

Well No. 2 was drilled in 1932 by Layne North-Central Co., Chicago. It is located 25 ft. south of Well No. 1 and was originally drilled to a depth of 831 ft. In 1938, the well was cemented in below a depth of 500 ft.

Sample-study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Glacial till	84	84
Sand	3	87
Glacial till	33	120
Torpedo gravel, clean	5	125
Glacial till	5	130
Sand	10	140
No record	10	150
Pennsylvanian system		
Sandstone and shale, thin limestone and coal beds	202	352
Ordovician system		
Galena-Platteville limestone and dolomite	322	674
Glenwood sandstone	11	685
St. Peter sandstone	146	831

Water from sand at 83 ft. was found to have a total mineral content of 1886 ppm., and a hardness of 1035 ppm. The sulfate concentration was 1110 ppm.

Samples collected from sandstones at 200,275 and 302 ft. were found to be of similar character to that obtained at 136 ft. This water was found to have a mineral content of 500 ppm. and a hardness of 200 ppm.

The well was cased with 10 in. pipe from the surface to 366 ft., casing off a gas vein at 302 ft. The gas was found to contain 66% methane. The bore hole was 12 in. in diameter from the surface to 366 ft. and 10 in. in diameter from 366 ft. to 831 ft. Upon completion, the well produced about 20 gpm.

Analysis (Lab. No. 71162) showed the water to have a mineral content of 840 ppm., a hardness of 13.7 gr. per gal., and an iron content of 0.6 ppm. The chloride content was 290 ppm. The water was reported to be highly corrosive to pump rods, brass fittings, mains and service pipes.

Consequently, it was filled in below a depth of 500 ft., and the casing was perforated so as to admit water from the upper water-bearing strata. In 1944, the supply from both wells had dwindled to below the required demand of 12,000 gpd., and steps were taken in search of a supplemental water supply.

The pump assembly consists of 351 ft. of 4-in. column pipe; a 3 3/4-in. Myers single-stroke cylinder operating with a 24-in. stroke at a rate of 28 strokes per min.; the overall length of the cylinder is 42 in.; 40 ft. of 3 1/2-in. suction pipe; 5-hp., 1740 rpm. Westinghouse electric motor, No. 19137. It is estimated that the pump delivers 6 to 7 gal. per min. However, it can operate only a few minutes before it becomes gas-locked. There has been one or two explosions at this well.

In May 1945, the State Geological Survey completed an electrical earth resistivity survey in the vicinity of Ransom in search of a sand and gravel deposit capable of yielding a satisfactory water supply. The area included in the survey covered approximately 30 sq. mi. centering on Ransom.

Well No. 3 was drilled in 1946 by Bolliger & Sons, Fairbury, and located in the northeastern part of the village, 165 ft. south of the Atchison, Topeka & Santa Fe R. R. right-of-way line and 190 ft. west of the right-of-way line of Route 170 (or approximately 2600 ft. N. and 250ft. W. of the S. E. corner of Section 16).

The well is 280 ft. deep and is cased with 6-in. pipe. It was reported that when the well was completed, the drillers operated the pump for 3 days (shut off at nights) at a rate of 18 gpm., but at any time when the rate was increased to 20 gpm., the pump would soon break suction.

A Paul single-acting cylinder pump with an 8-in. stroke and operated at a rate of 40 strokes per min. was originally installed in this well, but in July 1947, the cylinder pump was removed, and the turbine pump which had been in Well No. 1 was installed. The reason for the change of pump was because of the reduced discharge rate of the cylinder pump from 3 1/2 to 1 1/2 gpm.

The pumping assembly now consists of 158 ft. of 4-in. column pipe; 6-in., 10-stage Pomona turbine pump, No. S.R. 70, rated at 60 gpm.; the overall length of the pump is 10 ft.; 12 ft. of 4-in. suction pipe (including strainer); 7 1/2-hp., 1750 rpm. Westinghouse motor, No. 33-66N461. There is no air line in the well.

On July 11, 1947 the turbine had been operating 24 hr. and had not broken suction. Before installing the pump, the water level was 70 ft. below the top of the well.

Analysis of a sample (Lab. No. 110,857) collected June 25, 1947 after pumping 24 hr., showed the water in Well No. 3 to have a hardness of 8.0 gr. per gal., a residue of 645 ppm., and an iron content of 0.3 ppm.

Wells No. 1 and No. 3 are used 24 hr. daily while Well No. 2 operates only occasionally, its use being limited by the amount of gas in the well. Total pumpage from all 3 wells is estimated to be 16,000 gpd.

LABORATORY NO. 110,858

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	21.6	
Manganese	Mn	0.0		Fluoride	F	0.4	
Calcium	Ca	35.2	1.76	Chloride	Cl	29.0	0.82
Magnesium	Mg	13.4	1.10	Nitrate	NO_3	0.9	0.01
Ammonium	NH_4	0.4	0.02	Sulfate	SO_4	0.0	0.00
Sodium	Na	188.4	8.19	Alkalinity	(as $CaCO_3$)	512.	10.24
Color		0		Hardness	(as $CaCO_3$)	143.	2.86
Odor		Tr.		Residue		611.	
Turbidity		0		Temperature	54.2° F.		

TABLE 1

Water Levels

Date	Non-pumping ft.	Pumping ft.	Pumping Rate gpm.
1907	Depth of well 284 ft.		
1907	60		
1920	75	145	20
1931	154		
Jan. 1938	Deepened to 325 ft.		
May 1938	75	155	

LABORATORY NO. 71162

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.6		Silica	SiO_2	13.	
Manganese	Mn	0.		Chloride	Cl	290.	8.18
Calcium	Ca	53.8	2.09	Nitrate	NO_3	.4	.01
Magnesium	Mg	24.1	1.98	Sulfate	SO_4	24.1	.50
Ammonium	NH_4	.17	.01	Alkalinity	(as $CaCO_3$)	326.	
Sodium	Na	242.0	10.53	Hardness	(as $CaCO_3$)	233.5	
Turbidity		3.		Residue		840.	

LABORATORY NO. 110,857

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.3		Silica	SiO_2	21.8	
Manganese	Mn	0.0		Fluoride	F	0.3	
Calcium	Ca	39.8	1.99	Chloride	Cl	35.0	0.99
Magnesium	Mg	9.2	0.75	Nitrate	NO_3	0.9	0.01
Ammonium	NH_4	0.3	0.02	Sulfate	SO_4	8.2	0.17
Sodium	Na	213.7	9.29	Alkalinity	(as $CaCO_3$)	544.	10.88
Color		0		Hardness	(as $CaCO_3$)	137.	2.74
Odor		Tr.		Residue		645.	
Turbidity		10-		Temperature	54.5° F.		

RANTOUL
Champaign County
May 23, 1949

A limited public water supply was installed by the village of Rantoul (2367) about 1885. The installation included a well with a pump operated by a windmill.

In 1895, Wells No. 1 and 2 were drilled 16 ft. apart, south to north, at the water works plant at the northwestern corner of Ohio and Grove Ave., west of the Illinois Central R. R. (or approximately 115 ft. N. and 1070 ft. W. of the S. E. corner of Section 34, T. 22 N., R. 9 E.). Both wells were 120 ft. deep below a ground surface elevation of 752± ft., and were 10 in. in diameter with an 8-in. drop casing and 16 ft. of Cook strainer, having No. 60 slot openings.

In Mar. 1912, the non-pumping water level was 60 ft. below ground level. In May 1917, the non-pumping water level was 60 ft. and pumping in either well did not influence the water level in the other well. Wells 1 and 2 were equipped with Cook single-acting cylinder pumps.

Well No. 1 was abandoned about 1924. The casing and screen were pulled and the well covered by the concrete floor of the pumping station.

Well No. 2 was in service in 1934. The pump has been removed and it is intended to pull the casing and screen and fill the hole with gravel.

Well No. 3 was drilled in 1917 to a depth of 141 ft. and located 11 ft. north of Well No. 1 and 4 ft. south and 7 ft. west of Well No. 2. It is 23 ft. south of Well No. 4. The 10-in. outer casing was equipped with flanges and gaskets to eliminate pollution. A 16-ft. length of Cook screen had No. 60 slot openings.

In 1918, the non-pumping water level was 60 ft. below the surface and, when pumping in Wells No. 1 and 2, at maximum capacity of about 250,000 gpd., the water level in Well No. 3 was unchanged. About 120,000 gpd. was used by the city and 130,000 gpd. metered to Chanute Field.

On Feb. 18, 1924, before the pump was installed in Well No. 4, a production test was made for Wells 2 and 3 which pumps were operating. The production from each well was metered and over a 6-hr. pumping period the combined production rate was 341 gpm. When pumping from Well No. 3, only, the rate was 233 gpm. Well No. 3 is equipped with an old steam-head pump but has not been in service for several years. It is intended to pull the casing and screen and fill the well with gravel.

Analysis of a sample (Lab. No. 50982) collected Feb. 18, 1924, after 5-hr. pumping showed the water in Well No. 3 to have a hardness of 17.7 gr. per gal., a residue of 363 ppm., and an iron content of 2.4 ppm.

Well No. 4 was drilled by John Boten, Rantoul water superintendent, in 1922 to a depth of 142 ft., and is located 23 ft. north of Well No. 3, and 15 ft. south of Well No. 6. During drilling operations water was encountered at 80 ft. and then raised to 72 ft. below the top of the casing. The well is 10 in. in diameter and is equipped with a Cook double-acting plunger pump size 3 L. No. 1600 rated at 200 gpm. and attached to 130 ft. of 8-in. drop pipe. The pump is belt-driven from a 20-hp. Century electric motor at 865 rpm. Well No. 4 serves as an auxiliary supply unit during the summer months and is operated about once monthly.

Well No. 5 was drilled in 1925 to a depth of 138 ft. and 10-in. diameter, and located about 25 ft. north and 15 ft. east of Well No. 1. The hole was crooked and caused pumps to wear out rapidly. Well No. 5 was abandoned in 1933, and the casing was pulled and used in Well No. 6.

Because of a persistent rumor that water of softer quality had been obtained about 50 years before from a deep well in the south part of town, Well No. 6 was drilled in 1934 to a depth of 293 ft. by E. W. Johnson, Bloomington, and was located 15 ft. north of Well No. 4 and 20 ft. south and 70 ft. east of Well No. 7 (or approximately 165 ft. N. and 1070 ft. W. of the S. E. corner of Section 34). The ground elevation at the well is 752± ft.

Sample-study and driller's log of Well No. 6 furnished by the State Geological Survey:

Formation	Thickness ft.	Thickness in.	Depth ft.	Depth in.
Pleistocene system				
"Soil and clay"	83		83	
"Sand and gravel, water"	12		95	
Sand and gravel, clean	45		140	
Clay	2	9	142	9
Sand, very silty	7	3	150	
Till	87	8	237	8
Gravel, sandy, partly silty and clayey	2	4	240	
Clay and silt	17		257	
Sand and gravel	34		291	
Clay	2		293	

The 10-in. casing from abandoned Well No. 5 was installed in Well No. 6 and, with additional casing, the 10-in. casing extended from the surface to 150 ft. An 8-in. casing was set from the surface to 269 1/2 ft., below which was 15 ft. exposed length of 7 1/2-in. od. screen, having No. 40 slot openings. The bottom of the well was 284 1/2 ft. below ground level.

A four-hour production test was made by the State Water Survey on May 21, 1934. The pumping equipment at the time of the test consisted of 130 ft. of 6-in. column pipe; 7 1/2-in., 7-stage Sterling pump, No. S-715, having an overall length of 5 ft. 4 in.; 130 ft. of air line; 17 ft. 11 in. of 6-in. suction pipe. The pump head was belt-connected to a steam thrashing engine.

Before the test, static water level was 65 ft. below ground level. The test was divided into several periods, during which the pump speed was maintained as near constant as possible.

After one-hour pumping at an average speed of 1800 rpm. and at a rate of 260 gpm. the drawdown was 52 ft.

After ten-minutes pumping at an average speed of 1675 rpm., and a rate of 193 1/2 gpm. the drawdown was 38 ft.

After ten-minutes pumping at an average speed of 2215 rpm. and a rate of 350 gpm. the drawdown was 68 ft.

After ten-minutes pumping at an average speed of 2317 rpm. and a rate of 400 gpm., the drawdown was 78.6 ft.

On Oct. 31, 1944 Mr. Cheek, Water Superintendent, stated his belief that the water level had receded 10 ft. since the well was finished in 1934. If true, the water level should have been 75 ft. in 1944.

The pumping equipment now consists of 160 ft. of 6-in. column pipe (extended in 1940); 8-in., 8-stage Cook turbine pump, No. 1239; 160 ft. of air line; 16 ft. of 6-in. suction pipe; 25-hp., U. S. electric motor. The pump is in daily service and discharges to the ground storage reservoir at an estimated rate of 450 gpm.

Analysis of a sample (Lab. No. 116,796) collected Dec. 18, 1948 after one-hour pumping showed the water from Well No. 6 to have a hardness of 19.3 gr. per gal., a residue of 395 ppm., and an iron content of 1.4 ppm.

Well No. 7 was drilled in 1939 to a depth of 137 ft. by John Bolliger and Sons, Fairbury, and is located 185 ft. north of the center of Grove Ave. and 180 ft. east of the center of Penfield St. or 20 ft. north and 70 ft. west from Well No. 6, (or approximately 185 ft. N. and 1140 ft. W. of the S. E. corner of Section 34).

The well was cased with 10-in. pipe and with 24 1/2 ft. (22 ft. exposed) of Cook screen.

A production test was made by the State Water Survey on Dec. 5, 1939. After 4 1/2-hr. pumping at a final rate of 480 gpm. the drawdown was 28 ft. from a non-pumping water level of 64 ft. below ground level elevation of 752t ft. Five minutes after stopping the pump the water level was 66 ft. On Oct. 31, 1944 the non-pumping water level was 72 ft. The pump is now estimated to discharge at a rate of 900 gpm. over the aerator. On Dec. 18, 1948, after 2-hr. pumping, the water level was 95 ft. below the pump base and after a 30-minute shutdown the water level was 82 ft.

The pumping equipment includes a 10-in., 6-stage Cook turbine pump, No. 3939, having a bottom setting of 115 ft.; air line length of 115 ft.; 40-hp. U. S. electric motor. Well No. 7 is the principal source of public supply and is in daily service.

Analysis of a sample (Lab. No. 116,797) collected Dec. 18, 1948 after 2-hr. pumping showed the water from Well No. 7 to have a hardness of 17.5 gr. per gal., a residue of 322 ppm., and an iron content of 2.8 ppm. Methane gas is present in the water from these wells in a concentration of 1.8 cu. ft. per 1000 gal.

Only the water from Well No. 7 is aerated and filtered.

Well No. 8 was completed at a depth of 139 ft. in May 1949 by John Bolliger and Sons, and located at Tanner and Ohio St. (or approximately 537 ft. N. and 890 ft. W. of the S. E. corner of Section 34). The well was used with 12-in. wrought steel pipe from 1 1/2 ft. above to 120 ft. 7 in. below ground level and with 21 ft. 3 in. (20 ft. exposed) of 12-in. Johnson Everdur screen. The upper 9 ft. of the screen had No. 30 slot openings and the lower 11 ft. had No. 10 slots.

A production test was made on May 23, 1949 using State Water Survey calibrated measuring equipment. A Pomona test pump was used, and power furnished by belt-drive from a Ford truck.

Before the start of the test the water level was 69.7 ft. below the top of the casing. After 2-hr; pumping at a final rate of 354 gpm. the drawdown was 44 ft.

Metered pumpage for the village of Rantoul is estimated to average 790,530 gpd.

LABORATORY NO. 116,797

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.8		Silica	SiO_2	16.8	
Manganese	Mn	0.1		Fluoride	F	0.3	
Calcium	Ca	59.8	2.99	Chloride	Cl	2.0	0.06
Magnesium	Mg	36.6	3.01	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	2.8	0.16	Sulfate	SO_4	3.3	0.07
Sodium	Na	14.0	0.61	Alkalinity	(as $CaCO_3$)	332.	6.64
Turbidity		9		Hardness	(as $CaCO_3$)	300.	6.00
Color		0		Residue		322.	
Odor		0		Free CO_2		43.	
Temperature 54° F.				pH = 7.3			

RAYMOND
Montgomery County
Aug. 5, 1948

A public water supply was installed by the village of Raymond (818) in 193 6.

A test hole was developed as a permanent well in Apr. 1936 by L. R. Burt, Decatur, and located in the valley of a tributary of the West Fork of Shoal Creek, about 1 mile southeast of town (or approximately 2620 ft. N. and 1400 ft. W. of the S. E. corner of Section 17, T. 10 N., R. 4 W.). The ground surface elevation is 615± ft.

Sample-study log of well developed in 1936 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and till	12	12
Sand and pebbles	3	15
Gravel and sand, dirty	3	18
Granule sand, clean	5	23
Gravel, clean	6 1/2	29 1/2
Gravel, clayey	1 1/2	31
Pennsylvanian system		
Bedrock	at	31

The well is gravel packed, with a 26-in. outer casing extending from one foot above to 19 ft. below ground surface. A 12-in. inner casing terminates 17 ft. 7 in. below the surface. Below the inner casing is a 10-ft. 7 in. length of Johnson screen, having No. 100 slot openings. The bottom of the well is 31 ft. 2 in. below the top of the inner casing. The amount of gravel used was not reported.

On June 15-16, 1936 a production test was made by the State Water Survey. Before the test, the static water level was 15.3 ft. below the top of the inner casing. After pumping 12 hr. at a rate of 79 gpm., the drawdown was 4.8 ft.

The well is equipped with 22 ft. of 4-in. column pipe; 6-in., 13-stage Fairbanks-Morse turbine pump, No. 30520, rated at 75 gpm. against 152 ft. of head; the overall length of the pump is 62 3/4 in.; a strainer 11 1/4 in. in length is placed on the bottom of the pump; 7 1/2-hp., General Electric motor.

Analysis of a sample (Lab. No. 115,294) collected July 15, 1948 after 25-min. pumping at 75 gpm. showed this water to have a hardness of 16.7 gr. per gal., a residue of 374 ppm., and a trace of iron.

Pumpage is estimated to average 27,000 gpd.

LABORATORY NO. 115,294

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	Tr.	Tr.	Silica	SiO_2	24.9	
Manganese	Mn	0.0	0.00	Fluoride	F	0.1	
Calcium	Ca	76.1	3.81	Chloride	Cl	11.0	0.31
Magnesium	Mg	23.5	1.93	Nitrate	NO_3	0.4	0.01
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	34.6	0.72
Sodium	Na	28.1	1.22	Alkalinity (as $CaCO_3$)		296.	5.92
Turbidity		Tr.		Hardness (as $CaCO_3$)		287.	5.74
Color		0		Residue		374.	
Odor		0		Free CO_2 (calc.)		60.	
Temperature 54° F.				pH = 7.1			

The city of Red Bud (1302) installed a public water supply in 1915.

Water was originally obtained from a well drilledby Otto Hartman in 1914 and located at the rear of the city hall (or approximately 1100 ft. N. and 1650 ft. E. of the S. W. corner of Section 4, T. 4 S., R. 8 W.). This well was drilled to a depth of 294 ft. below a surface elevation of 465± ft.

The well was reported to be cased with 10-in. pipe to a depth of 20 ft. 8 in. and with 8-in. pipe from 20 ft. 8 in. to a depth of 246 ft. 10 in.

The well was equipped with a 6-in. by 24-in. Gould double-acting deep well pump set at a depth of 245 ft., gear-connected to a 20-hp. Westinghouse motor.

In 1915, the non-pumping water level was 60 ft. below the top of the well, and the well was producing about 50 gpm.

In 1918, it was reported that the pump was operated about 4 hr. per day at 40 gpm.

Analysis of a sample (Lab. No. 39787) collected July 21, 1918, showed the water to have a hardness of 13.1 gr. per gal., a residue of 457 ppm. and an iron content of 0.34 ppm.

It was reported that this well was abandoned because of pump trouble about 1919. It is now completely obliterated.

A well, now known as Well No. 1, was drilled in 1919 to a depth of 276 ft. by Metzler and Hartman, Red Bud, and located northwest of town (or approximately 2260 ft. S. and 430 ft. W. of the N. E. corner of Section 5). The surface elevation is 440± ft.

The well was cased with 5 5/8-in. pipe to a depth of 260 ft.

It was reported that when completed, the well produced 60-70 gpm. with no appreciable drawdown from a non-pumping water level of 15 ft. below the ground surface.

The well was equipped with an air lift having 260 ft. of 3-in. eductor pipe, and 230 ft. of 1-in. air pipe.

In 1925, it was reported that the air lift was operated about 3 hr.per day, and in 1934, the air lift was operated 24 hr. per day in order to keep up with demand.

A production test was made by the State Water Survey on Aug. 1, 1934. After 1-hr. pumping, the production had decreased from 33 to 29 gpm. with a drawdown of 55.5 ft. from a non-pumping water level of 38 ft. below the well curb.

The pumping equipment installed in 1940 consists of 190 ft. of 3-in. od. column pipe; 4-in., 18-stage Pomona turbine pump, No. S.W. 696, rated at 40 gpm. against 190 ft. of head at 3500 rpm.; the overall length of the pump is 5 ft. 5 1/4-in.; 5-hp. Westinghouse electric motor. In Mar. 1948, the pump was in service 10 hr. daily, at an estimated pumping rate of 30 gpm.

Analysis of a sample (Lab. No. 119,222) collected Aug. 26, 1949, showed the water to have a hardness of 16.7 gr. per gal., a residue of 353 ppm., and an iron content of 0.2 ppm.

Well No. 2 was drilled in 1934 to a depth of 283 ft. by Charles S. Wiese, Kirkwood, Mo., and was located 30 ft. south and 250 ft. east of Well No. 1 (or approximately 2290 ft. S. and 180 ft. W. of the N. E. corner of Section 5).

Sample-study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Till.	35	35
Mississippian system		
Chester series		
Golconda limestone, shale, and thin sandstone and siltstone beds	39	74
Cypress sandstone, silty	21	95
Paint Creek limestone, shale and thin sandstone beds	82	177
Yankeetown sandstone, calcareous	13	190
Renault calcareous sandstone and shale	35	225
Aux Vases sandstone, calcareous	57	282
Iowa Series		
Ste. Genevieve limestone	1	283

The well was reported to be cased with 10-in. pipe to 225 ft., and is equipped with 4-in. od. column pipe; 7-in., 15-stage Fairbanks-Morse

turbine pump, No. 22976, with the bottom of the suction pipe set at a depth of 196 ft. below the ground surface; 7 1/2-hp. Fairbanks-Morse electric motor. In Mar. 1948 the pump was in service 10 hr. daily at an average metered pumping rate of 50 gpm.

A production test was made by the State Water Survey on Sept. 1, 1934, when pumping at 48 gpm., the drawdown was 134 1/2 ft. from a non-pumping water level of 52 ft. below the ground surface.

Analysis of a sample (Lab. No. 119,223) collected Aug. 26, 1949, showed the water to have a hardness of 16.0 gr. per gal., a residue of 327 ppm., and an iron content of 0.7 ppm.

Well No. 3 was drilled in 1944 to a depth of 293 ft. by Braun Drilling Co., Red Bud, and was located 640 ft. north of Well No. 2, (or approximately 1650 ft. S. and 180 ft. W. of the N. E. corner of Section 5).

The surface elevation at the well site is 470t ft.

The well was cased with 12 1/2-in. od. pipe from the surface to 44 ft. and with 10-in. pipe from the surface to 286 ft. below which the hole was 8 in. in diameter. The bottom of the 10-in. casing was perforated opposite the. Aux Vases sandstone.

When tested by the driller, it was reported that the well produced 50 gpm. for 24 hr. with a drawdown of 100 ft. from a non-pumping water level of 40 ft. below the ground surface. In the summer of 1947, the drawdown was reported to be 150 ft. from a non-pumping water level of 40 ft.

The pump installation consists of 4-in. od. column pipe and overall length of 220 ft. of pump assembly to the bottom of the suction pipe; 6-in. Deming turbine pump, No. T 5488, rated at 60 gpm. against 206 ft; of head; 5-hp. U. S. electric motor.

In Mar. 1948, the pump was in service 10 hours daily at an average metered pumpage rate of 28 gpm.

Analysis of a sample (Lab. No. 119,224) collected Aug. 26, 1949, after pumping at 18 gpm. showed this water to have a hardness of 22.4 gr. per gal., a residue of 602 ppm., and an iron content of 0.2 ppm.

Pumpage is estimated to average 65,000 gpd.

LABORATORY NO. 119,224

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.2		Silica	SiO_2	15.8	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	98.6	4.93	Chloride	Cl	22.	.62
Magnesium	Mg	33.7	2.77	Nitrate	NO_3	8.0	.13
Ammonium	NH_4	.1	.01	Sulfate	SO_4	164.6	3.42
Sodium	Na	54.7	2.38	Alkalinity	(as $CaCO_3$)	296.	5.92
Turbidity		2		Hardness	(as $CaCO_3$)	385.	7.70
Color		0		Residue		602.	
Odor		0					

RICHMOND
McHenry County
July 25, 1947

A public water supply was installed by the village of Richmond (559) in 1927.

Water is obtained from a well drilled in 1927 to a depth of 170 ft. by W. L. Thorne Co., Des Plaines and located about 100 ft. south of Broadway and 130 ft. east of Main St. (approximately 1100 ft. N. and 2400 ft. W. of the S. E. corner of Section 9, T. 46 N., R. 8 E.). The ground surface elevation is 818.5 ft.

Correlated driller's log of well drilled in 1927 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay and gravel, water at 30'	40	40
Gravel, black	10	50
Clay	25	75
Clay and gravel	5	80
Sand	15	95
Sand and gravel	25	120
Clay	10	130
No record	15	145
Sand and gravel, dirty	5	150
Sand and gravel with clay	5	155
Sand and gravel	5	160
Limestone (?)	5	165
Sand and clay	5	170

The well was cased with 10-in. pipe to 163 ft. (1 ft. in rock). The drilling continued through about 7 ft. of limestone and 6 ft. of shale or blue clay, then backfilled with about 6 or 7 ft. of coarse gravel, hens-egg size. The casing was cut at a depth of 120 ft. below the surface and a No. 16 Cook strainer, 15 ft. long inserted between the depths of 105 and 120 ft. and the casing was pulled back, exposing 14 ft. of the strainer.

Before cutting the casing a 17-hr. production test was made. The maximum yield was only 100 gpm. With a drawdown of 75 ft., or a specific capacity of 1 1/3 gpm. per ft. of drawdown. After the strainer was installed, a production test was made on Apr. 29-30, 1927. Water was pumped at 4 different rates, ranging from 100 to 264 gpm., for a period of 36 hr. and the drawdowns, for each rate of pumping, indicated a specific capacity of 7 1/2 gpm. per foot of drawdown. With a drawdown of 40 ft. the well had a yield of 300 gpm. The non-pumping water level was 9.4 ft. below a ground reference point before and after the test. On July 8, 1947 the water level was 23 ft. below the pump base after a 2-hr. idle period and after 1-hr. pumping at 150 gpm. the water level was 65 ft.

The pump installation consists of 90 ft. of 4 1/2-in. column pipe; 7-in., 11-stage American Well Works turbine pump, Shop No. 61819, having a rated capacity of 150 gpm. against 220 ft. of head; 10 ft. of 5-in. suction pipe; 90 ft. of 1/4-in. gi. air line; 15-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 110,981) collected July 8, 1947 after 1 hr. of pumping at a rate of 150 rpm. showed the raw water to have a hardness of 17.8 gr. per gal., a residue of 314 ppm., and an iron content of 1.7 ppm.

The water is treated for iron removal. Analysis of a sample collected July 8, 1947 showed the treated water to have a hardness of 17.1 gr. per gal., a total mineral content of 320 ppm., and an iron content of 0.06 ppm.

The Hunter Golf Club and the Jefferson Ice Co. are the largest seasonal consumers. Pumpage averages 35,000 gpd.

LABORATORY NO. 110,981

	ppm.	epm.			ppm.	epm.
Iron (total) Fe	1.7		Fluoride	F	0.2	
Calcium Ca	66.4	3.32	Chloride	Cl	3.0	0.08
Magnesium Mg	33.7	2.77	Sulfate	SO_4	8.2	0.17
			Alkalinity (as $CaCO_3$)		296.	5.92
Turbidity	10+					
Color	0		Hardness (as $CaCO_3$)		305.	6.09
Odor	0		Residue		314.	
Temperature 51° F.			Free CO_2 (calc.)		25.	
			pH = 7.5			

A public water supply distribution system was installed in 1926 under private ownership of Otto Rueter, Flossmoor, to serve a subdivision known as Sauk Highlands located south of Sauk Trail and east of Richton Rd.

A well was drilled by W. L. Thorne, Des Plaines, in 1926 to a depth of 610 ft. It is located about 100 ft. east of the center of Richton Rd. and 1800 ft. south of Sauk Trail (or approximately 2230 ft. S. and 1480 ft. E. of the N.W. corner of Section 35, T. 35 N., R. 13 E.). It is cased with 10-in. pipe from the surface to a depth of 108 1/2 ft. and has 99.4 ft. of 8-in. liner installed at an unknown depth. The non-pumping water level in 1926 was 18 ft. below the top of casing, and the drawdown was 92 ft. when pumping at 200 gpm.

The well was equipped with an American Well Works double-stroke deep-well cylinder pump with a 6 1/2-in. by 24-in. cylinder placed at a depth of 100 ft., and a 15-hp. General Electric motor.

It is reported that the water supply and distribution system was deeded to the village of Richton Park (107). Mr. Rueter died in 1931 just as he was getting the subdivision under way, and the new well was never used.

The well and pump were rehabilitated in July 1946 by the village and will serve the Sauk Highlands development. The present operating rate of the pump is 19 strokes per min. against 65 psi.,or a theoretical displacement of 130.72 gpm. The water level, when the pump was out, was about 20 ft. below the top of the casing.

The existing residential section has no public water supply system.

RIDGE FARM
Vermilion County
Dec. 7, 1948

A public water supply was installed in 1935 by the village of Ridge Farm (890).

Water is obtained from a well drilled in 1935 to a depth of 87 ft. by W. L. Thorne Co., Des Plaines, and located at the east end of Ridge St. at the southwest corner of the public park, (or approximately 880 ft. S. and 1500 ft. E. of the N. W. corner of Section 31, T. 17 N., R. 11 W.).

The elevation of the ground surface at the well site is 720± ft. The well was cased with 24-in. pipe extending from ground level to 67 ft. and a 12-in. casing extending from ground level to 67 ft. with a 12-in. screen from 67 to 87 ft. The screen had 3/16-in. slot openings. The annular space between the casings and outside of the screen was packed with gravel.

A production test was made by the State Water Survey on May 20, 1935. Before the test, the static water level was 26 1/2 ft. below ground level and after 8-hr. pumping at 200 gpm., the drawdown was 51 ft. On Nov. 30, 1948 the altitude gauge on the air line showed 12 ft. after one-hour pumping at 170 gpm. and after 30 min. of non-pumping, the gauge showed 38 ft.

The pumping equipment consists of: 75 ft. of 6-in. id. column pipe; 7-in., 12-stage Fairbanks-Morse turbine pump, No. 26980, rated at 200 gpm.; 20-hp., 1740 rpm. Fairbanks-Morse electric motor No. 303626. The pump has been throttled to 170 gpm. to maintain a pumping water level of not less than 12 ft. above the bottom of the air line.

Analysis of a sample (Lab. No. 116,583) collected Nov. 30, 1948 showed this water to have a hardness of 19.3 gr. per gal., a residue of 347 ppm., and an iron content of 0.6 ppm.

Pumpage is estimated to average 28,000 gpd.

LABORATORY NO. 116,583

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.6		Silica	SiO_2	17.7	
Manganese	Mn	0.1		Fluoride	F	0.3	
Calcium	Ca	78.8	3.94	Chloride	Cl	15.0	0.42
Magnesium	Mg	32.7	2.69	Nitrate	NO_3	0.2	Tr.
Ammonium	NH_4	0.2	0.01	Sulfate	SO_4	44.2	0.92
Sodium	Na	3.2	0.14	Alkalinity	(as $CaCO_3$)	272.	5.44
Turbidity		2		Hardness	(as $CaCO_3$)	332.	6.63
Color		0		Residue		347.	
Odor		0		Free CO_2 (calc.)		35.	
Temperature 54° F.				pH = 7.3			

RIDGWAY
Gallatin County
Feb. 29, 1948

A public water supply was installed by the village of Ridgway (1167) in 1939.

Water is obtained from a well drilled in Oct. 1938 to a depth of 85 ft. by Albert Lancaster, Harrisburg, and located about 100 ft. north of South St. and 100 ft. east of the main track of the Baltimore & Ohio R. R. (or approximately 2150 ft. N. and 700 ft. E. of the S.W. corner of Section 30, T. 8 S., R. 9 E.). The ground surface elevation is 375± ft. The well is 10 in. in diameter and 10-ft. Johnson Everdur screen was placed in the bottom. The screen had No. 80 slot openings. Gravel was entered at a depth of 70 ft. and sand at a depth of 80 ft.

The well is equipped with: Fairbanks-Morse turbine pump, No. 2780; and 10-hp. Fairbanks-Morse electric motor.

The State Water Survey made a production test on Nov. 10, 1938. After 7 1/2 hr. pumping at a rate of 292 gpm.,the drawdown was 24 ft. from a non-pumping water level of 17 ft. below the ground surface.

Analysis of a sample (Lab. No. 113,567), collected Feb. 19, 1948, after 15-min. pumping at 100 gpm., showed the water to have a hardness pf 17.4 gr. per gal., a residue of 384 ppm., and an iron content of 3.7 ppm.

The water is aerated, filtered and softened. Analysis of a sample (Lab. No. 114,102) collected Feb. 19, 1948 showed the treated water to have a hardness of 3.0 gr. per gal., a mineral content of 418 ppm., and an iron content of 0.06 ppm.

Pumpage for 1947 averaged 29,000 gpd.

LABORATORY NO. 113,567

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	3.7		Silica	SiO_2	17.9	
Manganese	Mn	0.1		Fluoride	F	0.1	
Calcium	Ca	71.7	3.59	Chloride	Cl	7.0	0.20
Magnesium	Mg	28.8	2.37	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	2.8	0.16	Sulfate	SO_4	0.0	0.00
Sodium	Na	33.1	1.44	Alkalinity (as $CaCO_3$)		368.	7.36
Turbidity		50-		Hardness (as $CaCO_3$)		298.	5.96
Color		0		Residue		384.	
Odor		0		Free CO_2 (calc.)		36.	
Temperature 59.3° F.				pH = 7.4			

LABORATORY NO. 114,102

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.06		Fluoride	F	0.3	
				Chloride	Cl	10.0	0.28
Turbidity		0		Alkalinity (as $CaCO_3$)		380.	7.60
Color		0		Hardness (as $CaCO_3$)		52.	1.04
Odor		0		Total Mineral Content		418.	
Temperature 60° F.				Free CO_2 (calc.)		11.	
				pH = 7.9			

The water works for the village of Riverside (7935) were installed by the Riverside Improvement Co. in 1870 and acquired by the municipality shortly after its incorporation in 1875. The first supply was obtained from flowing wells 600 ft. deep.

Two deep wells 130 ft. apart were drilled in 1898 on the site at the northwest corner of Long CommonRd. and Burlington St. to compensate for a decrease in yield of existing wells and an increased demand. The first of the 2 wells, originally referred to as the West Well, and now known as Well No. 1, was drilled to a depth of 1980 ft. Well No. 2 was drilled to a depth of 2037 ft.

Leverett in his "Illinois Glacial Lobe," published in 1899, states that when these wells were drilled they overflowed, and in 1899 had receded to a depth of 20 ft.

When the air lifts were installed in both wells in 1922, they were tested for yields. Well No. 1 was found to yield 225 gpm., and the water level dropped from 75 to 325 ft. below the ground surface. Well No. 2 yielded 520 gpm., and the water level dropped from 250 to 285 ft. below the ground surface.

The 1980-ft. Well yielded water of 650 to 800 ppm. mineral content and 470 to 570 ppm. hardness. The iron content of each of 4 analyses made in 1902, 1913, 1915, and 1923 was high. A temperature of 52° F. was recorded in 1923 indicating the major source of the water from this well to be from the Niagaran dolomite.

The 2037-ft. well yielded water of 800 to 900 ppm. mineral content and 200 to 250 ppm. hardness. The iron content was 0.5 ppm. or less and the chloride content 220 to 290 ppm. indicating the major source of this water to be from the Mt. Simon sandstone. A temperature of 63° F. was recorded in 1920 and 61° F. in 1924.

Water for the public supply was obtained from Wells No. 1 and 2 until 1924 when Well No. 3 was placed into service. It was drilled by J. P. Miller Artesian Well Co., Brookfield, in 1923 and is located on Pine Ave. about 500 ft. west of Well No. 1 and 100 ft. north of the Chicago, Burlington & Quincy R. R. (or approximately 2250 ft. N. and 100 ft. E.of the S. W. corner of Section 36, T. 39 N., R. 12 E.). The well is 2047 ft. deep. The elevation at the top of the well is 617± ft.

The hole, casing, and liner diameter record was reported as given in Table 1.

TABLE 1

Hole Record

19-in.	from	51 1/2 to 509 1/2	ft.
15-in.	from	509 1/2 to 93 7	ft.
12-in.	from	937 to 1820	ft.
10-in.	from	1820 to 2047	ft.

Casing Record

20-in. from surface to 51 1/2 ft.
16-in. liner from 348 1/2 to 509 1/2 ft.
12-in. liner from 855 to 937 ft.

Upon completion of the well, water was pumped with 1000 gpm. turbine pump. The drawdown was 40 ft. from a water level of 260 ft. below the pump base. By July 1925 the well was supplying practically all the water required by the village. The yield of the well was then about 1000 gpm.

Repairs were made to the well in July 1932, the nature of which was not reported.

After the pump was pulled in July 1944, the water level was 367 ft. Due to recession in the water level, the pump was lowered 50 ft., and the following pump installation was made: 451 ft. of 10-in. column pipe; 14-in., 16-stage Peerless turbine designed for 26 ft. of head per stage; the overall length of the pump is 15 1/2 ft.; 36 ft. of 10-in. suction pipe (504.3 ft. to end of strainer); 450 ft. of air line; 150-hp. Electrical Machine & Manufacturing Co. motor.

A 5-hr.test was made Aug. 1; 1944. The reported production was 876 gpm. with a pumping water level at the bottom of the 450-ft. airline.

Water from Well No. 3 is of variable compositions depending on the length of idle period prior to pumping and the period of pumping prior to collecting the sample. Eight samples collected from 1926 to 1946 showed a mineral content of 774 to 854 ppm., a hardness of 296 to 566 ppm., a chloride content of 85 to 218 ppm., and a sulfate content of 117 to 254 ppm.

Analysis of a sample (Lab. No. 106,407) collected May 7, 1946 from a tap on the discharge line after 1-hr. pumping at 840 gpm., showed this water to have a hardness of 17.7 gr. per gal., a total mineral content of 828 ppm., and a content of iron of 0.1 ppm.

Well No. 3 was the source of the public water supply until 1931 when Well No. 4 was placed in service.

Well No. 4 was located about 200 ft. south of the north village limits near the junction of Northgate and Selborne Roads (or approximately 2440 ft. N. and 2340 ft. E. of the S. W. corner of Section 25). The elevation of the pump base is 619.4 ft.

The well was drilled to a depth of 900 ft. by W. L. Thorne Co., Des Plaines, and completed from 900 to 1980 ft. by R. D. Alexander, Springfield, Mo., in 1931, and immediately put into regular service. Elevation of top of drill casing is 621.4 ft.

The hole, casing, and liner diameter record is given in Table 2.

TABLE 2

Hole Record

21-in. from 61 to 518.8 ft.
15-in. from 518.8 to 1304 ft.
12-in. from 1304 to 1375 ft.
10-in. from 1375 to 1980 ft.

Casing and Liner Record

30-in. drive pipe from surface to 52 ft.
24-in. from 35 to 55 ft.
22-in. from 52 to 61 ft.
18-in. from surface to 129.3 ft.
18-in. liner from 337 to 518.8 ft.
12-in. liner from 661 to 1140 ft.
10-in. liner -

During the construction of the well, the following observations were made: On Dec. 10, 1930, the water level was 32 ft. when the well was 920 ft. below the drill floor; between depths of 1210 and 1225 ft. a water-course was encountered, and the water level dropped to 270 ft.; water-sand was struck between depths of 1855 and 1900 ft., and the water level was 280 ft.; on Apr. 6, 1931 after the drilling had reached the final depth of 1979.8 ft., the water level was 277 ft.

On Oct. 27, 1948, Mr. G. L. Opper wrote that in Aug. 1948 the well depth was measured at 1674 ft. below floor level.

On May 17 and 18, 1931, a 24-hr. test was made. When pumping at 1285 gpm.,the drawdown was 16 ft. from a water level of 270 ft. below the pump base.

Between Nov. 7, 1944 and Feb. 9, 1945, the well was repaired and a new pump installation was made. After the old pump was pulled on Nov. 10, 1944, the water level was 368 ft. below the top. A bridge was found at a depth of 1268 ft., which was removed; and the well was cleaned out to a depth of 1940 ft. A 12-in. liner was placed between the depths of 661 and 1140 ft. It was slotted at depths of 842.8, 993.7, and 1097.7 ft. At the depth of 1140 ft., a 10-in. liner, 101 ft. long, was connected with a 12-in. to 10-in. reducer 2 ft. long.

Pumping operations were resumed on Feb. 10, 1945. When pumping at 1662 gpm., the drawdown was 12 1/2 ft. from a water level of 372 1/2 ft. Pumping was continued on a schedule of 2 to 3 hr. daily with maximum rest periods of 15 to 16 hr. Daily readings were taken between Apr. 1, 1945 and Dec. 31, 1945, and Table 3 shows the water levels in ft. below the pump base were reported:

TABLE 3

Date	Non-Pumping ft.	Pumping ft.
Apr. 1945	369 to 373	380 to 384
May 1945	369	369
June 1945	369	385
July 1945	369 to 381	385 to 393
Aug. 1945	381	391 to 393
Oct. 1945	374 to 381	384 to 386
Nov. 1945		
Dec. 1945	373 to 374	383 to 384

Mr. Opper stated that in Aug. 1948, sixty ft. of 10-in. column pipe, a new pump, and air lines were added.

The pumping installation now consists of 480 ft. of 10-in. column pipe; 15 1/2-in., 11-stage Peerless turbine pump designed to deliver 1200 gpm. against 495 ft. of head; the overall length of the pump is 10 ft.; 2 airlines, one on the north side, 480 ft. long, and the other on the south side, 491 ft. long; the existing 200-hp. Electric Machinery Co. motor had been overhauled and reinstalled. Mr. Opper stated that in Aug. 1948 the non-pumping water level was 390 ft. below floor level and after 1-hr. pumping at 1350 gpm. the drawdown was 10 ft. After the second-hour pumping at 1324 gpm. the drawdown was 15 ft. Two hours after stopping the pump the water level was 393 ft.

Water from Well No. 2 is of variable composition depending on the same factors which influence

the quality from Well No. 3. Fifteen samples collected from 1931to 1945 showeda mineral content of 652 to 793 ppm., a hardness of 248 to 375 ppm., a chloride content of 33 to 158 ppm., and a sulfate content of 130 to 228 ppm. In General the presence of a greater proportion of water from the Niagaran dolomite is indicated.

A quality-source test (Analyses Nos. 104,618-104,625) conducted Oct. 29, 1945 showed the following tabulated data on samples collected after 15 1/2-hr. idle period:

The analyses show the first sample to contain a high proportion of water from the Niagaran dolomite; the next 3 samples to contain an appreciable proportion of water from the Mt. Simon sandstone; and subsequent samples to contain a somewhat lesser proportion of water originating in the Mt. Simon sandstone and slightly greater proportion of water originating in the Galesville sandstone.

The combined metered pumpage for the years 1943, 1944, and 1945 averaged 582,685 gpd. which varied from an average winter pumpage of 526,660 gpd. to an average summer demand of 722,900 gpd. During these years, Well No. 3 furnished nearly 44% of the total water used. All water for the public supply has been chlorinated since 1930.

In June 1948 a 16-in. and 12-in. pipe line connection was made to the 20-in. Brookfield-North Riverside Water Commissions feeder line near the intersection of Bloomingbank and Barrypoint Roads. This supply is used as a standby and a minimum of 100,000 gpd. is used with a normal summer maximum of 400,000 gpd.

Sample-study log of Well No. 3 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Top Soil" (glacial drift)	51	51
Silurian system		
Niagaran-Alexandrian dolomites, shale at base	279	330
Ordovician system		
Maquoketa shale, some dolomite	171	501
Galena-Platteville dolomite, some limestone	324	825
St. Peter formation		
Sandstone, incoherent	95	920
Shale, and pebbles of dolomite	17	937
Oneota dolomite	183	1120
Cambrian system		
Trempealeau dolomite	130	1250
Trempealeau and Franconia formations		
"Limestone"	80	1330
"Streaks of shale and lime"	45	1375
Galesville sandstone		
"Sandstone"	75	1450
Sandstone, partly dolomitic	70	1520
Eau Claire formation		
Sandstone, shale and dolomite	410	1930
Sandstone, incoherent	50	1980
Mt. Simon sandstone		
"Sandstone"	67	2047

LABORATORY NO. 106,407

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Fluoride	F	1.4	
Calcium	Ca	72.7	3.63	Chloride	Cl	162.0	4.06
Magnesium	Mg	29.1	2.39	Nitrate	NO_3	0.8	.4
				Sulfate	SO_4	146.0	3.40
Sodium	Na	185.4	8.06	Alkalinity (as $CaCO_3$)		324.	6.48
Turbidity		0		Hardness (as $CaCO_3$)		303.	6.06
Color		0		Residue		828.	
Odor		0		Free CO_2 (calc.)		63.	
Temperature 61.2° F.				pH = 7.1			

Analyses Nos. 104,618 - 104,625

Time	Fe	Cl	SO_4	Alk.	Hd.	Res.	Temp.
10/29/45							
8:02 AM.	Start pump. Non-pumping level 374 ft. to water						
8:05	0.4	33	227.7	300	375	652	55.2
8:08	0.4	126	159.6	316	258	762	55.9
8:13	0.3	142	143.2	304	250	780	61.2
8:23	0.3	140	150.6	300	264	766	61.1
8:38	0.1	132	159.8	296	281	766	60.8
8:53	0.1	124	168.3	280	304	750	60.6
9:23	0.2	122	177.1	272	324	742	60.4
9:46	0.3	112	178.3	276	335	734	60.4
9:47	Pumping level 385 ft. to water - stopped pumping.						

ROANOKE
Woodford County
July 23, 1947

A public water supply was installed by the village of Roanoke (1090) in 1914.

The village drilled a well in 1910 or 1912 to a depth of 120 ft. and located northwest of the pumping station to the rear of the village hall on ground 20 ft. higher than wells at the pumping station. It has 10-in. casing and is lined with yellow poplar wood. The well flows and is still in use but is not connected to the village water system. Analysis of a sample (Lab. No. 48855) collected Dec. 20, 1922, showed the water to have a hardness of 21.4 gr.per gal., a mineral content of 468 ppm., and an iron content of 3.0 ppm. Methane gas is reported to be present in the water.

Water is obtained from four wells drilled in 1913 by Ebert & Son, Washington. The wells are in a square arrangement, with 30 ft. spacing between wells and located in Block 23, south of the Santa Fe R. R. right-of-way, and east of Jefferson St. (or approximately 480 ft. N. and 200 ft. W. of the S. E. corner of Section 15, T. 27 N., R. 1 W.).

The tops of the wells are sealed, and each well is connected to the suction line of a McGowan 6 x 10-in. triplex pump which is operated at a speed of 50 rpm., with a displacement of 185 gpm. The pump is driven by a 15-hp. Century electric single-phase motor. The McGowan pump is now used for emergency and as a fire pump.

Each well is cased with 4-in. pipe to a depth of 22 ft., and a Cook screen 8 ft. long is placed below the casing in sand and gravel. Top of the wells is at elevation 715± ft.

Practically all of the water is now pumped from Wells No. 1 and 2 by a Fairbanks-Morse centrifugal pump rated at 110 gpm. and powered by a 5-hp. Fairbanks-Morse electric motor.

When the wells were drilled, the water level was four feet below the top of the wells. Pumping in one well for 48 hr. at a rate of 35 gpm. with one stop of 30 min. in the early part of the test, lowered the water level in the other three wells by one foot.

On Dec. 20, 1922 when the pump had operated for four hours, drawing water from all four wells, the valve on the suction line to one of the wells was closed, and the water level in that well was 7 1/2 ft. below the ground surface. The pump was then stopped, and the water level raised 27 in. in one hour and raised another inch during the next hour.

In Mar. 1947 the non-pumping water level was estimated to be six feet below the top of the wells.

Analysis of a sample (Lab. No. 109,531) collected Mar. 13, 1947 after the pump had been operating about 15 min., showed the water from Wells No. 1 and 2 to have a hardness of 26.9 gr. per gal., a residue of 567 ppm., and an iron content of 0.6 ppm.

Water is pumped over an aerator and through a filter for iron removal.

Pumpage is estimated at 60,000 gpd.

Two wells were drilled during Apr. and May, 1947 at the site of the municipal treating plant. The North Well is 39 ft. deep and cased with 29 ft. of 10-in. pipe and 10 ft. of Johnson screen. The upper four feet of the screen has No. 60 slot openings, and the lower six feet has No. 80 slot openings.

On May 13, 1947 a test pump was installed in the North Well by the driller; and after 1 1/2-hr. pumping at 450 gpm., the drawdown was 12 1/2 ft. below a non-pumping water level of seven feet below the top of the casing.

On July 23, 1947 both wells were capped and pumps were to be installed at a later date.

LABORATORY NO. 109,531

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.6		Silica	SiO_2	16.6	
Manganese	Mn	0.1		Fluoride	F	0.1	
Calcium	Ca	114.3	5.72	Chloride	Cl	14.0	0.39
Magnesium	Mg	42.7	3.51	Nitrate	NO_3	1.5	0.02
Ammonium	NH_4	0.7	0.04	Sulfate	SO_4	79.0	1.64
Sodium	Na	36.3	1.58	Alkalinity (as $CaCO_3$)		440.	8.80
Color		0		Hardness (as $CaCO_3$)		462.	9.24
Odor		0		Residue		567.	
Turbidity		10		Temperature 54° F.			

ROBERTS
Ford County
Oct. 24, 1948

A public water supply was installed by the village of Roberts (379) in 1890.

Water was obtained from a well drilled to a depth of 216 ft. In 1907, the well was reamed out from the original diameter of 3 in. and cased with 206 ft. of 4-in. pipe and 10 ft. of strainer. In 1915 the non-pumping water level was 95 ft. below a ground elevation of 780i ft., and was said to lower very little during pumping. In 1916 a pump cylinder was dropped in the well and the well was abandoned.

In 1916, a well was drilled to supply water for a creamery, but after a few months the well was purchased by the village and was designated as Well No. 2, and now known as the North Well.

The well was drilled to a depth of 220 ft. by Otto Stiegman, Roberts, and located at the pumping station back of the village hall on Main St;, north of Maple St. (or approximately 2255 ft. S. and 1438 ft. W. of the N. E. corner of Section 21, T. 25 N., R. 9 E.).

Well No. 3 was drilled in 1917 to a depth of 225 ft. by Chas. Roberts, Roberts, and located 13 ft. west of Well No. 2.

Both wells were cased with 3-in. pipe and with 10 ft. of 3-in. perforated pipe wrapped with No. 60 gauze.

In 1922, the non-pumping water level was reported to be 100 to 125 ft.

The galvanized casing in Well No. 3 was rusted out in 1939. The well was filled with concrete and abandoned.

Each well was equipped with a single-stroke plunger pump, with an 18-in. stroke, and operated at 22 gpm. Both pumps were operated as a unit from a walking beam. Power was furnished by a 7 1/2-hp. General Electric motor.

Well No. 4, now known as South Well, was drilled in Apr. 1940 to a depth of 232 ft. by M. Ebert Co., Washington, and located 13 ft. south of Well No. 2.

Correlated driller's log of Well No. 4 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Loam and clay	104	104
Sand	26	130
Clay and hardpan	78	208
Sand	24	232

Well No. 4 was cased with 4-in. pipe to a depth of 222 ft. and with 10 ft. of 4-in. Cook screen, having No. 14 slot openings. When completed the static water level was 86 ft. below the ground level.

Well No. 4 is equipped with a single stroke plunger pump, having a Eureka cylinder with 19 1/2-in. stroke, and operated at 23 gpm. Wells No. 4 and 2 are now operated as a unit from the walking beam. The 7 1/2-hp. motor is still in use. The combined discharge is about 32 gpm.

Analysis of a sample (Lab. No. 116,240) collected Oct. 24, 1948 from Wells No. 2 and 4 showed this water to have a hardness of 25.6 gr. per gal., a residue of 632 ppm., and an iron content of 2.3 ppm.

Pumpage is estimated to average 19,200 gpd.

LABORATORY NO. 116,240

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.3		Silica	SiO_2	22.6	
Manganese	Mn	0.0		Fluoride	F	0.4	
Calcium	Ca	113.4	5.67	Chloride	Cl	5.0	0.14
Magnesium	Mg	38.0	3.13	Nitrate	NO_3	0.2	Tr.
Ammonium	NH_4	2.4	0.13	Sulfate	SO_4	229.8	4.78
Sodium	Na	45.8	1.99	Alkalinity	(as $CaCO_3$)	300.	6.00
Turbidity		40		Hardness	(as $CaCO_3$)	440.	8.80
Color		0		Residue		632.	
Odor		Tr.		Free CO_2	(calc.)	31.	
Temperature		54.2° F.		pH = 7.4			

ROBIEN SUBDIVISION
Tazewell County
September 15, 1949

Robien Subdivision, an unincorporated community development by C.L. Wilkihs Inc., Peoria, is located on U. S. Highway No. 24 about 5 1/4 miles west of Washington.

A well was drilled in 1940 to a depth of 218 ft. by Chris Ebert, Washington and located about 1/4 mile north of the Highway or approximately 400 ft. N. and 1300 ft. W. of the S. E. corner of Section 24, T. 26 N., R. 4 W.). The ground elevation at the well site is 685t ft. No log is available but the driller reported penetrating a thick clay layer and setting the screen in coarse sand and gravel. Rock was not encountered. The well was cased with 6-in. steel pipe from 2.0 ft. above to 212 ft. below ground level and with 6.0 ft. of 6-in. Johnson Everdur, shutter-type, bronze screen.

The pumping equipment consists of 197 ft. of 4-in. column pipe; 28-stage Peerless turbine pump, No. 34477, having an overall length of 8.5 ft., the pump is rated at 75 gpm. against 75 psi. pressure head; under current operating conditions the discharge rate is reported to be about 125 gpm. against a low head, 15-hp., 1750 rpm. electric motor.

Analysis of a sample (Lab. No. 119,387) collected Sept. 15, 1949 when pumping at 125 gpm. showed this water to have a hardness of 21.1 gr. per gal., a residue of 375 ppm., and an iron content of 1.6 ppm.

The water is treated for iron removal.

Pumpage in 1948 averaged 23,300 gpd.

LABORATORY NO. 119,387

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.6		Silica	SiO_2	20.7	
Manganese	Mn	.1		Fluoride	F	0.1	
Calcium	Ca	92.7	4.64	Chloride	Cl	4.0	.11
Magnesium	Mg	31.6	2.60	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	.1	.01	Sulfate	SO_4	4.5	.09
Sodium	Na	7.1	.31	Alkalinity	(as $CaCO_3$)	368.	7.36
Turbidity		7		Hardness	(as $CaCO_3$)	362.	7.24
Color		0		Residue		375.	
Odor		0					
Temperature 53° F.							

A public water supply was first installed in the city of Robinson (4311) in 1896 by a man named Bartmuss. After several changes in ownership, the plant was purchased by the Central Illinois Public Service Co. in 1910. In 1940, the system was purchased by the Illinois Cities Water Co., the present owners. The system also furnishes water to Palestine and Oblong.

Water was originally obtained from 5 wells between 80 and 90 ft. deep and located in the city.

In 1910, a dug well was constructed 6 miles east of Robinson. This well was reported to be 28 ft. deep and 24 ft. in diameter.

The well walls were of brick, and were 14-in. thick, with the top extending 2 ft. above the ground surface.

Water was originally pumped by either of 2 Platt-Iron Works Co. duplex steam pumps.

The non-pumping water level in 1914 was reported to be 20 ft. below the surface. In 1925, it was reported that the well was seldom used. The well was abandoned and filled before 1928.

Analysis of a sample (Lab. No. 22841) showed the water to have a hardness of 10.8 gr.per gal., a residue of 217 ppm., and a trace of iron.

In 1916, two wells were drilled and located 55 ft. apart, and 15 ft. west of the dug well (or approximately 2500 ft. N. and 2090 ft. E. of the S. W. corner of Section 34, T. 7 N., R. 11 W.). The ground surface elevation at the well site is 450± ft.

Each well was drilled 10 in. in diameter, to a total depth of 50 ft., and each was equipped with a 16-ft. length of Johnson screen, having No. 30 slot openings.

Water is pumped by either of two 4-stage Manistee Iron Works Co., centrifugal pumps located in the basement of the pumping station. Each pump is rated at 400 gpm. against 520 ft. of head, operating at 1750 rpm.; and directly connected to a 75-hp. General Electric motor No. 5309272 operating at 1760 rpm. The equipment is in place but has not been in service since 1943. The wells may be abandoned after Well No. 5 is placed in service.

Analysis of a sample (Lab. No. 89985), collected Mar. 5, 1941, showed the water to have a hardness of 14.0 gr. per gal., a residue of 313 ppm., and an iron content of 0.3 ppm.

Well No. 3, or Thorpe Well, was constructed in 1926 by Thorpe Concrete Well Co., Alton, and is located about 75 ft. east of the 10-in. wells.

This well is about 60 ft. deep and is cased with 26-in. id. porous concrete casing below the bottom of the pit 8 ft. below the present pump base.

In 1928, the normal demand was supplied by this well. The non-pumping water level was 26 ft. 3 in. below the well curb, and the drawdown was reported to be 3 ft. after 2 or 3-hr. pumping. In 1938, the non-pumping water level was 21 ft. 3 in. and the pumping level 27 ft. 11 in. below the well curb. In 1941 water was pumped from this well at a rate of about 345 gpm. for about 8-10 hr.per day. The pumping water level was 33 ft. 10 in. below the top of the well curb.

Analysis of a sample (Lab. No. 83708), collected June 17, 1938, showed the water to have a hardness of 16.6 gr. per gal., a residue of 362 ppm., and an iron content of 0.26 ppm.

Well No. 4 or Kelly 1941 Well, was constructed in 1941 by the Kelly Well Co., Grand Island, Neb., and located about 125 ft. south and 70 ft. west of Well No. 3 (or approximately 2375 ft. N. and 2105 ft. E. of the S.W. corner of Section 34).

The well is 70 ft. 10 in. deep below a ground surface elevation of 450± ft. The bottom of the well is 72 1/2 ft. below the pump base.

Correlated driller's log of Well No. 4 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
No record	3	3
Sand and clay	11	14
Sand, some gravel	32	46
Sand	25	71

The well is cased with 17-in. id. by 22-in. od. concrete pipe from 1 ft. 8 in. above to 34 ft. 2 in. below the ground surface. A perforated concrete screen of the same size extends from 34 ft. 2 in. to 70 ft. 2 in., and a concrete plug extends to 70 ft. 10 in. A 26-in. protective casing back-filled with concrete was placed to a depth of 22 ft. below the pump base. Gravel was packed around

the casing and screen as follows: 50-in. diameter from surface to 18 ft.; 46-in. diameter from 18 to 44 ft.; 44-in. diameter from 44 to 71 ft.

When the well was completed, the contractor reported that when pumping at a rate of 625 gpm. the drawdown was 5 ft. 2 in. from a non-pumping water level of 24 ft. 10 in. below the ground surface.

The pumping installation, made June 6, 1941 consists of: 40 ft. of 7-in. column pipe; 10-in., 17-stage Sterling turbine pump, No. S3838, rated at 600 gpm. against 500 ft. of head, the overall length of the pump is 12 ft. 3 15/16 in.; 50 ft. of 1/4-in. copper tubing air line; 10 ft. of 7-in. suction pipe with 18 in. of tapered strainer; 100-hp. Westinghouse electric motor.

In Table 1 are shown water level observations in Well No. 4, on Nov. 8, 1946, and Feb. 14, 1948. There was no other pumping in the vicinity of Well No. 4. The water levels are in ft. below the pump base.

Well No. 4 is the principal source of supply.

Analysis of a sample (Lab. No. 114,506) collected Apr. 29, 1948, after 28-hr. pumping at 620 gpm., showed this water to have a hardness of 14.9 gr. per gal., a residue of 336 ppm., and an iron content of 0.1 ppm.

Well No. 5, or Kelly 1947 Well was constructed in Dec. 1947by the Kelly Well Co., and is located about 40 ft. north and 120 ft. east of Well No. 4 (or approximately 2415 ft. N. and 2225 ft. E. of the S. W. corner of Section 34).

The well is reported to be 60 ft. deep below a ground surface elevation of 450± ft. and to be constructed in the same manner as Well No. 4. A protective casing, back-filled with concrete, is set from 2 ft. above to 22 ft. below ground level. The well was not yet equipped for service in May 1948.

A production test was made from Well No. 5 by the contractor on Jan. 19, 1948. The influence of pumping in Well No. 5 was observed in Well No. 3 where there was no pumping, and observed in Well No. 4 where pumping was continuous. Water levels were measured from the pump base of the observed well. The observations are shown in Table 2.

TABLE 2

Pumping rate in gpm. Well No. 5	Water Level Well No. 5	Well No. 3	Well No. 4
0	27.0	29.0	31.5
850	33.9	28.5	33.0
1500	36.2	29.0	33.0
2000	37.0	29.0	33.5
1 1/2 hr. after shutdown	27.0	29.0	32.5

In May, 1948, Well No. 5 had not yet been equipped for service.

The combined metered pumpage from Apr. 1, 1947, to Apr. 1, 1948, averaged 724,850 gpd. The distribution of pumpage was:

Robinson	-	575,770 gpd.
Palestine	-	62,940 gpd.
Oblong	-	86,140 gpd.

TABLE 1

Water Level

Date	Non-Pumping	Pumping	Remarks
Nov. 8, 1946	29		After 15 min. idle period.
Nov. 8, 1946		37	After 24 hr. at 500 gpm. No. 3 pumping at 445 gpm.
Feb. 14, 1948	24		After 1 hr. idle period.
Feb. 14, 1948		33	After 1 hr. at 620 gpm. No other pumping.
Apr. 28, 1948		31	After 24 hr. at 600 gpm. No other pumping.

LABORATORY NO. 114,506

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	19.4	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	82.4	4.12	Chloride	Cl	10.0	0.28
Magnesium	Mg	11.8	0.97	Nitrate	NO_3	14.8	0.23
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	46.1	0.95
Sodium	Na	15.9	0.69	Alkalinity (as $CaCO_3$)		216.	4.32
Turbidity		0		Hardness (as $CaCO_3$)		255.	5.09
Color		0		Residue		336.	
Odor		0		Free CO_2 (calc.)		38.	
Temperature 57.3° F.				pH = 7.15			

The city of Rochelle (4200) established a municipal water supply about 1876.

Water was first pumped from an old stone quarry near the south end of town by 2 duplex pumps.

About 1897, Well No. 1 was drilled to a depth of 1896 ft. by F. M. Gray, Chicago, and located near the quarry, on the west side of Eighth St. between Ave. "A" and Ave. "B", about 1000 ft. southwest of the pump station. The quarry supply was abandoned. The well is 8 in. in diameter at the top and was reported to be cased to about 70 ft. The well was abandoned about 1907 but was cleaned and put back into service in 1919, at which time the non-pumping water level was reported to be 12 ft. below the ground surface and the drawdown was 38 ft. when pumping at 500 gpm. In 1923, the water level was 30 ft.

This well is equipped with 150 ft. of 4-in. column pipe; 4-in., 4-stage A. D. Cook turbine pump; 10 ft. of 4-in. suction pipe; 169 ft. of air line which extends 19 ft. below the top of the bowls; 25-hp. U. S. electric motor. This pump discharges at a rate of 190 gpm. and is used to supply water to the swimming pool and is maintained as a standby for emergency use.

Analysis of a sample (Lab. No. 41220) collected in June 1919, showed water from Well No. 1 to have a hardness of 16.9 gr. per gal., a residue of 307 ppm., and no iron content.

Well No. 2 was drilled in 1907 to a depth of 1026 ft. by the J. P. Miller Artesian Well Co., Chicago, and is located just outside the power station, (approximately 400 ft. N. and 1000 ft. E. of the S. W. corner of Section 24, T. 40 N., R. 1 E.). The ground elevation is 793± ft.

In 1940, the well was "shot" and then plugged at 800 ft. by Frank Gray. A 10-in. casing was set from the surface to 150 ft. Grout was placed outside the casing.

In 1930, the well was equipped with 145 ft. of column pipe; 8-in., 8-stage American Well Works turbine pump rated at 250 gpm.; 20-hp. U. S. Electric Manufacturing Co. motor operating at 1800 rpm.

In 1930, the non-pumping water level was reported to be 35 ft. below the ground surface, and in Dec, 1947, the non-pumping water level was estimated to be 35 ft., and when pumping at 250 gpm., the drawdown was 44 ft.

On Mar. 4, 1949, Mr. J. H. Russell, Water Superintendent, reported that the pumping equipment was replaced in 1948 by 190 ft. of column pipe and a 5-in., 7-stage American Well Works turbine pump rated at 350 gpm. When pumping in 1948 at 225 gpm. with this installation the drawdown was 145 ft.

Well No. 3 was drilled to a depth of 1484 ft. in 1923 by P. E. Millis and Co., Byron, and is located 150 ft. east of Well No. 2.

Hole Record

20-in. from surface to 131 ft.
15-in. from 170 to 301 ft.
12 1/2-in. from 301 to 1484 ft.

Casing Record

16-in. od. from surface to 131 ft.

The well is equipped with 140 ft. of 8-in. column pipe; 12-in., 6-stage American Well Works turbine pump rated at 600 gpm. at 1150 rpm.; 140 ft. of air line; 10 ft. of 8-in. suction pipe; 40-hp. General Electric motor operating at 1140 rpm. Air line is to the top of the bowls.

In 1930, it was reported that this well produced 680 gpm. with a drawdown of 77 ft. from a non-pumping water level of 35 ft. below the ground surface. On Dec. 4, 1947, the non-pumping water level was estimated to be 35 ft. below ground surface and the drawdown was 100 ft. when pumping at 680 gpm. Mr. Russell reported that on Mar. 4, 1949, when pumping at 560 gpm., the drawdown was 140 ft.

Analysis of a sample (Lab. No. 82732) collected Jan. 6, 1938, showed this water to have a hardness of 16.4 gr. per gal., a residue of 328 ppm., and an iron content of 0.07 ppm.

Well No. 4 was completed to a depth of 1450 ft. in Jan. 1929 by P. E. Millis and Co., and located 150 ft. east of Well No. 3.

Hole Record

20-in. from surface to 135 ft.
15-in. from 135 to 487 ft.
12-in. from 487 to 1450 ft.

Casing Record

16-in. casing from surface to 135 ft.
12-in. liner from 426 to 487 ft.

The well is equipped with 140 ft. of 8-in. column pipe; 12-in., 8-stage American Well Works turbine pump rated at 640 gpm.; 10 ft. of 8-in. suction pipe; 140 ft. of air line 30-hp., 1150 rpm. General Electric motor.

In 1930, it was reported that, when pumping at 680 gpm. the drawdown was 77 ft. from a non-pumping water level of 35 ft. below the ground surface. On Dec. 4, 1947, the non-pumping water level was estimated to be 35 ft. below the ground surface and the drawdown was 91 ft. when pumping at 640 gpm. Mr. Russell reported that on Mar. 4, 1949, when pumping at 660 gpm., the drawdown was 96 ft.

Analysis of a sample (Lab. No. 112,801) collected Dec. 4, 1947 after 2-hr. pumping at 640 gpm., showed this water to have a hardness of 19.1 gr. per gal., a residue of 325 ppm., and an iron content of 3.9 ppm. A previous analysis of a sample (Lab. No. 82,731) collected in 1938 showed the water to contain 2.0 ppm. iron. The temperature and quality indicates that little if any water is being obtained from the lower formations.

Water from Wells No. 1, 2, 3, and 4 is pumped to a reservoir.

Well No. 5 was drilled in 1938 to a depth of 502 ft. by W. L. Thorne Co., Des Plaines, and located on the north side of Sixth St., one-half block east of Fourteenth St., (or approximately 2000 ft. N. and 1100 ft. W. of the S. E. corner of Section 23). The elevation of the ground surface is 820± ft.

Hole Record

10-in. to bottom of well.

Casing Record

15-in. from +1 ft. to 43 ft.
10-in. from +1 ft. to 101 ft.

The 10-in. casing was sealed in with neat cement grout from the bottom to the top of the 15-in. casing.

A production test was made on Apr. 28, 1938 by the State Water Survey. A pump, furnished by the driller, was set at 200 ft. below the ground surface. After 12-hr. pumping at 700 gpm., the drawdown was 47 ft. from a non-pumping level of 36 ft. below the ground surface.

In 1947, one stage was added to the pump and the pump installation consists of 140 ft. of 8-in. column pipe; 6-stage American Well Works turbine pump, No. 61758, having a rated capacity of 650 gpm.; 140 ft. of air line; 10 ft. of 8-in. suction pipe; 40-hp. General Electric motor.

This pump discharges at a rate of 525 to 575 gpm., directly into the mains. In 1946, when pumping at 575 gpm., the drawdown was 92 ft. from a non-pumping water level of 36 ft. below the ground surface. The pump usually operates 24 hr. daily but at present time is being repaired.

Analysis of a sample (Lab. No. 83417) collected Apr. 28, 1938, after 12-hr. pumping at 700 gpm., showed the water to have a hardness of 16.3 gr. per gal., a residue of 278 ppm., and an iron content of 1.3 ppm.

Well No. 6 was drilled to a depth of 867 ft. in 1942 by the McCarthy Well Co., St. Paul, Minn. and located on the north side of Ave. "G" between South 3rd and South4th St. (or approximately 1625 ft. S. and 1525 ft. W. of Section 25). The ground surface elevation is 800± ft.

Hole Record

19-in. from surface to 156 ft. 6 in.
12-in. from 156 ft. 6 in. to 783 ft. 8 in.
10-in. from 783 ft. 8 in. to 867 ft.

Casing Record

12-in. casing from surface to 156 ft. 6 in.
10-in. liner from 613 to 783 ft. 8 in.

In 1942, the non-pumping water level was 40 ft. below the ground surface.

The pump assembly consists of 150 ft. of 8-in. column pipe; 12-in., 8-stage American Well Works turbine pump, rated at 600 gpm.; 150 ft. of air line; 20 ft. of 8-in. suction pipe; 60-hp. General Electric motor.

This well has not been used for 2 years, but it is expected to be returned to service, upon installation of an iron removal plant about June, 1948.

Water from Wells 5 and 6 is pumped directly into the mains.

In 1947, municipal pumpage averaged 1 1/4 mgd.

Sample-study log of Well No. 4 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay	4	4
Ordovician system		
Platteville dolomite	87	91
Glenwood sandstone, dolomite, and thin shale beds	49	140
St. Peter formation		
Sandstone, incoherent	300	440
Sandstone, chert and shale	70	510
Cambrian system		
Trempealeau dolomite, thin sandstone and shale beds	100	610
Franconia dolomite and sandstone	95	705
Galesville sandstone		
Sandstone, partly dolomitic	75	780
Sandstone, incoherent	75	855
Eau Claire formation		
Sandstone, shale, and thin dolomite beds	265	1120
Sandstone, incoherent	180	1300
Cambrian and Pre-Cambrian systems		
Mt. Simon and Fond du Lac sandstones and thin shale beds	150	1450

LABORATORY NO. 112.801

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	3.9		Silica	SiO_2	14.9	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	73.3	3.67	Chloride	Cl	2.0	0.06
Magnesium	Mg	34.8	2.86	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	0.2	0.01	Sulfate	SO_4	11.3	0.24
Sodium	Na	3.7	0.16	Alkalinity	(as $CaCO_3$)	320.	6.40
Turbidity		35		Hardness	(as $CaCO_3$)	327.	6.53
Color		0		Residue		325.	
Odor		Tr.		Temperature	51.5° F.		

The village of Rockdale (1532) installed a public water supply in 1914-1915.

Water was obtained from a well 660 ft. deep. It was located on the village site at the northwest corner of Otis and Midland Ave. (or approximately 500 ft. S. and 1240 ft. E. of the N. W. corner of Section 20, T. 35 N., R. 10. E.).

The well served as the source of the public water supply until Dec. 1944 when the pump was removed and the well abandoned.

A second well was drilled in 1945 about 10 ft. east, and it is reported that during the cementing of the new well, the cement grout flowed into the old well and plugged it, evidently flowing through a rock fissure about 90 ft. below the ground surface.

A log of the material penetrated, diameter, productive capacity, water levels, and mineral analyses of the water may be found in Bulletin No. 34.

The new well, known as Well No. 2, was drilled to a depth of 1586 ft. by the J. P. Miller Artesian Well Co., Brookfield, and completed in Feb. 1945. It is located about 20 ft. west of Midland Ave. and 110 ft. north of Otis Ave. (or approximately 500 ft. S. and 1250 ft. E. of the N. W. corner of Section 20). The elevation at the ground surface is 565± ft.

The hole and casing record is given in Table 1.

TABLE 1

Hole -Record

19 1/4-in. from surface to 431 ft. 5 in.
13-in. from 431 ft. 5 in. to 586 ft.

Casing Record

20-in. surface pipe from 0 to 19 ft.
14-in. id. from 0 to 431 ft. 5 in.

The annular space outside the 14-in. casing was cement grouted.

A production test was made on Mar. 1, 1945. After 8-hr. pumping at 118 gpm., the drawdown was 33 ft. from a water level of 286 ft. below the pump base, or a specific capacity of 3.5 gpm. per ft. of drawdown.

On Mar. 6, 1945 the well was "shot" with 300 lb. of gelatin between the depths of 1501 and 1515 ft. A considerable quantity of sand was baled out, and after cleaning, the distance to water was 283 ft. below the top of casing.

On Mar. 23, and 24, 1945, a production test was made. The rate of pumping was increased from 300 gpm. at the start to 530 gpm. after 7 hr. and continued at a uniform rate of 520 gpm. for the last 10 hr. of the test.

Apparent equilibrium was obtained after 12-hr. pumping with a drawdown of 74 ft. from a water level of 284 ft. below the pump base, or a specific capacity of about 7 gpm. per ft. of drawdown.

The following pump installation was made in May 1945: 360 ft. of 5-in. id. column pipe; 8-in., 18-stage (all bronze bowls) Peerless turbine pump rated at a capacity of 275 gpm. against a head of 430 ft.; the overall length of the pump is 10 ft.; 360 ft. of air line; 35 ft. of 5-in. suction pipe; 40-hp. electric motor.

A water level of 290 ft. was reported on June 26, 1945 after an idle period of 3 months following the production test.

On Oct. 7, 1946 a water level of 293 ft. was observed after a 6-hr. idle period and a water level of 319 ft. after 4 1/4-hr. pumping at an average rate of 265 gpm.

Analysis of a sample (Lab. No. 107,987), collected Oct. 15, 1946 after 2 3/4-hr. pumping at 255 gpm., showed the water in Well No. 2 to have a total hardness of 13.9 gr. per gal., a residue of 473 ppm. and an iron content of 0.2 ppm.

This well is now the source of the entire public water supply. The pumpage varies with the demand of the U. S. Navy. A maximum pumpage of 240,000 gpd. was reported on Dec. 20, 1945 and an average pumpage of 145,000 gpd. in Oct. 1946. Water can be supplied to the village by the American Can Co.

The water is chlorinated and had a chlorine residual of 1.0 ppm. at the pump house on Oct. 15, 1946.

For information relative to the industrial wells of the American Can Co., American Steel & Wire Co., and Joyce 7-Up Bottling Co., see Bulletin No. 34.

Sample-study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Surface"	10	10
Silurian system		
Niagaran-Alexandrian series		
Dolomite	83	93
Dolomite, shaly, shale at base	55	148
Ordovician system		
Maquoketa dolomite and shale	108	256
Galena-Platteville dolomite, some limestone	347	603
St. Peter sandstone, incoherent	148	751
Shakopee dolomite, thin shale and sandstone beds	39	790
New Richmond dolomite and sandstone	15	805
Oneota dolomite, some sandstone, thin shale beds	275	1080
Cambrian system		
Trempealeau dolomite	154	1234
Franconia dolomite, some shale, sandstone	116	1350
Galesville formation		
Sandstone, thin dolomite beds	120	1470
Sandstone, incoherent	63	1533
Eau Claire Dolomite, sandstone and shale	53	1586

LABORATORY NO. 107,987

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	11.9	
Manganese	Mn	0.0		Fluoride	F	1.1	
Calcium	Ca	61.4	3.07	Chloride	Cl	34.0	0.96
Magnesium	Mg	20.4	1.68	Nitrate	NO_3	Tr.	Tr.
Ammonium	NH_4	0.9	0.05	Sulfate	SO_4	104.1	2.17
Sodium	Na	84.9	3.69	Alkalinity	(as $CaCO_3$)	268.	5.36
Turbidity		10		Hardness	(as $CaCO_3$)	238.	4.76
Color		0		Residue		473.	
Odor		0		Free CO_2 (calc.)		36.	
Temperature 60.6° F.				pH = 7.25			

ROCKFORD
Winnebago County
June 25, 1949

A public water supply was installed for the city of Rockford (84637) in 1875 or 1876.

This article is a brief summary. A more complete description of the Rockford public water supply is given in State Water Survey's Report of Investigation No. 2, published in 1948.

Water was originally obtained from an infiltration well located at the pumping station on the west bank of Rock River and north of Peach St., now known as West Jefferson St. The well was 24 1/2 ft. in diameter and 20 i/2 ft. deep. In 1885 the first Mt. Simon sandstone well was drilled to a depth of 1530 ft. below a surface elevation of 710.9. and located near the pumping station in Well St. and south of Park Ave. From 1885 to 1888, four additional deep sandstone wells were drilled and in 1897 the sixth, deep sandstone well was drilled.

In 1891, it was necessary to augment the public supply. Five 8-in. St. Peter sandstone wells were drilled to average depths of 400 ft. The five St. Peter wells and three of the Mt. Simon wells, No. 1, 4 and 6, were connected to a shaft-and-tunnel system which was installed in 1896-98. The shaft-and-tunnel system was in operation until 1926, when it was abandoned, and replaced by the Tay St. group wells.

A new water works plant was constructed in 1923 and located at Tay and Cedar St. in the Kent Creek valley about ten blocks west of Rock River (or approximately 1300 ft. N. and 1600 ft. E. of the S. W. corner of Section 22, T. 44 N., R. 1 E.). Between 1921 and 1926 the Tay Street Group Wells were constructed. There were originally 4 wells in this group and they ranged in depths from 1600 to 1631 ft. All were cased with 12-in. pipe to 100 ft., below which the hole was 12 in. in diameter. The elevation of the ground surface is 720t ft. It was reported that rock was encountered in Group Well No. 2 at a depth of 80 ft. In 1923 the non-pumping water level was 29 ft. below the ground surface elevation of 730t ft.

Group Well No. 5 was drilled in 1926 to a depth of 1605 ft. and located at the corner of Tay and Preston St. The well was cased with 16-in. pipe to a depth of 97 ft. below which the hole was 16-in. diameter to 300 ft., and 12-in. from 300 ft. to the bottom. The ground elevation at the well is 725.9 ft.

Group Well No. 6 was drilled in 1926 to a depthof 1608 ft. and located at the corner of Tay and Chestnut St. The ground elevation at the well is 728.5 ft. The well was cased with 16-in. pipe to a depth of 97 ft., below which the hole diameter was 16 in. from 97 to 300 ft., and 12 in. from 300 ft. to the bottom.

Analysis of a sample (Lab. No. 113,685) collected March 5, 1948, showed the water from Well No. 6 to have a hardness of 22.7 gr. per gal., a total mineral content of 446 ppm. and an iron content of 0.6 ppm.

All Tay St. Wells are in use or available for use.

Between 1898, when the shaft-and-tunnel system was constructed, and 1923, when the Tay St. group wells were drilled, Unit Wells No. 7 and 8 were drilled to meet the increased summer demand. Because no more wells would be drilled in the Tay St. group, the designation of those wells was unchanged. They will continue to be called Group Wells 1 to 6 and the Unit Wells numbered from 1. The numbering of the Unit Wells was not in the order of drilling.

Unit Well No. 7 was drilled in 1913 to a depth of 1503 ft. by Wm. H. Cater, Chicago, and located at the Fire Station at the northwest corner of 18th Ave. and 11th St. (or approximately 1450 ft. S. and 1200 ft. E. of the N. W. corner of Section 36). The ground elevation is 731.9 ft. In 1925 the non-pumping water level was 16 ft. and when pumping at pump capacity, about 1400 gpm., the drawdown was 90 ft.

Unit Well No. 7A was drilled in 1947 to a depth of 200 ft. by C. W. Var.ner and located 100 ft. north of Unit Well No. 7. The well was cased with 30-in. pipe from the surface to 120 ft., and with 20-in. id. ci. pipe from the surface to 120 ft.

The annular space between the casings was filled with cement. A 15-in. Johnson screen was set from 120 to 200 ft. with 17 ft. of 14-in. od. pipe attached to the top of the screen and a lead packer fitted to the top of the 14-in. pipe.

A production test was made by the driller on July 26, 1947, using temporary pumping equipment for the test. Before pumping, the water level was 36 ft. below the top of the casing (elev. 732.0±), and after 5-hr. pumping at rates from 1311 to 1606 gpm. the drawdown was 23 ft.

The pumping equipment, installed in June,

1948, includes 105 ft. of column pipe; 14-in., 3-stage Pomona turbine pump, Serial No. SJ 94.

On June 23, 1948, after the well had been in service for 10 days, water was being pumped at a rate of 2800 gpm. with a drawdown of 27 ft. from a water level of 39 ft. below the pump base.

Analysis of a sample (Lab. No. 115,049) collected June 10, 1948, showed the water from Unit Well No. 7A to have a hardness of 23.3 gr. per gal., a total mineral content of 402 ppm. and an iron content of 2.7 ppm.

Unit Well No. 8 was drilled to a depth of 1502 ft. in 1914-15 by Wm. H. Cater, and located in the northwestern part of the city in the triangular park at the intersection of Auburn, Camp and Douglas St. (or approximately 2600 ft. N. and 1800 ft. E. of the S. W. corner of Section 13). The ground elevation at the well site is 723.9 ft. On Jan. 31, 1919, the non-pumping water level was 16.5 ft. and when pumping at 15 60 gpm. the drawdown was 83.5 ft.

Unit Well No. 1, originally Well No. 1 of the old Peach St. wells and located south of Park Ave. in Well St., was reconditioned in 1937-38 by W. L. Thorne Co., Des Plaines. The 10 in. casing was removed and the well reamed 18 in in diameter to 200 ft., and 15 in. from 200 to 1530 ft. An 18-in. casing was set to rock at 129 1/2 ft. below the pumphouse floor.

The pumping equipment consists of 125 ft. of 12-in. column pipe; 16-in., American Well Works L. C. turbine, No. 61518, rated at 2100 gpm. against 140 ft. of head at 1180 rpm. Power is furnished by a 100-hp., 1175 rpm. General Electric motor, No. 5454187.

After the repairs were completed, the water level was 18 ft. and when pumping at rates of 680, 910, 1200 and 2100 gpm., the respective drawdowns were 36, 47, 56 1/2 and 92 ft.

In a production test of Jan. 17, 1948, when pumping at 1570 gpm., the drawdown was 116.5 ft. from a water level of 18 ft.

Analysis of a sample (Lab. No. 113,231) collected Jan. 17, 1948, after 6-hr. pumping at 1570 gpm., showed the water from Unit Well No. 1 to have a hardness of 20.6 gr. per gal., a total mineral content of 364 ppm. and an iron content of 0.2 ppm.

Unit Well No. 1 is in service.

Unit Well No. 9 was drilled in 1928 to a depth of 1600 ft. by F. M. Gray, Jr., Milwaukee, Wis., and located at the northeast corner of Crosby St. and James Ave. (or approximately 850 ft. N. and 1425 ft. E. of the S. W. corner of Section 19, T. 44 N., R. 2 E.). The well was cased with 18-in. wi. pipe from the surface to 243 ft. 10 in., and with 12-in. pipe from 224 to 347 ft. 3 in. Below the 12-in. casing the hole is 17-in. diameter to 350 ft., and 12 1/2-in. diameter from 350 to 1600 ft. When the well was completed, the static water level was 90 ft. below a ground surface elevation of 809.4 ft.

The well was rehabilitated in 1936-37 by W. L. Thorne Co. A plug was placed at 530 ft., the base of the St. Peter sandstone, and the static water level was 105 ft. When pumping at a rate of 400 gpm., the drawdown was 17 ft. The well was then "shot" with five 100-lb. charges between depths of 680 and 1370 ft. After repairs were completed, the static level was 104 ft. and when pumping at a rate of 1300 gpm., the drawdown was 37-1/2 ft.

Unit Well No. 9 is in service.

Unit Well No. 6 was completed in Feb. 1941, to a depth of 1372 ft. by C. W. Varner, Dubuque, Iowa, and located in the northeast corner of Twenty-second St. and Nineteenth Ave. (or approximately 1540 ft. S. and 820 ft. E. of the N. W. corner of Section 31). The ground elevation at the well site is 789.9 ft.

Unit Well No. 6 was cased with 30-in. pipe from 9 ft. 4 in. to 177 ft. 4 in. and with 20-in. pipe from 5 ft. 10 in. above to 193 ft. 10 in. below ground level. Below the 20-in. casing the hole was 20-in. diameter to the bottom of the well. The pumping equipment consists of 190 ft. of 12-in. column pipe; 14 in., 2-stage American Well Works L. C. turbine pump, No. 64562, having an overall length of 4 ft. 3 in., and rated at 1900 gpm. against 173 ft. of head at 1765 rpm.; 190 ft. of airline; 21 ft. 4 in. of 12-in. suction pipe and 7.0 ft. of strainer; 100-hp. General Electric motor.

A production test was made by the driller on. Feb. 2, 1941. Before pumping, the water level was 98.0 ft. below the top of the 20-in. casing and, after 8-hr. pumping at 1549.4 gpm., the drawdown was 55.0 ft.

Unit Well No. 6 is in service.

Unit Well No. 5 was drilled to a depth of 1312

ft. in 1945 by C. W. Vainer and located northeast of the city (approximately 600 ft. N. and 1200 ft. E. of the S. W. corner of Section 18). The well was cased with 30-in. pipe to a depth of 291 ft. and with 20-in. ci. pipe from the surface to 323 ft. The annular space between the casings was filled with grout. Below the 20-in. casing, the hole was 20 in. in diameter to the bottom of the well.

A production test was made by the driller on June 5, 1945. Before pumping, the water level was 104 ft. below the top of the 20-in. casing (elev. 792.6). Before the 20-in. casing was grouted in, the water level was 11.0 ft. higher. After pumping 6 hr. at a rate of 1490 gpm., the drawdown was 76.23 ft. After the next 1-hr. pumping at 1212 gpm., the drawdown was 61.21 ft. and after the next 1-hr. pumping at 1000 gpm., the drawdown was 50.25 ft.

The pumping equipment consists of 210 ft. of 10-in. id. column pipe; 16-in., 2-stage Pomona turbine pump, Serial Number SF 1033, designed for 1700 gpm. against 193 ft. of head; 100-hp. electric motor.

Unit Well No. 3 was completed to a depth of 1120 ft. in May, 1948, by C. W. Varner, and located about one mile north of the city, about one quarter mile west of State Highway No. 2 (or approximately 960 ft. N. and 1360 ft. W. of the S. E. corner of Section 2, T. 44 N., R. 1 E.).

The well was cased with 20-in. pipe from the surface to 207 ft. The annular space outside the casing was filled with cement. When the well was completed, the static water level was 52.6 ft. below the top of the casing (elev. 757.3).

Unit Well No. 4 was completed in Jan., 1948, to a depth of 1219 ft. by C. W. Varner, and located in the southeast part of the city about 1000 ft. west of Blackhawk bridge (or approximately 50 ft. S. and 1760 ft. E. of the N. W. corner of Section 34). The elevation of the ground surface at the well site is 730.0± ft.

The well was cased with 30-in. pipe from the surface to 69 ft. and with 20-in. pipe in a 30-in. hole from the surface to 193 ft. The annular space between the 20-in. casing and the wall of the drill-hole was filled with grout. Below the 20-in. casing, the hole was finished at 20-in. diameter.

Sample-study log of Unit Well No. 4 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Glacial drift	65	65
Ordovician system		
Platteville dolomite	82	147
Glenwood dolomite, sandy	20	167
St. Peter sandstone	258	425
Cambrian system		
Trempealeau dolomite	80	505
Franconia sandstone, dolomite	85	590
Galesville sandstone, white	135	725
Eau Claire shale, siltstone, sandstone, dolomitic	405	1130
Mt. Simon sandstone	89	1219

Unit Well No. 10 was completed in Nov. 1947, to a depth of 1426 ft. by C. W. Varner and located at the junction of Newberg and Alpine Roads, about one-half mile east of the southeastern limits of the city (or approximately 150 ft. N. and 1640 ft. W. of the S. E. corner of Section 29, T. 44 N., R. 2 E.). The ground elevation at the well site is 880.0.

The well was cased with 30-in. pipe from the surface to 33 ft. and with 20-in. ci. pipe from the surface to 353 ft. The annular space outside the 20-in. casing was cemented in. Below the 20-in. casing, the hole is 20-in. diameter to the bottom.

The pumping equipment consists of 300-ft. of 12-in. column pipe; 16-in. 4-stage Pomona oil lubricated turbine pump designed for 2100 gpm. against 320 ft. of head; 200-hp. electric motor.

In a production test, in Aug. 1948, when pumping at a rate of 2100 gpm., the drawdown was 115 ft. from a non-pumping water level of 173 ft. below the pump house floor.

Maximum pumpage for the City of Rockford occurred in the summer of 1948, when 21 mg. was pumped in one 24-hr. period.

LABORATORY NO. 113685

	ppm.			ppm.	epm.
Iron (total) Fe	0.6	Chloride	Cl	17.0	0.48
		Nitrate	NO_3	13.9	0.22
Turbidity	Tr.	Sulfate	SO_4	83.9	1.75
Color	0	Alkalinity (as $CaCO_3$)		300.	6.00
Odor	Tr.	Hardness (as $CaCO_3$)		389.	7.78
Temperature 53° F.		Total Mineral Content		446.	

LABORATORY NO. 115049

	ppm.			ppm.	epm.
Iron (total) Fe	2.7	Chloride	Cl	9.0	0.25
		Nitrate	NO_3	12.0	0.19
Turbidity	20.	Sulfate	SO_4	56.0	1.16
Color	0.	Alkalinity (as $CaCO_3$)		320.	6.40
Odor	0.	Hardness (as $CaCO_3$)		400.	8.00
Temperature 53° F.		Total Mineral Content		402.	

LABORATORY NO. 113231

	ppm.			ppm.	epm.
Iron Fe	0.2	Chloride	Cl	11.0	0.31
		Nitrate	NO_3	3.3	0.05
Turbidity	Tr.	Sulfate	SO_4	35.6	0.74
Color	0.	Alkalinity (as $CaCO_3$)		300.	6.00
Odor	0.	Hardness (as $CaCO_3$)		353.	7.06
Temperature 54.6° F.		Total Mineral Content		364.	

ROCKTON
Winnebago County
Oct. 27, 1947

The public water supply for the village of Rockton (1156) was installed in 1909.

Water was obtained from one 8-in. diameter and two 6-in. diameter wells, located about 12 ft. apart, 150 ft. south of Main St. and 35 ft. west of Prairie St. (or approximately 1250 ft. S. and 1350 ft. E. of the N. W. corner of Section 24, T. 46 N.,R. 1 E.). The elevation of the ground surface is 740± ft.

The west well of the group was drilled in 1909 to a depth of 165 ft. and cased with 6-in. pipe into rock at 95 ft. below the ground surface.

C. D. Acly, Walworth, Wis., made a production test in Feb. 1938. When pumping at 80 gpm. the drawdown was reported to be 41 ft. below a non-pumping water level of 21 1/2 ft.

The East Well was drilled in 1913 to a depth of 65 ft. by James Welch and Fred Bruster, Beloit, wis., and was cased with 6-in. pipe to a depth of 45 ft. A 20-ft. Cook screen was placed in the bottom of the well.

The center well was drilled in 1920 to a depth of 96 ft. by Mr. Koreal, Beloit, Wis., and was cased to a depth of 76ft. with 8-in. pipe. A 20-ft. Cook screen was placed in the bottom of the well. This well was surged in Feb. 1938 by C. D. Acly who then made a production test. When pumping at 300 gpm. the drawdown was 52 ft. from a non-pumping water level of 18 ft. below the surface.

In 1924 water was being pumped in the 3 wells by a single Fairbanks-Morse 6-in. by 10-in. duplex power pump, belt-driven by a 10-hp. Fairbanks-Morse kerosene engine. The pumping equipment in the center well made in 1938 consists of 50 ft. of 5-in. column pipe; 7 1/2-in., 5-stage Layne turbine pump, No. 8901, rated at 250 gpm. against 150 ft. of head at 1750 rpm.; the overall length of the pump is 4 ft.; 20 ft. of 6-in. suction pipe; 15-hp. General Electric motor, No. 5431298, operating at 1750 rpm. full load. This pump is still in place, and the well serves as an emergency supply unit. The abandoned West and East Wells were filled with concrete in June, 1947.

In 1930, P. E. Millis, Byron, drilled a well 12 ft. south of the center well. This well is 395 ft. deep, 12 in. in diameter and is cased to rock. The well is equipped as follows: 66 ft. 5 in. of 7-in. column pipe; 12-in., 4-stage Layne turbine pump, No. 4608, rated at 300 gpm. against 210 ft. of head; 20 ft. of 6-in. suction pipe; 30-hp. Westinghouse motor operating at 1750 rpm.

This well is the source of the entire public supply. It is reported when drilling was completed in 1930 that the well overflowed the top of the casing which is about 5 ft. below the ground surface. The metered discharge rate was 450 gpm. in June 1947 when pumping to the 100-ft. elevated steel storage tank.

Analysis of a sample (Lab. No. 112,326) collected Oct. 12, 1947, after pumping 3 hr. at 450 gpm., showed this water to have a total hardness of 18.9 gr. per gal., a residue of 327 ppm., and an iron content of 0.3 ppm.

All water is chlorinated at the pumping station. All water used by business and industry is metered. The largest consumers are the Rockton Paper & Felt Co. and the Wagon Wheel Restaurant. The average estimated pumpage is 100,000 gpd.

In 1938, P. E. Millis, Byron, drilled a well to a depth of 199 ft. and located on the school grounds about 125 ft. north of Highway No. 2 south of the Rock River (or approximately 1800 ft. N. and 700 ft. E. of the S. W. corner of Section 24). The elevation of the ground surface is 740t ft.

Sample-study log of well drilled in 1938 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Silt	5	5
Ordovician system		
Platteville dolomite	90	95
Glenwood dolomite and sandstone	40	135
St. Peter sandstone	64	199

Hole Record

10-in. from surface to 104 ft.
8-in. from 104 to 199 ft.

Casing Record

10-in. casing through drift
7 3/4-in. id. casing from 1 1/2 ft. above ground surface to 104 ft.

The annular space between the 7 3/4-in. casing and the 10-in. hole was filled with cement grout.

During a production test when pumping at 120 gpm., the drawdown was 44 ft. from a non-pumping water level of 78 ft. below the top of the casing.

Analysis of a sample (Lab. No. 87368) collected Mar. 5, 1940, showed this water to have a total hardness of 18.0 gr. per gal., a residue of 333 ppm., and no iron content.

This well was abandoned as a source of supply about Sept. 1, 1947 because of dangers of contamination and pump difficulties caused from a discharge of considerable sand.

A 7-in. American Well Works turbine pump, No. 71341, rated at a capacity of 170 gpm. against 207 ft. of head, and a 15-hp. General Electric motor are still in place.

LABORATORY NO. 112,326

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.3		Silica	SiO_2	15.3	
Manganese	Mn	Tr.		Fluoride	F	0.1	
Calcium	Ca	65.6	3.28	Chloride	Cl	2.0	0.06
Magnesium	Mg	38.9	3.20	Nitrate	NO_3	1.6	0.03
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	7.8	0.16
Sodium	Na	2.3	0.01	Alkalinity	(as $CaCO_3$)	312.	6.24
Turbidity		Tr.		Hardness	(as $CaCO_3$)	324.	6.48
Color		0		Residue		327.	
Odor		0		Free CO_2	(calc.)	40.	
Temperature		53.2° F.		pH = 7.3			

The public supply for the city of Roodhouse (2557) was obtained originally from springs located about 7 1/2 miles northwest of Roodhouse (or approximately 1600 ft. S. and 2400 ft. W. of the N. E. corner of Section 23, T. 13 N., R. 13 W.).

In 1928, Layne North Central Co., Chicago, drilled 2 wells located near the springs, each to a depth of 150 ft. and cased to 16 ft. with 20-in. pipe. The wells were drilled in rock from the surface, and are only a few feet apart. The ground elevation at the well-site is 458± ft.

The North Well is equipped with a 15-in., 17-stage Layne turbine pump, No. 4605, rated at 600 gpm., with 6-in. suction and 10-in. discharge; 120-hp. Fairbanks-Morse vertical diesel engine, No. 918164. The bottom of the suction pipe is said to be 90 ft. below the top of the well.

The South Well is equipped with: 15-in.,12-stage Layne turbine pump, No. 4607, rated at 500 gpm. with 6-in. suction and 10-in. discharge; 75-hp. Fairbanks-Morse vertical diesel engine.

In Nov. 1948, the North and South wells were reported to discharge 460 and 400 gpm. respectively, and the non-pumping water level was estimated to be about 8 ft. below the pump base. There is no air line. The pumps are operated alternately.

Analysis of a sample (Lab. No. 116,394) collected Nov. 8, 1948 after 20-minutes pumping showed the water in the North Well to have a hardness of 19.5 gr. per gal., a residue of 389 ppm., and an iron content of 0.1 ppm.

All water is chlorinated.

Pumpage is estimated to average 200,000 gpd.

LABORATORY NO. 116,394

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	20.4	
Manganese	Mn	Tr.		Fluoride	F	0.2	
Calcium	Ca	87.1	4.36	Chloride	Cl	7.0	0.20
Magnesium	Mg	28.2	2.32	Nitrate	NO_3	3.4	0.05
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	30.6	0.64
Sodium	Na	10.4	0.45	Alkalinity (as $CaCO_3$)		312.	6.24
Turbidity		2		Hardness (as $CaCO_3$)		334.	6.68
Color		0		Residue		389.	
Odor		Cl		Temperature 54.5° F.			

ROSELLE
Du Page County
June 19, 1947

A public water supply was installed by the village of Roselle (694) in 1925.

Water is obtained from a well drilled to a depth of 182 ft. by W. L. Thorne Co., Des Plaines, and located about 100 ft. north of Irving Park Road and 50 ft. east of Roselle Road (approximately 1950 ft. S. and 2300 ft. W. of the N. E. corner of Section 3, T. 40 N.,R. 10 E.). The elevation at the ground surface is 770± ft.

The driller reported the following information: cased from the surface to a depth of 139.4 ft. with 10-in. pipe and the hole finished at 10-in. diameter in soft lime rock to a depth of 182 ft. where shale was encountered. On Jan. 30, 1926, the water level was 37 ft. 4 in. below the pump base after a 24-hr. idle period and while pumping at a rate of 110 gpm.for 1 1/2 hr., the drawdown was 14 ft.

In 1938 the pump was operated continuously for 14 days with no appreciable variation in the discharge rate of 100 to 110 gpm.

The existing pump installation, made on May 18, 1947, is: 120 ft. of 5-in. id. column pipe; 7-in., 15-stage Peerless turbine pump Serial No. 34545, having a rated capacity of 170 gpm. against 240 ft. of head; the overall length of the pump is 88 in.; 10 ft. of 4-in. id. suction pipe; 120 ft. of 1/4-in. copper tubing air line; a 15-hp. U. S. electric motor.

On May 17, 1947, the depth of the well was 181 1/2 ft.

On May 18, 1947, after 6 1/2-hr. pumping at 170 to 180 gpm. against a pressure of 57 psi. the drawdown was 58 ft. from a non-pumping water level of 42 ft. below the pump base.

Analysis of a sample (Lab. No. 110,475) collected May 29, 1947 from a tap in the pump house after 20-min. pumping at 175 gpm. showed this water to have a hardness of 19.1 gr. per gal., a residue of 441 ppm., and an iron content of 0.5 ppm.

Pumpage is estimated at 37,000 gpd.

LABORATORY NO. 110,475

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.5		Silica	SiO_2	24.6	
Manganese	Mn	0.0		Fluoride	F	0.5	
Calcium	Ca	68.3	3.42	Chloride	Cl	1.0	0.03
Magnesium	Mg	37.9	3.12	Nitrate	NO_3	0.6	0.01
Ammonium	NH_4	0.6	0.03	Sulfate	SO_4	162.7	3.39
Sodium	Na	25.3	1.10	Alkalinity (as $CaCO_3$)		212.	4.24
Turbidity		10-		Hardness (as $CaCO_3$)		327.	6.54
Color		0		Residue		441.	
Odor		0		Free CO_2 (calc.)		22.	
Temperature 51.1° F.				pH = 7.4			

ROSEVILLE
Warren County
Nov. 5, 1946

A public water supply was installed by the village of Roseville (1061) about 1895.

Water was obtained from an abandoned coal mine. A well was drilled in 1902 by the J. P. Miller Artesian Well Co., Brookfield about 20 ft. distant from the mine shaft on village-owned lots near the center of the village. The well was drilled to a depth of 1350 ft. and cased to a depth of 1070 ft. with 6 1/4 -in. pipe. Sandstone was penetrated at 1160 ft. The well was equipped with a Keystone deep-well cylinder pump with a displacement of approximately 75 gpm. The pump cylinder was set at 240 ft.

In 1914 the depth to water in the mine shaft was 18 ft. In 1915 the deep well was furnishing the entire village supply averaging 20,000 to 25,000 gpd. In 1923 while the well was out of service, due to repairs, the depth to water was reported as 140 ft., and the well has filled below a depth of 600 ft.

Due to complete failure of the deep well in 1924, two wells were drilled in 1924 by Layne-Bowler Co., Chicago, about 1/2 mile west of the village. The wells were 38 and 40 ft. deep respectively, and each one was 10 in. in diameter. They were abandoned in 1931 when the combined yield was 50 gpm.

Water was then obtained from a dug well, 15 ft. in depth and 4 ft. in diameter.

In 1934 a well, now known as No. 1, was drilled by W. L. Thorne Co.,Des Plaines, about 1/2 mile west of town (or approximately 210 ft. S. and 900 ft. W. of the N.'E. corner of Section 36, T. 9 N., R. 3 W.). The only available data on this well were taken from the engineer's proposal which specified a 30-in. outer casing and a 16-in. inner casing with 15 ft. of screen, having No. 250 slot openings, set from 19 ft. to 34 ft. below the pump house floor. The gravel pack was specified to be "pea gravel." Pumping is by direct suction with a Carver centrifugal pump, No. 213,297, and a 10-hp., 1750-rpm., General Electric motor. In Oct. 1946 this pump was being operated 12 hr. per day.

A standby unit is a Dayton-Dowd pump, No. 56458, rated at 60 gpm. against a head of 170 ft.

Analysis of a sample (Lab. No. 107,560), collected Aug. 15, 1946, showed the water in this well to have a hardness of 10.3 gr. per gal., a mineral content of 215 ppm., and an iron content of 1.2 ppm.

In 1936 Well No. 2 was drilled by W. L. Thorne Co. at a location 65 ft. northwest of Well No. 1 (or approximately 150 ft. S. and 960 ft. W. of the N. E. corner of Section 36). The well was drilled to a depth of 21 ft. below the top of the 16-in. inner casing which was about 2 ft. above normal ground level at 720± ft.

The casings and screen were set as follows: 30-in. od. casing from +2 ft. to 14 ft.; 16-in. od. casing from +2 ft. to 7 ft.; 16-in. od. No. 250 slot screen, with 7 ft. of effective length of screen from 12 to 19 ft. below ground surface.

A production test was made by the State Water Survey on July 23-24, 1936. After 21-hr. pumping at 40 gpm., the drawdown was 12.8 ft. from a non-pumping level of 3.7 ft. below the top of the 16-in. casing. At rates of pumping above 40 gpm., it was reported that the well yielded much fine sand.

Analysis of a sample (Lab. No. 107,561), collected Aug. 15, 1946, showed the water in Well No. 2 to have a hardness of 11.8 gr. per gal., a mineral content of 268 ppm., and an iron content of 0.1 ppm.

In Aug. 1946, Well No. 3 was drilled by C. W. Varner, Dubuque, at a location 57 ft. north of Well No. 1 and 60 ft. east of Well No. 2. The well was completed as a stabilized gravel-wall well at a depth of 23 ft. below the ground surface.

The casings and screen were set as follows: 20-in. od. casing from +4 ft. to 11.3 ft.; 12-in. id. casing from +4 to 11.3 ft.; 12-in. id. Johnson No. 30 slot screen from 11.3 to 23.3 ft.

After driving the 20-in. casing to 23 ft., the screen and inner casing were installed with centering spacers; and the annular space packed with about 28 cu. ft. of washed gravel. The outer casing was pulled back, and, by mild surging, about 5 ft. of fine sand was pulled into the well. The hole was drilled a few inches deeper into the underlying clay so that the screen is exposed to the full thickness of sand.

Production tests for all 3 wells were made by the State Water Survey on Aug. 14-15, 1946, and the non-pumping water level, with all pumps idle on Aug. 5, was 4.2 ft. below the top of the 12-in. casing of Well No. 3. With pumps in Wells No. 1 and 2 producing about 30 and 25 gpm. respectively, the water level in No. 3 was 8.6 ft. below the top of the casing. On Aug. 14, with pumps in No. 1 and 2 idle, pumping from Well No. 3 produced 39 gpm.

with a water level of 19.3 ft. The specific capacity of Well No. 3 was calculated to be 2.6 gpm. per ft. of drawdown.

Analysis of a sample (Lab. No. 107,559) collected Aug. 15, 1946 after pumping 7 hr. at 35 gpm., showed the water from Well No. 3 to have a hardness of 8.9 gr. per gal., a residue of 235 ppm., and an iron content of 0.2 ppm.

Pumpage is estimated at 40,000 gpd.

LABORATORY NO. 107,559

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	31.3	
Manganese	Mn	Tr.		Fluoride	F	0.2	
Calcium	Ca	32.9	1.64	Chloride	Cl	11.0	.31
Magnesium	Mg	15.9	1.31	Nitrate	NO_3	53.8	.87
Ammonium	NH_4	0.2	.01	Sulfate	SO_4	45.7	.95
Sodium	Na	4.8	0.21	Alkalinity (as $CaCO_3$)		52.	1.04
Color		10-		Hardness (as $CaCO_3$)		148.	2.96
Odor		0		Residue		235.	
Turbidity		10-		Free CO_2 (calc.)		33.	
Temperature		54.8° F.		pH = 6.6			

A public water supply was installed in 1904 by the village of Rossville (1428).

Water was obtained originally from three 3-in. wells, each 84 ft. deep and terminating in sand. The wells were located back of the Township hall. The supply became exhausted and the wells were abandoned in 1911.

In 1910, two 8-in. wells were drilled to depths of 126 and 131 ft. and located 25 ft. apart, north and south, at the water works plant, on the east side of Summit St., south of Holmes St. The North Well was abandoned in 1928 and has been plugged.

Well No. 1 was drilled in 1918 to a depth of 132 ft. by Harvey Winks, Williamsport, Ind., and located at the water works plant, 30 ft. north of the old South Well, now called Well No. 2. The well is about 105 ft. south of Holmes St. and 103 ft. east of Summit St. The elevation of the ground surface at the plant is 710± ft. Well No. 1 was cased with 8-in. pipe to 116 ft. and 14 ft. of Cook screen, having No. 58 slot openings. The well is equipped with an A. D. Cook No. 813, Size 2L double-stroke 5 3/4-in. cylinder pump set at 100 ft. (in 1938) and having an 18-in. stroke. The discharge from this pump, in 1938, was estimated at 100 gpm. In Nov. 1924 the non-pumping water level was 80 ft. below ground level.

Well No. 1 is in service during the asparagus packing season, Apr. 15 to June 15, and during the sweet corn packing season, Aug. 1 to Sept. 15. The well is maintained for emergency supply during the balance of the year.

Well No. 2, the south well drilled in 1910 is equipped with a Cook double-stroke 5 3/4-in. cylinder pump, No. 1483 Size 1 L, set at 65 ft. (in 1938) and having an 18-in. stroke. Power is furnished by a 10-hp., 1150 rpm. General Electric motor. The discharge from this pump (in 1938) was estimated at 100 gpm. In 1912 the non-pumping water level was 65 ft. below the ground level.

Well No. 2 is used during the asparagus and sweet corn packing season and otherwise is maintained as an emergency supply unit.

Well No. 3 was drilled in 1928 to a depth of 133 ft. by A. L. Winks, Lafayette, Ind. This well replaced the old North Well drilled in 1910, and was located just a few feet south of that well. It is 7 ft. south and 16 ft. west of Well No. 1 (or approximately 2350 ft. S. and 750 ft. E. of the N. W. corner of Section 12, T. 22 N., R. 12 W.).

Correlated driller's log of Well No. 3 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay	68	68
Sand	20	88
Gravel	10	98
Sand	20	118
Sand, water	15	133

Well No. 3 was cased with 8-in. pipe to 116 ft. and with a 20-ft. length of Cook screen, having No. 30 slot openings. The pump assembly, installed in Apr. 1946, consists of: 90 ft. of 4-in. column pipe; 6-in., 6-stage Pomona turbine pump, No. SF.492, having a rated capacity of 200 gpm. against 180 ft. of head and an overall length of about 10 ft.; 88 1/2 ft. of air line; 10 ft. of 4-in. suction pipe; 15-hp. General Electric motor.

On Aug. 12, 1938 the water level in Well No. 3, with all 3 pumps idle, was 53 ft. below the surface, and with the 3 pumps in operation the drawdown in Well No. 3 was 18 ft. When only one pump was in operation, the drawdown was slight.

On May 6, 1946, the non-pumping water level in Well No. 3 was 50 1/2 ft. below the pump base, at ground level, and when pumping at 150 gpm. in Well No. 3, with other pumps idle, the drawdown was 28 ft. When pumping in Well No. 2 and No. 3, the drawdown was 29 ft. On Nov. 29, 1948, with no pumping in Wells No. 1 and 2 and after 45-min. pumping at 175 gpm. in Well No. 3, the water level in Well No. 3 was 79 ft. below the pump base. After a 1 3/4-hour period of no pumping in any of the wells, the water level in Well No. 3 was 55 1/2 ft.

In May 1946, the capacity of the well was falling off regularly. The well was backwashed and surged for 1 1/2 hr. on May 11, while the other two pumps were being operated. Very little improvement in the well capacity resulted and no sand or silt was recovered from the well. Later on, surging was resumed and improved the yield for periods of four to six weeks. Surging was continued at various intervals until the spring of 1948 when beneficial results from surging petered out. Muriatic acid was then applied and this restored the original capacity and improved Wells No. 1 and 2. Well No. 3 has been surged twice since the acid treatment and considerable fine sand was removed each time.

Analysis of a sample (Lab. No. 116,584) collected Nov. 29, 1948 after 3/4-hr. pumping at 175 gpm. showed this water to have a hardness of 20.5 gr. per gal., a residue of 384 ppm., and an iron content of 2.9 ppm.

Pumpage is estimated to average 62,000 gpd.

During the packing season the pumpage is estimated to average 225,000 gpd.

LABORATORY NO. 116,584

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.9		Silica	SiO_2	21.4	
Manganese	Mn	Tr.		Fluoride	F	0.2	
Calcium	Ca	70.8	3.54	Chloride	Cl	3.0	0.08
Magnesium	Mg	42.3	3.48	Nitrate	NO_3	0.2	Tr.
Ammonium	NH_4	1.4	0.08	Sulfate	SO_4	11.9	0.25
Sodium	Na	17.3	0.75	Alkalinity (as $CaCO_3$)		376.	7.52
Turbidity		22		Hardness (as $CaCO_3$)		351.	7.02
Color		0		Residue		384.	
Odor		0		Free CO_2 (calc.)		48.	
Temperature 54° F.				pH = 7.3			

The installation of a public water supply was completed by the village of Round Lake (359) in 1914. The initial supply was obtained from a well drilled to a depth of 350 ft. by Adam Titus, Libertyville, in 1912.

The well is located about 110 ft. south of the main track of the Chicago, Milwaukee, & St. Paul R. R. and 430 ft. east of Cedar Lake Ave. (or approximately 1550 ft. S. and 2400 ft. W. of the N. E. corner of Section 29, T. 45 N., R. 10 E.). The elevation of the ground surface is 798± ft.

It is reported that the well is cased with 6-in. pipe from the surface to rock at a depth of 230 ft. below which the well is 6 in. in diameter to the bottom. When the well was completed, water was pumped at a rate of 150 gpm. for 24 hr. The water returned to its original level soon after the pump stopped. In the summer of 1922 when the pump was pulled, the depth to water was 43 ft. below the pump base.

The existing pump installation made in Jan., 1945, consists of 150 ft. of 4-in. od. column pipe; 6-in. 16-stage Cook turbine pump, Serial No. 1912; 150 ft. of air line without gage; 10-hp. General Electric motor.

When the installation was completed, a production test was made. When pumping at 175 gpm., the drawdown was 10 ft. below a non-pumping water level of 40 ft. below the pump base.

Analysis of sample (Lab. No. 107,669), collected Sept. 10, 1946 after 4-hr. pumping at 125 gpm., showed this water to have a hardness of 9.7 gr. per gal., a residue of 434 ppm. and an iron content of 0.1 ppm.

Well No. 2 was drilled in May, 1945 to a depth of 359 ft. by Henry Boysen, Jr., Libertyville, and located about 360 ft. north of the main track of the Chicago, Milwaukee, & St. Paul R. R. and 80 ft. wrest of the center line of Cedar Lake Ave. (or approximately 600 ft. S. and 2175 ft. E. of the N. W. corner of Section 29). The elevation of the ground surface is 790t ft.

Sample-study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay, glacial till and silt	169	169
Sand and gravel	2	171
Sand, silty	44	215
Sand and gravel	10	225
Silurian system		
Niagaran - Alexandrian dolomites	89	314
Ordovician system		
Maquoketa dolomite, shale at top and base	45	359

The well was reported cased with 226 ft. of 10-in. pipe from the surface to a seat in the bedrock below which the hole is 10-in. in diameter to the bottom.

An 8 1/2-hr. production test was conducted on May 19, 1945. Water was pumped at a rate of 290 to 295 gpm. during this period. The drawdown was 107 ft. below a non-pumping water level of 51 ft. below the top of casing.-

Analysis of a sample collected May 19, 1945 showed the water to be of quality very similar to that obtained from the No. 1 well excepting for a high turbidity and an iron content of 1.4 ppm. The temperature was recorded as 51.6° F.

The average metered pumpage for the period from Sept. 1, 1945 to Sept. 1, 1946 was 44,170 gpd. and varied from an average winter minimum of 31,000 gpd. to an average summer maximum of 70,500 gpd.

The water is not treated.

LABORATORY NO. 107,669

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	17.7	
Manganese	Mn	0.0		Fluoride	F	1.2	
Calcium	Ca	34.2	1.71	Chloride	Cl	4.0	0.11
Magnesium	Mg	19.3	1.59	Nitrate	NO_3	Tr.	Tr.
Ammonium	NH_4	0.4	0.02	Sulfate	SO_4	206.5	4.30
Sodium	Na	69.2	3.01	Alkalinity	(as $CaCO_3$)	96.	1.92
Turbidity		Tr.		Hardness	(as $CaCO_3$)	165.	3.30
Color		0		Residue		434.	
Odor		0		Free CO_2		3.	
Temperature		53° F.		pH = 7.8			

ROUND LAKE PARK
Lake County
Nov. 12, 1946

This is a subdivision of parts of Sections 20, 21, and 28, T. 45 N., R. 10 E., plotted as Renchan Beach Additions, and developed by L. B. Harris & Co. for residential purposes.

By 1946, it comprised 535 houses of which about 350 are permanent residences.

A community water supply was installed in 1939 and is owned and operated by the Boysen Water Service Co. Water is obtained from 2 limestone wells drilled by Henry Boysen, Jr., Libertyville.

Well No. 1, drilled in 1939 to a depth of 279 ft., is located in Block 155, Lot 18, about 20 ft. north of Locust Drive and 100 ft. east of Bellevue Drive (or approximately 618 ft. S. and 1450 ft. E. of the N. W. corner of Section 28, T.45 N.,R. 10 E.). The elevation of the ground surface is 800± ft. The well is cased with 6-in. diameter pipe from the surface to bed rock at a depth of 250 ft. and finished as a 6-in. hole in water-bearing limestone.

Upon completion of the well, a 6-hr. production test was made, pumping at a rate of 150 gpm. The drawdown was 26 ft. below a non-pumping water level of 46 ft. below the ground surface. After the well had been in service for 6 years, it was tested again for 6 hr. by pumping at a rate of 150 gpm. No changes in pumping and non-pumping water levels were observed.

The following pump installation is in service: 180 ft. of 4-in. screwed column pipe; 6-in., 32-stage Cook turbine pump rated at a capacity of 200 gpm. against 285 ft. of head; 180 ft. of air line; 10 ft. of 4-in. suction pipe; 20-hp. United States electric motor.

Analysis of a sample (Lab. No. 107,780), collected Sept. 30, 1946 after pumping for 12 min. at a rate of 200 gpm., showed this water to have a total hardness of 11.0 gr. per gal., a residue of 426 ppm., and an iron content of 0.4 ppm.

Well No. 2 was drilled in the winter of 1943 and 1944 to a depth of 362 ft., and located 25 ft. north of Knollwood Drive and 120 ft. west of Grandview Drive (or approximately 550 ft. N. and 2300 ft. W. of the S. W. corner of Section 21). The elevation of the ground surface is 790± ft.

This well was a failure and was abandoned as a dry hole. It was cased with 10-in. diameter black pipe from the surface to a depth of 269 ft. below which the hole was 10 in. in diameter to the bottom.

Well No. 3, drilled May 2 to 25, 1944 to a depth of 313 ft., is located in Block 155, Lot 17, about 70 ft. north of Locust Drive and 20 ft. east of Bellevue Drive, 100 ft. northwest of Well No. 1 (or approximately 568 ft. S. and 1350 ft. E. of the N. W. corner of Section 28). The elevation of the ground surface is 800± ft. The well is cased with 10-in. pipe from the surface to a depth of 260 ft. below which the hole is 10 in. in diameter to the bottom.

Water-bearing limestone was encountered 20 ft. below bed rock. After completion, an 8-hr. production test was made. When pumping at 100 gpm., the drawdown was 74 ft. below a non-pumping water level of 46 ft. below the ground surface.

The following pump installation is in service: 120 ft. of 4-in. screwed column pipe; a 6-in., 25-stage Cook turbine pump rated at a capacity of 150 gpm. against 285 ft. of head; 120 ft. of air line; 10 ft. of 4-in'. suction pipe; 15-hp. United States electric motor.

Analysis of a sample (Lab. No. 107,781), collected on Sept. 30, 1946 after 6 min. of pumping at a rate of 100 gpm., showed this water to have a total hardness of 11.3 gr. per gal., a residue of 468 ppm., and an iron content of 0.2 ppm.

Both wells are in service and are used extensively during the period from May 1 to Sept. 30 when all homes are occupied. The maximum pumpage is estimated to be 110,000 gpd. and the minimum, 50,000 gpd. The water is not treated.

LABORATORY NO. 107,780

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.4		Silica	SiO_2	16.3	
Manganese	Mn	0.0		Fluoride	F	1.1	
Calcium	Ca	39.6	1.98	Chloride	Cl	5.0	0.14
Magnesium	Mg	21.9	1.80	Nitrate	NO_3	0.0	0.00
Ammonium	NH_4	0.5	0.03	Sulfate	SO_4	214.3	4.46
Sodium	Na	67.9	2.95	Alkalinity	(as $CaCO_3$)	108.	2.16
Turbidity		0		Hardness	(as $CaCO_3$)	189.	3.78
Color		0		Residue		426.	
Odor		Tr.					
Temperature		53° F.					

ROXANA
Madison County
Dec. 1, 1948

A public water supply was installed in 1923 by the village of Roxana (1225). The village owned the distribution system and water was purchased from Shell Petroleum Corporation.

At that time there were seven wells, each drilled to a depth of 115 ft. and all wells had been constructed by Thorpe Concrete Well Co., Alton. Each well was cased with a 26-in. id. porous concrete strainer from the bottom to static water level and with a solid concrete casing from the top of the strainer to ground surface.

In Nov. 1926, water was being pumped from one of the wells at the rate of 3185 gpm. and after 16-hr. pumping the drawdown was 13 ft. 11 in. from a non-pumping water level of 38 ft. below the ground surface.

At that time the Shell Co. was pumping daily at a rate of 11,000 gpm.

Well No. 10 of Shell Co., was drilled in 1924 by Thorpe Concrete Well Co. and located 2368 ft. N. and 2457 ft. W. of the S. E. corner of Section 35, T. 5 N., R. 9 W. The well was 120 ft. deep below a ground elevation of 447± ft.

Correlated driller's log of Shell Co. Well No. 10, furnished by the State Geological Survey:

Formation	Thickness ft.	Thickness in.	Depth ft.	Depth in.
Pleistocene system				
Loam and clay	6	6	6	6
Sand	48		54	6
Sand and gravel	65	6	120	
Mississippian system				
Bed rock	at		120	

In 1936, Roxana purchased water from Wood River.

In Mar. 1937, Well No. 1 was constructed for the village of Roxana by Thorpe Concrete Well Co., and located at the northwest corner of Thomas Ave. and Chaffer St. (approximately 1180 ft. N. and 85 ft. W. of the S. E. corner of Section 27).

Well No. 1 was 126 ft. deep below a ground elevation of 439± ft. and cased with30-in. solid concrete pipe from the surface to 54 ft. and with 30-in. id. porous concrete screen from 54 to 126 ft. A production test was made by the State Water Survey on Mar. 25-26, 1937. Before the test the water level was 49 ft. below the top of the casing and after 5-minutes pumping at 530 gpm. the drawdown was 6 ft. The drawdown remained constant through 24-hr. pumping at the same rate.

The pumping assembly, installed in 1937, consists of 70 ft. of 6-in. column pipe; 8-in., 3-stage Johnson turbine pump, No. 6329, having an overall length of 6ft.; 2 ft. of tail pipe; 15-hp., 1750 rpm. General Electric motor. In Dec. 1948 a new turbine pump was being installed. The old turbine had become clogged with iron deposit.

Well No. 2 was completed in Apr. 1937 by Thorpe at a location 150 ft. north of Well No. 1. The well was constructed to the same depth, casing and screen dimensions as Well No. 1. The pumping equipment, installed in 1937, was identical with that in Well No. 1. The Johnson turbine pump was No. 6328.

A production test was made by the State Water Survey on Apr. 7-8, 1937. Before the test the water level was 50 ft. below the top of the casing and after 24-hr. pumping at 515 gpm. the drawdown was 5 1/2 ft. Pumping in Well No. 2 had a negligible effect on the water level in Well No. 1.

Analysis of a sample (Lab. No. 116,651) collected Dec. 4, 1948 showed this water to have a hardness of 18.7 gr. per gal., a residue of 410 ppm., and an iron content of 4.8 ppm.

The water from the three wells is treated for iron removal, but in Dec. 1948 Wells No. 1 and 3 were out 'of service and water was being purchased from Wood River. A sample of treated water collected Dec. 3 1, 1948 was found to have .04 ppm. iron.

Well No. 3 was drilled in 1944 to a depth of 122 1/2 ft. by Thorpe and located 150 ft. south of Well No. 1. The well was cased with 30-in. id. solid concrete pipe from the surface to 54 ft. and with 30-in. id. porous concrete pipe from 54 ft. to the bottom of the well.

The pumping equipment consists of 80 ft. of 5-in. column pipe; 10-in., 3-stage American Well Works turbine pump, No. 71023, rated at 400 gpm. against 103 ft. of head at 1750 rpm.; the overall length of the pump is six feet; 80 ft. of air line; two ft. of 5-in. suction pipe; 15-hp., 1750 rpm. U. S. electric motor.

When pumping to free discharge, the rate was 600 gpm. A Johnson right-angle gear and 4-cylinder gasoline engine are in place for reserve power.

In Dec. 1948 the well was temporarily out of service because of some repair work to be done.

Pumpage is estimated to average 600,000 gpd.

including water supplied to Shell Co. Refinery for drinking, showers, and toilets.

LABORATORY NO. 116,651

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	4.8		Silica	SiO_2	31.3	
Manganese	Mn	0.5		Fluoride	F	0.6	
Calcium	Ca	87.0	4.35	Chloride	Cl	19.0	0.54
Magnesium	Mg	25.0	2.06	Nitrate	NO_3	0.2	Tr.
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	105.9	2.20
Sodium	Na	7.6	0.33	Alkalinity	(as $CaCO_3$)	200.	4.00
Turbidity		47		Hardness	(as $CaCO_3$)	321.	6.41
Color		0		Residue		410.	
Odor		0		Temperature 57 1/2° F.			

The city of Rushville (2480) installed a public water supply in 1892.

Water was obtained originally from a well drilled in 1887-88 by the J. P. Miller Artesian Well Co., Chicago, and located in the northwest corner of the public square (or approximately 1700 ft. N., and 1050 ft. E. of the N. W. corner of Section 30, T. 2 N., R. 1 W.). This well was reported to be 2500 ft. deep below a ground surface elevation of 670t ft.

In 1888, the well was reported to be cased with 7-in. pipe to a depth of 91 ft. 6 in., and with 6-in. pipe to a depth of 317 ft. 6 in. The non-pumping water level was reported to be about 77 ft. with a pump set a depth of 150 ft., the well produced 60 gpm. for 25 hr. The water was highly mineralized, and the supply was abandoned.

The water works plant was moved to a location about 500 ft. north of Adams St. and 500 ft. east of the eastern limits of the city (or approximately 2300 ft. S. and 1100 ft. W. of the N. E. corner of Section 30). The ground surface elevation at the plant is 650± ft. Most of the supply was obtained from a pond fed by surface drainage and springs.

A well, at this location, was used when the pond did not furnish sufficient water. This well was drilled to a depth of 1510 ft. by Swante Swanson, Minneapolis, Minn. in 1902.

When the well was completed, the yield was 25-30 gpm. The very high mineral content made the water unsatisfactory for domestic and industrial uses.

Analysis of a sample (Lab. No. 10421) collected May 26, 1902, showed the water to have a hardness of 43.8 gr. per gal., and a residue of 4285 ppm.

A new water supply was installed in 1912. This consisted of a pumping station and a dug well, called Well No. 1, located in the valley of McElho Branch about 5 miles south of the city (approximately 100 ft. N. and 100 ft. W. of the S.E. corner of Section 19, T. 1 N., R. 1 W.). The ground surface elevation at the well site is 470± ft.

This well was 12 ft. in diameter, 24 ft. deep and was walled with brick. The walls were laid without mortar from the bottom to a height of about 4 ft., to allow the water to percolate through.

Water was pumped originally from this well by either of two 3-stage Alberger centrifugal pumps, each rated at 250 gpm. against 300 ft. of head. The maximum continuous production was about 150 gpm.

Analysis of a sample (Lab. No. 24310) collected Nov. 13, 1912, showed the water to have a hardness of 21.0 gr. per gal., a residue of 415 ppm., and an iron content of 0.3 ppm.

The yield of this well was insufficient to supply the demand, so a tile, connecting to the well, was laid below the bed of the stream. Later, part of the supply was taken directly from the stream.

Well No. 2 was dug in 1920 or 1921, and was located 3 1/2 ft. north of Well No. 1. This well was constructed of cement blocks with loose concrete joints. The well is 14 ft. in diameter at the top, 12 ft. in diameter at the bottom and 21 ft. deep. When tested by the city, this well produced 75 gpm.

Wells No. 1 and 2 were connected with a 10-in. pipe.

Well No. 3 was dug in 1922, and was located about 30 ft. southwest of Wells No. 1 and 2. This well was 18 ft. in diameter, 20 ft. deep, and was curbed with cement blocks with loose joints.

The non-pumping water level was reported to be about 3 ft. below the top of the well, and to be lowered about 2 ft. after 6 to 7-hr. pumping.

In 1922, it was reported that most of the water was pumped from the three wells by an 8-in. by 10-in. Fairbanks-Morse cylinder pump driven by a 25-hp. Kerosene engine. Suction pipes extended to within 3 ft. of the bottom of Well No. 1, and to within 2 ft. of the bottom of Well No. 3. In 1924, it was reported that this pump discharged 175 gpm. from the 3 wells.

Well No. 4, the fourth infiltration well, was dug 20 ft. deep, 18 ft. long and 8 ft. wide in 1936 by Glen Valentine, Rushville, and was located on the southeast side of McElho Branch, about 1/4 mile upstream from the pumping station.

Water was pumped from this well about 21 hr. per day at an average rate of 35 gpm.

The supply from all these sources continued to be inadequate. Water was piped or pumped from McElho Branch to the wells and thence to the distribution system at Rushville.

Well No. 4 caved in and filled up, and the other 3 wells were abandoned.

In 1936, E. W. Johnson, Bloomington, drilled a test well at a location southwest of the road and a few ft. northwest of McElho Branch. The well was drilled to shale and when completed the non-pumping water level was 7 1/2 ft. When tested on July 18-19, 1936, the well produced an average of 21.5 gpm. for 24 hr.

Four test wells were drilled in 1938 by John Goodell, engineer, Beardstown, and were located about 6 1/2 mile south and 2 mile east of Rushville, (or approximately 2600 ft. S. and 2000 ft. E. of the N. W. corner of Section 33, T. 1 N., R. 1 W.). The wells in an east-west line, numbered consecutively from east to west. Well No. 2 was 24.5 ft. west of Well No. 1. Well No. 3 was 40 ft. west of Well No. 1, and Well No. 4 was 82 ft. west of Well No. 1. The ground surface elevation at the site is about 435± ft.

Well No. 1 was 43 ft. deep; Well No. 2 was 28 ft. deep; Well No. 3, 27 ft. deep; and Well No. 4, 24 ft. deep. Two of the wells were cased with 4-in. pipe, and 2 with tin downspout.

A production test was made by the State Water Survey on Sept. 16, 1938. For test purposes, the wells were equipped with a rotary pump with a common connection to the suction pipes. Non-pumping water levels were, respectively, 9 and 9 1/2 ft. below the tops of the casings. After 4-hr. pumping from all 4 wells, the yield was 95 gpm. with drawdowns of 0.4 ft. in Well No. 1 and 0.5 ft. in Well No. 2. With Wells No. 3 and 4 cut off, the production was 58 gpm. with drawdowns of 0.4 ft. in Well No. 1 and 0.2 ft. in Well No. 2.

Four more test wells were drilled at approximately the same location. These wells were in an east-west line, and about 25 ft. apart. Each well was cased to a depth of 22 1/2 ft. with 2-in. pipe, below which was a 4 ft. length of No. 60 gauge well point. A production test was made by the State Water Survey on Nov. 15, 1938. Non-pumping water levels were, respectively, 11.3 and 11.45 ft. below the tops of the casings in Wells No. 1 and 4. Water was pumped from Wells No. 1,3, and 4 simultaneously. After 2-hr. pumping, the production was 46 gpm. No drawdown measurements were available, but the water level in Well No. 2 during the test was 11.45 ft.

Six permanent wells were completed at this site in 1940 by John Goodell, and were located in an east-west line on the north, or front, side of the pumping station, and were numbered from east to west. The wells were 23 ft. 4 in. apart except for Wells No. 3 and 4 which were 35 ft. apart. The tops of the wells were in concrete pits about 5 ft. deep. Each of the wells was about 25 ft. deep below the ground surface and was cased with 14 ft. of 4-in. pipe and a 6-ft. section of Johnson screen exposed below the casing. The screens in Wells No. 1, 2, 5 and 6 had No. 80 slot openings, in Wells No. 3 and 4, No. 125 slot openings.

When the wells were completed, they were tested individually by the engineers, and the following productions were reported:. Wells No. 1 and 2, 107 gpm. each; Well No. 3, 136 gpm.; Well No. 4, 94 gpm.; Well No. 5, 100 gpm.; Well No. 6, 120 gpm.

A production test was made by the State Water Survey on Jan. 23, 1940. For test purposes, the wells were connected to a common header pipe connected to a "More Trench" pump. The non-pumping water level was about 11 ft. below the ground surface. The wells produced 640 gpm. after 4 1/2-hr. pumping. Drawdown measurements in the wells were not available, but the water levels were lowered 1.35 and 1.5 ft., respectively, in 2-in. well points set adjacent to Wells No. 1 and 6.

The permanent pumping equipment consisted of a 2 1/2-in. Fairbanks-Morse centrifugal pump S972NE, No. 403842, rated at 300 gpm. The pump was driven by a 40-hp. Fairbanks-Morse electric motor No. 365177, operating at 3500 rpm.

Analysis of a sample (Lab. No. 87194) collected Feb. 3, 1940, showed the water from the six wells to have a hardness of 16.9 gr. per gal., a residue of 222 ppm., and an iron content of 0.8 ppm.

Those wells are not in service.

Water is now obtained from a well which was constructed in 1943 by Thorpe Concrete Well Co., Alton, and located at the southwest corner of the new pumping station (or approximately 1500 ft. N. and 2200 ft. E. of the S. W. corner of Section 33.).

The well is 50 ft. deep below ground level and is cased with 42-in. id. by 50-in. od. solid concrete pipe from 2 ft. above to 10 ft. below ground level and with 42-in. id. porous concrete screen from 10 to 58 ft. Originally the casing extended 6 ft. above ground, but one 4-ft. section was removed later. The ground surface elevation is 440± ft.

The well was equipped with the Fairbanks-Morse pump previously used on the 6 wells drilled in 1940.

The non-pumping water level is about 11 ft. below the top of the well and varies from 3 to 4 ft. with the Illinois River stages when pumping at a rate of 300 gpm. the drawdown was 1 1/4 ft.

Water is pumped by either of 2 Fairbanks-Morse centrifugal pumps. One of the pumps and its motor were removed from the 6-well group, which is no longer in service. The other pump, recently installed, is a 3-in. Fairbanks-Morse centrifugal, 5972 NE No. 581521, rated at 500 gpm. against 405 ft. of head at 3460 rpm.; 75-hp. Fairbanks-Morse electric motor, No. 539823, operating at 3520 rpm. A 6-in. suction pipe is placed in the well at 3 ft. below ground level and extends to 21 ft. below ground.

The porous concrete screen is becoming clogged with iron deposit, necessitating the throttling of the pumps to 150 to 250 gpm.

Analysis of a sample (Lab. No. 114,068) collected Ap"r. 5, 1948 showed this water to have a hardness of 20.4 gr. per gal., a residue of 382 ppm. and an iron content of 5.0 ppm.

All water is chlorinated.

Pumpage is estimated to average 275,000 gpd.

A well was completed in Apr. 1948 to a depth of 41 1/2 ft. by Thorpe Concrete Well Co. and located 40 ft. southeast of the pumping station and 95 ft. east of the well constructed in 1943. The well was cased with 30-in. id. by 40-in. od. solid concrete pipe from 2 ft. above to 10 ft. below ground level and with the same size porous concrete pipe screen from 10 to 38 ft. A concrete baee of 15-in. thickness was placed in the bottom of the screen.

On Apr. 29, 1948, the water level was 10 1/2 ft. below the top of the casing. The Fairbanks-Morse centrifugal pumps installed for the other well are to be connected to the suction pipe in this well.

Correlated driller's log of well drilled in 1902 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Dirt and clay	7	7
Pennsylvanian system		
Shale	142	149
Shale and stone	15	164
Shale	14	178
Shale and sandstone	34	212
Mississippian system		
Osage group		
Warsaw formation		
Shale	68	280
Keokuk-Burlington formations		
Limestone	224	504
Kinderhook group		
Shale	211	715
Devonian and Silurian systems		
Limestone	45	760
Ordovician system		
Maquoketa formation		
Shale	190	950
Galena-Platteville formations		
Limestone	56	1006
Shale (probably limestone)	118	1124
Limestone	121	1245
St. Peter formation		
Sandstone	265	1510

LABORATORY NO. 114,068

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	5.0		Silica	SiO_2	15.7	
Manganese	Mn	0.2		Fluoride	F	0.2	
Calcium	Ca	90.3	4.52	Chloride	Cl	5.0	0.14
Magnesium	Mg	32.7	2.69	Nitrate	NO_3	4.0	0.06
Ammonium	NH_4	0.7	0.04	Sulfate	SO_4	25.5	0.53
Sodium	Na	10.1	0.44	Alkalinity	(as $CaCO_3$)	348.	6.96
Turbidity		38		Hardness	(as $CaCO_3$)	361.	7.21
Color		0		Residue		382.	
Odor		Tr.					
Temperature		56° F.					

RUTLAND
La Salle County
June 13, 1947

A public water supply was installed by the village of Rutland (462) in Feb. 1941.

At that time a well was drilled by Daniel Schmidt, Mendota, and located 75 ft. north of the center line of Broad St. and midway between High and Pleasant St. (or approximately 75 ft. N. and 650 ft. E. of the S. W. corner of Section 7, T. 29 N., R. 2 E.).

The well is 54 ft. deep below a ground surface elevation of 704± ft., and is cased with 47 ft. of 8-in. pipe, below which is 8 ft. of 7 1/2-in. od. Cook screen with No. 40 slot openings. The top of the casing is 1 ft. above ground.

Water is pumped by 6-in., 4-stage American Well Works pump, No. 64586, rated at 35 gpm. against 64-ft. head at 1740 rpm. Power is furnished by a 1.5-hp. U. S. electric motor.

A production test was made on Feb. 21, 1941 by the State Water Survey. The non-pumping water level was 16 ft. below the top of the casing, and the drawdown was 12 ft. when pumping at a rate of 36 gpm. for 4 hr. At the time of the test, the well had not been fully developed.

Before this well was drilled, a resistivity survey was made in 1940, and a test well was drilled in 1940. The present well was drilled 5 ft. east of the test well.

Analysis of a sample (Lab. No. 110,651) collected June 13, 1947 from a tap in the pump house after pumping 30 min. showed the water from this well to have a hardness of 40.0 gr. per gal., a residue of 1255 ppm., and an iron content of 0.4 ppm.

An aerator and softener are installed but were not in operation when the sample was collected.

Pumpage is estimated at 6000 gpd.

LABORATORY NO. 110,651

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.4		Silica	SiO_2	19.6	
Manganese	Mn	0.1		Fluoride	F	0.9	
Calcium	Ca	179.7	8.99	Chloride	Cl	20.0	0.56
Magnesium	Mg	58.5	4.81	Nitrate	NO_3	5.5	0.09
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	729.0	15.17
Sodium	Na	131.1	5.70	Alkalinity (as $CaCO_3$)		184.	3.68
Color		0		Hardness (as $CaCO_3$)		690.	13.80
Odor		0		Residue		1255.	
Turbidity		10+		Temperature 56° F.			

A public water system for the village of St. Anne (1131) was installed by Mead & Co., Chicago, in 1898, and was operated by them until 1909. From 1909 to 1912, W. E. Daniels Co., Chicago, owned and operated the system. The Public Service Co. of Northern Illinois purchased the system in 1912 and operated it until 1923. A new water works was built and put into operation by the village in 1923.

Water was originally obtained from a well drilled in 1898 to a depth of 210 ft. and located 1/2 block west of Chicago Ave. on Grant St. (or approximately 1800 ft. N. and 200 ft. W. of the S.E. corner of Section4,T. 29 N., R. 12 W.). This well was cased with 6-in. pipe to a depth of about 100 ft. where limestone was entered. The surface elevation is 660± ft.

The non-pumping water level in 1915 was reported to be 60 ft. below the ground surface, and in Nov. 1921 it was reported to be 30 ft.

. Analysis of a sample (Lab. No. 30628), collected June 5, 1915, showed the water to have a hardness of 30.6 gr. per gal., a residue of 809 ppm., and an iron content of 2.6 ppm.

This well was filled and plugged shortly after a new well was placed in service.

The village commenced operation of the new waterworks in 1923. Water is obtained from a well, known as Well No. 1, drilled about 1919 to a depth of 257 ft. by Guy W. Peterson, Madison, Wis. The well is located about 50 ft. north of Guerten St. and 300 ft. east of Dixie Highway (or approximately 50 ft. N. and 2150 ft. W. of the S. E. corner of Section 4).

Correlated driller's log of Well No. 1 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Glacial drift	99	99
Silurian system		
Niagaran - Alexandrian series		
Limestone	158	257

The well is 10 in. in diameter and the ground surface elevation is 675± ft.

It was reported that the well produced 200 gpm. with a drawdown of 15 ft. below a non-pumping water level of 59 ft.

In Aug. 1947 the following pump installation was made and is now in service: 100 ft. of 5-in. column pipe; 8-in., 8-stage Pomona turbine pump, No. H 276, rated at 240 gpm., against a head of 180 ft.; 10 ft. of 5-in. suction pipe; 20-hp. Westinghouse electric motor.

In Aug. 1947 the distance to water was 57 ft. below the pump base, after the well had been idle 30 hr. Following the installation of the new turbine a drawdown of 16 ft. was reported when pumping at 285 gpm.

Analysis of a sample (Lab. No. 112,697), collected Nov. 26, 1947 after 20-min. pumping at 285 gpm. showed this water to have a hardness of 24.7 gr. per gal., a residue of 659 ppm., and an iron content of 1.8 ppm.

Well No. 2 was drilled in 1929 to a depth of 265 ft. by W. L. Thorne Co., Des Plaines, and is located about 150 ft. west of Well No. 1. The well is cased to rock with 94 ft. of 10-in. pipe.

The following pump installation, originally installed in 1929 and overhauled in 1937, is in service: 100 ft. of 6-in. column pipe; 8-in., 9-stage Pomona turbine pump, No. G575, rated at 300 gpm.; 40-ft. of 5-in. suction pipe; 40-hp. Westinghouse electric motor.

The pump is operated simultaneously with Well No. 1.

It was reported in 1937 that when pumping at a rate of 300 gpm., the drawdown was 16 ft. below a non-pumping water level of 57 ft.

Analysis of a sample (Lab. No. 82391), collected Nov. 17, 1937, showed the water to have a hardness of 21.6 gr. per gal., a residue of 542 ppm., and an iron content of 1.32 ppm.

Metered pumpage in Nov. 1947 averaged 85,000 gpd.

LABORATORY NO. 112,697

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.8		Silica	SiO_2	15.3	
Manganese	Mn	0.0		Fluoride	F	0.3	
Calcium	Ca	100.6	5.03	Chloride	Cl	5.0	0.14
Magnesium	Mg	41.8	3.43	Nitrate	NO_3	4.2	0.07
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	280.8	5.84
Sodium	Na	45.7	1.99	Alkalinity (as $CaCO_3$)		220.	4.40
Turbidity		10.		Hardness (as $CaCO_3$)		423.	8.46
Color		0		Residue		659.	
Odor		0		Free CO_2 (calc.)		28.	
Temperature 53.5° F.				pH = 7.3			

ST. CHARLES
Kane County
June 11, 1949

The system of water works was originally installed by the city of St. Charles (5870) in 1907.

Water was first obtained from a well drilled to a depth of 350 ft. which was located about 5 ft. north of the south line of Cedar Ave. and 15 ft. west of First Ave. North (approximately 500 ft. N. and 2100 ft. E. of the S. W. corner of Section 27, T. 40 N., R. 8 E.). The elevation of the ground surface is 695± ft. This well was reported 8 in. in diameter and cased to bedrock. A production of 120 gpm. was reported in Aug. 1914 when pumping with a plunger pump having a cylinder setting of 60 ft. The pump was frequently operated 24 hr. a day. The non-pumping water level was within 6 to 8 ft. of the top.

The well was infrequently used after 1919 and was abandoned about 1936. It has been filled with puddled clay and was capped and sealed with concrete.

Well No. 2 was drilled in 1911 and located at the southwest corner of Fourth and Pearl Ave. about 100 ft. north of the Chicago Great Western Railway (approximately 1450 ft. N. and 2300 ft. E. of the S. W. corner of Section 27). The elevation of the ground surface is 748t ft. The well was drilled to a depth of 850 ft. and the diameter at the surface was 10 in. and the 'bottom diameter about 8 in. Shortly after its completion, it was reported to produce 160 gpm. with a drawdown of 80 ft. from a non-pumping water level of 25 ft. below the surface.

The well was seldom used after 1919 untilit was repaired by W. L. Thorne Co., Des Plaines, in 1931. Following the repairs the well was equipped with a Pomona turbine pump rated at 400 gpm. against a head of 338 ft., and set at 250 ft. The non-pumping water level at that time was 55 ft. below the ground surface. When the pump was operated at 395 gpm. the drawdown was below the 250-ft. air line and the pump discharged air. When pumping was reduced to 350 gpm. the water level was 211 ft. below the pump base but the pump still discharged air. The well was used as an auxiliary supply unit until 1937, and was infrequently operated until 1941 when its use was discontinued. By that time the productive capacity of the well had decreased to 100 gpm. It is still equipped with the same pumping unit installed in 1931.

Well No. 3 was drilled in 1919 and located on the east bank of Fox River about 25 ft. south of Cedar St. and 100 ft. west of First Ave. North (approximately 450 ft. N. and 2000 ft. E. of the S. W. corner of Section 27). The elevation of the pump base is 690.3 ft. The well was drilled to a depth of 2198 ft. by F. M. Gray, Jr., Chicago.

Hole Record

20-in.	from	0 to	200 ft.
15-in.	from	200 to	475 ft.
12-in.	from	475 to	489 ft.
10-in.	from	489 to	865 ft.
8-in.	from	865 to	2198 ft.

Casing and Liner Record

20-in.	from	0 to	10 ft.
12-in.	from	0 to	243 ft.
10-in.	from	243 to	489 ft.
8-in.	from	830 to	950 ft.

Upon completion of the well, the water level was 14 ft. below the pump base after a 48-hr. idle period, and when pumping at 555 gpm. the water level was below the 104-ft. air line.

In the summer of 1946, when pumping at 600 gpm. water levels were below the 200-ft. air line. At that time unsuccessful attempts were made to raise the pump so that additional column pipe could be added. The well was continued in service until Feb. 27, 1947 when the pump stopped. About 2000 gal. of 28% hydrochloric acid were required to free the pump column from the 12-in. id. casing before the pump could be pulled for repairs. The pump assembly was reinstalled on Mar. 6, 1947 with 224 ft. of column pipe and 224 ft. of 1/4-in. iron pipe air line.

A 5 1/2-hr. production test was made on Mar. 9, 1947. After 3-hr. pumping at 550 gpm. (maximum pump capacity) the drawdown was 47 ft. from a non-pumping water level of 127 ft. below the pump base. The pumping rate was then reduced to 495 gpm. and after an additional '2 1/2 hr., when Well No. 4 was in operation, the drawdown was 43 1/2 ft.

The following pump installation was made in June 1947: 250 ft. of 7-in. Toncan iron column pipe; 10-in., 11-stage (all bronze bowls) American Well Works turbine pump, No. 61213, rated at 750 gpm. against 250 ft. of head; 10 ft. of 8-in. suction pipe; 250 ft. of 1/4-in. brass tubing air line; 75-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 111,561) collected Aug. 15, 1947 after 1 hr. 40-min. pumping at 850 gpm., showed this water to have a hardness of 17.0 gr. per gal., a residue of 469 ppm.,

and an iron content of 0.4 ppm. The chloride content indicates the presence of some water from the bottom 500 ft. of the well.

Daily pumping operations are alternated with Well No. 4.

Well No. 4 was completed in Oct. 1936 to a depth of 2200 ft. by the Varner Well Drilling Co. Inc., Dubuque, Iowa, and located on the east bank of Fox River about 100 ft. north of State St. and 210 ft. west of Cedar Ave. (approximately 950 ft. N. and 1900 ft. E. of the S. W. corner of Section 27). The elevation of the pump base is 691.6 ft.

Hole Record

24-in. from 0 to 55 ft.
22-in. from 55 to 400 ft.
15-in. from 400 to 1046 ft.
12-in. from 1046 to 2200 ft.

Casing and Liner Record

24-in. from 0 to 10 ft.
15 1/2-in. from 0 to 400 ft.
12-in. from 917 1/2 to 1046 ft.

The annular space outside of the 15 1/2-in. casing was filled with clay from 0 to 10 ft. and cement from 10 to 400 ft.

The well was "shot" at depths of 2160, 2100, and 1980 ft. Upon completion of the well the production was reported to be 1000 gpm. with a drawdown of 145 ft. from a non-pumping water level of 90 ft. below the top of casing.

The existing pump installation, made in 1936, is 240 ft. of 10-in. column pipe; 12-in., 7-stage Deming turbine pump, Figure 4700, having a rated capacity of 1000 gpm. against 250 ft. of head; the overall length of the pump is 6 ft. 10 in.; 30 ft. of 8-in. suction pipe; 250 ft. of air line, (defective); 100-hp. U. S. electric motor. Daily pumping operations are alternated with Well No. 3.

Metered pumpage from both wells for the years 1945 and 1946 averaged 458,970 gpd.

For the year 1946, industrial pumpage from limestone wells in the St. Charles area, averaged 200,000 gpd. and pumpage from sandstone wells averaged 610,000 gpd.

Well No. 5 was completed in Dec. 1947 at a depth of 2226 ft. by Varner and is located about 55 ft. north of Bowman St. and 65 ft. west of Third St. (approximately 2050 ft. S. and 1500 ft. E. of the N. W. corner of Section 34). The elevation of the ground surface is 760± ft. The water level was 190 ft. below top of casing.

Hole Record

30-in. from 0 to 295 ft.
24-in. from 295 to 315 ft.
23 1/2-in. from 315 to 1232 ft.
20-in. from 1232 to 2226 ft.

Casing Record

30-in. from 0 to 68 ft. 4 in.
24-in. from 0 to 296 ft.
The annular space between the casings was filled with cement.

After completion 4 charges of 400 lb. each were set off at 2020, 1855, 1280 and 1235 ft. depths.

The pumping equipment consists of 350 ft. of 10-in. gwi. column pipe; 14-in., 13-stage Aurora Pump Co. water lubricated turbine pump designed for 1200 gpm. at 360 ft. head; 350 ft. of 1/4-in. air line; 10 ft. of 10-in. suction pipe with strainer; 150-hp. electric motor rated at 1150 rpm.

LABORATORY NO. 111,561

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.4		Silica	SiO_2	14.1	
Manganese	Mn	0.0		Fluoride	F	1.1	
Calcium	Ca	74.3	3.72	Chloride	Cl	108.0	3.05
Magnesium	Mg	25.8	2.12	Nitrate	NO_3	2.4	0.04
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	30.9	0.64
Sodium	Na	63.5	2.76	Alkalinity (as $CaCO_3$)		244.	4.88
Turbidity		Tr.		Hardness (as $CaCO_3$)		292.	5.84
Color		0		Residue		469.	
Odor		0		Temperature 59.5° F.			

Sample-study log of Well No. 4 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Silurian system		
Niagaran-Alexandrian dolomites	65	65
Ordovician system		
Maquoketa shale and dolomite	155	220
Galena-Platteville dolomites	345	565
Glenwood sandstone and dolomite	65	630
St. Peter formation		
Sandstone	300	930
Conglomerate of sandstone, chert, shale, and dolomite	100	1030
Cambrian system		
Franconia sandstone and dolomite, some shale	55	1085
Galesville sandstone		
Sandstone, partly dolomitic	60	1145
Sandstone, incoherent	65	1210
Sandstone, partly dolomitic	45	1255
Eau Claire shale and dolomite, some sandstone	390	1645
Cambrian and Pre-Cambrian systems		
Mt. Simon and Fond du Lac sandstones	555	2200

The city of St. Francisville (1145) installed a public water supply in 1928.

Water is obtained from 2 wells drilled in 1928 by Enoch Potts, St. Francisville.

The South Well is located about 300 ft. north of Fairview Road and 450 ft. west of 13th St. (or approximately 2200 ft. S. and 1500 ft. W. of the N. E. corner of Section 20, T. 2 N., R. 11 W.). The well is 134 ft. deep below a ground surface elevation of 440± ft.

Correlated driller's log of the South Well furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Top soil	10	10
Mud and quicksand	23	33
Pennsylvanian system		
Brown sandstone	27	60
White sandstone	74	134

The hole and casing record is as follows:

Hole Record

10-in. from surface to 60 ft.
8-in. from 60 to 134 ft.

Casing Record

10-in. drive pipe from surface to 35 ft.
8-in. casing from surface to 60 ft.

It is reported that when "shooting" the well after it was drilled, the original 8-in. casing was blown out of the well, and was later replaced with 8-in. casing from the surface to 80 ft.

When the well was completed, it was reported that the non-pumping water level was 18 ft. below the surface, and that the well yielded 125 gpm. A pumping rate of 200 gpm. lowered the water level below the bottom of the suction pipe, which was reported to be near the bottom of the well.

The pumping equipment consists of an A. D. Cook double-acting plunger pump, Size 7 1/2 PH No. 2628, attached to 6-in. drop pipe, with a 5 3/4-in. diameter cylinder set near the bottom of the well. The pump has a 14-in. stroke and is operated at a speed of 24 spm. by a 7 1/2-hp. General Electric motor.

The pump is operated for an average period of 5 hr. daily and discharges an estimated 65 gpm.

Analysis of a sample (Lab. No. 114,430) collected Apr. 26, 1948. after 3 1/4-hr. pumping at 65 gpm. showed the water to have a hardness of 16.1 gr. per gal., a residue of 324 ppm. and an iron content of 0.2 ppm.

The North Well is located 100 ft. north and 25 ft. east of the South Well. This well is the same depth and the same construction as the South Well, and has always yielded some sand with the water.

The well is equipped with an A. D. Cook single stroke pump, No. 2567-IE, attached to 6-in. drop pipe and having a 4 1/2-in. diameter cylinder set near the bottom of the well. The pump has a 12-in. stroke and is operated at a speed of 26 spm. by a 10-hp. General Electric motor.

The pump is operated for an average period of 5 hr. daily and discharges at an estimated rate of 20 gpm. The pump was operated continuously for 60 hr.in Aug. 1947 and did not break suction.

Analysis of a sample (Lab. No. 114,431) collected Apr. 26, 1948 after 4 1/2-hr. pumping at 20 gpm. showed this water to have a hardness of 13.3 gr. per gal., a mineral content of 264 ppm. and an iron content of 0.1 ppm.

Pumpage is estimated to average 25,000 gpd.

LABORATORY NO. 114,430

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	27.4	
Manganese	Mn	0.4		Fluoride	F	0.2	
Calcium	Ca	80.3	4.02	Chloride	Cl	10.0	0.28
Magnesium	Mg	18.2	1.50	Nitrate	NO_3	2.3	0.04
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	33.5	0.70
Sodium	Na	5.1	0.22	Alkalinity (as $CaCO_3$)		236.	4.72
Turbidity		Tr.		Hardness (as $CaCO_3$)		276.	5.52
Color		0		Residue		324.	
Odor		0		Free CO_2 (calc.)		18.	
Temperature 58° F.				pH = 7.5			

ST. JOSEPH
Champaign County
Dec. 14, 1948

A public water supply was installed in 1940 by the village of St. Joseph (810).

Well No. 1 was drilled in 1940 to a depth of 76 ft. by Hayes and Sims, Champaign and located 40 ft. east of Second St. and 40 ft. north of the New York Central R. R. right-of-way (or approximately 360 ft. S. and 1420 ft. E. of the N. W. corner of Section 14, T. 19 N., R. 10 E.). The elevation of the ground surface at the well-site is 670t ft. A stratum of sand was encountered at a depth of 60 to 76 ft.

The well was of the gravel-pack filter type and cased with 1 6-in. pipe from the ground surface to 61 ft. and with 8-in. pipe from 2 ft. above to 63 ft. 4 in. below the surface. Below the 8-in. casing was 12 ft. 9 1/4 in. of 8-in. Johnson red brass screen, having No. 70 slot openings. The annular space between the casings and outside the screen was packed with gravel.

The pumping assembly, installed in 1940, consists of 50 ft. of 4 1/2-in. column pipe; 7-in., 3-stage American Well Works turbine pump, No. 63839, rated at 125 gpm. against 61 ft. of head at 1720 rpm.; the overall length of the pump is 2 1/2 ft.; 60 ft. of air line; 20 ft. of 5-in. suction pipe; 3-hp. General Electric motor, No. 5516427.

A production test was made by the State Water Survey on Sept. 20, 1940. The static water level was 13.0 ft. below the pump base (3 ft. above ground level) and after 10-minutes pumping at 125 gpm. the drawdown was 27 1/2 ft. On Feb. 4, 1946, the production was 84 gpm. with a drawdown of 47 ft., a decline in specific capacity of 2.7 gpm. per ft. of drawdown since Sept. 1940.

On Feb. 26, 1946 a chemical treatment of 500 gal. of 15% hydrochloric acid was applied to the well over a period of 3 hr. On Mar. 1, 1946 the production rate was 109 gpm. with a drawdown of 38 ft. from a non-pumping water level of 11 ft. One month later the production rate was reported to be 94.1 gpm. with a drawdown of 41 1/2 ft. On Dec. 9, 1947, the production rate was 47.8 gpm. and after a treatment with 50 lb. of Calgon and 15-lb. high test hypochlorite, the production rate was 56 1/2 gpm. The chemical treatments were supervised by Wilson and Anderson, Engineers, Champaign.

Well No. 1 is not in regular service. On Sept. 1, 1948 the yield rate had decreased to 16 gpm. On Nov. 11, 1948, a chemical treatment of 50 lb. of Calgon, 15 lb. of HTH and 10 lb. of sal soda was applied to the well and remained there for one week. The yield of the well was afterwards estimated to be 45 gpm. On Dec. 14, 1948 the non-pumping water level was 26 ft. below the pump base.

Analysis of a sample (Lab. No. 112,890) collected Dec. 15, 1947, after 15 1/2-hr. pumping at 56 1/2 gpm., showed this water to have a hardness of 18 gr. per gal., a mineral content of 3 72 ppm., and an iron content of 0.8 ppm.

In order to augment the water supply, 5 test holes were drilled in May 1948 by Hayes and Sims, following which Well No. 2 was constructed to a depth of 72 1/2 ft. and located 170 ft. south and 520 ft. west of Well No. 1, at the northeast intersection of Elm St. and the New York Central R. R. right-of-way. The well was of the gravel-pack filter type and cased with 16-in. od. pipe from 2 ft. above to 61 ft. below ground level and 8-in. pipe from 2 ft. above to 60 1/2 ft. below gound level. Below the 8-in. casing was 12 ft. 10 in. of 8-in. Johnson Everdur screen having an exposed length of 12 ft. and No. 60 slot openings. The bottom of the screen was set at 72 1/2 ft. below ground level. The annular space between the casings and outside the screen was packed with about 7 cu. yd. of gravel.

A production test was made by the State Water Survey on June 14, 1948. For test purposes the pumping equipment consisted of an 8-in., 8-stage Pomona turbine pump, with the bottom of the bowls at a depth of 62 ft. 4 in.; 55 ft. of 1/4-in. air line; no suction pipe. Before the test the static water level was 10.9 ft. below the top of the 8-in. casing. The pump was operated for two hours at full capacity. After an hour's shutdown, the water level had returned to 1.5 ft. below the static level. During the test the following pumping rates and drawdowns were observed:

Pumping Time hr.	Pumping Rate gpm.	Drawdown ft.
1	65	17.5
1	103	26.5
2	153	40.0
1	187	43.5

Forty minutes after shutdown the water level was 13.9 ft., or 3 ft. below the starting level. On the following morning, the static level was 10.9 ft.

On Dec. 14, 1948, after 20-minute pumping at 120 gpm. the water level was 49 ft. below the pump

base. After a 15-minute shutdown the water level was 23 ft.

The pumping equipment, installed Aug. 18, 1948 includes a 6-in. Aurora turbine pump, No. 39812, rated at 100 gpm. against 70 ft. of head; 60 ft. of 1/4-in. gi. air line; 3-hp., U. S. electric motor. The pump discharges at a rate of 120 gpm. over the aerator at Well No. 1.

Analysis of a sample (Lab. No. 116,713) collected Dec. 14, 1948 after 20-minute pumping at 120 gpm., showed this water to have a hardness of 18.9 gr. per gal., a residue of 388 ppm., and an iron content of 2.0 ppm.

The water is aerated and filtered. Analysis of a sample (Lab. No. 116,714) collected Dec. 14, 1948 showed the treated water to have a hardness of 18.9 gr. per gal., a mineral content of 362 ppm., and an iron content of 0.1 ppm.

From Jan. 1, 1948 to Dec. 14, 1948 metered pumpage averaged 33,245 gpd.

LABORATORY NO. 116,713

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.0		Silica	SiO_2	29.3	
Manganese	Mn	Tr.		Fluoride	F	0.2	
Calcium	Ca	78.5	3.93	Chloride	Cl	4.0	0.11
Magnesium	Mg	31.1	2.56	Nitrate	NO_3	0.6	0.01
Ammonium	NH_4	1.8	0.10	Sulfate	SO_4	1.0	0.02
Sodium	Na	22.8	0.99	Alkalinity	(as $CaCO_3$)	372.	7.44
Turbidity		11		Hardness	(as $CaCO_3$)	325.	6.49
Color		0		Residue		388.	
Odor		0		Free CO_2 (calc.)		76.	
Temperature		54.5° F.		pH = 7.1			

SANDWICH
DeKalb County
Oct. 14, 1947

A public water supply was installed by the city of Sandwich (2608) in 1884.

The initial supply was obtained from two 8-in. wells spaced about 2 1/2 ft. apart and located south of the Chicago. Burlington and Quincy R. R. near the northwest corner of Railroad and East St. (approximately 50 ft. S. and 1100 ft. E. of the N. E. corner of Section 36, T. 37 N., R. 5 E.). Each well was drilled to a depth of 120 ft. below the bottom of a 10-ft. diameter brick masonry storage reservoir 30 ft. deep with a sand bottom. These wells penetrated a coarse stratum of sand and gravel and overflowed the 8-in. casings about 26 ft. above the bottom of the reservoir. The flow was sufficient to supply a public demand of about 100,000 gpd. until about 1910 when their production suddenly decreased and pumping be - came necessary. The wells continued to furnish the entire public supply until another well was placed in service in 1912. They were maintained as a standby until about 1931 but are now abandoned and partially filled with clay and black earth.

A well, now called No. 1, was drilled to a depth of 600 ft. by the J. P. Miller Artesian Well Co., Brookfield, in 1911 and located about 40 ft. north of Railroad St. and 140 ft. West of East St. (approximately 65 ft. S. and 1050 ft. E. of the N. W. corner of Section36). The elevation of the ground surface is 667t ft. and the pump base is about 6 ft. below ground level.

The well is reported cased with 12-in. pipe to a depth of 139 ft. below which it has a diameter of 12 in. to the bottom. When completed the standing water level was about 17 ft. below the surface and a production of 275 gpm. was reported.

Pumping, at first, was by suction lift. The top of the well was in a pit and the suction pipe was about 10 ft. below the ground surface. On Apr. 7, 1921 the non-pumping water level was 12 ft. 9 in. below the center of the suction pipe and when pumping at 280 gpm. the drawdown was 5 ft. 1 in.

In Oct. 1925 the well was equipped with a turbine pump set in the pit with about 64 ft. of column pipe and 30 ft. of 8-in. suction pipe attached. At the time the pumping rate was 75 to 100 gpm.

The existing pump installation, made in 1939, is: 72 ft. of 8-in. column pipe; 12-in., 4-stage American Well Works turbine pump, No. 45629, having a rated capacity of 800 gpm. against 92 ft. of head; 60-hp. Westinghouse electric motor. There is no record of a suction pipe or an air line.

The operation of this well is alternated with Well No. 2.

Analysis of a sample (Lab. No. 112,145) collected Oct. 7, 1947 from a tap in the pump house 20 ft. from the pump discharge after 8-min. pumping at 750 gpm. showed this water to have a hardness of 23.4 gr. per gal., a residue of 43 7 ppm., and an iron content of 1.3 ppm.

Well No. 2, was added to the public supply in 1939 and located about 15 ft. north and 40 ft. west of Well No. 1. This well was drilled to a depth of 600 ft. by Joseph Egerer, Milwaukee.

Sample-study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Glacial till	20	20
Sand, pebbly	80	100
Gravel, sandy, silty	30	130
Cambrian system		
Trempealeau dolomite	140	270
Franconia sandstone, dolomite and shale	130	400
Galesville sandstone, partly dolomitic 400 to 485 ft.	185	585
Eau Claire shale, sandstone, and dolomite	15	600

Hole Record

12-in. from 156 to 395 ft.
10-in. from 395 to 600 ft.

Casing Record

12 1/2-in. from 0 to 156 ft.
10-in. from 301 to 396 ft.

Upon the completion of the well a production test was made on Jan. 24 and 25, 1939. Pumping was at a rate of 730 gpm. for the first 2 hr. and the drawdown was 44 ft. from a non-pumping water level of 20 ft. below the top'of the casing. The rate of pumping decreased to 700 gpm. but the drawdown remained constant throughout the remaining period of the test.

The existing pump installation, made in 1939. is: 90 ft. of 8-in. flanged column pipe; 12-in., 2-stage Peerless turbine pump No. 8548 rated at a capacity of 750 gpm. against 90 ft. of head; the overall length of the pump is 3 ft.; 10 ft. of 8-in. suction pipe and strainer; 90 ft. of 1/4-in. copper tubing air line; 30-hp. U. S. electric motor. The operation of this pumping unit is alternated with Well No. 1.

On Oct. 7, 1949 a non-pumping water level of 25 ft. below the pump base was reported (pump base is 1 1/2 ft. above ground leve1 aud 7 1/2 ft. above Well No. 1 pump base). Well No. 2 had been idle all day and Well no. 1 about 15 rnin. When pumping was resumed at Well No. 1, a drawdown of 8 ft. in 2 min. and 9 ft. in 5 rnin. was observed in Well No. 2. Complete recovery was made after Well No. 1 had been idle about one minute.

The water is treated for iron removal, softened and chlorinated.

From Jan. 1, 1946 to Oct. 1, 1947 the average metered pumpage was 300,000 gpd. which varied from an average winter minimum of 269,400 gpd. to an average summer maximum of 361,000 gpd.

LABORATORY NO. 112,145

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.3		Silica	SiO_2	22.6	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	89.8	4.49	Chloride	Cl	11.0	0.31
Magnesium	Mg	42.9	3.52	Nitrate	NO_3	0.3	Tr.
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	51.4	1.07
Sodium	Na	0.2	0.01	Alkalinity (as $CaCO_3$)		332.	6.64
Turbidity		10		Hardness (as $CaCO_3$)		401.	8.01
Color		0		Residue		437.	
Odor		0		Free CO_2 (calc.)		43.	
Temperature 52.9° F.				pH = 7.3			

SAN JOSE
Mason County
Feb. 11, 1948

A public water supply was installed by the village of San Jose (520) about 1884.

At that time a well was drilled and located at the pumping station south of Arch St. and west of Second St. (or approximately 500 ft. S. and 500 ft. W. of the N. E. corner of Section 1, T. 21 N., R. 5 W.). At first water was pumped by a wind mill. In 1911 the well was deepened to 105 ft. and cased with 85 ft. of 4-in. pipe below which a 20-ft. length of Cook strainer was placed. The cylinder was wedged in the casing at a depth of 85 ft.

In 1915 the non-pumping water level was 80 ft. below the pump base elevation of 598± ft. The well was abandoned about 1921.

In 1917 a second well, now called South Well, was drilled to a depth of 101 ft. by H. B. Smith, San Jose, and was located 20 ft. from the first well. In 1934 the well was cleaned and the original 6-in. casing was replaced by 97 ft. of new 6-in. casing, and a new 6-ft. length of screen having No. 10 slot openings. The pumping equipment consists of 6-in. single-acting Cook cylinder pump, with 24-in. stroke and set at 97 ft. belt-connected to a 10-hp., 360-rpm. Fairbanks-Morse gasoline engine. The cylinder is wedged in the casing at the top of the screen. The casing serves as a column pipe.

In July 1938 the non-pumping water level was reported to be 70 ft. below the surface.

In 1921, a third well, now called North Well, was drilled by H. B. Smith, and located 11 ft. northeast of the South Well. The well is now 103 ft. deep and is cased with 95 ft. of 6-in. pipe below which is 8 ft. of Cook screen, having No. 10 slot openings. The pumping equipment consists of 6-in. single-acting Cook cylinder pump with 24-in. stroke and operated at 30 spm.; 10-hp. Crocker Wheeler electric motor. The cylinder was reported to be wedged in the casing just above the screen.

The South and North Wells are cleaned and recased about every 12 yr. Water levels can be measured only when pumps are removed. Last water level measurement was 70 ft.

The pumps in both wells are operated simultaneously at rates of about 60 gpm. per pump.

Analysis of a composite sample (Lab. No. 113,465), collected Feb. 11, 1948, showed the water from both wells to have a hardness of 24.5 gr. per gal., a residue of 505 ppm., and an iron content of 0.8 ppm.

Pumpage is estimated to average 25,000 gpd.

LABORATORY NO. 113,465

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.8		Silica	SiO_2	21.8	
Manganese	Mn	0.1		Fluoride	F	0.1	
Calcium	Ca	100.0	5.00	Chloride	Cl	21.0	0.59
Magnesium	Mg	41.3	3.39	Nitrate	NO_3	34.6	0.56
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	96.1	2.00
Sodium	Na	6.4	0.28	Alkalinity (as $CaCO_4$)		276.	5.52
Turbidity		Tr.		Hardness (as $CaCO_3$)		420.	8.39
Color		0		Residue		505.	
Odor		Tr.					

SAUNEMIN
Livingston County
May 5, 1947

A public water supply was installed by the village of Saunemin (341) in 1926.

A well, North Well, was drilled in the village park in the northern part of the town (or approximately 1700 ft. N. and 1840 ft. W. of the S.E. corner of Section 15, T. 28 N., R. 7 E.).

The well was drilled by R.H. Kersey, South Bend, Indiana, to a depth of 584 ft. below a ground surface elevation of 684t ft.

Sample-study log of the North Well furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Clay, yellow"	205	205
Pennsylvanian system		
Shale, thin beds of limestone, sandstone, siltstone and coal	180	385
Silurian system		
Niagaran - Alexandrian series		
Dolomite, shaley	70	455
Dolomite	86	541
Dolomite, shaley, some shale	43	584

On July 26, 1926 the water level was 118 ft.; and after pumping several hours at 20. gpm., the drawdown was 49 ft. On Aug. 7, 1945 the non-pumping water level was 145 ft., and it was estimated that the production was 15 gpm.

The well was cased with 10-in. pipe from the surface to 253 ft. and with 8-in. pipe from 253 to 400 ft. The hole was 10 in. in diameter from the surface to near the bottom of the 8-in. casing. A 3 1/2-in. Meyers piston pump is attached to 296 ft. of 4-in. steel column pipe with 20 ft. of 4-in. suction pipe below the pump. Power is furnished by a 3-hp. electric motor. The cylinder and column pipe replaced old equipment in 1945. The pumping rate is about 8 strokes per min.,or 7 1/2 gpm. The pump operates 24 hr. daily.

Analysis of a sample (Lab. No. 110,181), collected May 5, 1947 after pumping at least 24 hr., showed the water from the North Well to have a hardness of 1.8 gr. per gal., a residue of 2526 ppm., and an iron content of 2.2 ppm.

In Apr. 1945 a new well, South Well, was drilled at the east end of Center St., about 3 blocks south of the old well (or approximately 390 ft. N. and 1600 ft. W. of the S.E. corner of Section 15).

The well was drilled by Ira French, Fairbury, to a depth of 198 ft. and cased with 8-in. pipe from the surface to 178 ft.

The pumping installation includes an A.D. Cook deep-well 2 1/4-in. cylinder pump, No. 1159, operating at a rate of 6 gpm. The pump is belt-connected to a 3-hp. Master Electric motor. The pump setting is not known.

When the well was completed, the water level was reported to be 20 ft. below the ground surface. When pumping at 15 gpm. or less, a steady flow was, produced; but when exceeding a rate of 15 gpm., the pump would break suction.

Analysis of a sample (Lab. No. 110,182), collected May 5, 1947 after pumping at least 24 hr., showed the water from the South Well to have a hardness of 5.7 gr. per gal., a residue of 474 ppm., and an iron content of 1.2 ppm.

The water is not treated.

Pumpage is estimated at 18,000 gpd. Occasionally the storage tank is filled, and the pumps canbe shut down, but generally both pumps operate 24 hr. daily.

LABORATORY NO. 110,181

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.2		Silica	SiO_2	11.3	
Manganese	Mn	0.0		Fluoride	F	6.0	
Calcium	Ca	9.9	.50	Chloride	Cl	1020.0	28.76
Magnesium	Mg	1.3	0.11	Nitrate	NO_3	3.3	0.05
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	97.5	2.03
Sodium	Na	982.1	42.70	Alkalinity	(as $CaCO_3$)	624.	12.48
Color		Tr.		Hardness	(as $CaCO_3$)	31.	.62
Odor		0		Residue		2526.	
Turbidity		Tr.					
Temperature		57° F.					

LABORATORY NO. 110,182

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.2		Silica	SiO_2	14.3	
Manganese	Mn	0.0		Chloride	Cl	12.0	.34
Calcium	Ca	20.0	1.00	Nitrate	NO_3	0.7	0.01
Magnesium	Mg	11.7	0.96	Sulfate	SO_4	1.9	.04
Ammonium	NH_4	4.9	.27	Alkalinity	(as $CaCO_3$)	400.	8.00
Sodium	Na	141.7	6.16				
Color		Tr.		Hardness	(as $CaCO_3$)	98.	1.96
Odor		0		Residue		474.	
Turbidity		Tr.					
Temperature		54° F.					

The public water supply was installed by the city of Savanna (4792) in 1886.

Well No. 1 was drilled by J. P. Miller Artesian Well Co., Brookfield, to a depth of 1435 ft. It was located at the foot of Washington St. on the west side of Main St. (or approximately 1560 ft. S.and 210 ft. W. of the N. E. corner of Section 9, T. 24 N., R. 3 E.). The ground surface elevation at that point is 590± ft.

The bore hole was 8 in. in diameter to a depth of 400 ft. and 5 in. in diameter below that depth to the bottom of the well. The well was cased with 6-in. pipe to a depth of 35 ft. into rock. Water flowed into a masonry collecting reservoir, 42 ft. in diameter and about 8 1/2 ft. deep. In 1908 water flowed from the well at a rate of about 500 gpm., and in 1945 the flow was negligible. The well is still connected for reservoir discharge, but has never been equipped with a pump.

Well No. 2 was drilled in 1908 at Murray and Third St., 1708 ft. distant from the collecting well (or approximately 150 ft. S. and 300 ft. W. of the N. E. corner of Section 9). It was drilled to a depth of 1443 ft. below a ground surface elevation of 602± ft.

The well was cased as follows: 10-in. galvanized pipe from 0 to 225 ft.; 8-in. galvanized pipe from 225 to 360 ft.; and 8-in. liner, through shale and marl, from 445 to 527 ft.

Water flowed from this well into the reservoir at the pumping station. The first flow was found during drilling at 600-ft. depth; and after the well was completed in 1908, the flow was reported to be 500 gpm. In the spring of 1945, the well was reported to have a small flow, and at this time the flow is estimated at 75 gpm. The well has never been equipped with a pump.

A man-hole covered with an iron plate, set in the brick pavement, was built around the top of the well. In 1908 the flow from the 2 wells approximated 1,000,000 gpd. In the summer of 1916 the supply from the 2 wells was about 700,000 gpd. which was the approximate demand.

Well No. 3 was drilled in 1917 by C. P. Brant & Co. and is located at the corner of Chicago Ave. and Main St., about 350 ft. southeast of Well No. 1 (or approximately 1850 ft. S. and 70 ft. W. of the N.E. corner of Section 9). It was drilled to a depth of 1852 ft. below a ground surface elevation of 583± ft.

The hole and casing diameter record was reported as follows:

Hole Record

12-in. from 0 to 760 ft.
10-in. from 760 to 880 ft.
8-in. from 880 to 1852 ft.

Casing Record

16-in. pipe from surface to 30 ft. (rock)
12-in. pipe from surface to 80 ft.
8-in. pipe from surface to 880 ft.

Cement was filled in the space between the 16 and 12-in. casings.

The first flow was found at a depth of 375 ft., and the second flow at 910 ft. The flow progressively increased as the drilling reached depths of 1100 and 1800 ft. The pressure at the time of completion was 4 1/2 lb. outside the 8-in. casing and 11 lb. inside the casing, and the rate of flow was 312 gpm., as estimated by filling a 52 gal. barrel in 10 seconds. During the pump-capacity test by Allis-Chalmers Co., in Dec. 1919, the flow from all 3 wells was reported to be 666 gpm., or 959,000 gpd. A comparison of hydrostatic pressures at time each of the 3 wells was completed, is given in Table 1.

TABLE 1

Well	Year Drilled	Hydrostatic Pressure psi.
No. 1	1890	30
No. 2	1908	14
No. 3	1917	11 (inside 8-in. casing) 4 1/2 (outside 8-in. casing)

By 1926 the free flow of the 3 wells did not equal the consumption demand. A booster station was constructed on high ground on North Fourth St. in Jan. 1927. A Worthington No. 2 centrifugal pump, driven by a 20-hp. electric motor, was installed. At the same time, a Worthington No. 8 Axiflo deep-well turbine pump, driven by a 30-hp. electric motor, was installed in Well No. 3, with the bottom of the pump reported to be set at a depth of 100 ft.

In Sept. 1927 a production test of the free flow from the 3 wells was made, followed by another test with the pump in Well No. 3 in operation. The highest free flow from all wells was found to be 407 gpm., with the depth of water in

the reservoir at 2 1/2 to 4 ft. A minimum free-flow rate was measured at 351 gpm. with the depth of water in the reservoir to 6 to 8 ft. It was reported that the free-flow rate from Well No. 3 was increased by a low stage in the reservoir and decreased by a high reservoir stage. When the pump in Well No. 3 was operating, the production from the 3 wells was about 800 gpm., and the production from Well No. 3 alone, while pumping, was about 645 gpm. During the summer of 1927, the production was estimated to be 820,000 gpd. based on an average use of electric power for pumping, of 21 1/4 hr. per day. Well No. 3 has an estimated free flow to the reservoir of about 100 gpm. and is equipped for pumping. In Dec. 1946 the rate of production when pumping was estimated to be 350 gpm.

The following pump installation, made in 1942, is in service: 60 ft. of 6-in. column pipe (plastex coated); 10-in., 2-stage American Well Works turbine pump, No. 66226, rated at a capacity of 325 gpm. against a head of 60 ft.; 60 ft. of air line; 10 ft. of 5-in. suction pipe; 7 1/2-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 104,678) collected Oct. 25, 1945, showed the water to have a hardness of 17.5 gr. per gal., a residue of 300 ppm., and an iron content of 0.8 ppm.

Well No. 4 was drilled in 1935 by C. W. Varner, Dubuque, Iowa, and located at the northeast corner of Pike and Bowen St. about 4100 ft. east of Well No. 3 (or approximately 2500 ft. S. and 1300 ft. W. of the N. E. corner of Section 10). It was drilled to a depth of 1308 1/2 ft. below a ground surface elevation of 610± ft.

During the drilling, water started flowing at a depth of 385 ft. and steadily increased as the drilling progressed. When the well was tested by the State Water Survey in Mar. 1935, static pressure raised the water level 13 ft. 2 in. above the top of the casing, and the free flow rate was 353 gpm. when the center line of the 4-in. discharge pipe was 20 in. above the pump house floor. The flow was 405 gpm. with the center line of the discharge pipe 6 in. above the floor. The drawdown was 29 in. below the top of the casing when pumping at a rate of 500 gpm., and 72 in. when pumping at 600 gpm.

The well is capped and water has always been pumped directly into the distribution system. In Dec. 1946 the rate of production was estimated to be 650 gpm.

The hole and casing diameter record is:

Hole Record

23-in. from surface to 318 ft.
15-in. from 318 to 542 ft.

12-in. from 542 to 1308 1/2 ft.

Casing Record

20-in. steel pipe from surface to 31 ft.
15 1/4-in. wrought iron pipe from surface to 318 ft.
12-in. wrought iron liner from 893 to 975 ft.

The following pump installation, made in Mar. 1946, is in service: 60 ft. of 8-in. column pipe (plastex coated); 12-in., 4-stage American Well Works turbine pump, No. 71617, rated at a capacity of 500 gpm. against 256 ft. of head; 10 ft. of 8-in. suction pipe (plastex coated); 50-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 104,679) collected Oct. 25, 1945 after pumping 3 hr. at 500 gpm., showed the water in Well No. 4 to have a hardness of 17.4 gr. per gal., a residue of 286 ppm., and an iron content of 0.8 ppm.

All water for the public supply has been chlorinated since 1939. A chlorine residual of 0.2 ppm. is maintained at the pump and reservoir.

The average metered pumpage to the public supply for the period from July 1 to Nov. 1, 1946 was 617,210 gpd., which varied from an average of 700,580 gpd. for the month of July to 539,480 gpd. for the month of Oct. A yearly record of metered pumpage available for the period from Jan. 1, 1938 to Jan. 1, 1939 showed an average of 493,540 gpd., and a seasonal variation from an average summer daily of 685,000 gal. to an average winter daily of 309,000 gal.

LABORATORY NO. 104,678

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.8		Silica	SiO_2	11.0	
Manganese	Mn	0.1		Fluoride	F		
Calcium	Ca	56.0	2.80	Chloride	Cl	8.0	.22
Magnesium	Mg	38.6	3.17	Nitrate	NO_3	2.2	.03
Ammonium	NH_4	0.2	.01	Sulfate	SO_4	21.6	.45
Sodium	Na	0.2	.01	Alkalinity	(as $CaCO_3$)	264.	5.28
Color		0		Hardness	(as $CaCO_3$)	299.	5.98
Odor		0		Residue		300.	
Turbidity		10-		Free CO_2 (calc.)		38.	
Temperature		63.6° F.		pH = 7.2			

LABORATORY NO. 104,679

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.8		Silica	SiO_2	13.0	
Manganese	Mn	Tr.		Fluoride	F		
Calcium	Ca	54.5	2.72	Chloride	Cl	7.0	0.20
Magnesium	Mg	37.6	3.09	Nitrate	NO_3	1.2	.02
Ammonium	NH_4	0.1	Tr.	Sulfate	SO_4	22.6	0.47
Sodium	Na	0.0	0.00	Alkalinity	(as $CaCO_3$)	256.	5.12
Color		0		Hardness	(as $CaCO_3$)	291.	5.82
Odor		10-		Residue		286.	
Turbidity		Tr.		Free CO_2 (calc.)		31.	
Temperature		58.5° F.		pH = 7.3			

Sample-study log of Well No. 4 furnished by the State Geological Survey:

Formation	Thickness ft.	Thickness in.	Depth ft.	Depth in.
Pleistocene system				
Soil	5		5	
Ordovician system				
Galena-Platteville formations				
Dolomite	245		250	
Dolomite, limestone and thin shale beds	80		330	
Glenwood shale, dolomite, some sandstone	40		370	
St. Peter sandstone	50		420	
Shakopee dolomite, some shale	110		530	
Oneota dolomite, thin sandstone beds at base	230		760	
Cambrian system				
Trempealeau dolomite	160		920	
Franconia shale, sandstone, thin dolomite bed	80		1000	
Galesville sandstone, partly dolomitic	100		1100	
Eau Claire sandstone, shale and dolomite	208	6	1308	6

SAYBROOK
McLean County
Oct. 9, 1948

The village of Saybrook (779) installed a public water supply in 1935.

A 6-in. test well was drilled by Johnson & Hinkle, Bloomington, in 1935 and was located 50 ft. south of Grove St. extended west between Main and Center St. (or approximately 950 ft. S. and 2500 ft. W. of the N. E. corner of Section 28, T. 23 N., R. 6 E.). The surface elevation is 755± ft. The well was reported to have been drilled to a depth of 155 ft. but was finished at 53 ft.

Sample-study log of the 6-in. test well furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Till	25	25
Gravel, dirty	34	59
Till	21	80
Granule sand, very silty	5	85
Granule sand, clean	5	90
Till	20	110
Granule sand, clean	5	115
Till	40	155

A production test was made Apr. 16, 1935. The well produced 75 gpm. with a drawdown of 2 ft. from a non-pumping water level of 23 ft.

The test well is being equipped as an emergency unit, with a Myers ejecto pump (catalogue No. F 300 BY) rated at 30 gpm.; and a 3-hp. General Electric motor.

On Sept. 25, 1948, when pumping from the permanent well, the water level in the test well was 25 ft. below the top.

The permanent well was drilled to a depth of 59 ft. by Johnson & Hinkle in 1935 and is located 6 ft. south and 5 ft. west of the test hole. A 10-in. casing extends from 9 in. above the ground surface to a depth of 37 ft. 5 in. A 10-in. screen, 21 ft. 9 in. overall length, with 20 ft. exposed, is attached to the bottom of the casing. The screen has No. 20 slot openings. The pump base is 3 ft. above ground level.

A production test was made May 20, 1935 by the State Water Survey. For test purposes, the well was equipped with a 6-in., 8-stage Layne Bowler turbine with the bottom of the suction pipe at a depth of 56 ft. below the ground surface. The well produced 325 gpm. with a drawdown of 6 ft. from a non-pumping water level of 23 ft. below the ground surface.

Permanent pumping equipment was installed as follows: 40 ft. of 5-in. od. column pipe; 7-in., 11-stage Fairbanks-Morse turbine pump, No. 28035, rated at 100 gpm., against a head of 160 ft. when operating at 1800 rpm.; 10 (?) ft. of suction pipe; 40 (?) ft. of 1/4-in. air line; 7 1/2-hp. Fairbanks-Morse electric motor, operating at 1740 rpm. The lengths of air line and suction pipe could not be confirmed.

On Sept. 25, 1948, after 40-minutes pumping at 80 gpm. the altitude gauge showed the water level to be 12 ft. above the bottom of the air line.

Analysis of a sample (Lab. No. 115,950) collected Sept. 25, 1948, after 40-minutes pumping, showed the water to have a hardness of 29.2 gr. per gal., a residue of 620 ppm., and an iron content of 0.1 ppm.

From Sept. 17, 1947 to Sept. 17, 1948 the metered pumpage averaged 32,810 gpd.

LABORATORY NO. 115,950

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	18.6	
Manganese	Mn	0.1		Fluoride	F	0.1	
Calcium	Ca	124.0	6.20	Chloride	Cl	24.0	0.68
Magnesium	Mg	46.7	3.84	Nitrate	NO_3	28.7	0.46
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	132.5	2.76
Sodium	Na	17.0	0.74	Alkalinity (as $CaCO_3$)		344.	6.88
Turbidity		0		Hardness (as $CaCO_3$)		502.	10.04
Color		0		Residue		620.	
Odor		E		Free CO_2 (calc.)		99.	
Temperature 53° F.				pH = 6.95			

SEATON
Mercer County
Nov. 7, 1946

A public water supply was installed by the village of Seaton (271) in 1912.

A well was drilled in 1912 by W. S. Van Tile, Millersburg, and located on the east side of the public square on ground owned by the village (or approximately 1300 ft. N. and 900 ft. E. of the S. W. corner of Section 24, T. 13 N., R. 4 W.).

The well was 244 ft. deep below a ground surface elevation of 615± ft., and cased with 128 ft. of 5-in. pipe into rock.

The pumping equipment is 150 ft. of column pipe; American Well Works double-acting deep well pump, No. 1820, rated at 40 gpm. against a head of 300 ft.; 5-hp. General Electric motor.

The non-pumping water level in 1912 was reported by the driller to be 50 ft. below the ground surface and at the same depth in Nov. 1946.

Analysis of a sample (Lab. No. 108,248), collected Nov. 7, 1946, at the reservoir, showed this water to have a hardness of 6 gr. per gal., a residue of 562 ppm., and an iron content of 0.1 ppm.

The water is not treated.

Pumpage is estimated at 15,000 gpd.

Correlated driller's log of well drilled in 1912 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil	40	40
Sand	83	123
Devonian system		
Lime rock	121	244

LABORATORY NO. 108,248

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	12.7	
Manganese	Mn	0.0		Fluoride	F	0.7	
Calcium	Ca	27.3	1.37	Chloride	Cl	29.0	0.82
Magnesium	Mg	8.3	0.68	Nitrate	NO_3	0.9	0.06
Ammonium	NH_4	3.3	0.18	Sulfate	SO_4	15.6	0.33
Sodium	Na	187.0	8.13	Alkalinity	(as $CaCO_3$)	460.	9.20
Color		0		Hardness	(as $CaCO_3$)	103.	2.06
Odor		Tr.		Residue		562.	
Turbidity		10					

SECOR
Woodford County
Mar. 4, 1947

A public water supply was installed by the village of Secor (335) about 1895.

Water was first obtained from Well No. 1 located near the town hall at the southeast corner of Oilman and Third St. (or approximately 2320 ft. N. and 1320 ft. E. of the S. W. corner of Section 5, T. 26 N., R. 1 E.). The elevation of the ground surface at this location is 735± ft. The well was cased with 6-in. pipe to a depth of 115 ft. and was equipped with a single-acting deep-well pump with a 4 1/2 by 18-in. working barrel set at a depth of 100 ft. A suction pipe, 10 ft. in length was attached below the cylinder. The pump capacity in 1915 was reported to be 30,000 gpd. At the same time the non-pumping water level was reported to be 60 ft. below the surface.

In Mar. 1943 it was reported that this well had been capped with concrete. The well was abandoned, but the pump gear was connected to a cylinder which now pumps air for pressure in the storage tank.

Analysis of a sample (Lab. No. 48838) collected Dec. 17, 1922 after pumping two hours, showed the water to have a hardness of 22.8 gr. per gal., a residue of 481 ppm., and an iron content of 4.0 ppm.

Well No. 2 was drilled in 1914 at a location 10 ft. south of Well No. 1. It is 8 in. in diameter and 158 ft. deep with 17 1/2 ft. of screen exposed to sand and gravel at the bottom of the well. It was reported that four water-bearing strata were cased off. It is equipped with a Meyers single-acting deep-well pump. The 5 3/4-in. cylinder was attached to 133 ft. of 6-in. column pipe. There was no suction pipe, but a screen was placed below the cylinder.

At present the pump has been pulled to put on new leathers and a new screen below the cylinder, but will be placed back in operation as soon as the repairs can be completed. The pump is operated from the same shaft that operates the old pump gears in Well No. 1. This shaft is belt-driven by a 10-hp. Century electric motor. A 12-hp. International gas engine is kept for emergency use.

In 1915 the non-pumping water level was reported to be 85 ft. below the surface which was 25 ft. lower than the level in Well No. 1. In 1922 when pumping in Well No. 1, the depth to water in Well No. 2 was reported to be 74 ft.

Analysis of a sample (Lab. No. 48874) collected Dec. 19, 1922 showed the water from this well to have a hardness of 27.2 gr. per gal., a residue of 481 ppm., and an iron content of 4.0 ppm.

Well No. 3 was drilled to a depth of 156 ft. in 1940 by Chris Ebert, Washington, and located about 18 ft. north and 19 ft. west from Well No. 2.

Sample-study and driller's log of Well No. 3 furnished by the State Geological Survey:

Formation	Thickness ft.	Thickness in.	Depth ft.	Depth in.
Pleistocene system				
"Soil and clay"	101		101	
"Gravel"	1		102	
"Clay"	2	6	104	6
Gravel	7	6	112	
"Clay"	23		135	
"Sand"	3		138	
Gravel, "main supply of water"	18		156	

The well is cased with 8-in. pipe and with a 20-ft. length of brass screen.

The well is equipped with: 111 ft. of column pipe; 7-in. od. American Well Works turbine pump, No. 63763, rated at 100 gpm. against a head of 244 ft.; 10-hp. General Electric motor. This wellatpresent supplies all of the water for Secor.

The non-pumping water level is estimated at 78 ft. below the top of the well.

Analysis of a sample (Lab. No. 109,442) collected Mar. 4, 1947 from the pressure tank, showed this water to have a hardness of 26.7 gr. per gal., a residue of 493 ppm., and an iron content of 5.5 ppm.

Pumpage is estimated at 15,000 gpd.

LABORATORY NO. 109,422

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	5.5		Silica	SiO_2	30.9	
Manganese	Mn	Tr.		Fluoride	F	0.3	
Calcium	Ca	106.2	5.31	Chloride	Cl	1.0	.03
Magnesium	Mg	46.5	3.83	Nitrate	NO_3	0.6	.01
Ammonium	NH_4	11.9	.67	Sulfate	SO_4	2.9	.06
Sodium	Na	10.4	.45	Alkalinity	(as $CaCO_3$)	508.	10.16
Color		0		Hardness	(as $CaCO_3$)	457.	9.14
Odor		0		Residue		493.	
Turbidity		50-					

SHABBONA
DeKalb County
Oct. 13, 1947

A public ground water supply was installed by the village of Shabbona (593) in 1897.

Water was originally furnished by 2 sand and gravel wells each having a depth of 150 ft. The West Well, now called No. 1, is still in service. It is located about 110 ft. north of the Chicago, Burlington & Quincy R.R. and 100 ft. east of the public park, (approximately 2300 ft. S. and 1200 ft. W. of the N. E. corner of Section 15, T. 38 N., R. 3 E.). The elevation of the ground surface is 900± ft.

The east well was reported to have a diameter of 8 in. and the west well 10 in. On Mar. 7, 1922 a combined production of 268 gpm. was obtained for short periods of 20 min. At this time a non-pumping water level of 90 to 100 ft. below the surface was reported.

The east well located about 15 ft. east of Well No. 1, has been abandoned and is capped with concrete.

Well No. 1 is now the source of the public supply. In 1944 it was equipped with a new turbine pump and in 1945 with 10 ft. of new 8-in., No. 20 slot Johnson screen. The well was acidized in the summer of 1945 at which time the non-pumping water level was 100 ft. below the pump base.

The existing pump installation, made in 1944, is: 130 ft. of 5-in. column pipe; 7-in., 11-stage American Well Works turbine pump, No. 70191, having a rated capacity of 100 gpm. against 268 ft. of head; 10 ft. of 5-in. suction pipe; 130 ft. of 1/4-in. galvanized iron air line; 10-hp. U. S. electric motor.

On Oct. 4, 1947 the non-pumping water level was reported to be 111 ft. and when pumping at 100 gpm. the water level was 113 ft.

Analysis of a sample (Lab. No. 112,127) collected Oct. 6, 1947 from a tap in the pump house about 20 ft. from the pump discharge showed this water to have a hardness of 19.4 gr. per gal., a residue of 357 ppm., and an iron content of 2.0 ppm.

Well No. 2, was drilled to a depth of 150 ft. by P. E. Millis, Byron, in 1931, and is located about 10 ft. north and 16 ft. east of Well No. 1. The diameter of the well is reported to be 10 in.

On June 22, 1938 Well No. 2 furnished nearly the entire public supply and pumping at that time was with an American Well Works single-acting plunger pump having a 7 3/4-in. cylinder placed at a depth of 140 ft. It was belt-driven by a 10-hp. Wagner electric motor and operated to deliver about 100 gpm. The same equipment is still in place, but the well is now seldom used and is maintained as an emergency supply unit.

Pumpage is estimated to be 65,000 gpd.

LABORATORY NO. 112,127

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.0		Silica	SiO_2	26.3	
Manganese	Mn	0.0		Fluoride	F	0.3	
Calcium	Ca	74.0	3.70	Chloride	Cl	2.0	0.06
Magnesium	Mg	36.0	2.96	Nitrate	NO_3	1.1	0.02
Ammonium	NH_4	0.6	0.03	Sulfate	SO_4	9.9	0.21
Sodium	Na	11.0	0.48	Alkalinity (as $CaCO_3$)		344.	6.88
Turbidity		20		Hardness (as $CaCO_3$)		333.	6.66
Color		5		Residue		357.	
Odor		0		Free CO_2 (calc.)		29.	
Temperature 51.6° F.				pH = 7.5			

SHANNON
Carroll County
Jan. 24, 1947

A water supply was installed by the village of Shannon (56l) in 1894.

At that time a well, pumping station, and elevated tank were constructed. The well was drilled to a diameter of 6 in. and to a depth of 200 ft. below a ground surface elevation of 940± ft., and is located approximately 1900 ft. S. and 1650 ft. E. of the S. W. corner of Section 19, T. 25 N., R. 6 E.

Correlated driller's log of well drilled in 1894 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil	10	10
Silurian and Ordovician systems		
Alexandrian series and Maquoketa formation		
Limestone	80	90
Ordovician system		
Maquoketa formation		
Slate rock	100	190
Galena formation		
Hard gray rock	25	215

The well was originally equipped with a single-acting deep well pump with 3 3/4 by 18-in. cylinder placed at 190 ft. Depth to water when the well was drilled was 80 ft. In Sept. 1945 George A. Lyons, well driller of Stockton, rehabilitated the well and reported the following work done:

Found the well to be 186 ft. deep and then deepened it to 250 ft. finishing with 5 3/4-in. bit. All the drilling was in blue clay. Found 6-in. galvanized 18 or 20-gauge casing, length unknown. Replaced the 3 3/4 by 18-in. cylinder pump with a new Clayton-Mark 24-in. stroke single-acting plunger pump, which is automatically controlled by tank pressure; the pump is operated at 30 strokes per min.; a 5-hp. Century electric motor.

After the rehabilitation work was completed, the non-pumping water level was reported to be 48 ft. No production test was made "as it supplied all the water the pump would pump" before the work was done, and the village officials did not want a test made.

Analysis, of a sample (Lab. No. 108,715) collected Dec. 17, 1946 from a tap in the pump house supplied by the elevated tank at the well, showed the water to have a hardness of 20.9 gr. per gal., a residue of 403 ppm., and an iron content of 0.4 ppm.

All water has been chlorinated since 1938.

An estimate of the average pumpage in Dec. 1946 is 15,000 gpd.

LABORATORY NO. 108,715

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.4		Silica	SiO_2	19.4	
Manganese	Mn	0.0		Fluoride	F	0.2	
Calcium	Ca	75.4	3.77	Chloride	Cl	14.0	0.39
Magnesium	Mg	41.3	3.39	Nitrate	NO_3	46.7	0.75
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	51.6	1.07
Sodium	Na	3.7	0.16	Alkalinity	(as $CaCO_3$)	256.	5.12
Color		0		Hardness	(as $CaCO_3$)	358.	7.16
Odor		Tr.		Residue		403.	
Turbidity		10-					

SHAWNEETOWN
Gallatin County
Feb. 18, 1948

The city of Shawneetown (1963) installed a public water supply in 1936.

Water was obtained from a well drilled in 1936 to a depth of 73 ft. by John Bolliger, Fairbury, and located near the intersection of Market St. and the Louisville & Nashville R. R. (or approximately 1500 ft. N. and 4000 ft. E. of the S. W. corner of Section 31, T. 9 S., R. 10 E.). The surface elevation is 340t ft.

Medium to coarse sand and gravel was encountered between the depths of 12 and 72 ft. The well was cased with 10-in. pipe to a depth of 41 ft. 10 in., and a 20-ft. length Johnson screen was installed from 41 ft. 10 in. to 61 ft. 10 in. The screen had No. 20 slot openings.

The State Water Survey made a production test on Apr. 30, 1936. After 8-hr. pumping at 453 gpm., the drawdown was 9.9 ft. from a non-pumping water level of 5.4 ft. below the top of the casing. When tested again on July 7-8, the well produced 300 gpm. with a drawdown of 6.7 ft. from a non-pumping water level of 15.3 ft. below the top of the casing.

The well was equipped with a Fairbanks-Morse pump, rated at 175 gpm. and set at a depth of 57 ft. and driven by a 15-hp. electric motor.

Analysis of a sample (Lab. No. 78367), collected July 8, 1936 after 24-hr. pumping, showed the water to have a hardness of 16.2 gr. per gal., a. residue of 338 ppm., and an iron content of 1.0 ppm.

The pump assembly was removed and installed in the new well in 1940. The filters were also removed and installed at the new Shawneetown plant. The 10-in. casing and sand screen are still in the well, but it has been filled with debris since the pump was removed by unauthorized persons.

Following the floods of 1937 and 1938-39, the city of Shawneetown was moved to higher ground about 3 miles northwest of the old town.

Three wells were drilled in 1938 at the site of New Shawneetown for test purposes and a temporary water supply.

Well No. 1 was. located approximately 1400 ft., S. and 1400 ft. W. of the N. E. corner of Section 26, T. 9 S., R. 9 E. This well was 6 in. in diameter and 85 ft. deep. The well was equipped with a Myers deep well cylinder pump rated at 8 gpm. and set at a depth of 81 ft.

Analysis of a sample (Lab. No. 84462), collected Oct. 18, 1938, showed the water from Well No. 1 to have a hardness of 21.0 gr. per gal., a residue of 364 ppm., and an iron content of 380 ppm.

Well No. 2 was located 120 ft. southwest of Well No. 1. This well was 6 in. in diameter and 105 ft. deep. The non-pumping water level was reported to be 45 ft. below the ground surface.

Analysis of a sample (Lab. No. 84618), collected with a bailer on Nov. 9, 1938, showed the water to have a hardness of 20.0 gr. per gal., a residue of 340 ppm., and an iron content of 700.0 ppm.

This well was never used.

Well No. 3 was located about 80 ft. northeast of Well No. 1, and was 6 in. in diarre ter and 223 ft. deep. The non-pumping water level was reported to be 43 ft. below the ground surface.

The well was equipped with a Meyers deep-well cylinder pump rated at 8 gpm. and set at a depth of 152 ft.

This well was used to supply the refugee camp at the new townsite and for construction purposes. The average pumpage was estimated to be 3000 gpd.

Analysis of a sample (Lab. No. 84825), collected Dec. 19, 1938, showed the water to have a hardness of 16 gr. per gal., a residue: of 379 ppm., and an iron content of 0.8. ppm.

These wells were drilled by the W.P.A. and were not apart of the public water supply system. They have been abandoned and the sites are obliterated.

In the summer of 1939, the State Geological Survey made an electrical earth resistivity survey in the vicinity of New Shawneetown. A continuation of the electrical earth resistivity survey was made Nov. 27, 1939 in the vicinity of the Shawneetown. levee.

As a result of the test, the municipal well for New Shawneetown was. drilled in 1940 by John Bolliger, at a location on the levee (or approximately 300 ft. S. and 1800 ft. W. of the N.E. corner of Section 36, T. 9 S., R. 9 E.).

This well was finished in coarse sand at a depth of 95 ft. below the top of the levee, which is at an elevation of 360t ft., and was cased with 10-in. pipe from 10 ft. above to 85 ft. below the top of the levee. Ten ft. of Johnson red brass screen was placed from 85 to 95 ft. The screen had No. 20 slot openings.

The State Water Survey made a production test on Mar. 19, 1940. For test purposes, the well was equipped with a 4-stage Pomona turbine pump set at a depth of 88 ft. After 18-hr. pumping at 200 gpm., the drawdown was 20 ft. from a non-pumping water level of 33 ft. below the top of the casing.

The pump installation consists of the same Fairbanks-Morse turbine pump and 15-hp. electric motor removed from the old Shawneetown Well in 1940. The turbine pump has a rated capacity of 175 gpm. but is now delivering about 150 gpm. to the booster pump at the treating plant.

It was reported that following a protracted period of drought in the summer of 1947, the productive capacity of the well decreased 50% and the pumping water level had dropped below the upper section of the screen.

Analysis of a sample (Lab. No. 113,565), collected Feb. 18, 1948 after 6-hr. pumping at 150 gpm., showed the water to have a hardness of 21.2 gr. per gal., a residue of 373 ppm., and an iron content of 2.3 ppm.

The water is treated for iron removal and chlorinated.

Analysis of a sample (Lab. No. 114,103), collected Feb. 18, 1948 showed the treated water to have a hardness of 21.9 gr. per gal., a mineral content of 374 ppm., and an iron content of 0.10 ppm.

Pumpage is estimated to average 81,000 gpd.

The old section of Shawneetown does not have a public water supply. Water for residential and business purposes is obtained from sand points driven to depths of 25 to 30 ft.

LABORATORY NO. 113,565

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.3		Silica	SiO_2	28.3	
Manganese	Mn	0.1		Fluoride	F	0.1	
Calcium	Ca	86.3	4.32	Chloride	Cl	3.0	0.08
Magnesium	Mg	35.9	2.95	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	12.1	0.25
Sodium	Na	4.8	0.21	Alkalinity	(as $CaCO_3$)	358.	7.16
Turbidity		40		Hardness	(as $CaCO_3$)	364.	7.27
Color		0		Residue		373.	
Odor		0		Free CO_2	(calc.)	75.	
Temperature		52.2° F.		pH = 7.1			

A public water supply was installed by the village of Sheffield (948) about 1894.

Water was first obtained from a dug well located back of the city hall, at the northwest corner of Cook and Main St. (or approximately 2250 ft. N. and 1100 ft. E. of the S. W. corner of Section 19. T. 16 N., R. 7 E.).

The well was 9 ft. in diameter and 46 ft. deep below a ground surface elevation of 686t ft. About 1902, increased demand made it necessary to construct another dug well, 5 ft. to the north of the first well. It was 10 ft. in diameter by 50 ft. in depth and was reported to be curbed with an 8-in. brick wall and cemented to a depth of 32 ft., below which wood curbing was used and driven into the clay at the bottom of the well.

The two wells were connected by a 2-in. pipe in the bottom of the 46-ft. well, and in 1920 the older well had been filled in. The well was equipped with an American Well Works deep-well pump with the bottom of a 6-in. cylinder set at 2 ft. above the bottom of the well.

In 1914, the water level was 36 ft. below the surface; and during pumping, the water was drawn down 12 ft. On Aug. 1, 1922, the water level was 31 ft. and the water was lowered to the base of the pump, about 10 ft., after 2 1/4-hr. pumping at 136 gpm. On the same date the inflow of the well was calculated at 95 gpm.

This well is still in existence but no longer used. The pump has been removed.

The supply is now obtained from 2 wells, one drilled in 1923 and the other in 1940. Both wells are located on the south side of Church St., 1/2 block west of Main St.

In 1923, a dug and drilled well now called East Well was constructed 200 ft. south of the old well, and located on the south side of Cook St. on the east side of the first valley west of Main St. The well was dug to a depth of 34 ft. below a ground surface about 3 ft. lower than at the old well. The walls and floor were concrete. From the bottom of the dug portion, a 16-in. pipe was sluiced in, with the bottom of the pipe set at 67 ft. below the surface. A 10-in. pipe, with 25 ft. of 9 5/8-in. copper-wrapped screen welded on at the bottom, was placed inside the 16-in. pipe. Pea gravel was. poured around the 10-in. pipe, and the screen and the 16-in. pipe withdrawn.

The original centrifugal pump unit was set in the pit. A Pomona turbine unit was installed in 1936 and the pump base set on top of the casing which was extended upward to about 1 ft. above the pump house floor level.

The well was cleaned out in 1936, and on Feb. 2, 1937, the water level was 41 ft. below the top of the casing. On Oct. 4, 1939, a short production test was made by the State Water Survey. The water level, before the test was 31 1/2 ft. below the pump base. After pumping 1 hr. at 106 gpm., the drawdown was 5 1/4 ft.; and, after the second hour of pumping at 147 gpm., the drawdown was 8 1/2 ft.

The Pomona turbine pump, installed in this well in 1936, was later removed and placed in another well, and the present installation consists of a Pomona turbine No. S. W. 1928. Power is furnished by a 5-hp., 1735 rpm. Westinghouse motor, No. 2740. The length and size of the column pipe is not known, but it is believed that the bottom of the bowls is set at 60 ft. below the pump base. This pump is operated about 3 hr. per day and discharges at a rate of 70 gpm.

Analysis of a sample (Lab. No. 111,808) collected Sept. 10, 1947, after, pumping 35 min. showed the water from the East Well to have a hardness of 40.2 gr. per gal., a mineral content of 914 ppm., and an iron content of 1.2 ppm.

The West Well was drilled in 1940 by D. E. Edwards, West Branch, Iowa, and located 10 ft. south and 25 ft. west of the East Well on the south side of Cook St. (or approximately 2040 ft.N. and 1075 ft. E. of the S. W. corner of Section 19). The well is 10 in. in diameter and 71 ft. deep and is cased to a depth of 63 ft. 2 in. with 10-in. wrought iron pipe, below which is 10 ft. of Johnson Everdur screen with No. 110 slot openings between depths of 63 ft. 2 in. and 71 ft. 2 in.

During the drilling of the West Well, 6 pilot holes were drilled and gravel was poured into the holes as the well was developed. The diameter of the holes varied from 3 5/16 to 8 in. and the distances of the holes from the West Well varied from 4 to 5 1/2 ft. On July 25-26, 1940, a production test of the West Well was made by the State Water Survey. Observations of water levels were made in the pilot holes and the East Well. Prior to the test, the water level in the West Well was 38 ft. below the ground surface. After 1-hr. pumping at 480 gpm. the drawdown in the West Well was 18.0 ft. and in the pilot holes the drawdown varied from 6.2 to 7.8 ft. The pumping rate was gradually decelerated and after 12 hr.,

when pumping at 180 gpm. the drawdown in the West Well was 8 1/2 ft. and in the pilot holes the drawdown was 6.2 ft. One hr. after stopping the pump the water level was 4.0 ft. below the level, prior to starting the test.

The pumping assembly formerly installed in the East Well and then removed in 1936, consists of: 60 ft. of column pipe; 8-in., 8-stage Pomona turbine pump, No. M-2809, rated at 200 gpm. against 180 ft. of head at 1760 rpm.; the overall length of the pump is 5 ft.; 15-hp., 1767 rpm., Westinghouse Electric motor, No. 8105880.

In Nov. 1941, the production declined. Mr. D. E. Edwards surged the well and removed a heavy clay deposit from the screen. The non-pumping water level was 40 ft. 4 in. below the pump base. In Mar. 1943, the pump was being operated on an average of 4 to 5 hr. daily to supply 305 services.

Analysis of a sample (Lab. No. 111,807) collected Sept. 10, 1947, after 3-hr. pumping, showed the water in the West Well to have a hardness of 30.2 gr. per gal., a residue of 603 ppm., and an iron content of 2.2 ppm.

The water is not treated.

Pumpage is estimated to be 72,000 gpd.

LABORATORY NO. 111,807

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.2		Silica	SiO_2	26.1	
Manganese	Mn	Tr.		Fluoride	F	0.4	
Calcium	Ca	111.8	5.59	Chloride	Cl	22.0	0.62
Magnesium	Mg	58.0	4.77	Nitrate	NO_3	4.9	0.08
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	154.5	3.21
Sodium	Na	17.0	0.74	Alkalinity	(as $CaCO_3$)	360.	7.20
Turbidity		10+		Hardness	(as $CaCO_3$)	518.	10.36
Color		10-		Residue		603.	
Odor		0		Temperature	54° F.		

A public water supply was installed for the city of Shelbyville (4092) in 1885 by the City Water Co., New York, New York. The system was purchased by the city in 1925.

Water was obtained from the Kaskaskia River until 1899.

In 1899, twenty-two wells were installed in the Kaskaskia River bottoms about 3/4 mile east of the center of the city. The wells were connected to two suction lines which intersect at a small angle at a point about 230 ft. north of the river (approximately 550 ft. N., and 1770 ft. E. of the S.W. corner of Section 8, T. 11 N., R. 4 E.). One suction line runs nearly parallel to the river to the northeast, and the other angles toward the river to the southwest. The ground surface elevation at the intersection is 560 ft.

Ten wells were located southwest of the intersection, and 12 wells to the northeast. The wells were located alternately about 20 ft. north and south of the main suction lines, and the intersections of the short suction pipes leading to them were about 50 ft. apart. The wells were numbered consecutively from southwest to northeast.

The wells were reported to be 6 in. in diameter and about 22 ft. deep, with 6-in. casings reported to extend to depths of 17-20 ft.

Well No. 17 was abandoned about 1918. Well No. 3 1/2, located between Wells No. 3 and 5, and Well No. 22 1/2, located at the east end of the line of wells, were drilled about 1916, and were reported to be similar in construction to the original wells.

All of the original wells and Well No. 3 1/2 were abandoned prior to 1930.

Analysis of a sample (Lab. No. 39741) collected July 15, 1918 showed the water from one of the wells to have a hardness of 17.7 gr. per gal., a. residue of 378 ppm., and an iron content of 0.6 ppm.

In 1912, Well A, originally constructed in 1886, as an intake and suction well, 26-ft. od. with 12-in. wall, was converted into a ground water well by deepening it as a 36-in. hole and placing 26-in. id. porous concrete pipe from 18 ft. below to 43 ft. below the top of the dug well curb. The top of the concrete casing is capped and sealed. This well is located about 60 ft. northwest of the intersection of the main suction lines. The dug well is curbed with brick and the top is roofed with lumber. On July 10, 1948 the depth to water was 20 ft. below the top of the well curb or 3.6 ft. below the river stage. The top of the curb is about elevation 575t ft.

Well A is not used during high water stages.

The dug wells, B and C, were constructed in 1918 by city employees at a location 75 ft. apart and about 225 ft. from the intersection of the two suction lines. Well B is 25 ft. and Well C is 75 ft. from the river bank.

Correlated driller's log of Well B furnished by the State Geological Survey:

Formation	Thickness ft. in.	Depth ft. in.
Pleistocene system		
Silt	7	7
Sand	10	17
Gravel	7	24
Pennsylvanian system		
Coal	1 - 8	25 - 8
Rock	at	25 - 8

These wells are 12 ft. id., 28 ft. deep, and are walled with concrete, 12 in. thick. In 1923, it was necessary to repair these wells. Blue clay had cut off the water. Four-inch perforated pipes were forced out 25 ft. below the top of the well walls into water-bearing gravel.

Wells B and C were subsequently connected to infiltration galleries. In 1938, about 75 ft. of 30-in. id. porous concrete pipe was laid between the 2 wells at a depth of 28 ft. In 1941, about 150 ft. of 30-in. id. porous concrete pipe was laid along the river bank northeast of Well B, at a depth of 28 ft.

In 1924, five wells were drilled by W. C. Warren, Shelbyville. These wells are opposite the original wells along the northeast end of the main suction line, and are designated Wells No. 16 1/2,17 1/2, 19 1/2, 21 1/2 and 22 1/2. These wells were 26 ft. deep, and were cased with 8-in. steel pipe, perforated at the bottoms. Corrosion and deposit clogged the perforations, and the wells were abandoned.

Wells, known as No. 4, 5, and 6, were drilled in 1929 by Thorpe Concrete Well Co., Alton, and located in a straight line near the river, with the nearest one about 60 ft. south of Well C. The wells were 26 ft. deep, and were cased with 26-

in. id. by 36-in. od. concrete. The lower sections were porous concrete.

Pumping vacuum could not be maintained in these wells and they were abandoned after tests made in July 1930.

In the spring of 1930, three more wells known as No. 1, 2, 3, were drilled by Thorpe Well Co. along the south side of the northeast main suction line. These wells were cased with 26-in. id. by 36-in. od. concrete pipe, and were 28 ft. deep below ground level. The lower sections of the casings were porous concrete screen. The tops of the casings are 5 to 6 ft. above ground level and are capped and sealed. The pumps are operated under vacuum.

A series of production tests was made on the city wells in July, 1930 by A. C. Stanfield, engineer. Water was pumped from the wells at the highest rates at which the pump did not break suction. Some of the results obtained are given in Table 1.

TABLE 1

Wells Pumped From	Discharge gpm.
1, 2, 3, 4, 5, 6	458
1, 2, 3, 4, 5	458
1, 2, 3	478
4, 5, 6	145
1, 2, 3, 4, 5, 6, C, 16 1/2, 17 1/2, 19 1/2, 21 1/2, 22 1/2,	612

Three wells, known as Wells No. 7, 8 and 9, were drilled in June 1934 by Thorpe Well Co., and located northeast of Wells No. 1, 2, and 3. The wells are 28 ft. deep below ground level and were cased with 40-in. od. concrete pipe and porous concrete screens. The tops of the casings are 4 to 5 ft. above ground level and are capped and sealed. The wells are in service and the pumps are operated under vacuum.

In 1934, it was reported that the water system yielded 1000 gpm., and that after 4-hr. pumping, the drawdown was 9 ft. from a non-pumping water level of 15 ft. below the ground surface. Water levels vary with the river stage.

In 1935, most of the city supply was obtained from Wells A, B, C, and one of the Thorpe Wells. The other 5 Thorpe wells were available, but seldom used.

Wells No. 10 and 11 were constructed in 1941 by Harry Riley, Shelbyville, and located on the easterly side of and close to the old southwest suction line. The concrete casings and screens were salvaged from the abandoned Wells No. 4, 5, and 6 and used to construct Wells 10 and 11. The wells are 28 ft. deep below ground level and are capped and sealed below the ground surface.

Wells No. 10 and 11 serve as auxiliary supply units in summer.

Until 1935 water was pumped from the wells by direct suction with pumps located in the pumping station about 200 ft. northwest of the intersection of the main suction lines. Two American Well Works centrifugal pumps of 1000 and 700 gpm. capacity were used. Power was furnished by two 23-hp. General Electric motors. One of the pumps has been disconnected. The other pump, No. 53936, rated at 1000 gpm. capacity serves as a booster to the storage reservoir.

Since 1935, the well pumping equipment has consisted of 2 identical, size 1, Nash-Hy-tor vacuum pumps, Test No. 63477 and 63478. The pumps will hold 26 ft. of vacuum pull by either of two 5-hp. General Electric motors, operating at 860 rpm.

Analysis of a sample (Lab. No. 115,262) collected July 10, 1948, after 7 1/2-hr. pumping at 800 gpm. from Wells No. 1, 2, 3, 7, 8, 9 and infiltration gallery B, showed the water to have a hardness of 17.3 gr. per gal., a residue of 314 ppm., and an iron content of 0.2 ppm.

The water is chlorinated.

From July 10, 1947 tp July 10, 1948, metered pumpage averaged 498,560 gpd.

LABORATORY NO. 115,262

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	13.9	
Manganese	Mn	0.2		Fluoride	F	0.1	
Calcium	Ca	73.1	3.66	Chloride	Cl	10.0	0.28
Magnesium	Mg	27.3	2.25	Nitrate	NO_3	5.4	0.09
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	50.0	1.04
Sodium	Na	1.4	0.06	Alkalinity (as $CaCO_3$)		228.	4.56
Turbidity		Tr.		Hardness (as $CaCO_3$)		296.	5.91
Color		0		Residue		314.	
Odor		0		Free CO_2 (calc.)		27.	
Temperature 63.3° F.				pH = 7.3			

SHELDON
Iroquois County
Nov. 11, 1948

A public water supply was installed in 1897 by the village of Sheldon (1036).

Several shallow wells were drilled but did not yield enough water. Then a well was drilled to a depth of 1850 ft. and located on the north side of Center St. about midway between Third and Fourth St. (or approximately 2600 ft. S. and 2200 ft. W. of the N. E. corner of Section 2, T. 26 N., R. 11 W.).

The hole and casing record are reported to be:

Hole Record

10-in. from 119 to 229 ft.
8-in. from 289 to 630 ft.
6-in. from 1157 to 1770 ft.

Casing Record

12-in. from 0 to 96 ft.
10-in. from 96 to 119 ft.
8-in. from 229 to 289 ft.
4 1/2-in. from 630 to 1157 ft.

The casing was replaced in 1907 and 1914. In 1922, the well was repaired by J. P. Miller Artesian Well Co., Brookfield, and cased to 1157 ft. After repairs, the depth of the well was 1672 ft. The 4 1/2-in. casing had been filled and the yield reduced.

In 1913 the non-pumping water level was reported to be 80 ft. below a ground level elevation of 682t ft., and in May 1923 the non-pumping water level was 50 ft. In 1913 and 1923 the yield was reported to be about 30 gpm.

Analysis of a sample (Lab. No. 38916) collected Feb. 5, 1918 showed this water to have a hardness of 1.4 gr. per gal., a residue of 600 ppm., and an iron content of 0.1 ppm.

The well was abandoned in 1926 because of inability to fish out the pump, accidentally dropped The well has been filled with cinders and capped with concrete.

A small diameter well was drilled about 1913, a few feet from the deep well and was used for a while but never produced much water. There is no evidence of the well. It is probably covered by the concrete floor of the main pumping station.

Well No. 2 was drilled in 1914 and located 4 1/2 blocks due north of the deep well, on the east side of Third St. north of Iroquois St. (or approximately 700 ft. S. and 2320 ft. W. of the N. E. corner of Section 2). When completed the well was said to be 130 ft. deep but in 1937, the depth was reported to be 112 ft.

The well was cased with 6-in. pipe with a perforated pipe screen, length unknown.

In 1918, the static water level was 20 ft. below ground surface. On Apr. 29, 1943 when pumping at 40 gpm. the drawdown was about 13 ft. from a water level of 27 ft.'

The well has filled with sand below a depth of 65 ft. and is out of service because the pump discharges sand with very little water. The pumping equipment includes a Pomona turbine pump, No. G 6707, and 5-hp. Westinghouse electric motor.

Analysis of a sample (Lab. No. 82390) collected Nov. 17, 1937 showed this water to have a hardness of 10.4 gr. per gal., a residue of 310 ppm., and no iron.

Well No. 3 was drilled in 1928 to a depth of 116 ft. by Guy Marvin and Tom Mills, Sheldon, and located 20 ft. west of Well No. 2. The well was cased with 10-in. pipe below which a home-made perforated pipe screen of unknown length was set in coarse gravel.

On Nov. 17, 1937 the non-pumping water level was 35 ft. and when pumping at 100 gpm. the drawdown was 10 ft. On Apr. 29, 1943, when pumping at 100 gpm. the drawdown was 16 ft. from a non-pumping level of 27 ft.

A new 10-in. casing and 10 ft. of 8-in. screen were installed, after which the yield rate was 25 gpm. The casing and screen have been removed and the well filled with gravel.

Well No. 4 was drilled in 1945 to a depth of 116 ft. by John Bolliger and Sons, Fairbury, and located 40 ft. south of Well No. 2. The ground elevation at the well-site is 683± ft.

The well was cased with 10-in. pipe, and with 16 ft. of 10-in. Johnson screen, and when completed, the static water level was 47 ft. below the ground surface. Water was pumped for several hours at a rate of 450 gpm. The turbine setting was 65 ft. below ground level.

Well No. 4 is the sole source of public supply at present. The pumping equipment includes a'

10-in. American Well Works turbine pump, No. 72340, having a rated capacity of 360 gpm. against a head of 100 ft.; 15-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 116,416) collected Nov. 10, 1948 after 15-minutes pumping showed the water to have a hardness of 9.6 gr. per gal., a residue of 302 ppm., and an iron content of 0.9 ppm.

Well No. 5 is being drilled by J. Bolliger & Sons and is located 63 ft. east of Well No. 4. It is being cased with 10-in. pipe and a 10-ft. length of 10-in. Johnson Everdur screen is on hand for installation. The top 4 ft. of the screen has No. 40 slot openings; the next 3 ft. has No. 60 slots and the bottom 3 ft. has No. 80 slots.

On Nov. 11, 1948 the drilling had reached a depth of 101 ft. The following pumping equipment, removed from Well No. 3, is to be installed in Well No. 5: 60 ft. of 4-in. column pipe; 6-in. Worthington turbine pump, 300 QDE 10, Serial No. T 1639, 5-hp. U. S. electric motor.

Pumpage is estimated to average 50,000 gpd.

Sample-study log of Well No. 4 furnished bythe State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Till	96	96
Sand, silty	4	100
Gravel, silty	5	105
Gravel, clean	11	116

LABORATORY NO. 116,416

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.9		Silica	SiO_2	17.6	
Calcium	Ca	42.2	2.11	Fluoride	F	0.8	
Magnesium	Mg	14.3	1.18	Chloride	Cl	3.0	0.09
Ammonium	NH_4	0.6	0.03	Nitrate	NO_3	0.2	Tr.
Sodium	Na	56.4	2.45	Sulfate	SO_4	3.7	0.08
Turbidity		3		Alkalinity (as $CaCO_3$)		280.	5.60
Color		0		Hardness (as $CaCO_3$)		165.	3.29
Odor		0		Residue		302.	
Temperature 54° F.				Free CO_2 (calc.)		20.	
				pH = 7.55			

A public water supply was installed in 1905 by the village of Sibley (374).

A well was drilled in 1907, to a depth of 117 ft., by Otto Stiegman, Roberts, and located about 200 ft. south of Ohio St. and 200 ft. east of Sciota St. (or approximately 870 ft. S. and 770 ft. E. of the N. W. corner of Section 35, T. 24 N., R. 7 E.). The ground elevation is 814± ft.

The well was cased with 107 ft. of 8-in. pipe and 10 ft. of 7 3/4-in. od. Cook screen, having No. 10 slot openings. The old 4 3/4-in. cylinder was worn out in 1925 and replaced by the present cylinder. At that time the water level was 46 ft. below the ground surface, and the pumping rate was estimated at 35 gpm. The well was repaired by L. F. Swanson, Gibson, in 1933 and a new screen installed. The slot openings were too small and the new screen did not give satisfaction. John Bolliger, Fairbury, replaced the new screen with 8 1/2 ft. of the old original screen in which additional openings were made, and the well continued to furnish the entire village supply. When the pump was out in 1945 the water level was 50 ft. below the pump base floor. This well is the source of the public supply.

The pumping equipment consists of a 24-in. Gould plunger pump No. 12559 with a 5 1/4-in. cylinder attached to 100 ft. of 5-in. drop pipe. The pump is operated at a speed of 27 spm. and is belt-driven by a 5-hp. General Electric motor. The discharge of the pump is estimated to be 50 gpm.

Analysis of a sample (Lab. No. 116,216) collected Oct. 16, 1948 after 30-minutes pumping showed this water to have a hardness of 15.9 gr. per gal., a residue of 310 ppm., and an iron content pf 0.8 ppm.

A 4-in. well was drilled in 1925 to a depth of 108 ft. and located at the south end of the pumping station. The pump installation includes a plunger pump with a 2 1/4-in. cylinder set at 86 ft., belt-driven by a 1 1/2-hp. General Electric motor.

The well is maintained for emergency use but has not been used since the spring of 1948 because of a belt-pulley being in poor repair.

Pumpage is estimated to average 12,000 gpd.

LABORATORY NO. 116,216

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.8		Silica	SiO_2	20.1	
Manganese	Mn	0.0		Fluoride	F	0.4	
Calcium	Ca	62.2	3.11	Chloride	Cl	2.0	0.06
Magnesium	Mg	28.5	2.34	Nitrate	NO_3	0.5	0.01
Ammonium	NH_4	0.7	0.04	Sulfate	SO_4	8.6	0.18
Sodium	Na	12.0	0.52	Alkalinity	(as $CaCO_3$)	288.	5.76
Turbidity		10		Hardness	(as $CaCO_3$)	273.	5.45
Color		0		Residue		310.	
Odor		0		Free CO_2 (calc.)		29.	
Temperature 53.5° F.				pH = 7.4			

A public water supply was installed in 1928 by the village of Sidell (653).

Water was originally obtained from a dug well purchased by the village about 1908, and located northwest of the intersection of Gray and Main St. (or approximately 1000 ft. N. and 200 ft. E. of the S.W. corner of Section 22, T. 17 N., R. 13 W.). The well was 4 ft. in diameter and 29 ft. deep from a ground level elevation of 683i ft. The well was lined with brick with the top five feet of the well widened to five feet diameter. The top of the manhole is in the bottom of a pit 6.5 ft. below ground level.

The pumping equipment consists of a Westco centrifugal pump No. 6 H 5-25-4543AB rated at 35 gpm. at 120 lb. head and a 5-hp. 1740 rpm. General Electric motor. In 1938, the pump was operated about 1 1/2 hr. daily, in three 30-min. periods. During prolonged periods of dry weather, the dug well did not furnish sufficient water. The supply was obtained from a deeper tubular well and the dug well was used as a reservoir.

The deeper well had also been drilled about 1908 and is located in the park about 50 ft. south and 100 ft. west of the dug well.

A. L. Stice, Danville, worked on this well in 1944. He reported the depth to be 107 ft. and the static water level to be 67 ft. below ground level.

InSept. 1947, C. E. Bremer and Sons, Lebanon, Ind., removed the pump and reported the following measurements of the well: total depth of well was 126 ft., cased with 6-in. pipe to 105 ft. and 3-in. pipe from 105 to 122 ft. The pumping assembly, as reinstalled, consisted of 4 ft. of pit section; 92.6 ft. of 1 1/4-in. drop pipe; 2 1/2-in. cylinder, 1.3 ft. long; 16.4 ft. of 1 1/4-in. suction pipe; power-driven hand pump from a 1/3-hp. Century electric motor.

In 1947 water was being pumped from this well into the dug well, and then was pumped from the dug well about 4 times daily. Before pumping, the water level in the dug well was about 6 ft. below the top of the manhole or 12 ft. below ground level. During wet periods, the water level was within 6 in. of the top of the manhole, and it was unnecessary to pump from the deep well.

On Sept. 24, 1947 a production test of the deep well was made by the State Water Survey. Water was pumped for about 12 hr. at a rate of 4.5 gpm. Three hours after stopping the pump, the water level was 97 ft. below ground level. The water was colored with shale and was pumped to waste on Sept. 25, then on Sept. 26 water was pumped into the dug well. After about 7 or 8 hr., the pumping rate was observed to be about 1.7 gpm.

The dug well is still the source of the public supply, augmented by the available yield from the drilled well. The latter can be used about six times daily for pumping periods of one hour each at an average of 2 gpm. On Dec. 1, 1948 the depth of the dug well was 29 ft. below ground level and the pump was operated for one hour at five A. M. after a 7-hr. non-pumping period. Subsequent pumping periods were limited to 30 min. following 2-hr. non-pumping periods. At 11:21 A.M. the non-pumping water level was 9.2 ft. below the top of the manhole cover and after 19-min. pumping at an estimated rate of 30 gpm. the drawdown was 9.0 ft. After a 20-min. non-pumping period the water level was 14.4. The rate of inflow was calculated to be 18 gpm.

Analysis of a sample (Lab. No. 116,652) collected Dec. 1, 1948 after 20-min. pumping showed this water to have a hardness of 34.0 gr. per gal., a residue of 1177 ppm., and an iron content of 0.3 ppm.

Pumpage is estimated to average 7100 gpd.

In an effort to supplement the water supply,. 17 test holes were drilled in July 1948 by Hayes and Sims, Champaign, and located in, and immediately adjacent to, the village limits. The best prospect was found just outside the southeast corporation limits where a water-bearing gravel formation was encountered at a depth of about 30 ft.

LABORATORY NO. 116,652

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.3		Silica	SiO_2	17.7	
Manganese	Mn	0.1		Fluoride	F	0.	
Calcium	Ca	140.0	7.00	Chloride	Cl	360.	10.15
Magnesium	Mg	57.1	4.70	Nitrate	NO_3	5.8	0.09
Ammonium	NH_4	0.2	0.01	Sulfate	SO_4	222.0	4.62
Sodium	Na	127.7	5.55	Alkalinity	(as $CaCO_3$)	320.	6.40
Turbidity		2		Hardness	(as $CaCO_3$)	585.	11.70
Color		0		Residue		1177.	
Odor		0		Free CO_2 (calc.)		62.	
Temperature 56.5° F.				pH = 7.1			

SIDNEY
Champaign County
Dec. 15, 1948

A public water supply was installed in 1939 by the village of Sidney (567).

Water is obtained from a well drilled in 1939 to a depth of 56 ft. by Guy McElwee, Sidney and located east of David St. and south of the Wabash R. R. (or approximately 1000 ft. S. and 1700 ft. W. of the N. E. corner of Section 16, T. 18 N., R 10 E.).

The elevation of the ground surface at the well-site is 665t ft.

Sample-study log of well drilled in 1939 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Sand, clayey	20	20
Till	18	38
Sand, slightly silty	2	40
No record	9	49
Sand and gravel, clean	3	52
Sand, slightly silty	4	56
Silt and sand	below	56

The well is cased with 46 ft. of 6-in. pipe and 10 ft. of 6-in. Cook brass screen, the lower 8 ft. of the screen, having No. 14 slot openings.

A production test was made by the State Water Survey on Aug. 15, 1939. Static water level was 22 ft. below the top of the casing and after 7-hr. pumping at 30 gpm. the drawdown was 11 1/2 ft. Thirty minutes after stopping the pump, the water level was 1 ft. below the starting level.

The pumping equipment includes a Fairbanks-Morse turbine pump, No. 5518, and a 2-hp. electric motor. In Dec. 1948, the pump would break suction after 7-hr. pumping at 65 gpm. and was throttled to 55 gpm.

Analysis of a sample (Lab. No. 116,738) collected Dec. 15, 1948, after 5 1/2-hr. pumping showed this water to have a hardness of 13.3 gr. per gal., a residue of 435 ppm., and an iron content of 3.1 ppm.

All water is aerated and filtered. Analysis of a sample (Lab. No. 116,739) collected Dec. 15, 1948 showed the treated water to have a hardness of 14.0 gr. per gal., a mineral content of 407 ppm., and an iron content of 0.1 ppm.

Metered pumpage averages 19,310 gpd.

LABORATORY NO. 116,738

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	3.1		Silica	SiO_2	23.8	
Manganese	Mn	0.0		Fluoride	F	0.6	
Calcium	Ca	55.3	2.77	Chloride	Cl	24.0	0.68
Magnesium	Mg	21.6	1.78	Nitrate	NO_3	0.5	0.01
Ammonium	NH_4	7.2	0.40	Sulfate	SO_4	4.9	0.10
Sodium	Na	77.3	3.36	Alkalinity (as $CaCO_3$)		376.	7.52
Turbidity		8		Hardness (as $CaCO_3$)		228.	4.55
Color		0		Residue		435.	
Odor		Tr.		Free CO_2 (calc.)		86.	
Temperature		54.2° F.		pH = 7.05			

SILVIS
Rock Island County
October 17, 1947

The public water works of the city of Silvis (2990) was installed in 1910.

Water was first obtained from a well dug in 1910 to a depth of 28 ft. and located opposite the city hall at the northeast corner of First Ave. and Twelfth St. (or approximately 1200 ft. S. and 1230 ft. E. of the N.W. corner of Section 32, T. 18 N., R. 1 E). The diameter of the well was 15 ft., and the well was lined with steel plate to its full depth. The elevation of the ground surface is 580± ft.

In 1912, it was reported that the water level varied with the Mississippi River level, one mile distant. In August 1923, there was 4 ft. of water in the well, but the water level did not change when pumping from the deep well 55 ft. to the south. At the same time, water was pumped from the shallow well twice daily, and the well was dewatered in 18 min.

Water is pumped by a single-stage Gould's centrifugal pump No. 156437, connected to a 2-hp. electric motor, No. 100491. There is also a Weinman centrifugal pump connected to a 3-hp. Master electric motor. The pump discharges into the reservoir at an estimated rate of 100 gpm. and in Oct. 1947 was operated about 24 hr. daily.

Analysis of a sample (Lab. No. 112,247), collected Oct. 17, 1947, showed the water in this well to have a hardness of 26.6 gr. per gal., a mineral content of 1312 ppm., and a trace of iron. The quality is not representative of waters from this depth in this vicinity. Approximately 60% of this water appears to have originated in the St. Peter-Jordan sandstone and entered the unconsolidated surface formation by way of the Ice Company's reservoir located 600 ft. northeast.

A second well was drilled in 1912 to a depth of 1985 ft. and located 55 ft. south of the old well. The well was cased with 15-in. cast iron pipe to a depth of 38 ft.; with 12-in. Byers pipe from 38 to 278 ft.; and with 9-in. Byers pipe from 278 to 1178 ft. The top of the casing was 10 ft. below the ground surface.

When the well was completed, the water flowed freely over the top of the well, and this furnished practically the entire supply for the city until 1923. At that time the free flow rate averaged 23 gpm. A 4-in. suction line was placed in the well to a depth of 30 ft., and the daytime pumping rate was estimated at 490 gpm. During pumping operations, the depth to water ranged from 20 to 21 ft. below the top of the. casing. On Oct. 17, 1947, the non-pumping water, level was 80 ft. below the pump base and when pumping at 475 gpm., the drawdown was 60 ft.

The existing pump assembly, installed in April 1947, consists of 150 ft. of 6-in. column pipe; 8-in., 9-stage Peerless oil lubricated turbine pump, No. 30495, rated at 500 gpm. against 150 ft. of head; the overall length of the pump is 5 1/2 ft.; 150 ft. of 1/4-in. copper air line; 10 ft. of 6-in. suction pipe; 30-hp., 1800 rpm. U. S. electric motor, No. 163256.

This pump is operated 7 to 8 hours daily.

Analysis of a sample (Lab. No. 112,246), collected Oct. 17, 1947, showed the water from this well to have a hardness of 27.1 gr. per gal., a residue of 1709 ppm., and an iron content of 0.2 ppm. A quality-source test made on Dec. 10, 1943 showed the presence of some water, from a depth above the St. Peter sandstone, to be entering the well at a rate of about 5 gpm.

The water is not treated. Pumpage is estimated to average 290,000 gpd.

LABORATORY NO. 112,247

	ppm.	epm.		ppm.	epm.
Iron (total) Fe	Tr.		Chloride Cl	430.	12.13
Turbidity	0		Alkalinity (as $CaCO_3$)	212.	4.24
Color	0				
Odor	0		Hardness (as $CaCO_3$)	457.	9.14
Temperature 58° F.			Total Mineral Content	1312.	

LABORATORY NO. 112,246

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	13.5	
Manganese	Mn	0.0		Fluoride	F	0.9	
Calcium	Ca	106.6	5.33	Chloride	Cl	620.0	17.48
Magnesium	Mg	48.3	3.97	Nitrate	NO_3	7.7	0.12
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	315.9	6.56
Sodium	Na	439.1	19.09	Alkalinity	(as $CaCO_3$)	212.	4.24
Turbidity		Tr.		Hardness	(as $CaCO_3$)	465.	9.30
Color		0		Residue		1709.	
Odor		0					
Temperature		63° F.					

Correlated driller's log of the Continental Ice Company well, Silvis, furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene and Pennsylvanian systems		
No record	32	32
Shale	118	150
Devonian and Silurian systems		
Limestone	285	435
Ordovician system		
Maquoketa formation		
Shale	235	670
Galena-Platteville formations		
Limestone	310	980
St. Peter formation		
Sandstone	40	1020
St. Peter and Shakopee formations		
Shale (probably shale and dolomite)	130	1150
Ordovician and Cambrian systems		
Shakopee, New Richmond, Oneota and Trempealeau formations		
Limestone and sandstone, alternating	520	1670

A public water supply was installed by the village of Somonauk (610) about 1880.

The initial source of the supply consisted of a single well now called the East Well, reported to have a depth of 190 ft. and a diameter of 10 in. Another well called the West Well drilled to a depth of 502 ft. was added to the supply in 1903.

These 2 wells have constituted the source of the entire public water supply. They are spaced about 11 ft. apart and are located in a pit 4 ft. below the ground surface about 90 ft. north of the center of the Chicago, Burlington and Quincy R.R. and 40 ft. east of the center of Gage St. (approximately 1570 ft. N. and 250 ft. W. of the S. E. corner of Section 32, T. 37 N., R. 5 E.).

The ground surface at the tops of the wells is 685± ft.

The productive capacities of these wells has never been definitely determined. A combined production of 340 gpm. was reported in 1915 and 365 gpm. in 1922. A non-pumping water level of 12 to 14 ft. below the ground surface was reported in the West Well on Mar. 9, 1922.

The West Well was drilled by the J. P. Miller Artesian Well Co., Brookfield, in 1903.

The West Well was reported cased with 10-in. pipe to a depth of 115 ft. and 13 ft. of 8-in. liner was placed between depths of 102 and 115 ft.

On Oct. 7, 1947, the water level in the West Well, when pumping at 175 gpm., was 18 ft. below the pump base. During this operating period the East Well pump "kicked in" for about one minute and the water level in the West Well was lowered an additional foot. The pumping water level in the East Well was 17 ft. below the same elevation.

Driller's log of the West Well correlated by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Sand, gravel, hardpan	?	?
Ordovician system		
St. Peter formation		
Limestone and sandstone	?	106
Sand rock, white	46	152
Shale, sandy, flinty	73	225
Ordovician - Cambrian systems		
Oneota - Trempealeau formations		
Limestone	235	460
Cambrian system		
Franconia formation		
Shale and limestone	42	502

Analysis of a sample (Lab. No. 112,144), collected Oct. 7, 1947 after 30-min. pumping at 175 gpm. when the east well pump was idle, showed this water to have a hardness of 20.2 gr. per gal., a residue of 343 ppm., and an iron content of 1.4 ppm.

Both wells are in daily service and are equipped with identical Aurora Pump Co. centrifugal pumps each having a rated capacity of 125 gpm. against a pressure of 50 psi., and each is powered by a 10-hp. Westinghouse electric motor. The pump in the East Well was installed in 1941, and in the West Well, in 1945. Pumping is automatically controlled, and both pumps generally are operated simultaneously.

The estimated average pumpage is 45,000 gpd.

LABORATORY NO. 112,144

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.4		Silica	SiO_2	22.0	
Manganese	Mn	0.0		Fluoride	F	0.2	
Calcium	Ca	79.8	3.99	Chloride	Cl	4.0	0.11
Magnesium	Mg	35.9	2.95	Nitrate	NO_3	1.5	0.02
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	13.6	0.28
Sodium	Na	0.7	0.03	Alkalinity	(as $CaCO_3$)	328.	6.56
Turbidity		10+		Hardness		347.	6.94
Color		0		Residue		343.	
Odor		0		Free CO_2 (calc.)		49.	
Temperature		52.7° F.		pH = 7.25			

SOUTH BELOIT
Winnebago County
Oct. 30, 1947

The public water supply for the city of South Beloit (2825) is owned and operated by the South Beloit Water, Gas and Electric Company. It is operated in connection with the water system in Beloit, Wisconsin, owned by the Wisconsin Power and Light Company, which furnishes water for the city of Beloit.

Water was originally obtained from wells located in Beloit, Wis.

Well No. 1: there are ten 8-in. gravel wells grouped at Well Station No. 1 in Beloit at the northeast corner of Pleasant St. and Eclipse Ave. These wells were drilled between 1916 and 1926 and are reported to be about 100 ft. in depth with 20-ft. brass screens at the bottom. They are pumped by a common suction manifold connected to 2 Fairbanks-Morse centrifugal pumps operated in tandem and have a combined capacity of 1400 gpm. On Aug. 14, 1947 the vacuum gauge reading indicated a pumping water level of 19 ft. below the suction line in the basement of the pumping station.

Well No. 2: three 10-in. gravel wells are located at Well Station No. 2 in the basement of the new electric plant on Pleasant St. near Emerson Ave. in Beloit. Water is pumped from the 3 wells by suction lift with a Fairbanks-Morse centrifugal pump, having an average discharge of 939.6 gpm.

Nine other wells, originally in this group, were abandoned when the new electric plant was constructed. The three remaining wells were drilled in 1924 and were reported to be about 100 ft. deep.

Well No. 3 was drilled in 1937 by C. W. Varner, Dubuque, Iowa, to a depth of 1200 ft. and is located in South Beloit, 25 ft. north of Clark St. and 35 ft. west of Pershing Road (or approximately 2215 ft. N. and 1115 ft. E. of the S. W. corner of Section 5, T. 46 N., R. 2 E.).

The surface elevation is 745t ft. After shooting, the well was cleaned to a depth of 1185 ft.

The hole and casing record is:

Hole Record

17-in. from surface to 352 ft.
12 3/4-in. from 352 to 1185 ft.

Casing Record

18-in. od. from surface to 230 ft. 5 in.

The well is equipped as follows: 120 ft. of 12-in. id. column pipe; 14-in., 4-stage Fairbanks-Morse turbine pump, rated at 1450 gpm. against 126 ft. of head at 1150 rpm.; 20 ft. of 10-in. id. suction pipe; 75-hp. Fairbanks-Morse electric motor, No. 347442.

In Nov. 1937, it was reported that the well was flowing 35 gpm. when tested and produced 1675 gpm. with a drawdown of 101 ft.

Analysis of a sample (Lab. No. 112,321) collected Oct. 24, 1947 after 3-hr. pumping at 1350 gpm. showed this water to have a hardness of 17.5 gr. per gal., a residue of 311 ppm., and an iron content of 0.2 ppm.

All water is chlorinated at the well.

The metered pumpage from Well No. 3 during the years of 1942 to 1946, inclusive, averaged 855,110 gpd. The metered pumpage from Tan. 1, 1947 to Oct. 1, 1947 averaged 993,845 gpd. About 265,000 gpd. is used by South Beloit.

Well No. 4, located in Beloit, is called the "east side deep well." It was drilled by C. W. Varner Well Drilling Co., Inc. in 1926 to a depth of 969 ft. and is still in service. This well is about 50 ft. north of Well Station No. 1 and was drilled an 18-in. hole from the surface to 300 ft.; 12-in. hole from 300 to 969 ft. The existing pump installation, made about Tune 1944, consists of 113 ft. of 10-in. column pipe; 14-in., 8-stage Layne-Bowler turbine pump, having an overall length of 9 ft.; 20 ft. of 10-in. suction pipe. The pump delivers about 1200 gpm.

Well No. 4 was "shot" in 1935.

Well No. 5 was drilled to a depth of 1225 ft. by C. W. Varner Well Drilling Co., Inc. in 1929 and located in Beloit about 1 mile north of Well No. 3 in South Beloit. Well No. 5 is about 1/2 mile west of Well No. 4.

Well No. 5 was drilled an 18-in. hole from the surface to 300 ft.; 12-in. diameter from 300 to 900 ft.; 8-in. from 900 to 1225 ft. The existing pump installation, made in May 1946, consists of 182 ft. of 10-in. column pipe; 14-in., 9-stage Fairbanks-Morse turbine pump having an overall length of 10 ft.; 20 ft. of 8-in. suction pipe. The pump discharge rate is about 1050 gpm. The well was "shot" in 1933. On May 21, 1946 the non-pumping water level was 55 ft. below the pump base (about ground level) after 21 days of idle period; and, after 48 hr. of operation, the pumping level was 62 ft. The well is still in service.

Well No. 8, located south of the new electric plant on the west side of Pleasant St. in Beloit, was drilled in Aug. 1945 to a depth of 140 ft. by C. W. Varner Well Drilling Co., Inc.

The well was cased with 24-in. pipe from the surface to a depth of 90 ft. below which was 50 ft. of 23-in. od. Johnson screen consisting of 23 ft. of No. 80 slot; 5 ft. of No. 150 slot; and 22 ft. of 187 1/2 slot openings.

The existing pump installation, made in May 1947, is: 70 ft. of 12-in. column pipe; 14-in., 4-stage Fairbanks-Morse turbine pump having an overall length of 4 ft.; 20 ft. of 10-in. suction pipe; 74 ft. of 1/4-in. copper tubing air line.

On May 21, 1947 after pumping 8 hr. at 2500 gpm. the drawdown was 25 ft. from a non-pumping water level of 21 ft. below the pump base. On June 21, 1947, the pump discharge averaged 2533 gpm. for 9 hr.

Sample-study and driller's log of Well No. 3 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Loam"	3	3
"Gravel"	119	122
"Gravel and shale"	16	138
"Gravel and sand"	82	220
"Shale"	5	225
Ordovician system		
St. Peter sandstone, some chert	10	235
Cambrian system		
Trempealeau dolomite	42	277
Franconia sandstone, shale, thin dolomite bed at base	78	355
Galesville formation		
"Sandstone, thin limestone beds"	39	394
"Sandstone"	76	470
Eau Claire formation		
Sandstone, some shale and dolomite	311	781
Sandstone, incoherent	89	870
Sandstone, partly incoherent, siltstone at base	90	960
Mt. Simon sandstone	45	1005
Pre-Cambrian system		
Fond du Lac sandstone	185	1190

LABORATORY NO. 112,321

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	18.1	
Manganese	Mn	0.5		Fluoride	F	0.1	
Calcium	Ca	59.4	2.97	Chloride	Cl	2.0	0.06
Magnesium	Mg	36.8	3.02	Nitrate	NO_3	14.2	0.23
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	9.1	0.19
Sodium	Na	7.6	0.33	Alkalinity (as $CaCO_3$)		292.	5.84
Turbidity		Tr.		Hardness (as $CaCO_3$)		300.	5.99
Color		0		Residue		311.	
Odor		0		Free CO_2 (calc.)		24.	
Temperature 53.2° F.				pH = 7.5			

SOUTH CHICAGO HEIGHTS
Cook County
July 13, 1946

A public water supply was installed by the village of South Chicago Heights (1,837) in 1915. Water is obtained from a well located back of the village hall at 2729 Jackson Ave., (or approximately 1650 ft. N. and 150 ft. W. of the S. E. corner of Section 29, T. 35 N., R. 14 E.

This well was originally drilled in 1893 to obtain oil or gas. It was abandoned and later purchased by the village. The well is reported to have been drilled to a depth of 2756 ft. and cased to rock at a depth of 60 ft. with 8-in. pipe. No other data on its construction are available. In Aug. 1918 a non-pumping water level of 42 ft. was reported, but no information could be obtained on the pumping water level. A pumping test of 14-hr. duration was conducted on Aug. 6 and 7, 1941. The water level was 65 ft. and when pumping at a rate of 285 gpm., a drawdown of 52 1/2 ft. was reported.

On Dec. 5, 1941 the following pump assembly was installed and is still in service: 50 ft. of 5-in. column pipe; 100 ft. of 4-in. column pipe; a 6-in., 6-stage Peerless turbine pump, rated at 350 gpm. against 198 ft. of head; the overall length of the pump is 3 ft. 3 in.; 150 ft. of air line, and a 30-hp. U. S. electric motor.

After this unit was installed a 6-hr. production test was made. After pumping 6 hr. at an average rate of 420 gpm. the water level was 128 ft. below the pump base.

Analysis of a sample (Lab. No. 109,008), collected Jan. 24, 1946 after pumping at approximately 420 gpm. for 20 min., showed the water to have a mineral content of 479 ppm., a hardness of 25.4 gr. per gal., and character typical for waters from the upper limestone in this vicinity. Water of similar character was noted in samples collected in 1918 and 1941.

LABORATORY NO. 109,008

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.4		Silica	SiO_2	20.6	
Manganese	Mn	0.0		Fluoride	F	0.2	
Calcium	Ca	93.0	4.65	Chloride	Cl	2.0	.06
Magnesium	Mg	49.1	4.04	Nitrate	NO_3	0.6	.01
Ammonium	NH_4	0.5	.03	Sulfate	SO_4	55.1	1.15
Sodium	Na	11.5	0.50	Alkalinity	(as $CaCO_3$)	400.	8.00
Color		0		Hardness	(as $CaCO_3$)	435.	8.70
Odor		0		Residue		479.	
Turbidity		10-					
Temperature		52.5° F.					

SOUTH ELGIN
Kane County
Sept. 1, 1947

A public water supply was installed by the village of South Elgin (961) in 1938.

Water is obtained from a well drilled in 1929 by W. L. Thorne Co., Des Plaines, to a depth of 685 ft. and deepened in 1938 to a depth of 1250 ft. The well is located about 70 ft. west of Collins St. and 200 ft. north of Prairie St. (approximately 1250 ft. S. and 230 ft. E. of the N. W. corner of Section 35, T. 41 N., R. 8 E.). The elevation of the pump base is 761.2 ft.

When the well was first drilled it was not equipped for pumping. The water distribution system was not laid until 1938.

Sample-study log of well drilled in 1929 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil	5	5
Sand	25	30
Glacial till	10	40
Gravel, clean	15	55
Silurian system		
Alexandrian dolomite	40	95
Ordovician system		
Maquoketa shale and dolomite	170	265
Galena-Platteville dolomites	350	615
Glenwood sandstone, some dolomite	70	685
St. Peter formation		
Sandstone	175	860
Sandstone and shale	49	909
Cambrian system		
Trempealeau dolomite, some sandstone	93	1002
Franconia sandstone, shale and dolomite	83	1085
Galesville sandstone	165	1250

When the deepening of the well was completed a 10-hr. production test was made by the State Water Survey on Apr. 14, 1938. Before the test, the water level was 142 ft. below the top of the casing. The following results were obtained.

Pumping Rate gpm.	Pumping Time hr.	Drawdown ft.
322	2	45 1/2
255	3	39
203	3	30 1/2
262	2	40

Hole Record

10-in. from 265 to 650 ft.
8-in. from 650 to 685 ft.

The hole diameter below 685 ft. is not known.

Casing and Liner Record

12-in. from 0 to 59 ft.
10-in. from 49 1/2 to 265 ft.
8-in. from 589 1/2 to 650 ft.
6-in. from 626 1/2 to 685 ft.

In 1946 the non-pumping water level was 179 ft. below the pump base and on Aug. 14, 1947 after pumping 30 min. at 100 gpm. the water level was 198 ft.

The existing pump installation, made in Nov. 1944, is 210 ft. of 4 1/2-in. wi. column pipe; 7-in., 9-stage American Well Works turbine pump, No. 61924, having a bronze bowl assembly length of 7 ft. and a rated capacity of 100 gpm. against 208 ft. of head; 10 ft. of 5-in. suction pipe; 210 ft. of 1/4-in. copper air line; 7 1/2-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 111,558) collected Aug. 14, 1947 after 30-min. pumping at 100 gpm. showed this water to have a hardness of 16.0 gr. per gal., a residue of 343 ppm., and an iron content of 0.7 ppm. The analysis shows the presence of an appreciable portion of water from formations above the Galesville sandstone.

The municipality owns a treatment plant for iron and hydrogen sulfide removal and softening.

Metered pumpage for the years 1943, 1944, 1945 and 1946 averaged 45,700 gpd.

LABORATORY NO. 111,558

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.7		Silica	SiO_2	13.3	
Manganese	Mn	0.0		Fluoride	F	0.6	
Calcium	Ca	66.4	3.32	Chloride	Cl	4.0	0.11
Magnesium	Mg	26.2	2.16	Nitrate	NO_3	0.9	0.01
Ammonium	NH_4	0.6	0.03	Sulfate	SO_4	23.4	0.49
Sodium	Na	22.0	0.94	Alkalinity (as $CaCO_3$)		292.	5.84
Turbidity		Tr.		Hardness (as $CaCO_3$)		274.	5.48
Color		0		Residue		343.	
Odor (at well)		H_2S		Free CO_2 (calc.)		18.	
Temperature 54.6° F.				pH = 7.6			

SOUTH PEKIN
Tazewell County
Feb. 18, 1947

The public water supply was installed by the village of South Pekin (1044) in 1926.

Water is obtained from 2 wells located in the pump house approximately 2800 ft. E. and 50 ft. S. of the N.W. corner of Section 34, T. 24 N., R. 5 W.

Well No. 1 was drilled in 1926 by Layne-Bowler Co., Chicago, to a depth of 90 ft. Below sandy soil the drilling was reported to be in sand the entire depth. Quicksand was encountered at a depth of 60 ft. The elevation of the ground surface is 510± ft. The well was cased with 12-in. wrought iron pipe, and below the casing a Layne screen of perforated pipe wrapped with gauze. A pit, 13 ft. in diameter and 39 1/2 ft. deep was constructed around the top of the casing which was then cut off 12 in. above the floor of the pit.

The well is equipped with a centrifugal pump taking direct suction from the well. A short production test was made in June 1926. Before the test the water level was 3 ft. 8 in. below the top of the casing; and while pumping at 350 gpm., the drawdown was 13 ft. 5 in.

When Well No. 2 was drilled in 1928, the centrifugal pump was removed from Well No. 1; and the casing in Well No. 1 was extended upward to 17 1/2 ft. above the floor of the pit. The diameter of this extension to the casing is reported to be 8 in. The well was then equipped with an A.D. Cook deep-well cylinder pump connected to a Stover 18-hp. gas engine. Well No. 1 is not used at present but is retained for emergency.

Well No. 2 was drilled in 1928 by H. B. Smith, San Jose, and located in the pit 5 ft. from the older well. It is 8 in. in diameter and 70± ft. deep front the bottom of the pit. The casing extends 1 ft. above the floor of the pit. Below the floor of the pit there is 50 ft. of 8-in. pipe and 20 ft. of strainer.

The well is equipped with a 3-in. Fairbanks-Morse centrifugal pump, No. 338876, rated at 350 gpm. with 12 ft. of 4-in. suction pipe. The pump is driven by a 30-hp., 3600 rpm. Fairbanks-Morse electric motor, No. 148983.

Analysis of a sample (Lab. No. 109,276), collected Feb. 18, 1947 after the pump had been operating about 10 min., showed the water from Well No. 2 to have a hardness of 23.2 gr. per gal., a residue of 496 ppm., and an iron content of 0.1 ppm.

Pumpage is estimated at 60,000 gpd.

LABORATORY NO. 109,276

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.1		Silica	SiO_2	21.4	
Manganese	Mn	Tr.		Fluoride	F	0.2	
Calcium	Ca	100.9	5.05	Chloride	Cl	17.0	.48
Magnesium	Mg	34.8	2.86	Nitrate	NO_3	8.6	.14
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	156.5	3.26
Sodium	Na	8.5	.37	Alkalinity	(as $CaCO_3$)	220.	4.40
Color		0		Hardness	(as $CaCO_3$)	396.	7.92
Odor		0		Residue		496.	
Turbidity		0					
Temperature		55.2° F.					

SOUTH WILMINGTON
Grundy County
Nov. 27, 1947

The public water supply for the village of South Wilmington (645) was installed in 1913.

Water is obtained from a well dug in 1913 and located about 13 ft. north of the center of Lynn St. and 80 ft. east of the center of Third Ave. (or approximately 1050 ft. N. and 1600 ft. E. of the S. W. corner of Section 11, T. 31 N. R. 8 E.). The surface elevation is 600± ft.

The well was originally dug 9 ft. by 12 ft. square to a depth of 22 ft., and the sides are now curbed with concrete. It was reported that the bottom four feet had filled in. The suction pipe extends to the bottom of the well, and water is pumped by an 8-in. by 10-in. Goulds single-acting triplex pump having a theoretical displacement of 350 gpm., when operated at 54 spm.; 30-hp. Westinghouse electric motor.

The water levels show seasonal fluctuations and vary with the amount of precipitation. During the summer and fall of 1947 the capacity of the pump was greater than the yield of the well, and pumping was limited to 10-min. periods every 2 1/2 hr. from 5 a.m. to 1 a.m. The recovery level was only one foot above the bottom of suction, or 21 ft. below the top of the well in 2 1/2 hr. of idle period. In the spring of 1947, the standing water level was reported to be five feet below the top of the well.

Analysis of a sample (Lab. No. 112,658). collected Nov. 18, 1947 after pumping 10 to 12 min. at about 300 gpm. showed the water to have a hardness of 26.4 gr. per gal., a residue of 581 ppm., and an iron content of 0.4 ppm.

All water is chlorinated at the pump house, located at the village hall, about three blocks from the well. Pumpage is estimated at 14,000 gpd.

A well was drilled recently to a depth of 32 ft. by Ira French, Fairbury, and located eight feet east of the dug well on Lynn St. The well is cased with 26 ft. of 8-in. pipe and 6 ft. of slotted screen. The bottom 12 ft. of the well is reported to be in water-bearing sand and gravel. A 6-in. test hole had been drilled at this location and was tested by pumping at a rate of 30 gpm. for eight hours without drawdown. Water levels are reported to be the same at the dug well.

The top of the casing was sealed on Nov. 18, 1947, and the council was considering the purchase of a turbine pump.

LABORATORY NO. 112,658

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.4		Silica	SiO_2	21.4	
Manganese	Mn	0.0		Fluoride	F	0.3	
Calcium	Ca	99.0	4.95	Chloride	Cl	23.0	0.65
Magnesium	Mg	50.1	4.12	Nitrate	NO_3	3.1	0.05
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	155.3	3.23
Sodium	Na	32.7	1.42	Alkalinity	(as $CaCO_3$)	328.	6.56
Turbidity		15		Hardness	(as $CaCO_3$)	454.	9.07
Color		0		Residue		581.	
Odor		Tr.		Free CO_2 (calc.)		23.	
Temperature		53.7° F.		pH = 7.4			

SPARLAND
Marshall County
Jan. 8, 1947

A public water supply was installed by the village of Sparland (509) in 1937.

Water is obtained from a well drilled in 1936 to a depth of 26 ft. by Mike Ebert Co., Washington, approximately 1690 ft. S. and 1990 ft. E. of the N. W. corner of Section 14, T. 12 N., R. 9 E.). The well was cased from the ground surface with 15 ft. of 10-in. pipe and with 11 ft. of Cook screen having No. 40 slot openings. The ground surface elevation is 460± ft.

The well is equipped with 20 ft. of 3-in. column pipe; 3 3/4-in., 11-stage Cook turbine pump, No. 2728, rated at 50 gpm. against a head of 220 ft.; the overall length of the pump is 41 in.; 10 ft. of 3 3/4-in. suction pipe;5-hp. U. S. electric motor.

A production test was made onOct. 8-9, 1936, under the supervision of the State Water Survey. The non-pumping water level was 7.3 ft. below the top of the casing; and after pumping 18 hr. at '168 gpm., the water was drawn down 7.0 ft. At no time during the test was the water drawn down below the top of the screen. However, due to seasonal variations in the water level, pumping rates in excess of 100 gpm. were not recommended.

A softener is installed in the pump house.

Analysis of a sample (Lab. No. 108,853) collected Jan. 8, 1947 after 18-hr. pumping at 168 gpm., showed this water to have a hardness of 36.8 gr. per gal., a mineral content of 797 ppm., and no iron content.

Pumpage is estimated at 35,000 gpd.

The Sparland High School obtains water from a well drilled to a depth of 378 ft. by Mike Ebert Co. and located 100 ft. N. and 1800 ft. E. of the S. W. corner of Section 11, T. 12 N., R. 9 E. The ground surface elevation at the well is 605± ft.

Correlated driller's log of the high school well furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Glacial drift	60	60
Pennsylvanian system		
Shale and rock, dry, no water	200	260
Coal	4	264
Shale	114	378

LABORATORY NO. 108,853

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.0		Silica	SiO_2	16.8	
Manganese	Mn	0.0		Fluoride	F	0.3	
Calcium	Ca	125.0	6.25	Chloride	Cl	11.0	.31
Magnesium	Mg	77.3	6.36	Nitrate	NO_3	7.2	.12
Ammonium	NH_4	0.1	.01	Sulfate	SO_4	355.5	7.40
Sodium	Na	16.8	.73	Alkalinity	(as $CaCO_3$)	276.	5.52
Color		0		Hardness	(as $CaCO_3$)	631.	12.62
Odor		0		Residue		797.	
Turbidity		0		Temperature 54° F.			

SPRING VALLEY
Bureau County
Aug. 15, 1947

A public water supply was installed by the city of Spring Valley (5010) in 1892.

Water was obtained in 1892 from a, dug well on the west side of Hennessy St. between Fourth and Fifth St. This well was abandoned long ago.

The public water supply for the city of Spring Valley is obtained from 5 wells. Two deep flowing wells and one drift well located at the south edge of the city, and 2 wells located in the northwest part of Spring Valley. Two wells, one 34 ft. 8 in. deep and the other, 29 1/2 ft. deep, have been drilled south of the city but are not yet in production.

In 1895 an artesian well was drilled 1480 ft. deep at the foot of the bluffs at the south edge of town and about 800 ft. east of the Chicago Rock Island and Pacific R. R. depot on the right-of-way, north of the tracks (or approximately 665 ft. S. and 635 ft. E. of the N. W. corner of Section 2, T. 15 N.,R. 11 E.). The well flowed upon completion, and the shut-in pressure at the ground surface was 30 psi. There is no pump in this well as the water flows by artesian pressure, to a collecting reservoir.

In 1905 a second well was drilled 70 ft. south of the first well, and was reported to be about 1480 ft. deep. Only the specifications for this well are available as to the casing sizes. These called for a 10-in. wrought iron casing to rock, 8-in. casing through coal measures and shale to a depth of about 400 ft., 6-in. casing below the 8-in. to exclude salt water and a 6-in. hole into the sandstone. It was specified that the casings were to be sealed to rock and to each adjoining casing.

Water flows from this well into the collecting reservoir.

In 1936, the supply had decreased and the South Well was "shot" by J. Otis Heflin, Joliet, after which the flow was increased about 50 gpm.; but in 1938 it had decreased to about the former flow. The North Well was not affected by the "shooting." In 1938, the combined flow of the wells was about 188 gpm.; in Sept. 1945 the combined flow was abput 121 gpm. and on June 1, 1947 it was reported to be 105 gpm.

Analysis of a sample (Lab. No. 104,109) collected Aug. 23, 1945 showed the water from the North Well to have a hardness of 15.1 gr. per gal., a mineral content of 744 ppm., and an iron content of 0.3 ppm.

Analysis of a sample (Lab. No. 104,112) collected on the same date from the South Well showed this water to be of similar quality.

In the summer of 1940, a start was made on prospecting for an additional source of water supply for the city. The search ultimately extended over a 6-year period.

In July and Aug. 1940, two electrical earth resistivity surveys were made by the State Geological Survey in the Illinois River valley flat on both sides of the river immediately south of the city. As a result, 9 test holes were drilled into sand and gravel on the north side of the river. Analyses by the State Water Survey (Lab. No. 89219) of the water from those holes showed the water to be of poor chemical quality having a hardness of 48.8 gr. per gal., and a mineral content of 1012 ppm.

On the south side of the river, the water-bearing sand and gravel deposits were shallow, and the water was unsatisfactory in quality, similar to that found on the north side.

During Oct. and Nov., 1941, two wells were drilled by Hayes and Sims, Champaign. The wells are known as City Well No. 3 and No. 4.

Well No. 3 is located about 525 ft. from center lines of State Highway No. 6, or approximately 1550 ft. S. and 1260 ft. E. of the N. W. corner of Section 34, T. 16 N., R. 11 E. Well No. 4 is about 60 ft. northeast of the center line of State Highway No. 6.

Well No. 3 is located about 525 ft. northwest of the Chicago and Northwestern R. R. and 63 ft. from the center line of State Highway No. 6 (or approximately 1520 ft. S. and 1250 ft. E. of the N. W. corner of Section 34). The well was finished in gravel at a depth of 33 ft. and cased with 12-in. pipe from 3 ft. above ground level to 27 ft. 7 in. Below the casing a Johnson "Armcp Iron" screen, with No. 40 slot openings, was set. A lead packer sealed the space between the casing and screen. The elevation of the ground surface is 600± ft.

The well is equipped with a 6-in., 5-stage American Well Works turbine pump, No. 65502, rated at 75 gpm. against a head of 50 ft. at 1740 rpm.; the overall length of the pump is 3 1/2 ft.; the pump is attached to 4-in. diameter column pipe; power is furnished by a 2-hp., 1800 rpm., U. S. electric motor.

A production test was made by the State Water Survey in Oct. 1941. Prior to the test, the water level was 25 ft. 8 in. below the top of the casing. After 5 1/2-hr. pumping at 49 gpm. the drawdown was 1 1/2 ft.

The well is in service about 8 hr. daily.

Analysis of a sample (Lab. No. 111,557) collected Aug. 15, 1947 showed the water in Well No. 3 to have a hardness of 46.2 gr. per gal., a mineral content of 857 ppm., and an iron content of 1.3 ppm.

Well No. 4 was completed in Nov. 1941, to a depth of 38 2/3 ft. and located 70 ft. northwesterly from Well No. 3. The well was cased with 12-in. pipe from 2 ft. 10 in. above the ground surface to 33 ft. below the surface. Below the casing, a 6.0-ft. length of Johnson "Armco Iron" screen, with No. 40 slot openings, was set.

On Nov. 6, 1941 a production test was made by the State Water Survey, using a single-acting piston pump. Power was furnished by the drilling. Prior to the test, the water level in Well No. 4 was 29 1/2 ft. below the top of the casing. After pumping 5 1/2 hr. at 39 gpm. the drawdown was 2 ft. and after 8 hr., the pumping rate was 46 gpm. with a drawdown of 2 3/4 ft. Ten min. after stopping the pump, the water level was 29 1/2 ft.

The pumping assembly consists of 6-in., 5-stage American Well Works pump, No. 65503, rated at 75 gpm. against a head of 50 ft. at 1740 rpm.; 2-hp., 1800 rpm. U. S. electric motor. The remainder of the assembly is reported to be similar to the installation in Well No. 3.

In Jan. 1945, it was reported that No. 3 was not operating because of lack of water and that the pump in No. 4 was submerged less than 18 in. when pumping at 40 gpm. In Sept. 1945, the production from both wells was estimated to be 90,000 gpd. or about 62 1/2 gpm. The decline in yield was attributed to a decline in storage of a shallow aquifer of very limited areal extent.

In July 1945 a well was drilled by Hayes and Sims in the Valley of Negro Creek, approximately 2500 ft. N. of the S. E. corner of Section 36, T. 16, N., R. 10 E., about 3 1/2 miles west of Spring Valley. The well was 25 ft. 4 in. deep below the ground surface elevation of 470± ft. and cased with 17 1/2 ft. of 16-in. pipe and 7 1/2 ft. of Johnson "Armco" wire-wound screen with No. 30 slot openings. The screen was exposed from 17 1/2 ft. to 25 ft. below ground level.

On Aug. 1, 1945, a production test was made by the State Water Survey. The water level before the test was 4.7 ft. below the ground surface; and after pumping 6 1/2 hr. at 235 gpm., the drawdown was 9.4 ft. The pumping water level was about 5 ft. above the top of the screen. The amount of ground water storage was calculated to be approximately 41 million gal., which could be extracted in about 45 months at an average discharge rate of 300,000 gpd. Since the recharge was calculated to be less than the probable average demand, and, during drought periods no recharge could be expected for longer periods, it was concluded that the development of a supply at this location was not justifiable. The well was abandoned, and the casing and screen salvaged.

In Aug. 1945, Well No. 5 was drilled by Hayes and Sims at a location in the river flat about 570 ft. south and 100 ft. east of the deep wells (or approximately 1235 ft. S. and 765 ft. E. of the N.W. corner of Section 2, T. 15 N., R. 11 E.).

The well is about 31 ft. deep below the ground surface with a 16-in. od. outer casing and a 12-in. id. inner casing and gravel packed between the casings. A Johnson No. 60 slot screen was installed with 6 1/2 ft. exposed length. The pump house was constructed later with the floor level 12.3 ft. above the ground surface, and the casings extended upward to the pump base at floor level.

On Apr. 1, 1946 the pumping installation was 30 ft. of 5-in., column pipe; an 8-in., 2-stage American Well Works turbine pump No. 71786 rated at 300 gpm. against 51 ft. of head at 1735 rpm.; the length of the pump is 3 ft.; 40 ft. of 1/4-in. iron pipe air line; 8 ft. of 5-in. suction pipe; 5-hp. U.S. electric motor.

On Aug. 27, 1946, the water level before pumping was 20 1/2 ft. below the pump base, and, when pumping at 325 gpm. against a total head of 35 ft., the drawdown was 3 ft. Interference in this well when the pumps in Wells No. 6 and 7 were operating simultaneously at 135 and 165 gpm. respectively, was about 1/2 ft.

Well No. 5 is in service about 8 hr. daily.

Analysis of a sample (Lab. No. 111,560) collected on Aug. 15, 1947 after 3 1/2-hr. pumping at 325 gpm., showed the water from Well No. 5 to have a hardness of 41.6 gr. per gal., a residue of 973 ppm., and an iron content of 0.2 ppm.

Well No. 6 was drilled by Hayes and Sims in May 1946, about 190 ft. south-southeast from No. 5. It was 34 ft. 8 in. deep below the ground surface and was cased with 16-in. od. pipe from 18 in. above to 27 1/2 ft. below the ground surface.

The finished elevation of the pump base is 12 1/2 ft. above the ground surface. A 16-in. telescope No. 50 slot Johnson "Armco" iron screen with 7 1/2 ft. exposed was set from 26 ft. to 34 ft. 8 in.

The pump has not been installed, and the pump house over the pump has not yet been completed.

On Aug. 27, 1946 the water level, before pumping, was 5.7 ft. below ground level, and, when pumping at 135 gpm., the drawdown was 9.9 ft. Interference in this well, when the pumps in No. 5 and No. 7 were operating simultaneously at 325 and 165 gpm., respectively, as 1 ft.

Analysis of a sample (Lab. No. 107,557) collected from Well No. 6 on Aug. 27, 1946, showed this water to have a hardness of 49.1 gr. per gal., a mineral content of 1128 ppm., and an iron content of 0.1 ppm.

Well No. 7 was drilled by Hayes and Sims in May 1946, about 300 ft. south of No'. 5 and 130 ft. south-southwest of No. 6. The well was completed at a depth of 29 1/2 ft. below the ground surface, with the casing and screen which was salvaged from the Negro Creek well. The 16-in. od. casing extended from 2 ft. above to 20 ft. 8 in. below ground level, with the finished elevation of the pump base at 10.9 ft. above ground and at exactly the same elevation as the finished elevations of the other two well casings. A 16-in. telescope No. 30 slot Johnson "Armco" iron screen with 7 ft. 8 in. exposed, was set from 20 ft. 10 in. to 29 1/2 ft.

The pump house was not completed and the pump had not been installed.

On Aug. 27, 1946, the water level, before pumping, was 4.4 ft. below ground level, and, when pumping at 165 gpm., the drawdown was 7.6 ft. Interference in this well, when the pumps in No. 5 and No. 6 were operating simultaneously at 325 and 135 gpm. respectively, was 0.7 ft.

Analysis of a sample (Lab. No. 107,558) collected from Well No. 7 on Aug. 27, 1946 after 2-hr. pumping at 165 gpm., showed the water to have a hardness of 42.3 gr. per gal., a mineral content of 974 ppm., and an iron content of 0.1 ppm.

All water for the public supply is chlorinated but not otherwise treated. Pumpage is estimated at 300,000 gpd.

LABORATORY NO. 111,557

	ppm.	epm.		ppm.	epm.
Iron (total) Fe	1.3		Fluoride F	0.1	
Turbidity	20		Chloride Cl	8.0	
Color	0		Alkalinity (as $CaCO_3$)	384.	
Odor	0		Hardness (as $CaCO_3$)	792.	
Temperature 51° F.			Total Mineral Content	857.	

LABORATORY NO. 111,560

	ppm.	epm.		ppm.	epm.
Iron (total) Fe	0.2		Silica SiO_2	20.4	
Manganese Mn	1.8		Fluoride F	1.0	
Calcium Ca	168.6	8.43	Chloride Cl	34.0	.96
Magnesium Mg	71.0	5.84	Nitrate NO_3	2.7	.04
Ammonium NH_4	0.1	.01	Sulfate SO_4	412.4	8.58
Sodium Na	40.9	1.78	Alkalinity (as $CaCO_3$)	324.	6.48
Color	0		Hardness (as $CaCO_3$)	714.	14.27
Odor	0		Residue	973.	
Turbidity	Tr.		Temperature 56° F.		

STANDARD
Putnam County
Apr. 10, 1947

The public water supply for the village of Standard (334) is obtained from a well owned by the B. F. Berry Coal Co., and located over 1/4 mile south of the Chicago, Milwaukee, St. Paul & Pacific R. R. station (or approximately 1550 ft. S. and 350 ft. W. of the N. E. corner of Section 11, T. 32 N., R. 1 W.).

The well was drilled in 1914 to a depth of 1767 ft. below a ground surface elevation of 600± ft.

The well was cased as follows:

16-in. from 0 to 95 ft.
12-in. from 95 to 287 ft.
10-in. from 287 to 346 ft.
6-in. from 300 to 1297 ft.

Water is pumped by air lift which replaced the old cylinder pump prior to 1927. In Jan. 1947 there was 500 ft. of 2-in. and 500 ft. of 1-in. air pipe.

In 1917 the non-pumping water level was reported to be 100 ft. below the surface, and in Jan. 1947 the non-pumping water level was 165 ft. below the surface.

Analysis of a sample (Lab. No. 109,929) collected Apr. 13, 1947 after 30-min. pumping, showed the water from this well to have a hardness of 13.8 gr. per gal., a residue of 3279 ppm., and an iron content of 2.2 ppm.

Pumpage is estimated at 20,000 gpd.

Sample-study and driller's log of well drilled in 1914 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Loam, clay and sand"	33	33
"Gravel, water-bearing"	3	36
"Clay, red"	55	91
Pennsylvanian system		
"Shale, thin limestone, sandstone and coal beds"	409	500
Shale, some siltstone at base	105	605
Silurian system		
Niagaran-Alexandrian dolomite and limestone	480	1085
Ordovician system		
Maquoketa shale and limestone	165	1250
Galena-Platteville dolomites	350	1600
St. Peter sandstone	167	1767

LABORATORY NO. 109,929

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.2		Silica	SiO_2	13.0	
Manganese	Mn	0.0		Fluoride	F	1.5	
Calcium	Ca	57.0	2.85	Chloride	Cl	1675.0	47.24
Magnesium	Mg	22.9	1.89	Nitrate	NO_3	1.1	0.02
Ammonium	NH_4	2.0	0.11	Sulfate	SO_4	143.4	2.96
Sodium	Na	1187.5	51.63	Alkalinity	(as $CaCO_3$)	312.	6.24
Color		0		Hardness	(as $CaCO_3$)	237.	4.74
Odor		0		Residue		3279.	
Turbidity		10		Temperature 62.5° F.			

STANFORD
McLean County
Oct. 28, 1948

The village of Stanford (482) installed a public water supply in 1911.

Water was obtained originally from a well drilled in 1911 to a depth of 131 ft. and located on Armstrong St. about 100 ft. south of Boundary Ave. (or approximately 1800 ft. N. and 2200 ft. E. of the S. W. corner of Section 21, T. 23 N., R. 1 W.). The surface elevation is 680± ft. This well was cased with 6-in. pipe and had 10 ft. of Cook screen placed at the bottom.

The well was equipped with a 4-in. by 24-in. Goulds double-acting deep well cylinder pump with the cylinder set at a depth of 110 ft.

The screen became clogged; and the well was abandoned in 1919.

Analysis of a sample (Lab. No. 31634) collected Sept. 28, 1915, showed the water to have a hardness of 21.3 gr. per gal., a residue of 430 ppm., and an iron content of 1.4 ppm.

In 1919 C. H. Johnson & Son, Bloomington, drilled a well to a depth of 235 ft. and located about 11 ft. north and 3 ft. west of the old well.

The water level upon completion of the well was about 100 ft. below the top of the well.

A Cook screen with No. 20 slot openings was installed. The upper part was wedged to the pump cylinder and removed.

The pumping installation made in Mar. 1945 consists of 100 ft. of 4-in. column pipe; 6-in., 19-stage Fairbanks-Morse turbine pump, No. SW 40492 rated at 75 gpm.; against 215 ft. of head; the pump bowls are porcelain enameled; 10 ft. of 4-in. suction pipe; 7 1/2-hp. Fairbanks-Morse electric motor.

Analysis of a sample (Lab. No. 115,979) collected Oct. 1, 1948 showed the water to have a hardness of 21.3 gr. per gal., a residue of 578 ppm., and an iron content of 2.3 ppm.

Pumpage is estimated to average 39,559 gpd.

Correlated driller's log of well drilled in 1919 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay	80	80
Sand, 20 feet of water	1	81
Clay and hardpan	59	140
Water gravel	1	141
Clay	76	217
Water sand	18	235

LABORATORY NO. 115,979

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.3		Silica	SiO_2	25.6	
Manganese	Mn	0.1		Fluoride	F	0.2	
Calcium	Ca	84.2	4.21	Chloride	Cl	55.0	1.55
Magnesium	Mg	37.8	3.11	Nitrate	NO_3	0.6	0.01
Ammonium	NH_4	8.7	0.49	Sulfate	SO_4	0.0	0.00
Sodium	Na	77.1	3.35	Alkalinity (as $CaCO_3$)		480.	9.00
Turbidity		10		Hardness (as $CaCO_3$)		366.	7.32
Color		20		Residue		578.	
Odor		0		Free CO_2 (calc.)		51.	
Temperature 54.5° F.				pH = 7.4			

STARVED ROCK STATE PARK
La Salle County
June 27, 1947

Starved Rock State Park obtains a water supply from 2 wells.

Well No. 1 was drilled in 1916 by J. C. Schomas, Ottawa, and is located 100 ft. west of the northwest corner of the swimming pool (or approximately 910 ft. S. and 205 ft. W. of the N. E. corner of Section 21, T. 33 N., R. 2 E.).

The well was formerly equipped with a centrifugal pump with 4-in. suction and 4-in. discharge, and a 5-hp., 1145 rpm. Fairbanks-Morse electric motor, No. 348896. This equipment is not in place, and the well is not in condition for use without considerable repair work.

In Aug. 1932 the free flow was reported to be 60 gpm., but about 1943 the free flow was estimated at 10 to 15 gpm.

Well No. 2, sometimes known as the "Garage Well," is located in the garage and service building (or approximately 1050 ft. S. and 1110 ft. W. of the N. E. corner of Section 21). The well was drilled in 1926 by J. C. Schomas to a depth of 475 ft. The casing record is not known.

Sample-study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Ordovician system		
St. Peter formation		
Sandstone	38	38
Shale and chert	7	45
Shakopee dolomite	155	200
New Richmond sandstone		
Sandstone, incoherent	70	270
Sandstone, partly dolomitic	80	350
Oneota dolomite	125	475

This well is said to have a free flow of 60 gpm., but on account of furnishing water to the higher portions of the park, the water is pumped to several elevated storage tanks. It is now the principal source of water supply for the park.

The well is equipped with: 70 ft. of 4-in. column pipe; 8-in., 11-stage American Well Works turbine pump, No. 70469, rated at 237 1/2 gpm. at 1760 rpm.; the length of the pump is 6 1/2 ft.; 20-hp., 1500 rpm. U. S. electric motor, No. 189608.

In June 1947, the pump was operated for 25-min. periods, and after 25-min. pumping, water was drawn down 25 ft. below the overflow, and 8 min. after the pump stopped, water flowed at the top of the casing. Water is supplied from this well to the lodge and cabins and to the camping and picnic grounds.

Partial analysis of a sample (Lab. No. 110,853) collected June 27, 1943 from the overflow pipe, showed the water from Well No. 2 to have a hardness of 23.0 gr. per gal., a total mineral content of 534 ppm., and no iron.

In June 1947, pumpage was estimated at95,000 gpd.

In June 1933 a well was drilled for the Citizens Conservation Corps Camp at Parkman Plain by C. W. Varner, Dubuque, Iowa. This well was drilled to a depth of 445 ft. and was finished in the Oneota dolomite after having been drilled through 85 ft. of New Richmond sandstone. The well was originally 8 in. in diameter to 303 ft. and 6 in. in diameter below that depth.

Samples of the water were collected as the drilling progressed, and when the well was completed. All the tests showed the water to be highly mineralized, high in sodium chloride, and exceptionally hard. A sample collected July 15, 1933 (Lab. No. 73235) showed the water to have a sodium chloride content of 2395 ppm., a mineral content of 3619 ppm., and a hardness of 69.0 gr. per gal.

An effort was made to locate the source of the sodium chloride, and the casing was pulled, the 6-in. hole reamed to 8-in. diameter to a depth of 366 ft. The well was recased with 8-in. pipe to the 366-ft. depth. This made very little difference in the quality of the water, and it was decided to use the water for showers and toilets and to haul the drinking water from the park well. The well was abandoned later.

LABORATORY NO. 110,853

	ppm.	epm.			ppm.	epm.
Iron (total) Fe	0.0		Chloride	Cl	91.0	2.57
Turbidity	10-		Sulfate	SO_4	24.1	.50
Color	0		Alkalinity (as $CaCO_3$)		328.	6.56
Odor	0		Hardness (as $CaCO_3$)		394.	7.88
Temperature 53.2° F.			Total Mineral Content		534.	

STATE REFORMATORY
FOR WOMEN
Livingston County
February 23, 1949

The State Reformatory for Women has a well 1203 ft. deep drilled in 1930 and located on the Institution's grpunds on State Highway No. 17, two miles west of Dwight, or near the northeast corner of the southeast one-quarter of Section 1, T. 30 N., R. 6 E.

The well is 16 in. in diameter at the top and equipped with 280 ft. of 4-in. column pipe; a Pomona turbine pump rated at 200 gpm.

Analysis of a sample (Lab. No. 117,372) collected Feb. 23, 1949 after 7-hr. pumping in a series source test, showed the water from this well to have a hardness of 19.2 gr. per gal., a residue of 1402 ppm., and an iron content of 1.0 ppm.

The water is aerated, softened, and chlorinated. It has a strong odor of hydrogen-sulfide, and has a serious corrosive action on the pump column pipe and bowls as well as the distribution system. Analysis of a sample (Lab. No. 117,373) collected Feb. 23, 1949 showed the treated water to have a hardness of 4.1 gr. per gal., a mineral content of 1722 ppm., and an iron content of 1.0 ppm.

A well was completed in Aug. 1935 to a depth of 210 ft. and cased with 6-in. pipe to a depth of 144 ft. A production test was made by the State Water Survey. Before the test was started, the water level was 32 ft. below a ground surface elevation. After 8-min. pumping at 12 1/4 gpm., the water was lowered to the bottom of the suction pipe at 186 ft. At the end of 4-hr. pumping at 8 gpm., the water was at the bottom of the suction pipe. The well was not placed in service.

Analysis of a sample (Lab. No. 76481) collected Aug. 7, 1935, showed the water from this well to have a hardness of 23,1 gr. per gal., a residue of 1279 ppm., and an iron content of 4.3 ppm.

A quality-source test (Analyses Nos. 117,363-117,372) conducted Feb. 23, 1949 showed the following data on the water obtained from this well.

The analyses showed that the first sample was composed largely of water which remained in the column pipe at the end of the previous pumping period. The next 3 samples showed an increasing chloride concentration although the temperature of the water remains low. The high concentration of chlorides is representative of water from the Pennsylvanian formation at a depth between 124 and 340 feet.

Subsequent samples showed a general decrease in chloride content particularly after 11:30 A.M. and the last sample appeared to contain approximately 19% water from the Pennsylvanian formation and 81% water from the St. Peter sandstone at the bottom of the well.

The rate of pumpage was estimated to be about 90 gpm. The data also show that some 20,000 gallons of Pennsylvanian water entered the well during the 27 1/2-hr. idle period preceding the test and during the period of pumpage on February 23.

Well No. 2 was completed to a depth of 1201 ft. in Sept. 1948 by Milaeger Drilling Co., Milwaukee, Wis., and located just north of the overhead storage tank, (or approximately 450 ft. N. and 100 ft. W. of the S. E. corner of Sec. 1). The ground elevation at the well site is 648± ft.

The driller reported the hole and casing record as follows:

Hole Record

21-in.	from	0 to	402 ft.
15-in.	from	402 to	507 ft.
10-in.	from	507 to	1201 ft.

Casing Record

21-in. drive pipe	from	0 to	124 ft.
15-in. liner	from,	256 to	420 ft.
12-in. casing	from	0 to	140 ft.
10-in. casing	from	140 to	510 ft.

The annular space out side the 12 and 10-in. casing was pressure-cemented. A production test was made on Sept. 22-23, 1948 using the State Water Survey calibrated measuring equipment. Temporary pumping equipment was used. Before the test, the water level was 150 ft. below the top of the casing. After 24-hr. pumping at rates gradually increased from 85 to 150 gpm., the drawdown was 146 ft. One hr. after shutdown the water level had recovered to 163 ft. Analysis of a sample (Lab. No. 115,872) collected Sept. 23, 1948 after 20 1/2-hr. pumping at 152 gpm. showed this water to have a hardness of 20.4 gr. per gal., a residue of 1278 ppm., and an iron content of 0.6 ppm. Only a slight odor of H_2S was noted to be present.

LABORATORY NO. 117,373

	ppm.	epm.			ppm.	epm.
Iron (total) Fe	1.0		Chloride	Cl	700.	19.74
Ammonium NH_4	Tr.	Tr.	Nitrate	NO_3	0.0	00.00
			Alkalinity	(as $CaCO_3$)	240.	4.80
Turbidity	1		Hardness	(as $CaCO_3$)	70.	1.40
Color	0		Total Mineral Content		1722.	
Odor	Tr.					

Analyses Nos. 117,363 - 117,372

Date & Time	Temp. °F.	Fe ppm.	Cl ppm.	Alk. ppm.	Hd. ppm.	Res. ppm.	NH_4 ppm.
2-23-49							
9:22:40	Started pump						
9:23	Water discharged						
9:24	54.0	2.7	620	236	341	1610	
9:26	54.0	1.2	860	240	387	1956	
9:30	54.3	0.5	950	224	429	2082	
9:38	54.5	0.4	1040	228	429	2191	1.0
9:53	55.1	0.5	1020	228	429	2160	1.0
10:23	56.4	0.3	1000	252	458	2136	
11:23	57.8	0.3	970	228	426	2076	
12:53	58.5	0.2	770	240	387	1822	1.0
2:23	58.8	0.2	620	252	352	1610	1.2
3:23	59.1						
4:23	59.1	0.2	545	268	330	1402	1.0

Sample-study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Till; soil at top	65	65
Sand and gravel	10	75
Till	25	100
Gravel	10	110
Pennsylvanian system		
Sandstone, silty	105	215
Shale; thin beds siltstone, limestone, coal	148	363
Ordovician system		
Maquoketa formation		
Limestone, cherty	47	410
Dolomite	10	420
Limestone, argillaceous; little shale	15	435
Shale; limestone	45	480
Galena formation		
Limestone, cherty at base	190	670
Platteville formation		
Limestone and dolomite, cherty	190	860
St. Peter formation		
Sandstone, incoherent	341	1201

STATE TRAINING SCHOOL
SHERIDAN
La Salle County
July 15, 1947

The State Training School for Boys, Sheridan Branch, is located approximately 1/2 mile south and 3/4 mile west of Sheridan in Section 17, T. 35 N., R. 5 E. The well is 885 ft. deep and is cased with 20-in. and 18-in. pipe. The ground elevation is 600± ft.

The pumping equipment consists of 8-in., 6-stage Pomona turbine pump, No. S. A. 19, rated at 70 gpm.; 10-hp., 1750 rpm. General Electric motor, No. 5531679.

The well flows, and after pumping 2 hr. at a rate of 70 gpm., the. drawdown is 25 ft.

Analysis of a sample (Lab. No. 111,093) collected July 15, 1947 after pumping 2 hr. at 70 gpm., showed the water from this well to have a hardness of 18.2 gr. per gal., a mineral content of 339 ppm., and an iron content of 0.2 ppm.

The water is chlorinated. The water used in boilers and the laundry is softened.

Metered pumpage from July 3, to July 14, 1947 averaged 23,170 gpd.

Sample-study log furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Ordovician system		
Shakopee dolomite	33	33
New Richmond formation		
Sandstone, thin bed of shale at 41 feet	57	90
Sandstone and dolomite	25	115
Oneota dolomite, thin bed of sandstone and shale at base	173	288
Cambrian system		
Trempealeau dolomite	212	500
Franconia sandstone, some dolomite	135	635
Galesville formation		
Sandstone, thin dolomite beds	125	760
Sandstone, incoherent	60	820
Eau Claire shale, some dolomite and sandstone	65	885

LABORATORY NO. 111,093

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	16.2	
Manganese	Mn	Tr.		Fluoride	F	0.2	
Calcium	Ca	75.6	3.78	Chloride	Cl	8.0	8.
Magnesium	Mg	30.2	2.48	Nitrate	NO_3	2.1	0.03
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	3.1	0.06
Sodium	Na	12.4	0.54	Alkalinity	(as $CaCO_3$)	324.	6.48
Color		0		Hardness	(as $CaCO_3$)	313.	6.26
Odor		0		Residue		339.	
Turbidity		10		Temperature	55.5° F.		

STEELEVILLE
Randolph County
July 19, 1949

Beginning in 1928, the village of Steeleville (1212) purchased water from the Gilster Milling Co. Well No. 2. The well was 265 ft. deep and was reported to have produced 60 gpm. with a drawdown of more than 42 ft. from the non-pumping water level of 8 ft.

The pumping equipment consisted of a Chippewa double-acting deep-well pump, driven by a 7 1/2-hp. electric motor.

Analysis of a sample (Lab. No. 74832) collected July 12, 1934, showed the water to have a hardness of 11.1 gr. per gal., a residue of 329 ppm., and an iron content of 0.4 ppm.

The purchase of water was discontinued in 1935.

Village Well No. 1 was drilled in 1935 to a depth of 285 ft. by Fred M. Luth, St. Louis, Mo., and located 1/2 block north of the city park on the north side of the alley, 200 ft. north of Garfield St. and 85 ft. west of James St. (or approximately 2200 ft. S. and 1275 ft. E. of the N. W. corner of Section 16, T. 6 S., R. 5 W.). The elevation of the ground surface at the well-site is 425± ft.

Sample-study log of Well No. 1 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Earth, clay, sand, gravel"	69	69
Pennsylvanian system		
Shale, limestone, calcareous sandstone, thin coal bed	26	95
Sandstone, slightly calcareous	45	140
Shale, sandstone, thin coal bed	15	155
Sandstone, partly incoherent	90	245
Sandstone and shale	5	250
Sandstone, partly incoherent	25	275
Sandstone and shale	10	285

An anchor packer was installed at a depth of 158 ft. to prevent the admission of surface water.

The State Water Survey made a production test on Apr. 23, 1935. For test purposes the well was equipped with an air lift with a 4-in. eductor pipe and 1 1/2-in. air pipe, and 239 ft. of 1/4-in. air line. The well produced 95 gpm. with a drawdown of 96 ft. from a non-pumping water level of 29 ft. below the ground surface. Three days after removal of the pump in Sept. 1947, the water level was 59 ft. below the pump base. On Mar. 5, 1948 the water level was 57 ft. below the pump base. On July 19, 1949, the water level was 60 ft. below the pump base.

The hole and casing record is as follows:

Hole Record

10-in. from surface to 190 ft.
8-in. from 190 to 285 ft.

Casing Record

8-in. pipe from surface to 190 ft.
Perforated from 180 to 190 ft.

The pumping equipment installed in 1935 and repaired in Sept. 1947, consists of 150 ft. of 4 1/2-in. 'id. column pipe; 6-in. Worthington turbine pump No. 911009, Size 613Q33, having an overall length of 16 ft. and a metered discharge rate of 110 gpm.; 10 ft. of 4 1/2-in. id. suction pipe and strainer; 15-hp. General Electric motor.

Analysis of a sample (Lab. No. 75998) collected Apr. 23, 1935, showed the water to have a hardness of 8.7 gr. per gal., a residue of 364 ppm., and an iron content of 0.1 ppm.

Well No. 2 was drilled in 1945 to a depth of 319 ft. by Fred M. Luth, and is located near the northeast corner of the intersection of Green and West St. about 1400 ft. northeast of Well No. 1 (or approximately 1600 ft. S. and 2370 ft. W. of the N. E. corner of Section 16). The elevation of the ground surface at the well-site is 435± ft. The well was cased with 10-in. pipe from the surface to 65 ft. and with 8-in. pipe from the surface to 240 ft. An anchor rubber packer was installed at a depth of 202 ft.

A production test was made by the State Water Survey July 14, 1945. The test pump consisted of a 5-in. by 8-ft. cylinder attached to 270 ft. of 5-in. column pipe, and operated by the well rig. A 1/4-in. air line extended to a depth of 275 ft. below the top of the casing. The well produced 93 gpm. with a drawdown of 83 ft. from a non-pumping water level of 69 ft. below the top of the casing.

The pump installation, completed in Sept. 1947, consists of an 8-in., 12-stage Worthington turbine pump, OBE-14, Serial No. T-7523, with 4 5/8-in. discharge pipe and 15-hp. U. S. electric motor. The air line gauge is defective and no water levels have been reported since the installation. The metered pump discharge rate in Mar. 1948 averaged 85 gpm.

Analysis of a sample (Lab. No. 113,726) collected Mar. 6, 1948 after 1-hr. pumping at 88 gpm., showed the water to have a hardness of 10.3 gr. per gal., a residue of 342 ppm., and an iron content of 0.1 ppm.

Well No. 2 furnishes the entire supply and from Nov. 4, 1947 to Mar. 5, 1948 metered pumpage averaged 29,460 gpd. Summer pumpage is estimated to average 34,000 gpd.

LABORATORY NO. 113,726

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	15.2	
Manganese	Mn	Tr.		Fluoride	F	0.1	
Calcium	Ca	47.7	2.39	Chloride	Cl	22.0	0.62
Magnesium	Mg	13.7	1.12	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	0.6	0.03	Sulfate	SO_4	13.4	0.28
Sodium	Na	57.0	2.48	Alkalinity	(as $CaCO_3$)	256.	5.12
Turbidity		Tr.		Hardness	(as $CaCO_3$)	176.	3.51
Color		0		Residue		342.	
Odor		0		Free CO_2	(calc.)	20.	
Temperature 59° F.				pH = 7.5			

The water works at Steger (3369) was installed by the village in 1910.

Water for the public supply was obtained from a well drilled to a depth of 318 ft. located about 200 ft. south of the center of 234th St. and 110 ft. east of the center of Halsted St. (or approximately 200 ft. S. and 1550 ft. W. of the N. E. corner of Section 5, T. 34 N., R. 14 E.). The elevation of the ground surface is 715± ft.

Rock was reported encountered at a depth of 94 ft. below the surface. The well is cased with 12-in. pipe to a depth of 147 ft. On Mar. 4, 1914 a non-pumping water level of 75 ft. below the pump base was reported. At that time water was pumped at a rate slightly over 300 gpm. A non-pumping water level of 35 ft. below the pump base was reported in Apr. 1926.

In Aug. 1945 the J. P. Miller Artesian Well Co., Brookfield, re-installed the following pump, assembly with new column and suction pipe: 60 ft. of 6-in. id. column pipe; 8-in. 7-stage American Well Works turbine, Shop No. 68597, rated at a capacity of 300 gpm. against 192 ft. of head; 20 ft. of 5-in. suction pipe with strainer; 20-hp. General Electric motor.

Upon completion of the above installation, a short production test was made. After pumping 1 1/2 hr. at 350 gpm., the drawdown was 4 ft. below a water level of 43 ft. below the pump base. Both pump base and floor level are approximate ground surface.

This well has been in daily service since Aug. 1945. The normal period of operating is 9 hr. daily which is doubled for peak summer demands.

Analysis of a sample (Lab. No. 107,861), collected Oct. 3, 1946 from the pump discharge after pumping at 350 gpm. for 20 min., showed the water to have a total hardness of 24.0 gr. per gal., a residue of 432 ppm., and an iron content of 0.6 ppm.

Well No. 2 was drilled to a depth of 325 ft. by Thos. Kramer & Sons, Harvey, and completed on July 29, 1935. This well is located about 30 ft. due south of the older well. It was cased from the surface to a depth of 110 ft. with 12-in. pipe below which the hole was 12 in. in diameter to the bottom. A record of the material penetrated shows a formation of drift from the surface to a depth of 89 ft. follpwed by limestone for the balance of the hole. Water-bearing limestone was reported encountered at depths of 105 ft., 140 ft., 145 ft., 165 ft., 210 ft., and 290 ft.

When the well was completed, the distance to water, below the top of the casing, was 33.6 ft. It was tested for 24 hr. at a rate of 400 gpm. without showing any appreciable drawdown. The top of casing and pump base is 2 ft. above floor level.

On Apr. 2, 1942, a water level of 31 ft. below the pump base was reported after a 30-min. idle period, and a water level of 32 1/2 ft. after pumping 1 hr. at an estimated rate of 300 gpm.

The following pump installation, made in 1935, was in service Oct. 3, 1946: 60 ft. of 6-in. column pipe; 8-in., 9-stage Pomona turbine pump, Serial No. M-2030, rated at a capacity of 300 gpm. against 170 ft. of head; the overall length of the pump is 5 1/2 ft.; 10 ft. of 6-in. suction pipe; 60 ft. of air line; 26-hp. Johnson right-angle gear drive powered by a 20-hp. General Electric motor.

Water levels and pumping periods are identical with the older well. Analysis of a sample (Lab. No. 107,862), collected from the cooling line on Oct. 3, 1946 after 25-min. pumping at 300 gpm., showed the water from Well No. 2 to have a total hardness of 24.4 gr. per gal., a residue of 426 ppm., and an iron content of 0.3 ppm.

LABORATORY NO. 107,861

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.6		Silica	SiO_2	14.7	
Manganese	Mn	0.0		Fluoride	F	0.2	
Calcium	Ca	90.2	4.51	Chloride	Cl	2.0	.06
Magnesium	Mg	45.5	3.74	Nitrate	NO_3	0.4	.01
Ammonium	NH_4	0.5	.03	Sulfate	SO_4	51.2	1.03
Sodium	Na	6.9	.30	Alkalinity	(as $CaCO_3$)	372.	7.44
Turbidity		0		Hardness	(as $CaCO_3$)	413.	8.26
Color		0		Residue		432.	
Odor		0		Free CO_2 (calc.)		62.	
Temperature 52° F.				pH = 7.2			

STERLING
Whiteside County
Oct. 10, 1947

The water works system for the city of Sterling (11,363) was installed in 1885 when a 25-year franchise was granted to a Mr. Baxter of Portland, Maine. In 1910 the franchise was renewed for 25 years. Subsequently, the system was owned by the Illinois Water Service Co. and is now owned by the Northern Illinois Water Corporation. Water is also supplied to the city of Rock Falls.

Water is obtained from 4 wells located at the pumping plant site at the foot of 17th Ave. on the bank of Rock River. All of the wells flowed freely, and in 1915 the total flow was estimated at 1.8 mgd. and in 1921 it was 1.5 mgd. In 1931 the non-pumping water level in all of the wells was about 7 ft. below the ground surface, and in 1938 it was 20 ft.

Well No. 1 is located at the foot of 17th Ave. just east of the pump house (or approximately 2530 ft. S. and 570 ft. W. of the N. E. corner of Section 22, T. 21 N., R. 7 E.). The well was drilled in 1886 to a reported depth of 1430 ft. below a ground surface elevation of 645t ft. The well was surrounded, at the top, by a circular brick basin, 8 ft. in diameter by 15 ft. deep. In 1946, before rehabilitation by C. W. Varner, Dubuque, Iowa, the well was found to be 1434 ft. deep and cased with 101 ft. of 8-in. pipe and an unreported length of 10-in. surface pipe. The diameter at the bottom was 5 5/8 in.

Varner removed the 8 and 10-in. casings, and after the repair work, the hole and casing record 'was reported as:

Hole Record

19-in. from surface to 105 ft.
8-in. from 105 to 990 ft.
5 5/8-in. from 990 to 1434 ft.

Casing Record

20-in. od. surface pipe to 33 ft.
12-in. id. casing from surface to 105 ft.

The annular space outside the 12-in. casing was filled with cement grout.

After pulling the old 8-in. casing, a short production test was made by the driller. When pumping at 345 gpm., the drawdown was 22 ft. below a non-pumping water level of 33 1/2 ft. On May 24, 1946 after the well repairs had been completed, a production test was made by the State Water Survey. Temporary pumping equipment was installed for the test as follows: 85 ft. of column pipe; 7-in., 7-stage turbine pump; no suction pipe. Water was pumped for 24 hr. May 22 and 23 to clean up the well, and the water was clear after 4-hr. pumping. On May 24, after pumping 20 hr. at 405 gpm., the drawdown was 31 ft. from a non-pumping water level of 32 ft. Ten minutes after the pump was shut off, the water level returned to 33 1/2 ft. During the test, the pumps in Wells 2 and 4 were operating throughout the period.

New pumping equipment was then installed to replace the old air lift and consists of 80 ft. of 6-in. column pipe; 7-in., 8-stage Peerless turbine pump, No. 33036, rated at 400 gpm.; the overall length of the pump is 5 ft.; 80 ft. of air line; 20 ft. of 5-in. suction pipe; 15-hp. U. S. electric motor. The 1-in. shaft is water lubricated. Pump assembly will be changed in the near future.

Analysis of a sample (Lab. No. 118,203) collected in May 1949 after 4-hr. pumping at 470 gpm., showed the water in Well No. 1 to have a hardness of 18.6 gr. per gal., a residue of 333 ppm., and an iron content of 0.3 ppm.

Well No. 2 was drilled in 1899 to a depth of 1606 ft. and deepened in 1947 to 1610 ft. The well is located about 200 ft. northeasterly from No. 1. Originally the well flowed, but it was equipped with an air lift pump to increase the production at peak demand. In 1938 the pumping rate was estimated at 490 gpm.

In 1947 the well was rehabilitated by C. W. Varner. The original 48-ft. 8-in. length of 8-in. wi. casing was removed and replaced by a 20-in. od. steel pipe driven to a depth of 50 ft. The hole was reamed to 18-in. diameter, and 12-in. id. steel pipe was installed from the surface to 127 1/2 ft. The annular space between the 20-in. and 12-in. casings was filled with cement grout. In cleaning out the well, the 8-in. hole was extended from 1606 to 1610 ft. In the original construction of the well, it had been reported that a 6 5/8-in. liner was set from 650 to 850 ft. During the repair work, little trace of this liner was found except that a slight bridge was encountered at about 1065 ft. depth, and the old liner was suspected to have caused the bridge.

On Apr. 8, 1947 a production test was made by the State Water Survey. Throughout the test the pumps in Wells 1 and 4 were operating, but the pump in No. 3 well was not operating. After

5 3/4-hr. pumping at 134 gpm., the drawdown was 33 ft. from a non-pumping water level of 42 1/2 ft. below the top of the casing. The pumping water level was 2 ft. above the top of the bowls.

Before the repair work, this pump was reported to produce about 380 gpm. When the old casing was removed, a number of holes were found. The purpose of the new casing was to shut off waters from the upper strata.

On June 5, 1947 it was reported that the well had been deepened to 1725 ft. at a diameter of 8 in., and 2 shots had been set off; the first shot at 1600 ft. and the second shot at 1640 ft. After the shooting, the hole was bridged at 750 to 800 ft. depth. The hole was subsequently cleaned out to 1655 ft., and the water level was reported to be 43 ft.

On July 15, 1947 it was reported that after the well was cleaned out to 1655 ft., further trouble was encountered because of red marl cave in the St. Peter sandstone. The 8-in. hole below the 12-in. casing was reamed to 12-in. diameter to a depth of 750 ft., and 107 1/2 ft. of 8-in. id. liner was set opposite the cave-in area and driven to a tight seat with the bottom of the liner at 758 1/2 ft.

On Sept. 15, 1947 a production test was made by the State Water Survey. Pumps in Wells 1,3, and 4 were started 2 hr. ahead of the start of the test, and No. 1 was operated continuously at approximately 430 gpm. No. 3 was operated throughout the test at 440 gpm. except for a 1/2-hr. period early in the test. No. 4 was operated at 455 gpm. except for a 2-hr. period late in the test. Because of the inadequate capacity of the pump, equilibrium could not be established. After 9 1/2-hr. pumping at 314 gpm., the drawdown was 41 1/2 ft. from an initial non-pumping level of 35.9 ft. below the top of the 20-in. casing. The pumps in Wells 1, 3, and 4 were operating when the water level in Well No. 2 was observed at 35.9 ft. It was observed that the pumping level in No. 2 was approximately 4 1/2 ft. higher when No. 4 was not operating but when No. 1 and No. 3 were operating.

Present pump installation in Well No. 2: 110 ft. of 6-in. column pipe; 8-in., 3-stage Pomona turbine pump, No. 80662, overall length 35 in.; 10 ft. of 6 5/8-in. od. suction pipe; 123 ft. of 1/4-in. copper air line; 15-hp. General Electric motor, No. 5428799.

On Oct. 10, 1947, the non-pumping water level was 35 ft. below the top of the well.

Analysis of a sample (Lab. No. 118,293) collected in May 1949 after pumping 4 hr. at 380 gpm., showed the water in Well No. 2 to have a hardness of 18.1 gr. per gal., a residue of 357 ppm., and an iron content of 0.5 ppm.

Well No. 3 was drilled by Levi Wilson, Chicago, in 1901 to a depth of 1830 ft. and located just southwest of the pump station and about 105 ft. west of Well No. 1.

The Ohio Drilling Co., Massillon, Ohio, may have drilled the well. In 1931 a letter from that company stated that the well had been cased with 8-in. pipe to a depth of 84 1/2 ft.; a 6 5/8-in. liner was set from 635 to 700 ft. to shut off a cave; and a 5 1/2-in. liner was set from 1265 to 1300 ft. The hole was stated to be 6 5/8-in. diameter from 700 to 1300 ft.

In 1946 Varner Well Co. repaired the well. The old 8-in. casing was removed and found to be in poor condition with numerous holes and a bad shoe. The old liners were drilled out. The hole was reamed out to 132 ft. and 36 ft. of 20-in. od. casing was driven into rock; the hole was reamed to 18-in. diameter from 36 to 132 ft.

After the repair work was completed about Sept. 1, 1946, the hole and casing record were reported as given in Table 1.

TABLE 1

Hole Record

8-in. from 132 to 738 ft.
6-in. from 738 to 1417 ft.
5-in. from 1417 to 1830 ft.

Casing Record

15-in. od. casing from surface to 9 ft.
13-in. od. casing from 9 to 52 ft.
12-in. id. casing from 52 to 132 ft.
6-in. id. liner from 645 to 738 ft.
The easing was cemented in from the surface to 132 ft.

Abrief production test was made by the State Water Survey on Sept. 17, 1946 after which the well was sounded and no filling had occurred. One wekk later, a 7-hr. test was made. With Wells 1, 2, and 4 in operation, the non-pumping water level in No. 3 was 38 ft. below the pump base; and when pumping in Well No. 3 at 405 gpm.,

the drawdown was about 42 ft.

On Oct. 20, 1946 the test pump and assembly in the well was replaced by a pump assembly made up from the old equipment in Well 3 and 4, as follows: 80 ft. of 6-in. id. column pipe; 8-in., 4-stage Peerless turbine pump, No. 5525; the overall length of the pump is 5 ft., and the metered capacity at the time was 475 gpm.; 11 1/2 ft. of 5-in. suction pipe; 15-hp., 1800 rpm. U. S. electric motor.

Analysis of a sample (Lab. No. 118,204) collected in May 1949 after pumping 2 hr. at 400 gpm., showed the water from Well No. 3 to have a hardness of 19.0 gr. per gal., a residue of 353 ppm., and an iron content of 0.1 ppm.

Well No. 4 was drilled in 1909 to a depth of 1630 ft. and located about midway between Wells No. 1 and No. 2. The free flow from the well was adequate except during peak demand, consequently an air lift was installed, and in 1931 a Peerless turbine pump rated at 500 gpm. against a head of 67 ft., replaced the air lift. In 1938 the production from this well was reported to be 560 gpm., and it supplied more than three-fourths of the demand which averaged 850,000 gpd. In 1945 the non-pumping water level was reported at 21 ft., and the production was 540 gpm.

On Oct. 7, 1946 the Varner We'll Drilling Co. commenced the repair work of Well No. 4. At that time the combined pumpage rate from Wells 1 and 3 was estimated at 900 gpm., and the water level in No. 4 was 38 ft. below the drill floor. The repair work consisted of the removal of 198 ft. of 8-in. gwi. casing and driving 67 ft. of 20-in. od. casing to bedrock. The hole was reamed to 19-in. diameter to a depth of 198 ft., and 12-in. id. casing was set from surface to 198 ft. The annular space outside the 12-in. casing was sealed with cement grout. No other work was performed in the lower portion of the well. The hole size was reported to be 8 in. in diameter from 198 to 680 ft. and 5 3/4 in. in diameter from 680 to 1630 ft. The top of a liner was found at 680 ft. In the original data on the well, this liner was reported to be 6 5/8 in. in diameter and 60 ft. 3 in. long.

On Jan. 2, 1947 the driller performed a short production test. It was reported that the drawdown was 14 1/2 ft. after 3-hr. pumping at 411 gpm. On Jan. 3, 1947, the State Water Survey performed a short test with the same temporary pump assembly. After 6-hr. pumping at 408 gpm., the drawdown was 23 ft. On both occasions the pumps in Wells 1 and 2 were operating continuously at rates of 450 gpm. each.

On Sept. 16, 1947 while the pumps in Wells 1 and 2 were operating continuously and after a 2 1/2-hr. non-pumping period in Well No. 4, the water level in No. 4 was 44 ft. Then after 7 1/2-hr. pumping in No. 4 at 460 gpm. with No. 1 and No. 2 in operation, the drawdown in No. 4 was 26 ft. On Oct. 10, 1947 the non-pumping water level was 47 ft.

Present pump assembly in Well No. 4: 102 ft. of 6 5/8-in. od. column pipe; 5-stage Peerless turbine, No. 3701; Bronze bowls, 42-in. overall length; 10 ft. of 6 5/8-in. od. suction pipe; 115 ft. of 1/4-in. copper air line; 15-hp. U. S. motor, No. 96486.

Analysis of a sample (Lab. No. 118,205) collected in May 1949 after 9-hr. pumping at 500 gpm., showed the water from Well No. 4 to have a hardness of 16.6 gr. per gal., a residue of 340 ppm., and an iron content of 0.5 ppm.

Metered pumpage averages 1.45 mgd.

Well No. 2 of the Lawrence Brothers Manufacturing Co. was drilled in 1946 by Allabaugh Well Co., Rockford, and located approximately 500 ft. S. and 1200 ft. W. of the N. E. corner of Section 28). The ground elevation is 640± ft.

Sample-study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Cinders, clay, sand"	20	20
Silurian system		
Niagaran-Alexandrian series		
Dolomite	85	105
Siltstone	10	115
Ordovician system		
Maquoketa shale and dolomite	195	310
Galena-Platteville dolomites, thin sandstone beds in lower part	372	682
Glenwood sandstone, thin shale and dolomite beds	28	710
St. Peter formation		
Sandstone, incoherent	41	751
Shale and chert	11	762

LABORATORY NO. 118,205

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.5		Silica	SiO_2	12.4	
Manganese	Mn	0.0		Fluoride	F	.3	
Calcium	Ca	58.3	2.91	Chloride	Cl	23.	.65
Magnesium	Mg	33.7	2.77	Nitrate	NO_3	.2	Tr.
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	19.5	.41
Sodium	Na	11.5	.50	Alkalinity	(as $CaCO_3$)	256.	5.12
Turbidity		2		Hardness	(as $CaCO_3$)	284.	5.68
Color		0		Residue		340.	
Odor		0					

STEWARD
Lee County
Dec. 12, 1947

A water system was installed by C. T. Beitel about 1909 to supply the village of Steward (244). Sometime prior to 1937 this system was taken over by the Illinois Northern Utilities Co. and since 1939 the systemhas been municipally owned.

Water is obtained from a well located 45 ft. south of Main St. and 55 ft. west of Dewey St. (or approximately 80 ft. S. and 120 ft. W. of the N. E. corner of Section 20, T. 39 N., R. 2 E.). The surface elevation is 823± ft. The well is 8 in. in diameter and 100 ft. deep and terminates in sand and gravel.

The pump assembly, made in Apr. 1936, is 50 ft. of 4-in. column pipe; 6-in. American Well Works oil-lubricated turbine pump, No. 60572, rated at 40 gpm., operating at 345 rpm.; overall length of pump is 28 1/2 in.; 10 ft. of 3 1/2-in. suction pipe; 50 ft. of air line; 5-hp. General Electric motor, No. 5402060.

In Oct. 1923, the non-pumping water level was reported to be 30 ft. below the ground surface and on Dec. 12, 1947 was 26 ft. below the pump base which is at approximate ground level.

Analysis of a sample (Lab. No. 112,900) collected Dec. 12, 1947, showed the water to have a hardness of 15.6 gr. per gal., a residue of 292 ppm., and an iron content of 0.8 ppm.

Pumpage is estimated at 10,000 gpd.

LABORATORY NO. 112,900

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.8		Silica	SiO_2	24.6	
Manganese	Mn	0.0		Fluoride	F	0.2	
Calcium	Ca	65.3	3.26	Chloride	Cl	2.0	0.06
Magnesium	Mg	25.3	2.08	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	0.2	0.01	Sulfate	SO_4	7.6	0.16
Sodium	Na	5.3	0.23	Alkalinity	(as $CaCO_3$)	268.	5.36
Turbidity		10.		Hardness	(as $CaCO_3$)	267.	5.34
Color		0		Residue		292.	
Odor		Tr.					

STILLMAN VALLEY
Ogle County
Dec. 3, 1947

The village of Stillman Valley (333) installed a public water supply in 1938.

Water is obtained from a well drilled to a depth of 300 ft. in Aug., 1938 by C. W. Varner, Dubuque, Iowa, and located 300 ft. south of Roosevelt St. and 160 ft. east of Spruce St. (or approximately 1100 ft. N. and 1300 ft. E. of the S. W< corner of Section 1, T. 24 N., R. 11 E.). The surface elevation is 725± ft.

Correlated driller's log of well drilled in 1938 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Sand and gravel	55	55
Ordovician system		
Platteville formation		
Limestone, yellow and blue	60	115
Glenwood formation		
Shale and lime	38	153
St. Peter formation		
Sandstone	147	300

The pumping equipment consists of 150 ft. of 4-in.od. column pipe; 6-in., 20-stage Fairbanks-Morse and Co. oil-lubricated turbine pump, No. 35200, rated at 100 gpm. against 250 ft. of head at 1750 rpm.; the overall length of the pump is 7 ft. 7 3/4 in.; 20 ft. of 5-in. od. suction pipe; 10-hp. Fairbanks-Morse hollow shaft motor operating at 1750 rpm.

Hole Record

12-in. from surface to 160 ft.
8-in. from 160 to 300 ft.

Casing Record

15-in. from surface to 10 ft.
12-in. from surface to 59 ft. 3 in.
8-in. from surface to 161 ft. 4 in.

The driller reported a production test immediately after completion. After pumping 9 hr. at 203 gpm., the drawdown was 55 ft. from a non-pumping water level of 30 ft.

Analysis of a sample (Lab. No. 112,797) collected Dec. 3, 1947 after 9-hr. pumping at 203 gpm. showed this water to have a hardness of 17.7 gr. per gal., a residue of 310 ppm., and an iron content of 1.1 ppm.

Pumpage is estimated to average 20,000 gpd.

LABORATORY NO. 112,797

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.1		Silica	SiO_2	17.8	
Manganese	Mn	Tr.		Fluoride	F	0.1	
Calcium	Ca	70.6	3.53	Chloride	Cl	1.0	0.03
Magnesium	Mg	30.7	2.52	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	8.4	0.18
Sodium	Na	0.0	0.00	Alkalinity (as $CaCO_3$)		292.	5.84
Turbidity		20		Hardness (as $CaCO_3$)		303.	6.05
Color		0		Residue		310.	
Odor		Tr.		Temperature 56° F.			

STOCKTON
Jo Daviess County
Jan. 11, 1947

A public water supply was installed by the village of Stockton (1440) in 1898.

The first well was constructed in 1898 in the southern part of the village (or approximately 1700 ft. N. and 1000 ft. W. of the S. E. corner of Section 11, T. 27 N., R. 4 E.).

Ground surface elevation at the well site is 1000± ft. The well was equipped with a Keystone Driller Co. pump with a 7 3/4-in. cylinder and 18-in. stroke. The cylinder was set at a depth of 300 ft. with 26 ft. of suction pipe attached. The well was repaired by the J. P. Miller Artesian Well Co., Brookfield, in 1908-1909. The company reported that the well was reamed to 12 in. in diameter to a depth of 300 ft., and below 300 ft. the hole was 8 1/4 in. in diameter. Three hundred ft. of 6-in. casing was placed with the bottom at a depth of 617 ft., and 154 ft. of 5-in. casing was placed with the bottom at a depth of 723 ft. The well caved badly at a depth of 1440 ft.

After repairs were completed, water was pumped at a rate of 150 gpm. During the spring of 1923, the village water supply was supplemented by a well leased from the Chicago Great Western R. R. and located on the northerly side of the tracks about 300 ft. northwest of the village well. The railroad well was 1528 ft. deep and equipped with a Keystone Driller Co. double-stroke deep well pump with a 5 3/4-in. cylinder and 18-in. stroke. The cylinder was attached to 340 ft. of 6-in. column pipe. In Oct. 1923 the 2 wells produced 160 gpm., and the railroad well, operating alone, produced 85 gpm.

The village well has not been in service during the past 20 years. All pumping equipment has been removed; and the well, pump house, and concrete reservoir are in a state of abandonment. The well is located in a pit below the floor of the pump house and is accessible.

In 1923 a well, called the North Well, was drilled by Gust Wilson, Hayfield, Minn., in the northwest part of the village (or approximately 1500 ft. S. and 2600 ft. W. of the N. E. corner of Section 11). The well was drilled to a depth of 494 ft. below a ground surface elevation of 1055± ft. and cased with 12-in. pipe to rock at a depth of 130 ft. The driller reported that sandstone was encountered at 470 ft., and the non-pumping water level was at a depth of 148 ft. The well produced 140 gpm. for a 20-hr. test period in 1925. In May 1938 the non-pumping level was reported to be 236 ft.

The well was used as an auxiliary supply unit until May 1944 when the pumping equipment was removed. It has subsequently been abandoned and is capped and sealed.

Another well, known as the South Well, at the pumping station, was drilled in 1925 and is about 30 ft. southwest of the North Well. The depth was measured in 1937 and found to be 462 ft. During construction, this well was "shot" and cleaned, and the North Well was "shot" but not cleaned afterward. The South Well contained part of a driller's bit, as reported in 1937.

The South Well was equipped with a 17-stage Fairbanks-Morse turbine pump and 420 ft. of 6-in. column pipe. It was fitted with a Johnson right angle drive turbine head, No. 4170. Power was furnished by a 6-cylinder, 60-hp. Fairbanks-Morse diesel engine, No. 796385. When the well was completed in 1925, the non-pumping water level was reported to be 148 ft. below the ground surface. In Mar. 1937 the non-pumping water level was at 210 ft.; and when pumping at a rate of 160 gpm., the drawdown was 200 ft. The well was abandoned in Apr. 1938, and the pump was removed, repaired, and installed in the North Well which had been cleaned and deepened by Varner. The South Well is capped and sealed.

Well No. 4 was drilled to a depth of 528 ft. in Feb. 1938 by Varner Well Drilling Co., Dubuque, Iowa; but when during a production test the drawdown was 154 ft. while pumping at 196 gpm., it was decided by the village officials to drill deeper. The non-pumping water level was reported to be 119 ft. below a ground surface elevation of 1000± ft.

The well is located at the northeast corner of Main and Queen St. (or approximately 2200 ft. N. and 1300 ft. W. of the S. E. corner of Section 11). In June 1938 the well had been deepened by Varner to a depth of 1277 ft.

The well was drilled to a diameter of 17 in. from the top to 77 ft. and 12 1/2-in. casing was set at that length and grouted. Below 77 ft. the hole was 12 1/2 in. in diameter. On May 31, 1938 the water level was at 143 ft.; and after 2-hr. pumping at 394 gpm., the drawdown was 135 ft.

The well was in continuous service as the principal source of the public supply from June 1938 to Sept. 1944 when the pump was pulled due to a decline in production to 200 gpm. Holes were found in some sections of the column pipe. The pump was repaired, overhauled, and re-

installed with 46 ft. of additional column pipe in Oct. 1944, and the pump assembly now consists of 370 ft. pf 6-in. column pipe; 10-in., 12-stage (bronze impellers) Sterling turbine pump,'No. S 2671; 20 ft. of 6-in. suction pipe with 4 ft. of 6-in. perforated strainer; 60-hp. General Electric motor.

A water level of 242 ft. 2 in. below the pump base was reported on Oct. 1, 1944 after the well had been idle for a period of 12 hr.

On Jan. 7, 1946 observations of water levels below the pump base were made during a 7 1/2-hr. period of continuous pumping at a uniform rate of 320 gpm. The distance to water before the test, after a 12-hr. idle period, was 258 ft. 8 in. The following drawdowns were observed: after 1 hr., 72 ft. 7 in.; after 3 hr., 73 ft. 5 in.; after 6 hr., 74 ft.; and after 7 1/2 hr., 74 ft. The apparent specific capacity of the well was about 4.3 gpm. per ft. of drawdown.

Analysis of a sample (Lab. No. 108,628) collected Dec. 10, 1946 after 2-hr. pumping at 310 gpm., showed the water from Well No. 4 to have a hardness of 18.2 gr. per gal., a residue of 305 ppm., and an iron content of 0.4 ppm.

Well No. 5 was drilled in 1942 by Thorpe Bros. Well Co., Des Moines, Iowa. The well is located on the west side of Golf Road about midway between the extensions of High and Columbia St. (or approximately 1500 ft. S. and 2600 ft. W. of the N. E. corner of Section 11).

After the well was completed in 1942 the driller made a pumping test and reported the yields as given in Table 1.

After the test, the water rose to 258 ft. 9 in. below the surface and remained at this level.

The hole and casing diameter record is:

Hole Record

12-in. from surface to 523 ft.
10-in. from 523 to 860 ft.

Casing Record

12-in. from surface to 132 ft.
10-in. liner from 523 to 610 ft.

Considerable delay was experienc in obtaining the necessary pumping equipme, and the well was not placed in service until 1544 when the following installation was made: 400 ft. of 7-in. od. column pipe; 10-in., 11-stage Pomona turbine pump, No. S. C. 126, rated at a capacity of 400 gpm. against 420 ft. of head; 20 ft. of 7-in. od. suction pipe; 60-hp. Westinghouse electric motor. This pumping unit was in service until Oct. 13, 1946. The following changes in the installation are to be made: 390 ft. of 7-in. od, column pipe; 30 ft. of 6-in. id. column pipe; and a 10-in., 14-stageturbine pump rated at a capacity of 340 gpm. against 420 ft. of head.

All local water demands are furnished by the village.

The average metered pumpage for the public supply during the period from July 1, 1944 to Dec. 1, 1946 was 304,248 gpd. During this period, the average metered consumption of the Chicago Great Western R. R. was 147,211 gpd., and the Kraft Foods Co., 105,551 gpd. which indicates an average pumpage of 51,486 gpd. for residential and other commercial purposes.

The village does not have a sanitary sewer system, but had 450 water service connections in use in Nov. 1946.

LABORATORY NO. 108,628

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.4		Silica	SiO_2	12.6	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	60.5	3.03	Chloride	Cl	3.0	.08
Magnesium	Mg	38.9	3.20	Nitrate	NO_3	1.0	.02
Ammonium	NH_4	0.1	.01	Sulfate	SO_4	17.1	.36
Sodium	Na	3.2	.14	Alkalinity (as $CaCO_3$)		296.	5.92
Color		0		Hardness (as $CaCO_3$)		312.	6.24
Odor		0		Residue		305.	
Turbidity		0		Free CO_2 (calc.)		59.	
Temperature 56.1° F.				pH = 7.1			

Sample-study log of Well No. 4 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Till	30	30
Ordovician system		
Maquoketa shale	25	55
Galena-Platteville dolomites	335	390
Glenwood sandstone, some shale	10	400
St. Peter formation		
Sandstone	267	667
Conglomerate of shale, chert and sandstone	38	705
Oneota chert, sandstone and dolomite	56	761
Cambrian system		
Jordan dolomite and sandstone	29	790
Trempealeau dolomite	85	875
Franconia sandstone, some shale and dolomite	98	973
Galesville formation		
Sandstone, some clay and dolomite at base	37	1010
Sandstone, incoherent	80	1090
Eau Claire sandstone, partly water-bearing, some shale	187	1277

TABLE 1

375 gpm. with a drawdown of 99 ft. (3.77 gpm. per ft. of drawdown)
290 gpm. with a drawdown of 85 ft. (3.41 gpm. per ft. of drawdown)
250 gpm. with a drawdown of 77 ft. (3.25 gpm. per ft. of drawdown)
220 gpm. with a drawdown of 71 ft. 10 in. (3.06 gpm. per ft. of drawdown)
195 gpm. with a drawdown of 62 ft. 10 in. (3.1 gpm. per ft. of drawdown)

STONE PARK
Cook County
June 14, 1946

A public water supply system was placed in service by the village of Stone Park (636) in 1944.

Water is obtained from a well located on the west side of 39th Ave. about 150 ft. north of Division St. (or approximately 2445 ft. S. and 630 ft. E. of the N. W. corner of Section 4, T. 39 N., R. 12 E.).

This well was drilled to a depth of 291 ft. by W. J. Wentz and completed on Mar. 10, 1942. The elevation of the ground surface is 636± ft.

Correlated driller's log of well completed in 1942 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Glacial drift	44 1/2	44 1/2
Silurian system		
Niagaran-Alexandrian series		
Limestone, white, hard and fairly compact	195 1/2	240
Limestone, dark, creviced	50	290
Ordovician system		
Maquoketa formation		
Shale	1	291

The hole and casing diameter record is reported as follows: 48 ft. of 12-in. casing below a point 3 1/2 ft. above the normal ground surface; 12-in. hole to a depth of 216 ft.; 11-in. hole from 216 ft. to the bottom.

A test was conducted Mar. 19,-20, 1942. After 12-hr. pumping at 86 gpm., the drawdown was reported 13 ft. from a non-pumping water level of 171.8 ft. below the top of the casing.

The following pump installation, made in 1942, is still in service: 230 ft. of 4 1/2-in. column pipe; 7-in., 11-stage American Well Works turbine pump rated at 100 gpm. against 260 ft. of head; the overall length of the pump is 7 ft.; 230 ft. of air line; 10 ft. of 5-in. suction pipe; 15-hp. U. S. electric motor. The pump base is on a concrete block 4 ft. above the level of the pump house floor.

On Nov. 26, 1943, the non-pumping water level was 185 ft.

Analysis of a sample (Lab. No. 106,699) collected June 10, 1946 from a tap on the pump discharge pipe after 3-min. pumping at 100 gpm., showed this water to have a hardness of 41.0 gr. per gal., a residue of 959 ppm., and an iron content of 1.3 ppm. This quality of water is not unusual for waters from this depth in this vicinity.

A chlorinator was installed on May 9, 1946.

The estimated average pumpage in 1945 was 20,000 gpd.

LABORATORY NO. 106,699

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.3		Silica	SiO_2	14.2	
Manganese	Mn	0.1		Fluoride	F	0.1	
Calcium	Ca	158.4	7.92	Chloride	Cl	44.0	1.24
Magnesium	Mg	74.5	6.12	Nitrate	NO_3	2.6	0.04
Ammonium	NH_4	0.3	0.01	Sulfate	SO_4	395.1	8.22
Sodium	Na	59.1	2.57	Alkalinity (as $CaCO_3$)		356.	7.12
Color		0		Hardness (as $CaCO_3$)		702.	14.04
Odor		0		Residue		959.	
Turbidity		20		Free CO_2 (calc.)		94.	
Temperature		51.2° F.		pH = 7.0			

STONINGTON
Christian County
Aug. 7, 1948

The village of Stonington (1103) installed a public water supply in 1906.

The original source of supply consisted of 2 wells, drilled in 1906 and located close together on the south side of Division St. between Maple and Pine St. (or approximately 1350 ft. S. and 1550 ft. E. of the N. W. corner of Section 27, T. 14 N., R. 1 W.). The ground surface elevation at this location is 580± ft.

These wells were 6 in. in diameter, 40 ft. deep, and each well was equipped with 10 ft. of Cook brass screen, having No. 14 slot openings.

Water was pumped from the wells by means of an 8-in. by 36-in. Cook pump rated at 105,000 gpd.

It was reported in 1913 that the non-pumping water level in the wells was 10-12 ft. below the ground surface, and that the pump was operated 'about 12 hr. per day in winter, and 18 hr. per day in summer.

Analysis of a sample (Lab. No. 37,390) collected June 26, 1917, showed the water to have a hardness of 21.4 gr. per gal., a residue of 482 ppm., and an iron content of 2.5 ppm.

Another well, similar to the first 2 wells, was drilled later.

In 1922, it was reported that 2 of the 3 wells, had been abandoned, and that the third well was seldom used.

A dug well was constructed in 1920, and was located about 25 ft. south and 25 ft. east of one of the old wells. It is located about 185 ft. south of the center of Division St., on the west side of the alley between Maple and Pine St.

This well is 10 ft. square, 48 ft. deep and is open at the bottom. The water is reported to come from a stratum of gravel 14 ft. thick.

Water was originally pumped from the well by means of a 9-in. by 6-in. by 12-in. Dean Brothers steam pump, placed in the well on a platform at a depth of 27 ft. The pump was reported to be operated about 8 hr. per day at 20-21 spm., giving a discharge of about 110 gpm. In 1922, it was reported that the non-pumping water level was about 28 ft. below the ground surface, and that after 4-days continuous pumping, the drawdown was not more than 4 ft.

Prior to 1930, the steam pump was replaced by a 3-stage American Well Works turbine pump, rated at 200 gpm., driven by a 15-hp. Fairbanks-Morse electric motor, operating at 1147 rpm. This pump is still in place, as an emergency unit.

In 1934, a Fairbanks-Morse turbine pump was installed beside the American Well Works pump. The new pump was rated at 80 gpm. against 140 ft. of head. The bottom of the suction pipe is at a depth of 44 ft., and the power is furnished by a 7 1/2-hp. Fairbanks-Morse electric motor, operating at 1730 rpm.

On Nov. 2, 1934, a production test was made, using the newer pump. After 4-hr. pumping, the last hr. at a rate of 81 gpm.; the drawdown was 4.2 ft. from a non-pumping water level of 18.9 ft. below the floor of the pump house.

Analysis of a sample (Lab. No. 91,011) collected July 7, 1941, showed the water to have a hardness of 19.8 gr. per gal., a residue of 427 ppm., and an iron content of 2.7 ppm.

In 1946, two test holes were drilled by Woollen Bros., Wapella. Test Hole No. 1 was located on Swim St. between Livergood and Main St. (or approximately 2120 ft. S. and 540 ft. E. of the N.W. corner of Section 27). The hole was 4 in. in diameter and 161 ft. deep, and the non-pumping water level was reported to be 40 ft.

Sample-study log of Test Hole No. 1 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil, loess and till	21	21
Sand, slightly silty, sand and gravel at top	12	33
Till	6	39
Soil, till, silt, some clay	69	108
Sand, slightly silty, granule gravel at base	9	117
Soil, silt and till	39	156
Sand, clean	3	159
Pennsylvanian system		
Shale	2	161

In 1946 and 1947, three wells were drilled by Cyrus Stevens, Findlay, and located at the water works and on both sides of the alley, south of Division St. All 3 wells are in service and are

equipped with identical Burks jet pumps, Fig. 53216, and 1 1/2-hp. Wagner electric motors. The diameter of the pressure pipe is 1 in. and the eductor pipe is 1 1/2 in. Each pump discharges at a rate of 20 gpm. over the coke tray-aerator.

Well No. 1 was completed to a depth of 47 ft. in 1946 and is located 35 ft. north and 30 ft. east of the dug well. The well was cased with 4-in. pipe from the surface to 28 ft. and with 2 1/2-in. pipe from the surface to 40 ft. The outer pipe was to case off a fine white sand. Six ft. of 2 1/4-in. Johnson No. 25 well point was placed below the 2 1/2-in. casing.

The static water level was 28 ft. below the ground surface, when the well was completed.

Well No. 2 was completed to a depth of 48 ft. in the summer of 1947 and is located 10 ft. north and 6 ft. west of the dug well. The well was cased with 2 1/2-in. pipe from the surface to a depth of 40 ft. and with 6 ft. of Johnson No. 35 well point.

When the well was completed, the static water level was 30 ft. below ground level.

Well No. 3 was completed to a depth of 38 ft. in the summer of 1947 and located 35 ft. north and 6 ft. east of the dug well. The well was cased with 3-in. pipe from the surface to a depth of 31 1/2 ft. and with 9 ft. of 2 3/4-in. welded silicon brass screen, having No. 35 slot openings. When the well was completed, the static water level was 30 ft. below ground level.

In July 1948, Well No. 3 was in continuous service at 20 gpm. Analysis of a sample (Lab. No. 115,422) collected July 27, 1948 showed the water from Well No. 3 to have a hardness of 22.4 gr. per gal., a residue of 505 ppm., and an iron content of 1.6 ppm.

All water is aerated, filtered, softened, and chlorinated. Analysis of a sample (Lab. No. 115,509) collected July 27, 1948 showed the treated water to have a hardness of 2.2 gr. per gal., a mineral content of 498 ppm., and an iron content of 0.1 ppm.

From July 1, to 26, 1948 pumpage was estimated to average 69,370 gpd.

LABORATORY NO. 115,422

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.6		Silica	SiO_2	22.8	
Manganese	Mn	0.2		Fluoride	F	0.3	
Calcium	Ca	99.6	4.98	Chloride	Cl	44.0	1.24
Magnesium	Mg	33.1	2.72	Nitrate	NO_3	5.3	0.09
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	90.7	1.89
Sodium	Na	33.1	1.44	Alkalinity (as $CaCO_3$)		296.	5.92
Turbidity		20		Hardness (as $CaCO_3$)		385.	7.70
Color		0		Residue		505.	
Odor		0		Free CO_2 (calc.)		53.	
Temperature 55.5° F.				pH = 7.15			

LABORATORY NO. 115,509

		ppm.				ppm.	epm.
Iron (total)	Fe	0.1		Fluoride	F	0.2	
				Chloride	Cl	41.0	1.16
Turbidity		0		Alkalinity (as $CaCO_3$)		296.	5.92
Odor		0		Hardness (as $CaCO_3$)		37.	0.74
Color		0		Total Mineral Content		498.	
Temperature 59.5° F.				Free CO_2 (calc.)		5.	
				pH = 8.2			

STRAWN
Livingston County
Apr. 28, 1947

A public water supply was installed by the village of Strawn (199) in 1895.

Water was obtained from a well located in the town hall on the north side of Herman St. (or approximately 4000 ft. S. and 1100 ft. E. of the N.W. corner of Section 3, T. 25 N., R. 7 E.). The well was dug to a depth of 40 ft. and a diameter of 9 ft.

In 1909, due to public opinion against the dug well, a well was drilled near the old well and to a depth of 45 ft. into sand and gravel. It was cased with 6-in. pipe to a depth of 40 ft. below which was placed a 5-ft. length of screen made from a '6-in. gas pipe and with 1/4-in. holes spaced 1/2-in. center to center. The ground surface elevation is 770± ft.

Water was pumped by a Gould 7 by 8-in. triplex pump connected to a 7 1/2-hp., 900 rpm. electric motor.

In 1915 the water level was reported to be 20 ft. below the surface. The well has been capped and is not used.

Analysis of a sample (Lab. No. 67045), collected July 29, 1930, showed the water to have a hardness of 21.4 gr. per gal.; a mineral content of 460.6 ppm., and an iron content of 2.0 ppm.

In 1933 a new well was drilled by John Bolliger, Fairbury, and located about 15 ft. west of the pump house or 15 ft. north and 25 ft. west of the old well. It is 60 ft. deep and cased with 6-in. pipe.

Water is pumped by the Goulds triplex suction pump,< which was used on the old well. The pump is in poor condition, and will probably be replaced soon. Power is furnished by a 10-hp., 865-rpm. General Electric motor.

Analysis of a sample (Lab. No. 110,082), collected Apr. 28, 1947 after pumping 5 hr., showed the water to have a hardness of 22.2 gr.per gal., a residue of 444 ppm., and an iron content of 6.6 ppm.

The water is not treated.

Pumpage is estimated to average 8000 gpd.

LABORATORY NO. 110,082

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	6.6		Silica	SiO_2	16.8	
Manganese	Mn	Tr.		Fluoride	F	0.5	
Calcium	Ca	88.9	4.45	Chloride	Cl	13.0	0.37
Magnesium	Mg	38.8	3.19	Nitrate	NO_3	0.2	Tr.
Ammonium	NH_4	0.2	.01	Sulfate	SO_4	104.9	2.18
Sodium	Na	7.8	0.34	Alkalinity	(as $CaCO_3$)	272.	5.44
Color		0		Hardness	(as $CaCO_3$)	382.	7.64
Odor		0		Residue		444.	
Turbidity		10					
Temperature		54.5° F.					

A public water supply was installed for the village of Stronghurst (691) in 1915.

A well was drilled on Lot 11, Block 7 (or approximately 2150 ft. S. and 300 ft. W. of the N.E. corner of Section 25, T. 9 N., R. 5 W.). The well was 1009 ft. deep below a ground surface elevation of 675± ft. and was cased with 10-in. pipe from 0 to 800 ft. and 8-in. pipe from 800 to 872 ft. below which the hole was 6 in. in diameter.

A Keystone Driller Co. plunger pump is installed with a 5 3/4-in. diameter cylinder and 18-in. stroke. The cylinder is reported to be set at a depth of 172 ft., and the discharge estimated at 100 gpm. Power is furnished by a 10-hp., 1445-rpm. Western Electric motor. In Oct. 1927 the non-pumping water level could not be measured, but it was reported to be a little more than 86 ft. The well is maintained for emergency use only, and the pump is operated about once a month.

Analysis of a sample (Lab. No. 80387) collected Feb. 3, 1934, showed the water to have a hardness of 50.3 gr. per gal., a residue of 2391 ppm., and an iron content of 0.5 ppm.

The present water supply is obtained from a well located about 1/4 mile south of the village limits (or approximately 1100 ft. N. and 25 ft. E. of the S.W. corner of Section 30, T. 9 N., R. 4 W.). The original drilling was carried on by D.E. Edwards, West Branch, Iowa, in Apr. - May 1938. The depth of the well was 69 1/2 ft., and a 12-in. casing was set from 0 to 45 1/2 ft.; 10-in. slotted pipe was set from 33 to 54 ft.; the hole was 10-in. diameter below the casing to 63 ft. and an 8-in. hole from 63 to 69 1/2 ft.

Correlated driller's log of well drilled in 1938 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Drift, clay	37	37
Mississippian system		
Keokuk - Burlington formations		
Yellow limestone	9	46
Chert, limestone, mud	23 1/2	69 1/2

A production test was made by the State Water Survey on June 17 - 18, 1938. The water level before the test was 26 ft. below the top of the 12-in. casing; and after 21-hr. pumping at 61 gpm., the drawdown was 6.8 ft. Pumping was performed by a plunger pump operated by the drill rig, and this equipment failed after 21 hr. The water was very turbid all through the test.

An attempt to make a. 24-hr. test was made by the State Water Survey Sept. 14. 1938; but after 5-hr. pumping at 75 gpm., the discharge became very muddy, the pumping rate decreased sharply, and the drawdown, which had been fairly constant, began to increase appreciably. Assuming that the well was being damaged, the test was discontinued.

The well was sounded and found to be 62 ft. in depth instead of the original depth of 69 1/2 ft. It was found that the 12-in. casing was virtually suspended from a wood clamp left by the driller. The cloudiness in the water was presumed to be caused by a loose seating of the 12-in. casing in the rock, allowing drift material to wash into the well. Recommendations were made by the State Water Survey that pumping be continued until the water cleared up, before any additional production tests were made.

A third production test was made by the State Water Survey on Sept. 26 - 27, 1938. The water level before the test was 24.6 ft. below the top of the casing; and after 23-hr. pumping at 62 gpm., the drawdown was 11 1/2 ft. The water was clear throughout the test.

Although the numerical results in the third test indicated that a desired yield of 50 gpm,, might be expected, the State Water Survey recommended that the well be reconstructed; and the State Department of Health felt considerable doubt about continued acceptable quality of the water because of the defective construction.

The well was reconstructed by Ellis Jones, Burlington, Iowa, in the latter part of 1938. It was cleaned out to the original depth of 69 1/2 ft., and the bottom 2 ft. was filled with cement grout making the final depth at 67 1/2 ft.

The original 10-in. casing was removed, and a continuous string of 10-in. pipe was installed from the top to bottom and rested on the top of the plug. The 12-in. casing was not removed, but cement grout was placed between the casings from the top to the bottom of the 12-in. casing. The 10-in. casing was slotted between depths of 40 and 65 1/2 ft. Two 10-in. holes were drilled close beside the well, one to a depth of 37 ft., the other to 42 ft. Gravel was placed in the holes and tamped with the drill bit. A total of 14 cu. yd. of gravel was used.

On Jan. 16-17, 1939 a production test was made by the State Water Survey. The water level was 25 ft. below the top of the casing before the test; and after pumping 24 hr. at 51 gpm., the drawdown was 12 1/2 ft. Thirty min. after the pump was shut down the water level had raised to 28 1/2 ft. The water was clear at all times except for a few minutes in the latter part of the test.

A test was made by the State Water Survey on Apr. 3-4, 1939. The water level before the test was 25 ft.; and after pumping 24 hr., at 42 gpm., the drawdown was 16 ft. Equilibrium was maintained after 12-hr. pumping at a rate of 43 gpm. Five hr. after the pump was shut down, the water level had raised to 26 1/2 ft.

The following pump assembly, installed in Oct. 1939, is in service: 60 ft. of 4-in. column pipe; 6-stage Aurora turbine pump, No. **10438,** rated at 40 gpm. against 51 ft. of head; the over-all length of the pump is 5 ft.; 60 ft. of air line; no suction pipe but a strainer on bottom of pump; 1 1/2-hp., 1440-rpm. Westinghouse electric motor, No. 1-40 W 406.

Analysis of a sample (Lab. No. 107,985) collected Oct. 13, 1946 after 9-hr. pumping at 43 gpm., showed this water to have a hardness of 18.1 gr. per gal., a residue of 333 ppm., and an iron content of 2.1 ppm.

An aerator, filter, and softener are installed, but were not in complete operation in Oct. 1946.

Pumpage is estimated at 35,000 to 38,000 gpd. On Oct. 15, 1946 the non-pumping water level was reported to be 26 to 28 ft. below the ground.

LABORATORY NO. 107,985

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.1		Silica	SiO_2	18.8	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	72.8	3.64	Chloride	Cl	4.0	0.11
Magnesium	Mg	31.0	2.55	Nitrate	NO_3	0.3	Tr.
Ammonium	NH_4	1.1	0.06	Sulfate	SO_4	23.7	0.49
Sodium	Na	6.2	0.27	Alkalinity	(as $CaCO_3$)	296.	5.92
Color		0		Hardness	(as $CaCO_3$)	310.	6.20
Odor		0		Residue		333.	
Turbidity		40					
Temperature		53° F.					

SUBLETTE
Lee County
Dec. 12, 1947

The village of Sublette (282) installed a public water supply about 1893.

Water was first obtained from a well drilled in 1893 and located across the street from the center of the business district. Little water was furnished from this supply.

Water is now secured from a well drilled in 1898 to a depth of 752 ft. by the J. P. Miller Artesian Well Co., Brookfield, and located on Pennsylvanian St. across the railroad tracks, north of the business district (or approximately 350 ft. N., and 90 ft. W. of the S. E. corner of Section 9, T. 19 N., R. 11 E.). The surface elevation is 920± ft.

Correlated driller's log of well drilled in 1898 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Glacial drift	443	443
Ordovician system		
Galena-Platteville formation		
Dolomite	157	600
St. Peter formation		
Sandstone	152	752

The casing record is: 10-in. casing from surface to 364 ft.; 6-in. casing from 364 to 443 ft.; 6-in. hole from 443 to 752 ft.

In 1920 the non-pumping water level was 220 ft. In 1936, after the new pump had been installed when pumping at 90 gpm., the drawdown was reported to be 19 ft. from a non-pumping level of 226 ft. below the top. On Dec. 12, 1947, after 4-hr. pumping at an estimated rate of 90 gpm., the drawdown was 12 ft. from a non-pumping water level of 220 ft.

The existing pump assembly, made in pr. 1936, is: 250 ft. of 5-in. column pipe; 7 7/16-in., 11-stage Pomona turbine pump, No. N-768, rated at 100 gpm. against 250 ft. of head at 1760 rpm.; the overall length of the pump is 5 ft. 10 5/8 in.; 20 ft. of 5-in. suction pipe; 250 ft. of 1/4-in. air line; 15-hp. Westinghouse electric motor, No. 8105935, operating at 1767 rpm.

Analysis of a sample (Lab. No. 112,898) collected Dec. 12, 1947 after 4-hr. pumping at 90 gpm., showed water from this well to have a hardness of 16.0 gr. per gal., a residue of 306 ppm., and an iron content of 2.5 ppm.

Pumpage is estimated to be 30,000 gpd.

LABORATORY NO. 112,898

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.5		Silica	SiO_2	18.8	
Manganese	Mn	0.0		Fluoride	F	0.2	
Calcium	Ca	62.6	3.13	Chloride	Cl	1.0	0.03
Magnesium	Mg	28.8	2.37	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	1.1	0.06	Sulfate	SO_4	1.6	0.03
Sodium	Na	6.0	0.26	Alkalinity	(as $CaCO_3$)	288.	5.76
Turbidity		20		Hardness	(as $CaCO_3$)	275.	5.50
Color		0		Residue		306.	
Odor		Tr.		Temperature	53.6° F.		

SUGAR GROVE
Kane County
Sept. 1, 1947

A private water supply was installed about 1890 to serve a hotel and several nearby residences. The hotel and well are now owned and operated by. Mrs. Katherine Lohrah.

Water was obtained from a 3-in. well 90 ft. deep located on the hotel property about 57 ft. north of the center of the Chicago, Burlington, and Quincy R. R. and 108 ft. west of Main St. (or approximately 2550 ft. S. and 2400 ft. E. of the N. W. corner of Section 21, T. 38 N., R. 7 E.). The elevation of the ground surface is 727± ft. This well was in service until another well was drilled at the same site. The older well was abandoned because of sand-clogging of the pump.

The newer well was drilled in 1905 by B. L. Palmer & Sons, Aurora, to a depth of 230 ft. and a diameter of 4 in. The driller reported penetrating 185 ft. of drift followed by 45 ft. of shale. Drilling was stopped at the top of a limestone formation.

The well is equipped with a plunger pump rated at 6 gpm. and a 3/4-hp. Emerald electric motor. The top of the well is in a pit about 6 ft. below the ground surface below which the cylinder was lowered from a 60-ft. setting to a depth of 80 ft. in the fall of 1946.

Analysis of a sample (Lab. No. 111,526) collected Aug. 11, 1947, from a tap in the well pit after 6-hr. pumping at 6 gpm., showed this water to have a hardness of 7.0 gr. per gal., a residue of 371 ppm., and an iron content of 0.4 ppm.

Estimated pumpage is 5000 gpd.

The well serves the hotel and 50 services.

A petition has been circulated for the creation of a "Public Water District."

LABORATORY NO. 111,526

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.4		Silica	SiO_2	11.6	
Manganese	Mn	0.0		Fluoride	F	1.6	
Calcium	Ca	27.2	1.36	Chloride	Cl	5.0	0.14
Magnesium	Mg	12.6	1.03	Nitrate	NO_3	3.9	0.06
Ammonium	NH_4	2.0	Tr.	Sulfate	SO_4	6.0	0.12
Sodium	Na	103.3	4.49	Alkalinity	(as $CaCO_3$)	328.	6.56
Turbidity		10-		Hardness	(as $CaCO_3$)	120.	2.39
Color		0		Residue		371.	
Odor		0		Free CO_2	(calc.)	9.	
Temperature		51.2° F.		pH = 8.0			

The city of Sullivan (3101) installed a public water supply in 1885.

No information is available regarding the history of the system prior to 1916. The supply in 1916 was obtained from three wells. Two of these wells were located about 60 ft. apart at the water and light station at the southeast corner of Water and McClellan St. (or approximately 1200 ft. N. and 2240 ft. W. of the S. E. corner of Section 2, T. 13 N., R. 5 E.). The ground surface elevation is 685± ft. These wells were about 300 ft. deep, and were reported to obtain their supply from a stratum of sandstone. In 1921, it was reported that the non-pumping water level in one of the wells was 100 ft. when the other pump was being operated.

The third well in use in 1916 was located on the Rork lot at the southeast corner of Adams and Madison St. (or approximately 1450 ft. N. and 300 ft. W. of the S. E. corner of Section 2). The well was reported, in 1916, to be 10 in. in diameter, and 79 ft. deep. In 1923, the well was reported to be 12 in. in diameter and 90 ft. deep. It is not known whether this well is the same as the one in use in 1916, as several wells were reported to have been drilled and abandoned at this location.

All three wells have been filled in.

A well, known as Kersey Well No. 1, was drilled in 1916 by Omer Kersey, Sullivan, and located at the rear of the city hall on Jefferson St. between Madison and North St. (or approximately 1850 ft. N. and 150 ft. W. of the S. E. corner of Section 12).

This well was 280 ft. in depth below the floor of a four-foot pump pit, and was cased with 12-in. pipe to a depth of 183 ft.

A production test was made on Oct. 11-12, 1916. The well yielded 33 gpm. The non-pumping water level was 93 ft. below the top of the casing. After pumping for 9 1/2 hr., the water level in Kersey Well No. 2, located about 350 ft. southwest,was lowered 6 ft. from a non-pumping water level of 99 ft. below the ground surface.

In 1924, it was reported that the pump was driven by a 7 1/2-hp. electric motor, and was operated 16-18 hr. per day. This well has been filled in.

Analysis of a sample (Lab. No. 35,520) collected Oct. 12, 1916, showed the water to have a hardness of 14.9 gr. per gal., a residue of 1080 ppm., and an iron content of 6.5 ppm.

The well, called Kersey Well No. 2, was located on the Rork lot. This well was reported to have been 270 ft. deep, and cased with 12-in. pipe.

The non-pumping water level in 1916 was reported to be 99 ft. below the ground surface.

It is not known whether this well was ever used.

A well known as the Jackson St. Well was drilled about 1919, and located at the southwest corner of the intersection of Jackson and Lebanon St. (or approximately 2550 ft. N. and 700 ft. E. of the S. W. corner of Section 1). The ground surface elevation is 650± ft. This well was 10 in. in diameter and 260-270 ft. deep. It has been filled in.

A well, leased by the city, was located on the Powers lot, north of the Illinois Central R. R. and west of Hamilton St. (o.r approximately 950 ft. N. and 1600 ft. W. of the S. E. corner of Section 2).

This well was 90 ft. deep, and was equipped with a 5-in. by 20-in. deep-well pump. In 1924, itwas reported that the pump was operated 24 hr. per day and the well was reported to produce about 18,000 gpd.

All of the preceding wells were abandoned about 1926.

In 1925, Layne-Bowler Co., Chicago, drilled five test wells about 2.6 miles south of the Court House. Two permanent wells were then completed, and are known as the North Well and the South Well.

The North Well is located about 100 ft. from Test Well No. 1 (or approximately 700 ft. S. and 1800 ft. W. of the N. E. corner of Section 23). The ground surface elevation is 637± ft.

The well was drilled to a total depth of 129 ft.

The hole was drilled 30 in. in diameter, and a 24-in. outer casing and an 18-in. inner casing were installed with the bottoms at a depth of 70 ft., and a 45-ft. section of 18-in. screen was attached to the bottom of the inner casing, placing the bottom of the screen at 115 ft. The annular spaces between the casings and outside the screen were gravel-packed.

Correlated driller's log of the North Well furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay	64	64
Sand and gravel	37	101
Hardpan	3	104
Gravel	3	107
Clay and gravel	22	129

The well was tested on Feb. 26, 1926 by the State Water Survey. After five-hours pumping at an average rate of 584 gpm., the drawdown was 43.5 ft. from a non-pumping level of 54.5 ft. below the top of the inner casing.

Another test was made on July 31,1926 by the State Water Survey. The well produced 660 gpm. with a drawdown of 19 ft. from a non-pumping water level of 58 ft. below the pump base plate. After the pump had been stopped for three hours and eighteen minutes, the water level had returned to within 0.6 ft. of the non-pumping level.

The pumping equipment, installed in 1937, consists of 90 ft. of 5-in. column pipe; 8-in., 5-stage,(type 724) Fairbanks-Morse turbine pump, No. 29378, rated at 250 gpm.; 10-hp. Fairbanks-Morse electric motor.

Analysis of a sample (Lab. No. 115,142) collected June 29,1948, after continuous pumping at 200 gpm. showed the water to have a hardness of 19.6 gr. per gal., a residue of 349 ppm., and an iron content of 3.2 ppm.

The South Well is located 500 ft. south and 153 ft. west of the North Well.

The well is 120 ft. deep and is of the gravel-pack type, with 24-in. outer casing and 18-in. inner casing. A 45-ft. section of screen was installed with the bottom at a depth of 120 ft.

The non-pumping water level on Feb. 26, 1926 was 55.75 ft. below the top of the outer casing. On July 31, 1926, after the pumps in both wells had been idle for more than three hours, the water level was 58.7 ft. below the pump base plate.

The pumping installation, made in 1937, is identical with the installation made in the North Well. Each pump is now estimated to discharge 200 gpm. to the aerator.

Analysis of a sample (Lab. No. 80,351) collected Feb. 5, 1934, showed the water to have a hardness of 19.3 gr. per gal., a residue of 380 ppm., and an iron content of 2.6 ppm.

The water is aerated, softened and chlorinated. Analysis of a sample (Lab. No. 115,184) collected June 29, 1948 showed the treated water to have a hardness of 7.4 gr. per gal., a mineral content of 156 ppm., and an iron content of 0.22 ppm.

From June 1 to 29, 1948 pumpage was estimated to average 407,325 gpd.

LABORATORY NO. 115,142

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	3.2		Silica	SiO_2	20.1	
Manganese	Mn	Tr.		Fluoride	F	0.1	
Calcium	Ca	78.4	3.92	Chloride	Cl	5.0	0.14
Magnesium	Mg	33.7	2.77	Nitrate	NO_3	3.4	0.05
Ammonium	NH_4	0.4	0.02	Sulfate	SO_4	4.1	0.09
Sodium	Na	10.4	0.45	Alkalinity (as $CaCO_3$)		344.	6.88
Turbidity		40		Hardness (as $CaCO_3$)		335.	6.69
Color		0		Residue		349.	
Odor		0		Free CO_2 (calc.)		49.	
Temperature 55.5° F.				pH = 7.25			

LABORATORY NO. 115,184

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.22		Fluoride	F	0.1	
Turbidity		0		Chloride	Cl	6.0	0.17
Color		0		Alkalinity (as $CaCO_3$)		112.	2.24
Odor		M		Hardness (as $CaCO_3$)		126.	2.52
Temperature 57° F.				Total Mineral Content		156.	

Water works were first installed by the city of Sycamore (4702) about 1888.

The source of the public supply until 1903 was from a group of tubular wells drilled in the northern part of the city from which water flowed into a collecting reservoir. Six of these wells were drilled to a depth of 65 ft. from the bottom of the reservoir. The center of the reservoir was located about 100 ft. south of the Chicago Great Western R. R. main track and 280 ft. east of the center of N. Locust St. (approximately 1020 ft. S. and 370 ft. W. of the N. E. corner of Section 32, T. 41 N., R. 5 E.). Six other shallow wells were drilled along the south right-of-way of the Chicago Great Western R. R. from the reservoir to a distance of about 2000 ft. east of the reservoir. Water flowed by gravity to the reservoir.

The reservoir and the wells were held for emergency purposes until about 1907. The reservoir was subsequently filled, and all of the wells were abandoned and are now obliterated.

In 1903 the city of Sycamore contracted with the Central Illinois Light Co. to supply the city with water from deep rock wells. The wells and pumping equipment are owned by the company and the city owns and maintains the distribution system. The company now owns 4 wells from which the city obtains its water supply.

The 2 original wells, now called No. 1 and No. 2, are housed in the old pumping station, located about 100 ft. north of W. Elm St. and 110 ft. east of S. Maple St. (approximately 2550 ft. S. and 1600 ft. W. of the N. E. corner of Section 32). They are spaced about 18 ft. apart and were drilled by the J. P. Miller Artesian Well Co., Brookfield. The elevation of the ground surface is 870± ft.

Well No. 1, the north well, was drilled to a depth of 902 ft. in 1902. It is reported cased with 12-in. pipe from the surface to a depth of 208 ft., 10-in. pipe between depths of 205 and 226 ft., and 8 1/4-in. pipe between depths of 226 and 237.4 ft. The well was drilled as a 12-in. hole to a depth of 226 ft., 10-in. hole between depths of 226 and 237.4 ft., followed by a 8 3/16-in. hole to the bottom.

On June 17, 1930, the non-pumping water level was 43 ft. below the surface and on Apr. 4, 1940 the same non-pumping water level was reported, and on the same date when pumping in Wells 1 and 2 at rates of 175 and 625 gpm. respectively, the drawdown in Well No. 1 was 7 1/2 ft. after 1-hr. simultaneous pumping.

The existing pump installation, made in 1940, is: 100 ft. of 7-in. od. column pipe; 10-in., 7-stage Pomona turbine pump having a Worthington pump head and a rated capacity of 600 gpm. against 200 ft. of head; 100 ft. of 1/4-in. copper tubing air line; 50-hp. General Electric motor.

In Aug. 1947 the non-pumping water level was 53 ft. below the pump base. On Sept. 19, 1947, after 4-hr. pumping at 500 gpm. (pump in Well No. 2 idle) the water level was 59 1/2 ft. below the pump base.

Analysis of a sample (Lab. No. 111,946) collected Sept. 19, 1947 after 4-hr. pumping at 560 gpm., showed this water to have a hardness of 19.7 gr. per gal., a total mineral content of 362 ppm., and an iron content of 2.2 ppm.

This well is the principal source of the public supply, and pumping time averaged 20 hr. daily during July, Aug., and the greater part of Sept. 1947.

Well No. 2, the south well, was drilled to a depth of 907 ft. in 1907. The drillers log, hole size and casing record are not available. The company records show a production of 600 gpm. on Oct. 8, 1929 with a drawdown of 16.2 ft. below a non-pumping water level of 44 ft. below the surface.

The existing pump installation is reported as: 130 ft. of 6-in. column pipe; 8-in., 12-stage Worthington turbine pump with a 12-in., 2-stage booster unit near the top; 20 ft. of 6-in. suction pipe; 75-hp. General Electric motor. This pumping unit delivers about 625 gpm. It is operated for short intervals about every 2 weeks and maintained for emergency purposes.

The last non-pumping water level observed was 44 ft. 5 in. below the pump base on May 2, 1934.

Well No. 3 was drilled to a depth of 1002 ft. by W. L. Thorne Co., Des Plaines, in 1914, and located about 100 ft. south of the Chicago Great Western Railroad main track and 150 ft. east of N. Locust St. (approximately 1100 ft. S. and 500 ft. W. of the N. E. corner of Section 32). The elevation of the ground surface is 840t ft.

The well is reported cased with 12-in. pipe at the top and finished as a 6-in. hole at the bottom.

After the completion of the well a production

of 300 gpm. with a drawdown of 49 ft. was reported in a short test of several hours.

Sample-study log of Well No. 3 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Soil and clay"	20	20
"Gravel, fine, and sand"	40	60
"Gravel, coarse, good water"	10	70
"Gravel, sand, and layers of shale"	25	95
"Gravel, very coarse, and sand"	35	130
"Gravel, hardpan, and boulders"	20	150
Ordovician system		
Galena-Platteville dolomites	355	505
Glenwood dolomite	50	555
St. Peter sandstone	250	805
Cambrian system		
Trempealeau dolomite	197	1002

On June 17, 1930 a non-pumping water level of 19 ft. below the surface was reported. At that time a production of 225 gpm. was obtained when pumping with a Glendora triplex plunger pump having a cylinder 9 5/8 in. in diameter and 12 ft. 6 1/4 in. long attached to 110 ft. of drop pipe and operating at a stroke of 18 in.

This well is in service as an auxiliary supply unit. It is still equipped with the same Glendora triplex plunger pump which is belt driven by a 25-hp. General Electric motor. The pump is operated about 3 hr. daily during the summer months and now delivers 200 gpm.

A non-pumping water level of 15 ft. below the top of the casing in the pit, or 21 ft. below the ground surface was observed in 1947.

Well No. 4 was drilled to a depth of 1290 ft. by the J. P. Miller Artesian Well Co. in 1923-1924. It is located north of the intersection of Harvester St. and the DeKalb branch of the Chicago and North Western Railway (approximately 1400 ft. N. and 1750 ft. E. of the S. W. corner of Section 32). The elevation of the ground surface is 855± ft.

The well was cased with 16-in. od. drive pipe from the surface to a seat in the limestone at a depth of 213 ft. Below the casing the hole is 15-in. in diameter to a depth of 550 ft., 12-in. between depths of 550 and 887 ft., and 10 in. from 887 ft. to the bottom.

When the well had reached a depth of 1006 ft. a test was made which showed a production of 250 gpm.

Upon completion of the well it was tested and showed a production of 300 gpm. At this time a non-pumping water level of 136 ft.below the surface was reported.

The existing pump installation, made in 1944, is: 170 ft. of 6-in. column pipe; 10-in., 7-stage American Well Works turbine pump, No. 69088, rated at a capacity of 600 gpm. against 250 ft. of head; 10 ft. of 6-in. suction pipe; 170 ft. of 1/4-in. galvanized iron air line; 50-hp. U. S. electric motor.

On Aug. 20, 1947 the non-pumping water level was 102 ft. below the pump base located in a pit about 5 ft. below the ground surface. The pumping water level is below the 170-ft. air line.

The well is in operation about 12 hr. daily during the summer months.

Analysis of a sample (Lab. No. 111,944) collected Sept. 19, 1947 after 4-hr. pumping at 407 gpm., showed this water to have a hardness of 19.6 gr. per gal., a residue of 352 ppm., and an iron content of 1.4 ppm.

The average combined metered pumpage for the period from Jan. 1 to Sept. 1, 1947 was 630,800 gpd.

LABORATORY NO. 111,946

	ppm.	epm.			ppm.	epm.
Iron (total) Fe	2.2		Fluoride	F	0.4	
Turbidity	10		Chloride	Cl	7.0	0.20
Color	0		Sulfate	SO_4	25.5	0.53
Odor	0		Alkalinity (as $CaCO_3$)		320.	6.40
Temperature 51.5° F.			Hardness (as $CaCO_3$)		338.	6.76
Free CO_2 (calc.)	21.		Total Mineral Content		362.	

pH = 7.6

LABORATORY NO. 111,944

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.4		Silica	SiO_2	24.6	
Manganese	Mn	Tr.		Fluoride	F	0.4	
Calcium	Ca	72.2	3.61	Chloride	Cl	6.0	0.17
Magnesium	Mg	37.7	3.10	Nitrate	NO_3	2.1	0.03
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	16.7	0.35
Sodium	Na	3.7	0.16	Alkalinity	(as $CaCO_3$)	316.	6.32
Color		0		Hardness	(as $CaCO_3$)	336.	6.71
Odor		0		Residue		352.	
Turbidity		10±		Free CO_2 (calc.)		17.	
Temperature		52.5° F.		pH = 7.7			

TAMPICO
Whiteside County
Nov. 7, 1947

The public water supply was installed by the village of Tampico (727) about 1912.

Three wells were located on the north side of the pumping station (or approximately 700 ft. N. and 500 ft. E. of the S. W. corner of Section 14, T. 19 N., R. 6 E.). The wells were spaced in triangular arrangement 10 ft. apart, and were driven to a depth of about 25 ft. in sand and gravel. The elevation of the ground surface is 545± ft. Each of the wells was cased with 4-in. pipe with 6 ft. of No. 8 Cook strainer at the bottom.

In 1917, the casing of one of the wells was broken while being pulled. The well was plugged, and a pit was dug at the bottom of the well. Four 2-in. wells were driven in the pit.

In 1919, twelve 2-in. wells, in groups of four, were driven by Fred Howland, Tampico, and located on the south side of the pumping station. Five ft. of screen point was placed in the bottom of each well. Every year, the screen point was renewed or cleaned. In 1924, the 12 wells driven in 1919 were furnishing the entire supply, and the old wells on the north side of the station were used only in emergency.

On July 11, 1940, 12 new wells were put in service and all of the old wells were abandoned, and reported to be plugged. The new wells were installed by A. J. Pierson, Manlius, and located about 9 ft. apart in an east-west line, 36 ft. south of the pumping station. Each well consists of a 2-in. well point driven to a depth of 30 to 32 ft.

All wells were originally connected at the top to a Fairbanks-Morse duplex pump with 10 ft. of 5-in. suction pipe. The pump was replaced, prior to 1940, by a Westco horizontal turbine-type pump, No. BR 715-140435-B1, rated at 160 gpm. Power is furnished by a 10-hp. Century electric motor, No. 314415.

The village wells are now connected to 2 pumps with a 5-in. suction pipe. The Westco pump is used for automatic operation. A Gould triplex pump, belt-driven by a 15-hp. Wagner Electric motor is used for manual control.

In Oct. 1947, A. J. Pierson, Manlius, acidized the wells which were driven in 1940, and drove 12 new wells. A new well was driven 4 ft. south of each of the old wells. Two-in. driven pipes were used with Peerless sand points of unknown length. All of the new wells were driven to a depth of 30 ft. below the ground surface.

On Nov. 7, 1947 the non-pumping water level was 13 to 15 ft. below the ground surface. The drawdown was not known but was believed to be close to the bottom of the wells.

Analysis of a sample (Lab. No. 112,513) collected Nov. 7, 1947 after 5-min. pumping, showed the water from the wells to have a hardness of 14.6 gr. per gal., a residue of 334 ppm., and an iron content of 0.3 ppm.

The water is not treated.

Pumpage is estimated at 50,000 to 60,000 gpd. of which approximately 27,000 is used by a dairy.

Pumpage in 1947 was reported to average 60,000 gpd.

LABORATORY NO. 112,513

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.3		Silica	SiO_2	16.4	
Manganese	Mn	0.2		Fluoride	F	0.2	
Calcium	Ca	64.0	3.20	Chloride	Cl	4.0	0.11
Magnesium	Mg	21.7	1.79	Nitrate	NO_3	6.5	0.10
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	83.5	1.74
Sodium	Na	14.7	0.64	Alkalinity (as $CaCO_3$)		184.	3.68
Turbidity		0		Hardness (as $CaCO_3$)		250.	4.99
Color		0		Residue		334.	
Odor		0		Temperature 53.5° F.			

A public water supply was installed by the city of Taylorville (8313) in 1888.

Water was first obtained from a dug well, but the supply was insufficient and other wells have been drilled near the original well, located on the pumping station property at Cherokee and Vine St. In 1911 and 1912, eight 8-in. wells were drilled at this location, each to a depth of 92 ft., and these wells were in use until 1923. In 1913, the water level was 25 ft. and in 1923, it was 48 ft. below the top of the well. These wells had been abandoned in 1925.

Analysis of a sample (Lab. No. 42,306) collected Dec. 20, 1919 showed the water to have a hardness of 33.0 gr. per gal., a residue of 805 ppm., and an iron content of 1.21 ppm.

In 1923, two wells were drilled at the pumping station by Sickel Water Production Co., Aurora. The wells were 105 ft. apart and located 33 ft. west of the Cherokee St. sidewalk. The wells were 100 ft. deep below a surface elevation of 610± ft. and were cased with 18-in. pipe to a depth of 80 ft. with 22 ft. of screen below the blank pipe.

In Dec. 1923, the driller made a production test of the south well. Before the test, the water level was 35 ft. below the ground surface and with no other pumps operating, the yield was 800 gpm. at the start. After 3-hr. pumping, the production declined to 300 gpm.

In 1928, municipal officials became aware of a need for an additional water supply, and preferred to obtain one of a softer quality. In 1929-1930, an exhaustive researchwas carried on by the city and cooperated in by the State Water Survey and State Geological Survey for the location of a 10 mgd. supply for an industry and 200,000 gpd. for the city. The 10 mgd. supply for the industry was not found to be available.

Well No. 1, North Well, drilled in 1923, was repaired by L. R. Burt, Decatur, in 1930. The well was equipped with 62 ft. of drop pipe; 17-in., 2-stage Aurora pump, Type T.M.B., having an overall length of 3 ft. 1 in.; 22 ft. of 8-in. suction pipe; 25-hp., 1200 rpm. Fairbanks-Morse electric motor, No. 117004.

In 1938, the drawdown was 35 ft. when pumping at 775 gpm. The well was abandoned and filled up in 1943. The pump w.as installed later in Well No. 7.

Well No. 2, South Well drilled in 1923, was reported in 1938 to have been capped and abandoned.

Well No. 3 was drilled to a depth of 100 ft. by A. D. Cook in 1929 and located south of the pumping station. The well was cased with 80 ft. of 18-in. pipe and 20 ft. of screen made up with the lower 14 ft. being Cook screen having No. 125 slot openings, and the upper 6 ft. being Johnson screen, having No. 60 slot openings. In 1938, when pumping at 800 gpm. the drawdown was 35 ft. The well was abandoned in Aug. 1940, and the pump removed and installed in Well No. 6.

Well No. 4 was drilled to a depth of 115 ft. by L.R. Burt in 1936 and located 10 ft. north and 20 ft. west of the northwest corner of the pumping station, (or approximately 800 ft. S. and 800 ft. W. of the N.E. corner of Section 27, T. 13 N., R. 2 W.). The well was cased with 89 1/2 ft. of 18-in. pipe and with 25 1/2 ft. of Johnson screen, the lower 15 ft. having No. 125 slot openings and the upper 10 1/2 ft. having No. 60 slot openings. The elevation of the pump house floor is 625.6 ft.

In 1938, the well was reported to be equipped with 74 ft. 7 in. of column pipe; 15-in., 11-stage Layne Bowler turbine pump, No. 3880, having an overall length of 8 1/2 ft.; 99 ft. 7 in. of air line; 32 ft. of suction pipe; 75-hp., 1200 rpm. Fairbanks-Morse electric motor, No. 15762.

On June 16, 1938, the non-pumping water level was 34 ft. below the pump base. On Aug. 24, 1944, the water level was 40 ft. and when pumping at 600 gpm., the drawdown was 30 ft. In the summer of 1945, production from this well declined to 265 gpm. Pumping at any higher rate would cause the pump to break suction. An acid treatment was applied, and the production increased to 610 gpm. with a drawdown of 42 ft. from a non-pumping water level of 45 ft. In Jan. 1948 the production rate had declined to 50 to 65 gpm. and on Jan. 13, 1948, an acid treatment was made. On Jan. 29,. 1948, the water level was 52 1/2 ft. and after 2-hr. pumping at 570 gpm., the drawdown was 36 1/2 ft.

Analysis of a sample (Lab. No. 115,464) collected Aug. 3, 1948 after 4 1/2-hr. pumping showed this water to have a hardness of 43.2 gr. per gal., a mineral content of 882 ppm., and an iron content of 3.0 ppm.

Well No. 4 is in service as an auxiliary supply unit.

Well No. 5 was drilled to a depth of 119 ft. by L.R. Burt in 1937 and located 65 ft. west of Well No. 4. The well was cased with 100 ft. of 18-in. pipe below which was placed 19 ft. of screen made up of 15 ft. of Cook screen with No. 127 slot openings and 4 ft. of Johnson screen with No. 60 slot openings. The elevation of the pump house floor is 627.0 ft. The pump base is 8 in. above floor level.

On June 16, 1938, when pumping at 870 gpm., the drawdown was 39 ft. On Aug. 24, 1944, the water level was 40 ft. and when pumping at 600 gpm., the drawdown was 40 ft.

In the summer of 1945, three acid treatments were applied to this well with little benefit. In Aug. 1945, the pump was throttled to 80 lb. discharge pressure and was reported to produce approximately 425 gpm. On Apr. 1, 1947, two acid treatments were applied to the well and 3 production tests were made by the State Water Survey. Before the acid treatment, the non-pumping water level was 50 ft. below the pump base and after 1-hr. pumping at 72 1/2 gpm., the drawdown was 54 1/2 ft. Forty min. after stopping the pump the water level was 50 ft. Then 500 gal. of 15% HCL with inhibitors was pumped into the well. Following the necessary pumping to waste, water was pumped at a rate of 150 gpm. with a drawdown of 60 ft. Then 1500 gal. of acid was pumped into the well, after which water was pumped from the well at 277 gpm. for 1 hr., with a drawdown of 54 ft. Seven min. after stopping the pump, the water level returned to 50 ft., the original level before the test.

The existing pump assembly, installed after Apr. 1, 1947, consists of 80 ft. of 5-in. column pipe; 5-stage Pomona turbine pump No. SH-1146 rated at 275 gpm.; 106 ft. 8 in. of 1/4-in. air line; 21 1/2 ft. of 5-in. suction pipe; 15-hp. electric motor.

On Jan. 29, 1948, the non-pumping water level was 46 ft. 8 in. below the pump base and the drawdown was 27 1/2 ft. when pumping at an unknown rate. In May 1948, the water level was 47 ft. 8 in. after a 10-day idle period. On July 31, 1948, after 45-min. pumping at 250 gpm., the water level was 77 ft. 8 in. below the pump base. Pumps in Well No. 8, about 230 ft. west and Well No. 6 about 110 ft. east were operating at the time. Three min. after stopping the pumps in Well No. 5 and No. 6 but with No. 8 still operating, the water level in Well No. 5 recovered to 47 ft. 8 in., which was the water level in May. On Aug. 3, 1948 the non-pumping water level in Well No. 5 was 48 ft. 2 in. after the pump in Well No. 4, about 65 ft. east, had been in operation 4 1/2 hr. and pumps No. 6 and 8 were idle.

Well No. 5 is in active service, and is operated 10-12 hr. daily in summer.

Analysis of a sample (Lab. No. 115,462) collected Aug. 2, 1948 after 45-min. pumping showed this water to have a hardness of 36.3 gr. per gal., a mineral content of 716 ppm., and an iron content of 1.8 ppm.

Well No. 6 was drilled in 1940 to a depth of 110 ft. by L. R. Burt and located 10 ft. north and 15 ft. west of the northeast corner of the pumping station. The elevation of the pump house floor is 623.9 ft.

Correlated driller's log of Well No. 6 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and clay	15	15
Sand, some clay	25	40
Sand and gravel	74	114

The well was cased with 84 1/2 ft. of 12-in. id. pipe and 27 ft. of 12-in. Johnson screen made up with No. 125 slot openings in the lower 15 ft., No. 80 slot openings in the next 5 ft., and No. 60 slots in the top 5 ft.

The pump assembly is the one removed from Well No. 3 and consists of 80 ft. of 7-in. column pipe; 3-stage Pomona turbine pump, No. G-8729, rated at 600 gpm. at 1750 rpm.; the length of the pump is 3 ft.; 24 ft. of suction pipe; 80 ft. of 1/4-in. air line; 15-hp. Westinghouse electric motor, No. 8030174. The air line is defective.

In Aug. 1940, the non-pumping water level was 40 ft. and after 1/2-hr. pumping at 900 gpm., the drawdown was 14 ft. On Aug. 24, 1944, the water level was about 40 ft. and when pumping at 600 gpm., the drawdown was 20 ft. In Feb. 1947 when pumping at 265 gpm. the drawdown was 27 ft. from a water level of 50 ft.

Well No. 6 is in active service and is operated simultaneously with Well No. 5.

Analysis of a sample (Lab. No. 115,463) collected Aug. 2, 1948 after 30-min. pumping showed this water to have a hardness of 53.0 gr. per

gal., a residue of 1238 ppm., and an iron content of 2.8 ppm.

Well No. 7 was drilled to a depth of 128 ft. in 1943 by L. R. Burt, and located in the northwest corner of the water works property. The well was cased with 18-in. pipe from 5 to 98 ft. and with 32 ft. of Johnson brass wire-wound screen, with 30 ft. "exposed, the lower 20 ft. with No. 125 slot openings and the upper 10 ft. with No. 100 slots.

The pump assembly, installed in Aug. 1944, after removal from Well No. 1, consisted of 96 ft. of 8-in. column pipe; 12-in., 2-stage Aurora pump; 22 ft. of 8-in. suction pipe; 96 ft. of air line.

After completion of the well, the static water level was 49 ft. below the pump house floor elevation of 629.6 ft. and when pumping at 900 gpm., the drawdown was 5 ft. In Aug. 1945, when pumping at 550 gpm., the drawdown was 6 ft. from a non-pumping level of 49 ft. In Feb. 1947, the production rate was 264 gpm. and the drawdown 11 ft. from a non-pumping water level of 50 ft.'

On Feb. 26, 1947, the city engineer reported production rates and drawdowns in Wells 4, 5, 6, 7 and 8. The static level was measured in Well No. 4 at 50 ft. and was assumed to be the same in the other 4 wells.

In Dec. 1947, because of excessive pumping of sand, the formation caved in around the screen. The pump and screen have been removed. On Aug. 2, 1948, the depth to water measured 50.4 ft. from the pump house floor elevation of 629.6 ft.

Well No. 8 was drilled in 1945 to a depth of 130 ft. by L. R. Burt, and located 150 ft. west of Well No. 7 (or approximately 780 ft. S. and 1100 ft. W. of the N. E. corner of Section 27). The elevation of the top of the well is 630.4 ft.

The well was cased with 104 ft. of 18-in. od. pipe and 28 1/2 ft. overall length of 15-in. Johnson Everdur screen with a 25-ft. exposed length, and having No. 187 slot openings.

The well is equipped with 95 ft. of column pipe; 12-in., 4-stage, American Well Works turbine pump, No. 71712, rated at 600 gpm.; the overall length of the pump is 4 1/3 ft.; 28 ft. of suction pipe; 50-hp. U. S. electric motor; a 1/4-in. air line is installed but the length is unknown.

When the well was completed, the water level was 44 ft. below the top of the well. On July 31, 1948 after 8-hr. pumping at 600 gpm., the altitude gauge read 39 ft. When not pumping, the gauge read 50 ft.

Analysis of a sample (Lab. No. 115,442) collected July 31, 1948 after 8-hr. pumping, showed this water to have a hardness of 41.0 gr. per gal., a residue of 1019 ppm., and an iron content of 2.2 ppm.

Some test holes were drilled in 1947 by Hayes and Sims, Champaign. Test Hole No. 7 was drilled to a depth of 109 ft. and located 4160 ft. N. and 2500 ft. W. of the S. E. corner of Section 24.

Analysis of a sample (Lab. No. 113,186) collected Jan. 14, 1948 showed the water from this test hole to have a hardness of 11.3 gr. per gal., a mineral content of 249 ppm., and an iron content of 0.2 ppm.

Well No. 9 was drilled to a depth of 100 ft. in Jan. 1948 by Hayes and Sims and located near their Test Hole No. 5 about 115 ft. north and 60 ft. east of the northeast corner of Ash and Shawnee St. (or approximately 295 ft. N. and 55 ft. E. of the S. W. corner of Section 23). The ground surface elevation is 618± ft.

The well was cased with 16-in. pipe from 2 ft. above to 79 ft. 1 in. below ground level below which a 16-in. Johnson Everdur screen was placed with the bottom at 101 ft. 5 in. The exposed length of screen was 20 ft. with the lower 7 ft. having No. 70 slot openings and the upper 13 ft. having No. 60 slots.

The State Water Survey made a production test on Mar. 12, 1948 using temporary pumping equipment of 60 ft. of 6-in. column pipe and an 8-stage turbine pump. "Before the test, the water level was 37.2 ft. below the top of the casing (elevation 620 ft.). After 5-hr. pumping at 352 gpm., the drawdown was 17.1 ft. After 7 1/4-hr. pumping at 414 gpm., the drawdown was 22.3 ft. Twenty min. after stopping the pump, the water level had returned to the original starting level.

The well is not yet in service. The pump installation includes an Aurora Pump Co. turbine No. 33739 and 30-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 113,788) collected Mar. 12, 1948, after 7 1/2-hr. pumping showed this water to have a hardness of 30.9 gr. per gal., a residue of 684 ppm., and an iron content of 4.7 ppm.

Total pumpage for the city of Taylorville is estimated to average 0.9 mgd.

LABORATORY NO. 115,442

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.2		Silica	SiO_2	26.1	
Manganese	Mn	0.3		Fluoride	F	0.3	
Calcium	Ca	178.3	8.92	Chloride	Cl	42.0	1.18
Magnesium	Mg	62.6	5.15	Nitrate	NO_3	22.5	0.36
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	381.6	7.94
Sodium	Na	45.1	1.96	Alkalinity	(as $CaCO_3$)	328.	6.56
Turbidity		30		Hardness	(as $CaCO_3$)	704.	14.07
Color		0		Residue		1019.	
Odor		0		Free CO_2	(calc.)	63.	
Temperature		58.2° F.		pH = 7.1			

TEUTOPOLIS
Effingham County
May 20, 1948

The village of Teutopolis (806) installed a public water supply in 1942.

The village supply is obtained from a well drilled in Jan. 1941 to a depth of 74 ft. by Layne-Western Co., Chicago, and located at the site of Test Hole No. 8 about 250 ft. south of the Pennsylvania R.R., and 200 ft. west of the east limits of the village (or approximately 800 ft. S. and 200 ft. W. of the N.E. corner of Section 24, T. 8 N., R. 6 E.). The elevation of the ground surface at the well site is 603± ft.

Correlated driller's log of well drilled in 1941 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and clay	44	44
Sand and gravel, slightly dirty	21	65
Sand	10	75
Sand and gravel	2	77
Sand with clay	8	85

The well is cased with 26-in. pipe from 2.5 ft. above to 45 ft. below the ground surface, and with 12-in. pipe from the pump base to 59 ft. and with a Layne shutter screen from 59 to 74 ft. The top 10 ft. of the screen is 12 in. in diameter, and the bottom 5 ft. is cone-shaped, with a diameter of 23 in. at the bottom. The screen has 3/16-in. slot openings. The annular space between the casings and outside the screen was filled with selected washed gravel.

A production test was made by the State Water Survey on Feb. 6, 1941. For test purposes, a belt-driven deep-well turbine pump was installed. After 10-hr. pumping at 66 gpm. the drawdown was 29 ft. The rate was then increased to 160 gpm. and at the end of the 15-hr. pumping period the drawdown was 36.5 ft. from a non-pumping water level of 17.5 ft. below the ground surface.

On May 14, 1948 after a 2-hr. idle period, the water level altitude was 18 ft. and after 18-hr. non-pumping the water level altitude was 23 1/2 ft.

The permanent pump is a Fairbanks-Morse turbine, No. 12057, and power is furnished by a 3-hp. electric motor.

Analysis of a sample (Lab. No. 114,726) collected May 14, 1948, after 20-min. pumping at 70 gpm., showed the water to have a hardness of 19.1 gr. per gal., a residue of 473 ppm., and an iron content of 1.0 ppm.

The water is aerated, softened and chlorinated.

Analysis of a sample (Lab. No. 114,786) collected May 14, 1948 showed the treated water to have a hardness of 5.3 gr. per gal., a mineral content of 268 ppm., and an iron content of 0.36 ppm.

From May 1, 1947 to May 1, 1948, metered pumpage averaged 21,350 gpd.

From Jan. 9, 1942 to May 14, 1948 metered pumpage averaged 18,850 gpd.

LABORATORY NO. 114,726

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.0		Silica	SiO_2	29.5	
Manganese	Mn	Tr.		Fluoride	F	0.3	
Calcium	Ca	83.9	4.20	Chloride	Cl	24.0	0.68
Magnesium	Mg	28.3	2.33	Nitrate	NO_3	4.5	0.07
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	21.6	0.45
Sodium	Na	57.7	2.51	Alkalinity	(as $CaCO_3$)	392.	7.84
Turbidity		5		Hardness	(as $CaCO_3$)	327.	6.53
Color		0		Residue		473.	
Odor		Tr.		Free CO_2	(calc.)	50.	
Temperature		55.7° F.		pH = 7.3			

LABORATORY NO. 114,786

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.36		Fluoride	F	0.2	
Calcium	Ca	Tr.	Tr.	Chloride	Cl	24.0	0.68
Magnesium	Mg	21.3	1.75	Alkalinity	(as $CaCO_3$)	128.	2.56
Turbidity		5		Hardness	(as $CaCO_3$)	91.	1.82
Color		0		Total Mineral Content		268.	
Odor		0		Free CO_2 (calc.)		.07	
Temperature 57.7° F.				pH = 9.65			

THOMSON
Carroll County
Jan. 23, 1947

A public water supply was installed by the village of Thomson (529) in 1903.

Water was obtained from a 3-in. diameter well which was 37 ft. below a ground surface elevation of 600± ft. The top of the well was in a pit 5 ft. below the surface; and a 3-in. diameter U. S. Wind Engine & Pump Co. screen, 5 ft. in length, was set in fine sand. Power was furnished by a 12-hp. kerosene engine. The well was abandoned soon after the second well was drilled in 1918.

An 8-in. diameter well was drilled in 1918 by Mr. Warfield, Savanna, in the same pit several feet south of the old well. The new well was located on Market St. about 100 ft. east of the Chicago, Milwaukee & St. Paul R. R. tracks (or approximately 385 ft. N. and 1800 ft. W. of the S.E. corner of Section 24, T. 23 N., R. 3 E.). The railroad tracks have been removed. The well is equipped with a Fairbanks-Morse triplex pump with 5 by 8-in. cylinder and produced about 96 gpm. Power is furnished by a 10-hp. Fairbanks-Morse gasoline engine. The non-pumping water level in Aug. 1924 was 25 ft. below the surface.

The entire supply is now obtained from a well located 13 ft. north of the old 8-in. well and drilled in Nov. 1938 by D. E. Edwards, West Branch, Iowa. It is located about 22 ft. north of Walnut St. and 40 ft. west of Market St. (or approximately 385 ft. N. of the center of Main St. and 290 ft. E. of the center line of the Chicago, Burlington & Quincy R. R.), and has an elevation at the surface of the ground of 600t ft.

The well is reported to have penetrated hardpan at the bottom, but blue muck flowed into the well after it was drilled, which was shut off by backfilling the well with gravel. It has a sand screen which has not been removed for several years.

The well is 6 in. in diameter and 60 ft. deep and is equipped with the following pump installation, made in Nov. 1938; 40 ft. of 4-in. id. column pipe; 6-in., 14-stage Pomona turbine pump, No. S.R. 1381, rated at a capacity of 70 gpm. against a total head of 140 ft.; the overall length of the pump is 5 ft. 9 1/4 in.; 5-hp. Westinghouse electric motor.

The pump discharges into an elevated storage tank at the site which has a height of 70 ft. at the bottom. A recent check of pump performance indicates a delivery of 82 gpm. to the tank.

Analysis of a sample (Lab. No. 108,673) collected Dec. 14, 1946 after 10-min. pumping at 82 gpm., showed the water to have a hardness of 9.7 gr. per gal., a residue of 233 ppm., and an iron content of 0.9 ppm.

All water for the public supply has been chlorinated since 1945. A chlorine residual of 0.3 ppm. is maintained at the pumping station.

There were 103 service connections in use in Nov. 1946 of which about 95% were metered. All but about 25 residences are connected to the public supply. These residences are supplied by private wells driven to depths of 18 to 32 ft. which are 2 in. in diameter and have 3-ft. sand points.

An estimate of the average pumpage in Dec. 1946 is 10,000 gpd. The maximum summer pumpage is estimated to be 15,000 gpd.

LABORATORY NO. 108,673

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.9		Silica	SiO_2	27.7	
Manganese	Mn	0.1		Fluoride	F	0.4	
Calcium	Ca	43.0	2.15	Chloride	Cl	1.0	0.03
Magnesium	Mg	14.4	1.19	Nitrate	NO_3	41.0	0.66
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	36.6	0.76
Sodium	Na	0.5	0.02	Alkalinity (as $CaCO_3$)		96.	1.92
Color		0		Hardness (as $CaCO_3$)		167.	3.34
Odor		Tr.		Residue		233.	
Turbidity		20		Free CO_2 (calc.)		7.	
Temperature		53,2° F.		pH = 7.55			

A public water supply was installed by the village of Thornton (1101) in 1924. Water has been obtained from three limestone wells during this period.

The first well was drilled by W. L. Thorne in 1923 and is located at the southeast corner of Schwab and Railroad St. (or approximately 2550 ft. N. and 2600 ft. E. of the S. W. corner of Section 34, T. 36 N., R. 14 E.). The elevation of the ground surface at the top of the well is 617± ft.

The driller reported that the well was cased to a depth of 42.5 ft. with 12-in. pipe below which the hole is 10 in. in diameter to the bottom. The depth to water was 30 ft. and the drawdown was 225 ft. when pumping at a rate of 75 gpm.

In Aug. 1926 water could be pumped at a rate of 45 gpm. for not more than 45 or 50 min. before drawing air. After a similar period of rest, pumping could be resumed for a like period, and the operation was continued on this schedule. The bottom of the suction pipe was at a depth of 368 ft.

The following pump installation, made in 1935, is still in place: 300 ft. of 5-in. od. wrought iron column pipe; 8-in., 17-stage Pomona turbine pump rated at 125 gpm. against 300 ft. of head; overall length of the pump is 8 ft. 9 in.; 10 ft. of 5-in. suction pipe; 20-hp. General electric motor. This pumping unit could be operated for only 30 min. before breaking suction, and the production rate would decline from 140 to 50 gpm.

In Apr. 1941 a production test of this well indicated that its capacity was about 35 gpm.

During the year ending June 30, 1948 water was pumped for shorter daily periods and the production rates were: 100 gpm. for the first 30 min.; 80 gpm. for the first hr.; 50 gpm. for the second hr.

During the period between May 1, 1945 and July 1, 1946, the metered pumpage averaged 8520 gpd. and varied from a winter minimum of 5420 gpd. to a summer maximum average of 11,670 gpd.

Analysis of a sample (Lab. No. 106,966) collected on July 5, 1946 after 33 min. of continuous pumping at 100 gpm., showed this water to have a hardness of 24.2 gr. per gal., a total mineral content of 576 ppm., and character not unusual for limestone waters in this vicinity.

A second well was drilled in 1928 to a depth of 408 ft. It is located about 50 ft. west of Water St. and 200 ft. south of Eleanor St. (or approximately 650 ft. S. and 2350 ft. E. of the N.W. corner of Section 34). The elevation of the ground surface at this location is 620i ft.

The well is reported to be cased to a depth of 18 ft. with 12-in. pipe below which the bore is 12 in. in diameter in rock to the bottom of the hole. After completion on Sept. 1, 1928, the water level was 76 ft. below the pump base; and after pumping at 160 gpm., the water was lowered 130 ft.

During a test in July 1939, a production of 100 gpm. was reported. In June 1941 the following pumping equipment was installed: 370 ft. of 5-in. od. wrought iron column pipe; 8-in., 24-stage Pomona turbine pump rated at 125 gpm. against 520 ft. of head; 25-hp. General Electric motor. The air line has been reported to end at a depth of 370 ft. On July 2, 1946 the pressure gage indicated a non-pumping water altitude of 133 ft. and a pumping altitude of 100 ft. after 1 hr. of pumping at a rate of 120 gpm.

Analysis of a sample (Lab. No. 106,967) collected at that time, showed the water to have a hardness of 39.6 gr. per gal., a total mineral content of 813 ppm., and character not unusual for limestone waters in this vicinity.

Well No. 3 was drilled in 1943 by Claude E. Kramer of Harvey, Illinois. It is located about 650 ft. northeast of Well No. 2 and 100 ft. west of State St. (or approximately 10 ft. S. and 2500 ft. E. of the N. W. corner of Section 34). The elevation of the surface of the ground is 622± ft.

The well is 250 ft. deep and is cased with 8-in. pipe to limestone at a depth of 25 ft. Below this, the hole is 8 in. in diameter to the bottom.

Sample-study log of Well No. 3 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Glacial drift"	25	25
Silurian system		
Niagaran dolomite		
Dolomite	35	60
Dolomite, partly silty	95	155
Dolomite	65	220
Dolomite, silty and shaly	30	250

After completion, the well was tested for several hours by pumping at a rate of 200 gpm. The pumping water level was 120 ft. below the top of the casing.

The following pumping equipment, installed in 1944, is now in service: 150 ft. of 4 1/2-in. od. wrought iron column pipe; 6-in., 27-stage Pomona turbine pump rated at 150 gpm. against 306 ft. of head; 20 ft. of 4 1/2-in. suction pipe; 150 ft. of air line; 15-hp. Westinghouse electric motor. After pumping for 4 hr. at 100 gpm. the drawdown was 10 ft. from a non-pumping water level of 97 ft. below the pump base.

A sample of water was collected on July 2, 1946 after 2 1/4 hr. of pumping at a rate of 93 gpm.

Analysis of a sample (Lab. No. 106,968) collected July 2, 1946 after 2 1/4-hr. pumping at 93 gpm., showed the water from this well to have a hardness of 36.0 gr. per gal., a total mineral content of 741 ppm., and character not unusual for limestone waters in this vicinity.

A record of metered pumpage from May 1, 1945 to July 1, 1946 shows an average of 48,527 gpd. and varies from a winter minimum average of 40,000 gpd. to a summer maximum average of 55,500 gpd. Since 1929 all water for the public supply has been chlorinated.

LABORATORY NO. 106,966

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	17.7	
Manganese	Mn	0.0		Fluoride	F	0.7	
Calcium	Ca	87.2	4.36	Chloride	Cl	14.0	0.39
Magnesium	Mg	47.8	3.93	Nitrate	NO_3	2.8	0.05
Ammonium	NH_4	0.5	0.03	Sulfate	SO_4	145.4	3.03
Sodium	Na	52.2	2.27	Alkalinity	(as $CaCO_3$)	356.	7.12
Color		0		Hardness	(as $CaCO_3$)	415.	8.30
Odor		0		Residue		576.	
Turbidity		0		Free CO_2 (calc.)		52.7	
Temperature		52.6° F.		pH = 7.25			

LABORATORY NO. 106,967

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	12.4	
Manganese	Mn	0.0		Fluoride	F	0.3	
Calcium	Ca	150.4	7.52	Chloride	Cl	20.0	0.56
Magnesium	Mg	73.3	6.03	Nitrate	NO_3	5.7	0.09
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	332.6	6.92
Sodium	Na	13.1	0.57	Alkalinity	(as $CaCO_3$)	328.	6.56
Color		0		Hardness	(as $CaCO_3$)	678.	13.56
Odor		0		Residue		813.	
Turbidity		0		Free CO_2 (calc.)		106.1	
Temperature		52.8° F.		pH = 6.9			

LABORATORY NO. 106,968

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.4		Silica	SiO_2	13.3	
Manganese	Mn	0.0		Fluoride	F	0.3	
Calcium	Ca	136.0	6.80	Chloride	Cl	22.0	0.62
Magnesium	Mg	67.5	5.55	Nitrate	NO_3	6.2	.10
Ammonium	NH_4	0.2	0.01	Sulfate	SO_4	320.1	6.66
Sodium	Na	5.1	0.22	Alkalinity	(as $CaCO_3$)	260.	5.20
Color		0		Hardness	(as $CaCO_3$)	618.	12.36
Odor		0		Residue		741.	
Turbidity		10					
Temperature		52.5° F.					

TINLEY PARK
Cook County
June 26, 1946

A public water supply was installed by the village of Tinley Park (1136) about 1892, primarily for fire protection. The initial supply was obtained from a 6-in. well, 120 ft. deep, located back of the village hall about 60 ft. south of 173rd Place and 250 ft. west of Oak Park Ave. (or approximately 950 ft. N. and 2250 ft. E. of the S.W. corner of Section 30, T. 36 N., R. 13 E.). This well was abandoned and plugged in 1915, shortly after the 915-ft. well was completed.

A second well was drilled in 1914 to a depth of 800 ft. by Mr. Palmer of Blue Island. It was not completed to the St. Peter sandstone because all of the drill bits were broken. It is located about 35 ft. south of 173rd Place and 190 ft. west of Oak Park Ave. (or approximately 975 ft. N. and 2310 ft. E. of the S.W. corner of Section 30). The ground surface elevation is 702± ft. The well is reported to be cased with 12-in. pipe from the surface to rock at a depth of 92 ft., below which the bore is 10 in. in diameter through the limestone. An 8-in. liner is installed through the shale and the hole is 6 in. in diameter at the bottom.

The well is now equipped with a Deming centrifugal pump, rated at 350 gpm. against 116 ft. of head; 30 ft. of 6-in. suction pipe; 15-hp. U.S. electric motor.

This pumping equipment was installed in 1938, and since then this well has been the principal source of the public water supply. The non-pumping water level is 12 ft., and the pumping water level is 14 ft. below the ground surface.

Analysis of a sample (Lab. No. 106,885), collected from a tap at the pump discharge on June 25, 1946 after 15 min. of pumping at 350 gpm., showed this water to have a hardness of 27.0 gr. per gal., a total mineral content of 501 ppm., and character not unlike that of water from the upper limestone in this vicinity.

A third well was drilled in 1915 to a depth of 915 ft. by Mr. Palmer of Blue Island. It is located about 200 ft. west of Oak Park Ave. and 25 ft. south of 173rd Place (or approximately 985 ft. N. and 2300 ft. E. of the S.W. corner of Section 30).

The elevation of the ground surface is 702± ft. This well is reported to have penetrated the St. Peter sandstone. It is cased with 12-in. pipe from the surface to work at a depth of 92 ft.; is 10 in. in diameter through the upper limestone; has an 8-in. liner through the shale; and is 6 in. in diameter to the bottom.

When the well was completed the water was 10 ft. below the ground surface. During a 3-hr. test when pumping at 250 gpm. the water level was lowered 1 ft. The depth to water, when not pumping in 1918, was reported to be 12 ft., and in 1924 it was 16 ft. The well is equipped with a Keystone Driller Co. double-acting plunger pump with a 7 3/4-in. cylinder and 18-in. stroke. The cylinder is placed at a depth of 60 ft. and 6 ft. of suction pipe is attached. The pump is operated about 3 times a week for a period of several hours and now delivers about 200 gpm. Samples of water collected from this well in 1918 and 1923 were shown by analysis to be of similar character to the water obtained from the 800 ft. well.

The estimated combined average pumpage is 84,000 gpd. The water for the public supply is not treated.

LABORATORY NO. 106,885

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.5		Silica	SiO_2	16.6	
Manganese	Mn	0.0		Fluoride	F	0.3	
Calcium	Ca	103.1	5.16	Chloride	Cl	5.0	.14
Magnesium	Mg	49.7	4.09	Nitrate	NO_3	1.2	.02
Ammonium	NH_4	0.1	.01	Sulfate	SO_4	72.4	1.51
Sodium	Na	3.9	.17	Alkalinity	(as $CaCO_3$)	388.	7.76
Color		0		Hardness	(as $CaCO_3$)	463.	9.26
Odor		0		Residue		501.	
Turbidity		Tr.		Free CO_2 (calc.)		135.1	
Temperature		52.5° F.		pH = 6.9			

TISKILWA
Bureau County
Sept. 19, 1947

About 1906 the village of Tiskilwa (920) acquired control for public use a water supply which has been installed years before by the Chicago, Rock Island, & Pacific R. R.

Water was obtained from an impounding reservoir fed by springs and surface water, and located about 3/4 mile south of the western limits of the village. In 1911, the water was being used for fire protection only. Considerable public opposition had arisen because of possible contamination of the water from the surface drainage off of a pasture land watershed.

During the summer of 1911, W. S. Shields Co. measured the flow from the springs and found an average flow of about 45,200 gpd. Later a concrete retaining wall, about 150 ft. long, was constructed to separate the spring water from the surface water which flowed into the reservoir. Water was collected from the springs in 2 concrete, reservoirs of 30,000 gal. capacity each. The reservoirs were approximately 100 ft. above the ground surface at the village, and water was supplied by gravity flow through a 4-in. main. In 1928, the original reservoir was nearly filled with silt.

In 1937 the pressure in the distribution system was 40 psi. One large spring had been recently cleaned out, and the yield was much greater.

Analysis of a sample (Lab. No. 81760) collected Aug. 12, 1937, from a tap in a residence, showed this water to have a hardness of 329 ppm., a residue of 407 ppm., and a trace of iron.

In 1914, 2 concrete tanks, 20 ft. in diameter and effective depth of 14 ft., were constructed. Water from the springs flow into the tanks, and the water from the well is pumped into the tanks. The water, as supplied to the distribution system, is therefore a mixture of spring and well water.

In 1940, in order to augment the spring supply, a well was drilled for the village by Henry C. Albrehct, Ohio, and located in High St., extended about 150 ft. south of South St. (or approximately 750 ft. S. and 1200 ft. E. of the N.W. corner of Section 18, T. 15 N., R. 9 E.).

The well is 92 ft. deep below a ground surface elevation of 540± ft., and is cased with 77 ft. of 8-in. pipe and 15 ft. of 6-in. Clayton-Mark Everdur screen with No. 18 slot openings.

The pumping equipment consists of 60 ft. of 4-in. column pipe; 8-in., 10-stage Cook turbine pump, No. 4376, rated at 100 gpm. at 266 ft. of head; the length of the pump is 71 11/16 in.; 60 ft. of 1/4-in. air line; 20 ft. of 4 1/2-in. suction pipe; 10-hp. U. S. electric motor, 1500 rpm.

When the pump was installed, the non-pumping water level was 32 ft. below the pump base; and when pumping at 150 gpm., the drawdown was 16 ft.

On Dec. 7, 1945, the non-pumping water level was 46 ft. below the pump base, and after pumping 20 min., the drawdown was 5 ft.

Analysis of a sample (Lab. No. 111,943) collected Sept. 19, 1947 after pumping 25 min., showed this water to have a hardness of 20.7 gr. per gal., a residue of 455 ppm., and an iron content of 2.3 ppm.

Total pumpage from the well and spring is estimated at 55,000 gpd.

LABORATORY NO. 111,943

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.3		Silica	SiO_2	29.0	
Manganese	Mn	Tr.		Fluoride	F	0.5	
Calcium	Ca	82.0	4.10	Chloride	Cl	7.0	0.20
Magnesium	Mg	36.5	3.00	Nitrate	NO_3	7.6	0.12
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	43.4	0.90
Sodium	Na	26.5	1.15	Alkalinity (as $CaCO_3$)		352.	7.04
Turbidity		10+		Hardness (as $CaCO_3$)		355.	7.10
Color		10		Residue		455.	
Odor		0		Temperature 53.5° F.			

TOLEDO
Cumberland County
June 10, 1948

The village of Toledo (852) installed a public water supply in 1926.

A water supply project was started in 1899, but an impounding reservoir was used for a number of years as a source of supply for the Municipal Light Plant, which was subsequently sold to the Central Illinois Public Service Co. and abandoned.

Several test holes were drilled in 1925 in the area near the west bank of Cottonwood Creek and 1/4 mile north of East Main St., extended, State Highway No. 121.

The permanent well was constructed by Fred Thorpe, Alton, and was located on the west bank of Cottonwood Creek (or approximately 1300 ft. N. and 850 ft. E. of the S. W. corner of Section 29, T. 10 N., R. 9 E.). The ground surface elevation at the well-site is 555± ft.

Correlated driller's log of the permanent well furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and clay	10	10
Gravel	9	19
Sand	1	20
Hardpan	at	20

The well was 20 ft. deep, and was cased with 8 ft. of 16-in. id. by 22-in. od. solid concrete pipe and 12 ft. of same size porous concrete screen.

A production test was made Aug. 17 and 18, 1925. After pumping at an average rate of 75 gpm. for 3 hr. the drawdown was 15 ft. from a non-pumping water level of 4 1/2 ft. below the ground surface.

The pump installation consisted of a 4 3/4-in. by 20-in. Chippewa 2-stroke deep well pump driven by a 7-hp. electric motor.

In 1928, it was reported that the pump was operated at 25 spm., with a displacement of 75 gpm. The well yielded about 60 gpm. After 1-hr. pumping, the water level was 11 ft. 8 1/2 in. After the pump had been stopped for 17 1/2 min. the water level was 4 ft. 3 in.

The porous concrete screen became clogged, and the well was abandoned shortly after the completion of the new well in 1933. The pump was removed in May 1947 and the well has been capped and sealed.

Analysis of a sample (Lab. No. 62583) collected Sept. 20, 1928, showed the water to have a hardness of 16.2 gr. per gal., a residue of 376 ppm., and an iron content of 3.2 ppm.

The New Well was dug in 1933 by Fred Coats, Toledo, and is located 50 ft. west of the first well. This well is 20 ft. deep below the well curb, 22 ft. below the pump base and 18 ft. below normal ground level. The lower 10 ft. is cased with an 8-in. brick wall laid dry, and the upper 10 ft. with bricks laid in mortar and water-proofed with asphalt. The well is 11-ft. id. and the pumping equipment, installed in May 1947, consists of 20 ft. of 4-in. column pipe; 3-stage Peerless turbine pump, No. 33560; 5-hp. U. S. Electric motor. The pump discharge is 125. gpm. at the surface.

The non-pumping water level was 8 ft. in 1941. The normal non-pumping level is 10 ft. below the curb. In Mar. 1948 the water level was 6 ft. below the curb. In Aug. 1946, after 5-hr. pumping at 85 gpm. the drawdown was 7 ft. from a non-pumping water level of 10 ft. One hr. after stopping the pump, the water level recovered all but 1 ft. of the drawdown.

Analysis of a sample (Lab. No. 114,918) collected June 2, 1948 after 4-hr. pumping, showed the water to have a hardness of 13.4 gr.per gal., a residue of 337 ppm., and an iron content of 2.0 ppm.

All water is treated for iron removal, softened and chlorinated. Analysis of a sample (Lab. No. 115,175) collected June 2, 1948 showed the treated water to have a hardness of 4.3 gr. per gal., a mineral content of 328 ppm., and an iron content of 0.17 ppm.

From May 1947 to June 2, 1948 metered pumpage averaged 23,045 gpd.

LABORATORY NO. 114,918

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.0		Silica	SiO_2	23.8	
Manganese	Mn	0.2		Fluoride	F	0.3	
Calcium	Ca	57.2	2.86	Chloride	Cl	16.0	0.45
Magnesium	Mg	21.1	1.73	Nitrate	NO_3	1.1	0.02
Ammonium	NH_4	0.4	0.02	Sulfate	SO_4	32.7	0.68
Sodium	Na	36.3	1.58	Alkalinity	(as $CaCO_3$)	252.	5.04
Turbidity		25		Hardness	(as $CaCO_3$)	230.	4.59
Color		0		Residue		337.	
Odor		Tr.		Free CO_2	(calc.)	33.	
Temperature		52.5° F.		pH = 7.3			

LABORATORY NO. 115,175

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Fluoride	F	0.1	
Turbidity		0		Chloride	Cl	15.0	0.42
Color		50		Alkalinity	(as $CaCO_3$)	260.	5.20
Odor		M		Hardness	(as $CaCO_3$)	74.	1.48
Temperature		59° F.		Total Mineral Content		328.	
pH = 7.8				Free CO_2	(calc.)	10.	

TOLONO
Champaign County
Dec. 15, 1948

A public water supply was installed about 1895 by the village of Tolono (876).

Water was originally obtained from two wells drilled in 1895 and located at the water works plant on Holden St., east of Bourne St. Well No. 1, also called South Well, was drilled to a depth of 146 ft. and cased with 6-in. pipe to 133 ft. and 12 ft. of Cook screen having No. 60 slot openings. This well contributed to the supply until about 1934 when it yielded very little water but a large amount of gas escaped from the well. Well No. 1 was abandoned soon thereafter. The well has been filled and plugged. The casing was not removed.

Well No. 2, also drilled in 1895 to a depth of 145 ft., was located 20 ft. west of Well No. 1. This well yielded a strong flow of gas and was abandoned about 1897. Later on, gas from this well was being used to heat the diesel engine which furnished power for pumping, and sufficient gas is now furnished to heat water at the station. The casing has not been removed.

Well No. 3, also called North Well, was drilled in 1901 to a depth of 157 1/2 ft. and located 200 ft. east of Bourne St., 100 ft. north of Holden St. and 37 ft. north of Well No. 1. The ground elevation at the water works is 736± ft. In drilling Well No. 3, a gas pocket was encountered at a depth of 103 ft.

Well No. 3 was cased with 8-in. pipe to 145 1/2 ft. and with 12 ft. of Cook screen, having No. 60 slot openings. In 1914, the non-pumping water level was 40 ft. below ground level and in 1928 the water level was 70 ft. In July 1934 this well was capable of producing at a rate of 49 gpm. and was the sole source of supply, although, when operating 24 hr. daily, the demand still exceeded the supply. The water level on June 19, 1942 was 80 ft.

The pumping equipment includes a 6-in. Aurora Pump Co. turbine pump, No. 38504, having a rated capacity of 100 gpm. against 170 ft. of head; 7 1/2-hp. U. S. electric motor. The pump has been throttled to 90 gpm. to maintain a pumping water level of 10 ft. above the bottom of the air line. Between May 23 and June 16, 1948, non-pumping water levels were 64 ft. above the bottom of the air line. The pump base is 2 ft. above the ground surface.

Since May 22, 1948 Well No. 3 has been the sole source of supply.

Analysis of a sample (Lab. No. 116,737) collected Dec. 15, 1948 after 6-hr. pumping showed the water from Well No. 3 to have a hardness of 25.3 gr. per gal., a residue of 736 ppm., and an iron content of 5.2 ppm. Methane gas is present in the water from these wells in a concentration of 9.0-9.5 cu. ft. per 1000 gal.

Well No. 4 was drilled in July, 1934 by E. W. Johnson, Bloomington, and located just outside the east wall of the pump station and 15 ft. southeast of Well No. 3 (or approximately 1900 ft. N. and 540 ft. W. of the S. E. corner of Section 26, T. 18 N., R. 8 E.).

. Sample-study log of Well No. 4 furnished by the State Geological Survey:

Formation	Thickness ft.	Thickness in.	Depth ft.	Depth in.
Pleistocene system				
Soil and till	130		130	
Sand and silt	5		135	
Sand and granule gravel	7		142	
Till	12	4	154	4
Gravel and sand	2	8	157	
Till	26		183	
Sand, clean	1	6	184	6
Pennsylvanian system				
Siltstone	24	6	209	

Well No. 4 was cased to 168 ft. with 10-in. pipe and then reduced to 8-in. diameter casing to about 178 1/4 ft. below which was 7 ft. 10 in. exposed length of 8-in. Cook screen having No. 40 slot openings. The bottom of the screen was 186 1/4 ft. below the surface. The well was equipped with a 7-in., 14-stage Sterling turbine pump with 4-in. column pipe and 8 ft. 11 in. of suction pipe. The bottom of the suction pipe was set at 185 ft. 2 in.

The driller made a production test, July 1, 1934, and reported the static level, prior to the test, to be 71 ft. 10 in. When operating at 70 gpm., or more, the pump broke suction, with a drawdown of 114t ft.

In 1938, the yield suddenly stopped and the well was subsequently abandoned. The pump was removed and installed in Well No. 5. The casing and screen are still in the well.

Analysis of a sample (Lab. No. 74759) collected July 2, 1934 showed this water to have a hardness of 13.7 gr. per gal., a residue of 486 ppm., and an iron content of 1.0 ppm.

Well No. 5 was drilled in 1937 by L. R. Burt, Decatur, and located 40 ft. south and 200 ft. east of the intersection of Locust St. and Central Ave. (or approximately 1880 ft. S. and 660 ft. E. of the N. W. corner of Section 25). Well No. 5 was about 1800 ft. northeast of the pumping station. The well was fitted with a screen having slot openings varying from No. 10 to 60 but, in a test by the driller, the yield did not exceed 25 gpm.

In 1938, an attempt to develop the well was made by Woollen Bros., Wapella. The 10-in. casing and screen were removed and, after the lower 15 ft. had been slotted, was reinstalled with the bottom set at 185 ft. The slot openings were 1/8 in. by 18 in.

A production test was made by the State Water Survey on July 25, 1938. Before the test the static water level was 76 ft. below the top of the casing. After 4 1/2-hr. pumping at 98 gpm., the drawdown was 62 ft. On June 19, 1942 the non-pumping water level was reported to be the same as in 1938.

The pumping equipment was removed and repaired in 1940, and now consists of 151 ft. of 4-in. column pipe; 7-in., 14-stage Sterling turbine pump, No. S - 1303, having an overall length of 8 ft.; 151 ft. of air line; 5 ft. 4 in. of 4-in. suction pipe; 15-hp. U. S. electric motor No. 92254.

Well No. 5 has not been used since Sept. 25, 1948. The pump discharged fine sand and the yield rate decreased to about 25 gpm.

Analysis of a sample (Lab. No. 109,850) collected Apr. 21, 1947, after 3-hr. pumping showed this water to have a hardness of 17.6 gr. per gal., a residue of 548 ppm., and an iron content of 1.7 ppm.

Two test holes were drilled in Nov. 1941 by Woollen Bros. after which Well No. 6 was drilled to a depth of 145 ft. and located at the site of the second one of the test holes, on the east side of Third Ave., 200 ft. north of Locust St. (or approximately 1560 ft. S. and 50 ft. W. of the N. E. corner of Section 26). The well was cased with 10-in. pipe from 1 1/2 ft. above to 140 1/2 ft. below ground level and 6-ft. 9-in. length of Johnson Armco-iron screen having No. 100 slot openings. Four feet of the screen was exposed to the aquifer and the bottom of the screen was set at 145 ft.

On June 18, 1942, a production test was made by the State Water Survey. For test purposes a cylinder pump was installed and operated from the well rig. The bottom of the suction pipe was 142 1/2 ft. below the top of the casing. Before the test, the static water level was 77 ft. below the top of the casing and after 6-hr. pumping at 97 gpm. the drawdown was 60 ft. Ten minutes after shutdown of the pump the drawdown was 4.0 ft. and 1 1/2 hr. after shutdown the water level was at the original static level.

Due to organic growth clogging the screen a treatment of 500 gal. of 30% hydrochloric acid was applied to the well in Mar. 1945. The treatment did not produce the intended result of disposing of the growth. During the treatment, an evolution of gas from outside the casing occurred which was controlled by alternate pumping and back-washing of the well. After the gas evolution had stopped 2600 lb. of gravel was required to back-fill the space around the casing.

At the time of the acid treatment, the pumping equipment was noted to consist of 130 ft. of 4-in. column pipe; 7-in., Pomona water-lubricated turbine pump having an overall length of 7 ft.; 6 1/2 ft. of 4-in. suction pipe; 143 ft. of air line.

After the gas evolution stopped, the water was clear, and the pump would operate continuously at 101 gpm.; but, at any higher rate, would break suction. Well No. 6 has not been used since Dec. 1947.

Pumpage is estimated to average 75,000 gpd.

A water treatment plant is under construction. All water will be softened and treated for iron removal.

LABORATORY NO. 116,737

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	5.2		Silica	SiO_2	29.8	
Manganese	Mn	0.0		Fluoride	F	0.4	
Calcium	Ca	109.6	5.48	Chloride	Cl	8.0	0.23
Magnesium	Mg	38.9	3.20	Nitrate	NO_3	0.5	0.01
Ammonium	NH_4	13.3	0.74	Sulfate	SO_4	1.0	0.02
Sodium	Na	113.2	4.92	Alkalinity	(as $CaCO_3$)	704.	14.08
Turbidity		28		Hardness	(as $CaCO_3$)	434.	8.68
Color		0		Residue		736.	
Odor		Tr.		Free CO_2 (calc.)		287.	
Temperature 54° F.				pH = 6.8			

TOLUCA
Marshall County
Feb. 23, 1948

A public water supply was installed by the city of Toluca (1433) in 1908.

Water is obtained from a well drilled in 1908 to a depth of 2000 ft. by J. P. Miller Artesian Well Co., Brookfield, and located on Cedar St. north of Railroad St. (or approximately 240 ft. N. and 2300 ft. E. of the S. W. corner of Section 5, T. 29 N., R. 1 E.). The ground surface elevation is 705± ft.

The driller reported that the material penetrated in the upper part of the well was principally limestone and shale. A first vein of salt water was noted below shale in limestone between depths of 615 and 628 ft. A second vein of salt water was noted between depths of 915 and 1095 ft.; sand was noted at 935 ft. and shale at 1118 ft. Sandstone was noted at 1705 ft.

The casing record was as follows:

12-in.	casing from	0	to 76 ft.
10-in.	casing from	60	to 310 ft.
8-in.	casing from	297	to 592 ft.
6-in.	casing from	587	to 848 ft.

Records indicate that the 6-in. casing was then placed lower, but that the upper part of it was removed; and an 8-in. casing was placed on the 6-in. casing up to 139 ft. below the ground surface. The well was 6 in. in diameter at the bottom. When the drilling reached 1820 ft., the water level was 125 ft. below the surface; and when completed, the water level was at 165 ft.

In 1916 the S. B. Geiger Well Co., Chicago, cleaned out the well to a depth of 1904 ft. The 12-in. casing was removed, and the well cased with 250 ft. of 8-in. pipe and 600 ft. of 6-in. pipe placed as follows: 8-in. casing from 0 to 250 ft.; 6-in. casing from about 250 to 850 ft.

On June 17, 1924 a production test was made by the State Water Survey. The well was equipped, at the time, with an air lift with 1 1/4-in. air pipe and 3-in. discharge pipe. The non-pumping water level was reported to be 147 ft. 4 in. below the top of the casing (18 in. above the ground surface). After pumping 13 min. at a rate of 81 gpm., the drawdown was 21 ft. 10 in.; and after 1-hr. pumping, the drawdown was 23 ft. 2 in.

In Jan. 1948 the well was cleaned out to a reported depth of 1900 ft. by Ira French and Sons, Fairbury. The hole was bridged at a depth of about 1250 ft. but the bridge was easily removed. A production test was made on Feb. 23, 1948 using State Water Survey calibrated measuring equipment. The temporary pumping equipment consisted of 210 ft. of 4-in. column pipe; 4-stage turbine pump having an overall length of 3 ft.; 240 ft. of 1/4-in. gi. air line; 30 ft. of 4-in. suction pipe. The distance from the top of the pump base to the bottom of the suction pipe was 243 ft. The top of the pump base is 2 ft. above the pumphouse floor. On Feb. 7, 1948, after a 2 1/2-week non-pumping period, the water level was 171 ft. below the top of the pump base and on Feb. 23, after a 3-hr. non-pumping period the water level was 176.7 ft. After 2-hr. pumping at a rate of 48.8 gpm. the drawdown was 27.3 ft. The rate was increased and after 1 1/2-hr. pumping at 105 gpm. the drawdown was 61.6 ft.

Analysis of a sample (Lab. No. 108,881) collected Jan. 10, 1947, showed this water to have a hardness of 11.7 gr. per gal., a total mineral content of 2322 ppm., and an iron content of 4.0 ppm. The presence of an appreciable proportion of water other than from the St. Peter sandstone is evident. At various times since 1908 the chloride content has varied from 480 ppm. to 1500 ppm.

Pumpage in 1924 averaged 62,000 gpd. In May 1938 pumpage averaged 113,000 gpd., and in Dec. 1946 pumpage was estimated at 200,000 gpd.

LABORATORY NO. 108,881

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	4.0		Silica	SiO_2	13.9	
Manganese	Mn	0.0		Fluoride	F	3.0	
Calcium	Ca	50.4	2.52	Chloride	Cl	1080.0	30.46
Magnesium	Mg	17.9	1.47	Nitrate	NO_3	0.8	.01
Ammonium	NH_4	1.9	.11	Sulfate	SO_4	183.1	3.81
Sodium	Na	822.9	35.78	Alkalinity	(as $CaCO_3$)	280.	5.60
Color		0		Hardness	(as $CaCO_3$)	200.	4.00
Odor		0		Residue		2322.	
Turbidity		30±		Temperature 70° F.			

TONICA
La Salle County
July 22, 1947

A public water supply was installed by the village of Tonica (510) in 1934. Prior to that time the village had a water system which consisted of cisterns scattered about the village and which were interconnected.

A well was drilled in 1934 by Guy Kinsey, Wenona, and located near the center of the village on the east side of the Illinois Central R. R. (or approximately 1800 ft. S. and 300 ft. E. of the N. W. corner of Section 25, T. 32 N., R. 1 E.). The ground elevation is 660t ft.

Sample-study log of well drilled in 1934 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Glacial till	135	135
Sand, coarse, clean	15	150
Sand, silty	15	165
Glacial till	10	175
Sand, coarse	5	180
Pennsylvanian system		
Shale, some limestone, coal and siltstone	70	250

The well is 250 ft. deep and cased with 6-in. black standard pipe to a depth of 167 ft. and with 4 1/2-in. perforated black standard pipe from 167 to 220 ft. The lower 30 ft. of the well is uncased.

It was reported that during drilling operations, water veins were encountered at depths of 168, 200, and 246 ft.

When the drilling reached a depth of 202 ft., a production test was made by the driller. The static water level was 145 ft. below the top of the well; and after pumping at a rate of 6 gpm. for 36 hr., the drawdown was 35 ft. On May 20, 1936 with the pump out of the well, the distance to water was 130 ft.

The pump was again pulled on Jan. 8, 1937 at which time it was reported that the water level was 132 ft. below the top of the well.

On Oct. 4, 1937, the pump was again pulled. A black odorous sludge was found above the cylinder, a red sludge about 4 ft. below the cylinder, and a gray sludge near the bottom of the suction pipe.

On the recommendation of the State Water Survey, the well was treated with a chlorine solution and a charge of dry ice dumped in the well to loosen the sludge and to try to force the water out of the top of the well. After 2 treatments of chlorine and 2 charges of dry ice, the pump was replaced. The well was pumped for 6 hr., the overflow going into the street gutter. The pump was then connected to the distribution system, and the water pumped into the system directly. Some sludge is still present in the well, but it is not of sufficient quantity to interfere with pumping.

The pump installation consists of 204 ft. of 2 1/2-in. drop pipe; 3 1/2-in. A.D. Cook cylinder pump, No. 9 L.S. No. 26 L.S.9, having a 9-in. stroke and rated at 15 gpm.; 2 ft. length of cylinder; 10 ft. (including strainer) of 1 1/4-in. suction pipe; 3-hp., 1720 rpm. General Electric motor.

The pump operates 24 hr. daily. This well, and a well located about 75 ft. north and owned by the Tonica Milk Products Co., interfere with each other.

Analysis of a sample (Lab. No. 110,700) collected June 17, 1947, showed the water to have a hardness of 5.5 gr. per gal., a residue of 431 ppm., and an iron content of 0.6 ppm.

In 1943, Russell G. Allabaugh, Sterling, drilled a well for the village close to the water tower. This well was drilled to a depth of 240 ft. A small amount of water was found at a depth of 30 ft., but no more water was found, and the well was abandoned.

Later in 1943, Mr. Allabaugh drilled a new well for the village in the northern part of town west of the Illinois Central R. R. (or approximately 700 ft. S. and 50 ft. E. of the N. W. corner of Section 25). The well is known as the North Well and is 193 ft. deep and cased with 6-in. pipe with 11 ft. of screen at the bottom. The top of the well is at the elevation of 665± ft.

The pump is an A. D. Cook, No. 9 L.S., No. 1005 L.S.9, having a 9-in. stroke and operated at a rate of 56 strokes per min. The discharge is estimated at 7 gpm., which is reported to be the capacity of the well.

Non-pumping water level is reported to be 176± ft. from the top of the well.

This well operates 24 hr. daily and is reported to interfere with other wells close by.

Analysis of a sample (Lab. No. 110,701) collected June 17, 1947, showed the water in the North Well to have a hardness of 12.0 gr. per gal., a residue of 482 ppm., and an iron content of 3.3 ppm.

The water is not treated.

Total pumpage from village wells is estimated at 20,000 gpd.

The Tonica Milk Products Co. has a well located about 100 ft. north of the village South Well. This well supplies the water for the company plant and produces about 8 to 10 gpm. At present the Milk Products Co. uses about 4800 gpd.

A resistivity survey was made for the village in 1938, and in 1945 a further resistivity survey was conducted at the request of the Tonica Milk Products Co. The last survey was concentrated in the sections north of the village.

In Apr. 1946, C. E. Woodruff, Ottawa, completed a well on the tract of land recently purchased by the Tonica Milk Products Co. and located about 1000 ft. W. and 1000 ft. N. of the S. E. corner of Section 24). It is about 1 mile northeast of Tonica and approximately 100 ft. east of the Chicago, Burlington, & Quincy R. R. and 265 ft. north of the Tonica-Lowell road. The ground elevation is 645i ft.

This well is 226 ft. deep and is cased with 6-in. pipe to a depth of 211 ft., below which is a 15-ft. length of 6-in. Johnson screen with No. 14 slot openings. In Apr. 1947 water was pumped for 5 hr. at a rate of 75 gpm. The drawdown was not reported. In June 1947, the non-pumping water level was reported to be between 90 and 100 ft.; and after pumping 1 hr. at 120 gpm. the water level was 190 ft. or 22 ft. above the bottom of the suction.

Analysis of a sample (Lab. No. 111,171) collected July 22, 1947 from a tap at the pressure tank, showed the water in the new well of the Tonica Milk. Products Co. to have a hardness of 16.2 gr. per gal., a mineral content of 845 ppm., and an iron content of 2.4 ppm.

LABORATORY NO. 110,700

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.6		Silica	SiO_2	16.6	
Manganese	Mn	0.0		Fluoride	F	0.8	
Calcium	Ca	20.0	1.00	Chloride	Cl	14.0	0.39
Magnesium	Mg	10.9	0.90	Nitrate	NO_3	2.5	0.04
Ammonium	NH_4	0.8	0.04	Sulfate	SO_4	0.0	0.00
Sodium	Na	132.7	5.77	Alkalinity	(as $CaCO_3$)	364.	7.28
Color		0		Hardness	(as $CaCO_3$)	95.	1.90
Odor		0		Residue		431.	
Turbidity		Tr.		Temperature	53.5° F.		

LABORATORY NO. 110,701

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	3.3		Silica	SiO_2	15.8	
Manganese	Mn	0.0		Fluoride	F	0.8	
Calcium	Ca	41.7	2.09	Chloride	Cl	41.0	1.16
Magnesium	Mg	24.7	2.03	Nitrate	NO_3	1.0	0.02
Ammonium	NH_4	4.3	0.24	Sulfate	SO_4	0.0	0.00
Sodium	Na	103.5	4.50	Alkalinity	(as $CaCO_3$)	384.	7.68
Color		35		Hardness	(as $CaCO_3$)	206.	4.12
Odor		0		Residue		482.	
Turbidity		10		Temperature	53° F.		

LABORATORY NO. 111,171

	ppm.		ppm.
Iron (total) Fe	2.4	Fluoride F	0.8
Turbidity	20	Chloride Cl	238.0
Color	0	Alkalinity (as $CaCO_3$)	340.
Odor	B_S	Hardness (as $CaCO_3$)	279.
Temperature 51.2° F.		Total-Mineral Content	845.

A public water supply was installed by the city of Toulon (1230) in 1911.

At that time a well was drilled by W. H. Gray & Bros., Chicago, on North Franklin St. (or approximately 1225 ft. N. and 1225 ft. E. of the S. W. corner of Section 19, T. 13 N., R. 6 E.). The well was drilled to a depth of 1445 ft. and was 10 in, in diameter to a depth of 201 ft.; 8-in. diameter from 201 to 385 ft.; and 6-in. diameter for the bottom 1060 ft. The upper 100 ft. was cased. The top of the well is 725± ft.

The well was originally equipped with an electrically-driven American deep-well pump with a 5 3/4-in. cylinder set at 225 ft. In 1913 the non-pumping water level was 90 ft. below the top of the well. After pumping for 24 hr. at about 150 gpm., the water was not drawn down below the suction. In Sept. 1920 the cylinder was set at 240 ft. without any suction pipe attached. The non-pumping water level was reported to be 180 ft., and the pumping rate was about 142 gpm.

In July 1923, a Harris air lift pump was installed, and air was admitted into the well through a 2-in. well point, five feet in length and attached to 450 ft. of 2-in. pipe. The old American pump cylinder was found to be wedged in the casing. The pump delivered about 200 gpm. Air was supplied by an Ingersoll-Rand Imperial Type 10 air compressor, driven by a 50-hp. Wagner Electric motor. In 1941 the pumpage rate was about 175 gpm., and the non-pumping water level was estimated to be 190 ft. below the surface.

In 1943 the well was rehabilitated by the Varner Well Drilling Co., Dubuque, Iowa. The old cylinder was fished out, all old casing removed, the base hole reamed out, and new casing installed. The new hole and casing data are shown in Table 1.

TABLE 1

Hole Record

12-in. from 0 to 400 ft.
10-in. from 400 to 985 ft.
8-in. from 985 to 1452 ft.

Casing Record

10-in. casing from 0 to 400 ft.
8-in. liner from 755 to 985 ft.

A production test was made by the State Water Survey on Dec. 7, 1943. For test purposes the permanent deep-well turbine pump assembly was installed and consisted of 250 ft. of 5-in. column pipe; 8-in., 10-stage Peerless turbine pump having an overall length of 8 ft.; 260 ft. of 1/8-in. air line; 20 ft. of 5-in. suction pipe; 25-hp., 1600 rpm. U. S. electric motor.

Preliminary to the test of Well No. 1, pumping was carried on in Well No. 2 for a period of two hours and then followed a 20-min. quiet period, after which the water level in No. 1 was observed to be 192 ft. below the top of the casing. Pumping was then started in Well No. 1, and after seven hours at a rate of 160 gpm., the water was drawn down 51 ft. During the subsequent hour, both pumps were operated simultaneously, and the drawdown in Well No. 1 was determined to be 54 1/2 ft. when pumping at 150 gpm. During the following hour, Well No. 2 was shut down, and the drawdown in No. 1 was determined to be 51 1/2 ft. while pumping at 160 gpm. Pumping in Well No. 1 was then stopped, and after a seven-hour rest period, the water level was 198 ft. or 6ft. lower than it was before the start of the test.

Analysis of a sample (Lab. No. 98424) collected Dec. 7, 1943 after 7-hr. pumping at 160 gpm., showed the water from Well No. 1 to have a hardness of 10.4 gr. per gal., a residue of 1253 ppm., and an iron content of 1.2 ppm.

Well No. 1 is maintained for emergency use.

Well No. 2 was drilled in Aug. 1942 by C. W. Varner Well Drilling Co. and located 75 ft. east of Well No. 1, south and east of the intersection of Vine and Franklin St. (or approximately 1230 ft. N. and 1300 ft. E. of the S. W. corner of Section 19). The well was drilled to a depth of 780 ft.

With 59 ft. of 18-in. drive pipe and a 16-in. casing set from the surface to 382 ft., a production test was made by the State Water Survey on Aug. 19-20, 1942. Before the test, the water level was 203.2 ft. below the top of the casing. Both before and during the production test, the water level in the annular space between the two casings was found to be approximately 20 ft. below the top. After 2.8-hr. pumping at 207 gpm., the water was drawn down 18.3 ft., and after 21 1/2-hr. pumping at 316 gpm., the drawdown was 35.8 ft., which was a decline in the specific capacity of the well from 11.9 to 8.83 gpm. per foot of drawdown. Considerable H_2S was noted.

Following the production test, an additional 10-in. diameter casing was placed in the well.

The complete hole and casing record is shown in Table 2.

TABLE 2

Hole Record

17-in. from 0 to 400 ft.
14-in. from 400 to 422 ft.
12 3/4-in. from 422 to 780 ft.

Casing Record

18-in. od. steel drive pipe from 0 to 59 ft.
16-in. od. steel casing from 0 to 382 ft.
10-in. casing from +2 in. above top of the 16-in. pipe to 445 ft.

A shoe was placed at the bottom of the 10-in. casing, and the 10-in. casing was cemented in for the entire 445 ft. A concrete base for the pump head is built flush with the top of the 10-in. casing.

A second production test was made by the State Water Survey on Sept. 10, 1942 at which time the same pumping equipment was used as in the August test, except that only 250 ft. of column pipe and shafting was used. The non-pumping water level was checked by an electric drop line and observed at 204 ft. below the pump foundation. At the same time, the non-pumping water level in Well No. 1 was found to be 2 2/3 ft. higher. The pump in Well No. 2 was operated for a period of 2 1/2 hr. at 239 gpm., drawing the water down 38.7 ft., indicating a specific capacity of 6.17 gpm. per foot of drawdown. This was approximately 55% of the specific capacity as determined in the August test before the 10-in. casing was installed. The temperature of the water was observed to be 0.2° F. higher than in the August test. These data pointed to the fact that some of the upper waters had been cased out. H_2S was not reported to be present although the water quality was very similar to that obtained on Aug. 20.

Analysis of a sample (Lab. No. 94063) of water collected Sept. 10, 1942 showed the water to have a hardness of 6.5 gr. per gal., a residue of 1744 ppm., and an iron content of 0.3 ppm.

On Dec. 10, 1943 the production rate of Well No. 2 was checked by the State Water Survey, and it was found that the pump was delivering 225 gpm. and lowering the water level 19 1/2 ft. The specific capacity of the well was calculated to be 11 1/2 gpm. per foot of drawdown, and the water temperature was recorded at 59.4° F. These data compare closely with the data of Aug. 1942.

A description of the pump installation in this well has not been made available.

Analysis of a sample (Lab. No. 108,720) collected on Dec. 20, 1946 after 15-min. pumping, showed the water from Well No. 2 to have a hardness of 7.5 gr. per gal., a residue of 1623 ppm., and an iron content of 0.1 ppm.

Pumpage is estimated at 110,000 gpd.

LABORATORY NO. 98424

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.2		Silica	SiO_2	11.0	
Manganese	Mn	0.0		Chloride	Cl	300.0	8.46
Calcium	Ca	41.2	2.06	Nitrate	NO_3	2.8	0.05
Magnesium	Mg	17.7	1.45	Sulfate	SO_4	235.7	4.90
Ammonium	NH_4	1.6	0.09	Alkalinity	(as $CaCO_3$)	362.	7.24
Sodium	Na	392.2	17.05	Hardness	(as $CaCO_3$)	175.	3.50
Turbidity		100		Residue		1253.	
Color		0		pH = 7.4			
Odor		Tr.		Temperature 61.5° F.			

Driller's and sample-study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Clay	25	25
"Sand and gravel"	10	35
"Shale and gravel"	20	55
Pennsylvanian system		
"Shale, some limestone, thin sandstone bed at base"	250	305
Mississippian system		
Kinderhook formation		
"Shale"	70	375
Devonian system		
Cedar Valley dolomite	55	430
Wapsipinicon limestone, thin dolomite and sandstone at base	42	472
Silurian system		
Niagaran-Alexandrian series		
Dolomite	28	500
"Limestone"	265	765
Ordovician system		
Maquoketa formation		
"Shale and limestone"	15	780

LABORATORY NO. 94063

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.3		Silica	SiO_2	10.8	
Manganese	Mn	0.1		Chloride	Cl	560.0	15.79
Calcium	Ca	25.8	1.29	Nitrate	NO_3	0.6	0.01
Magnesium	Mg	11.4	0.93	Sulfate	SO_4	239.0	4.98
Ammonium	NH_4	1.9	0.11	Alkalinity (as $CaCO_3$)		448.	8.96
Sodium	Na	630.4	27.41	Hardness (as $CaCO_3$)		111.	2.22
Turbidity		10		Residue		1744.	
Color		0		Free CO_2 (calc.)		17.	
Odor		0		pH = 7.6			
Temperature 60° F.							

LABORATORY NO. 108,720

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	9.9	
Manganese	Mn	0.0		Fluoride	F	1.9	
Calcium	Ca	29.0	1.45	Chloride	Cl	490.0	13.82
Magnesium	Mg	13.5	1.11	Nitrate	NO_3	0.9	0.01
Ammonium	NH_4	1.6	0.09	Sulfate	SO_4	263.5	5.48
Sodium	Na	561.7	24.42	Alkalinity (as $CaCO_3$)		388.	7.76
Color		0		Hardness (as $CaCO_3$)		128.	2.56
Odor		0		Residue		1623.	
Turbidity		10-		Temperature 59.8° F.			

TREMONT
Tazewell County
Mar. 30, 1949

A public water supply was installed by the village of Tremont (935) in 1911.

Well No. 1 was drilled to a depth of 132 ft. in 1911 and located on Washington St., 100 ft. west of Sampson St. (or approximately 1000 ft. S. and 450 ft. E. of the N.W. corner of Section 19, T. 24 N., R. 3 W.). The well was double-cased with an 8-in. outer pipe and a 6-in. inner pipe with a 10-ft. length of screen in the bottom. The well penetrates 4 ft. of a water-bearing stratum. During a test yield at the time of completion of the well, it was reported that a 4-in. stream was pumped for 12 hr. with apparently no diminution of the supply. The non-pumping water level was 92 ft. below the ground surface. In 1922 it was reported that when pumping in excess of 70 gpm., the water level was drawn down to the pump cylinder which was placed at the top of the screen. In 1922 the water level was reported to be 6 or 7 ft. above the bottom. The well was repaired in 1934 by Wm. Roecker, Morton, and is now equipped with a Pomona turbine pump, No. N-86, rated at 50 gpm. and driven by a 7 1/2-hp. Westinghouse electric motor.

In 1923 Well No. 2, now known as the East Well, was drilled by Mike Ebert, Washington, and located 31 ft. east of the old well. This well is 135 ft. deep, terminating in sand and gravel. A water-bearing stratum was encountered at 125 ft. The well is cased with 8-in. pipe to a depth of 125 ft. and 10 ft. of screen is placed in the bottom.

Water was pumped by a Cook double-acting deep-well pump with a 5 3/4 in. by 18-in. cylinder placed inside the screen. No suction pipe is attached. When the well was completed, the non-pumping water level was 123 ft.

In 1938 the pump in the East Well was being operated about once a week and served only as a reserve source, yielding very little water. This well was later abandoned. At the time this well was abandoned, the West Well was failing.

In 1939, Well No. 3 was drilled by Chris Ebert, Washington, and located in the southeast part of the village (or approximately 1200 ft. S. and 1400 ft. E. of the N.W. corner of Section 19). The well is 133 ft. deep below a ground surface elevation of 662± ft. The base of the pump is at elevation 663 1/2t ft., or 18 in. above floor of pump house.

The pump assembly is as follows: 125 ft. of 4 1/2-in. od. column pipe; 6-in., 20-stage Pomona Electric Uni-drive pump, No. S.W. 2019, rated at 100 gpm. against a total head of 250 ft.; the overall length of the pump is 8 ft.; 125 ft. of airline; 8 in. of 4 1/2-in. od. suction pipe; 10-hp. Westinghouse electric motor.

Analysis of a sample (Lab. No. 109,154), collected Feb. 6, 1947 after the pump had been operating 5 hr., showed the water from Well No. 3 to have a hardness of 22.4 gr. per gal., a residue of 463 ppm., and an iron content of 2.3 ppm.

Well No. 4 was completed in Mar. 1949 to a depth of 154 ft. by Chris Ebert, and located about 142 ft. south of Well No. 3. The well is cased with 10-in. pipe from the surface to 144 ft. and with 10-ft. 11-in. Johnson brass screen with the bottom set at 154 ft. Ten feet of the screen is exposed to sand and gravel and the upper 6 ft. of the screen has No. 40 slot openings and the lower 4 ft. has No. 30 slots.

A production test was made on Mar. 30, 1949 under the supervision of the State Water Survey. During the test, several water level observations were made in Well No. 3, and no interference was observed. Before the test the water level was 119.3 ft. below ground level and after 1 1/2-hr. pumping at 50.5 gpm. the drawdown was 18.9 ft. The pumping rate was then reduced and the pump in Well No. 3 was started. After 2 1/2-hr. pumping at a rate of 39.0 gpm. the drawdown was 15.0 ft.

Analysis of a sample (Lab. No. 117,690) collected Mar. 30, 1949, after 5 3/4-hr. pumping, showed this water to have a hardness of 21.3 gr. per gal., a residue of 427 ppm., and an iron content of 1.5 ppm.

Well No. 4 was not yet equipped with a permanent pump.

Pumpage is estimated to average 105,000 gpd.

LABORATORY NO. 109,154

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.3		Silica	SiO_2	23.6	
Manganese	Mn	0.0		Fluoride	F	0.2	
Calcium	Ca	75.9	3.80	Chloride	Cl	3.0	.08
Magnesium	Mg	47.1	3.87	Nitrate	NO_3	1.8	.03
Ammonium	NH_4	1.6	.09	Sulfate	SO_4	2.7	.06
Sodium	Na	33.4	1.45	Alkalinity	(as $CaCO_3$)	452.	9.04
Color		0		Hardness	(as $CaCO_3$)	384.	7.68
Odor		0		Residue		463.	
Turbidity		20					
Temperature		54.2° F.					

The city of Trenton (1316) installed a public water supply in 1909.

Old Well No. 1, also called East Well, was located at the water works 50 ft. north and 70 ft. east of the intersection of Fourth and Sycamore St. (or approximately 2500 ft. S. and 600 ft. E. of the N. W. corner of Section 20, T. 2 N., R. 5 W.). The well was originally constructed about 1899 as a cistern 15 ft. in diameter and 20 ft. deep. Later the well was dug 6 ft. in diameter and 60 ft. deep below the bottom of the cistern. Finally an 8-in. hole was bored to total depth of 235 ft. below the ground surface elevation of 490± ft. Small holes were made in the casing at the bottom of the dug portion, so water from the old cistern and well could enter the pump suction.

In 1914, it was reported that the well was equipped with a Cook steamhead pump. This well was used chiefly to furnish water for steam purposes, and in 1923, was reported to be seldom used. In 1928, the well was not used, although pumping equipment was still in the well and in 1938, it was reported that the dug portion of the well was backfilled and the casing capped with concrete.

Old Well No. 2, now called City Well No. 3, was drilled in 1909 to a depth of 237 ft. and located 8 ft. north and 8 ft. east of the northeast corner of Fourth and Sycamore St. The well was reported to be cased with 10-in. pipe to rock at a depth of about 100 ft., and the hole was 8-in. in diameter below that depth.

Water was originally pumped by air lift, but this method was unsuccessful. A 2 3/4-in., 12-20-in. variable stroke Gould single-acting deep-well pump was installed with the cylinder set at a depth of about 230 ft. Power was furnished by a 3-hp. electric motor. This pump has a capacity of 15.4 gpm. when operating with maximum stroke at 30 spm. In 1923, the pump was operated 24 hr. per day. The water level was reported to be 140 ft. after a 3 or 4-hr. quiet period and the pumping water level was near the bottom of the well. In 1934 the well was "shot" by Charles Wise, St. Louis, Mo., and the capacity was reported to have been increased. In 1938, most of the city supply came from this well. The non-pumping water level was about 80 ft. below the ground surface.

Well No. 3 is in service as an auxiliary supply unit, and is equipped with a Gould plunger pump, Fig. 1454, Size 20, and a 3-hp. Westinghouse electric motor. The pump is operated at a rate of 20 spm. and discharges about 12 gpm.

Old Well No. 3 was drilled in 1909 to a depth of 237± ft. and was located 8 ft. south and 8 ft. east of the southeast corner of Fourth and Sycamore St. The well was cased to rock at a depth of about 100 ft., below which the hole was 8 in. in diameter.

In 1923, it was reported that the pump was operated 24 hr. per day. The non-pumping water level was 140 ft., and the pumping water level was near the bottom of the well.

Old Well No. 4 was drilled in 1909 to a depth of 237± ft. and was located 8 ft. south and 75 ft. east of the southeast corner of Fourth and Sycamore St. This well was cased to rock at a depth of about 100 ft. deep, and the hole was 8 in. in diameter below the casing.

The well was originally equipped with an air lift, but the connections were removed before 1914, and the well has not been reported in use since that time.

Both old Wells 3 and 4 have been abandoned, and the casings capped.

Analysis of a sample (Lab. No. 49982) collected Aug. 23, 1923, showed water from the city supply to have a hardness of 4.1 gr. per gal., a residue of 1050 ppm. and an iron content of 0.8 ppm.

A well, now called City Well No. 1 and also known as the condenser well of the Pevely Dairy Co., was leased from the Trenton Milling Co. about 1938. It is located at the southwest corner of Apple and Commercial St. (or approximately 1200 ft. N. and 900 ft. E. of the S.W. corner of Section 20). The well was reported to be 242 ft. deep and 12-in. diameter to the bottom. It was, at one time, reported to have been "shot" with 125 lb. of dynamite.

The pumping equipment, installed in Dec. 1947, consists of: 200 ft. of 3-in. id. column pipe; 4-in., 11-stage Pomona turbine pump, No. 3702, rated at 50 gpm. against 210 ft. of head at 3500 rpm.; the overall length of the pump is 53 in.; unknown length of air line; 30 ft. of 3-in. id. suction pipe; 5-hp. General Electric motor.

The pump is operated continuously for 6 days a week.

City Well No. 2 was drilled in 1945 to a depth

of 245 ft. by Melvin Butler, St. Louis, Mo., and located at the east end of Second St. about 100 ft. east of Cedar St. (or approximately 1900 ft. N. and 2500 ft. E. of the S.W. corner of Section 20). The well was cased to rock with 10-in. pipe and penetrated 30 ft. of sandstone.

When the well was completed, water was pumped for 10 hr. at a rate of 52 gpm. At the end of the pumping period, the drawdown was 60 ft. from a non-pumping water level of 160 ft. below the top of the casing.

The existing pump installation, removed from City Well No. 3, consists of: 210 ft. of 3 1/2-in. od. column pipe; 6-in., 17-stage Pomona turbine pump, No. SR 1084, rated at 50 gpm. against 210 ft. of head; overall length of pump is 85 5/8-in.; unknown length of air line; 5-hp. Westinghouse electric motor.

The pump is operated continuously for 6 days a week and discharges about 30 gpm.

Analysis of a sample (Lab. No. 113,938) collected Mar. 24, 1948, while pumping at 30 gpm., showed this water to have a hardness of 5.7 gr. per gal., a residue of 967 ppm., and an iron content of 0.1 ppm.

A well was drilled for the city to a depth of 244 ft. in Aug. 1947 by Melvin Butler, and located 300 ft. south and 150 ft. east of City Well No. 2. The well was cased with 8-in. pipe. A yield test was made with the bailer for a period of about 30 min. and showed about 17 1/2 gpm. The well has not been placed in service. A wooden plug has-been driven in the top of the casing.

There are 300 metered services, including Trenton Milling Co. and Monogram Shoe Co.

Pumpage is estimated to average 75,000 gpd.

LABORATORY NO. 113,938

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	11.7	
Manganese	Mn	Tr.		Fluoride	F	0.7	
Calcium	Ca	35.5	1.78	Chloride	Cl	215.0	6.06
Magnesium	Mg	1.9	0.15	Nitrate	NO_3	2.3	0.04
Ammonium	NH_4	0.3	0.02	Sulfate	SO_4	0.6	0.01
Sodium	Na	344.1	14.96	Alkalinity	(as $CaCO_3$)	540.	10.80
Turbidity		Tr.		Hardness	(as $CaCO_3$)	97.	1.93
Color		0		Residue		967.	
Odor		0		Free CO_2 (calc.)		2.	
Temperature 58° F.				pH = 8.8			

A public water supply was installed by the city of Tuscola (2838) in 1898. The water works were sold to a private company in 1899 and are now owned by the Illinois Cities Water Co.

A well drilled in 1898 to a depth of 3017 ft., produced about 50 gpm.

Analysis of a sample (Lab. No. 2931) collected Nov. 10, 1898 showed this water to have a hardness of 8.1 gr. per gal., a mineral content of 964 ppm., and an iron content of 1.6 ppm.

In 1904 a surface supply was developed in a small creek west and south of town, a tributary of the Embarrass River. In 1912, two wells were drilled, one to a depth of 850 ft. and the other to a depth of 230 ft. The production from these wells was so small that, in 1914, the supply was obtained from the old deep well and the creek. All three wells were 10-in. diameter and cased to rock. In 1898 the water level in the 3017-ft. well was 28 ft., and in 1914 was 90 ft. below the ground surface elevation of 663± ft. The wells were located at the pumping station (or approximately 2075 ft. S. and 750 ft. E. of the N. W. corner of Section 34, T. 16 N., R. 8 E.).

In 1916, two wells were drilled by Meister Bros., Tuscola, and located near the eastern corporation limits, less than one mile east of the pumping station.

Well No. 1, South Well, was located at the northwest corner of McPherson and Daggy St. and was 287 ft. deep and cased with 8-in. pipe to 118 ft. After 1931, Well No. 1 was used as a standby unit for several years and has now been abandoned. The plunger pump has been removed.

On July 23, 1946 the water level was estimated at 179 ft.

Well No. 2, North Well, was drilled to a depth of 300 ft. and located at the southwest corner of McPherson and Wilson St., 130 ft. north and 20 ft. east of Well No. 1 (or approximately 2180 ft. N. and 420 ft. W. of the S. E. corner of Section 34). The well was cased with 127 ft. 10 in. of 8-in. pipe.

On Mar. 19, 1918, after the pump in Well No. 1 had been operating several hours at 68 gpm;, the non-pumping water level in Well No. 2 was 82 1/4 ft. and 24 minutes after pumping in both wells, the drawdown in Well No. 2 was 11.54 ft. Well No. 2 was producing 72 gpm.

On Aug. 31, 1927 the combined production from both wells was 75 gpm. as recorded by meter. The pump in Well No. 1 was operated continuously and in Well No. 2 about 3 to 4 hours daily.

In 1945 the pump could not produce more than 75 gpm. and was throttled to that rate. On July 23, 1946 the production rate from Well No. 2 was 27 gpm. The well was then acidized, after which the production was 35 1/2 gpm. The non-pumping water level was 91 ft.

The well was maintained as a standby unit until Dec. 1948, when the pump was removed to Well No. 5.

Analysis of a sample (Lab. No. 89981) collected Mar. 5, 1941 showed this water to have a hardness of 13.6 gr. per gal., a residue of 353 ppm., and an iron content of 0.5 ppm.

Well No. 3 was drilled in 1931 to a depth of 523 ft. by Geo. Meister and located about 460 ft. west of Well No. 1 (or approximately 2030 ft. N. and 840 ft. W. of the S. E. corner of Section 34).

The well was cased with 119 1/2 ft. of 10-in. pipe below which the hole 'was 10 in. in diameter to the bottom.

In 1937, when pumping by air lift with 377 ft. of 3-in. eductor pipe, the production was 100 gpm. On June 7, 1946 a production test was made by the State Water Survey. Before the test was started, the pump had been operating for some time. After a 1 1/4-hr. shutdown the water level was 193 ft. below the surface. After 2 1/4-hr. pumping at a final rate of 73 gpm. the drawdown was 121 ft. The drawdown was fairly steady at 18 ft. when the pumping rate did not exceed 70 gpm. Unstable water level conditions occurred when pumping in excess of 71 gpm.

The pumping assembly installed in 1942 consists of 300 ft. of 4-in. column pipe; 7-in., 15-stage Peerless turbine pump, No. 14588, rated at 125 gpm. against 305 ft. of head; the overall length of the pump is 8 ft.; 320 ft. of 3/8-in. gi. air line; 30 ft. of 4-in. suction pipe; 15-hp. U. S. electric motor.

Well No. 3 has been maintained as an auxiliary supply unit since Well No. 4 was placed in service on Dec. 15, 1946.

Well No. 4 was drilled in 1946 to a depth of 694 ft. by H. E. Meister and located 20 ft. west

of Ohio, and 120 ft. north of Houghton St. (or approximately 1700 ft. N. and 2040 ft. W. of the S. E. corner of Section 34). The ground elevation at the well site is 663± ft.

Sample-study log of Well No. 4 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and till	105	105
No record	10	115
Sand, silty	3	118
Till	4	122
No record	13	135
Mississippian system		
Osage shale, some siltstone	95	230
Kinderhook shale, thin sandstone bed at base	38	268
Devonian system		
Dolomite, some limestone thin siltstone beds	155	422
Silurian system		
Niagaran formation		
Dolomite	404	634
Dolomite, shaly and siltstone	60	694

The well was cased with 12-in. id. pipe from the surface to 170 ft. and 10-in. pipe from 159 to 282 ft. below which the hole is 10-in. diameter to the bottom.

The pump assembly consists of 350 ft. of 5-in. column pipe; Fairbanks-Morse turbine pump, No. AF55138, rated at 125 gpm.; the overall length of the pump is 15 ft.; 380 ft. of 1/4-in. gi. air line; 20 ft. of 5-in. suction pipe; 20-hp. General Electric motor, No. TCJ6562216.

A production test was made by the State Water Survey on Oct. 21, 1947. Before the test, the water level was 119 ft. below the surface and after 6 1/2-hr. pumping at a final rate of 143 gpm. the drawdown was 104 ft. At 1 3/4 hr. after the shutdown the water level had returned to 135 ft.

Well No. 4 has been the sole source of supply since it was placed in service in Dec. 15, 1946.

Analysis of a sample (Lab. No. 112,250) collected Oct. 21, 1947 after 6 1/2-hr. pumping showed this water to have a hardness of 14.4 gr. per gal., a residue of 412 ppm., and an iron content of 0.5 ppm.

All water is aerated and chlorinated.

Well No. 5 was completed to a depth of 553 ft. in Nov. 1948 by H. E. Meister and is located 50 ft. west of Prairie St. on the center line of Scott St. extended, (or approximately 950 ft. N. and 50 ft. W. of the S. E. corner of Section 34). The ground elevation at the well-site is 660± ft. It was reported that bed rock was encountered at 125 ft.

The well was cased with 12 1/2-in. od. pipe from the surface to 125 ft. and with 10-in. id. pipe from the surface to 135 ft. Below the casing the hole was finished at 10-in. diameter. The annular space between the casings was filled with nine bags of cement. When the well was finished the water level was 112 ft. below the top of the casing.

The pumping assembly, installed in Dec. 1948, consists of 250 ft. of 4-in. column pipe; 10-stage Peerless turbine pump, No. 14233, (removed from Well No. 2) having an overall length of 10 ft.; 30 ft. of 4-in. suction pipe with strainer; 280 ft. of 1/4-in. air line; 15-hp. U. S. electric motor No. 285915.

A production test was made on Apr. 19, 1949, using State Water Survey calibrated measuring equipment. Before starting the test, the water level was 126 ft. After 1-hr. pumping at 90 gpm. the drawdown was 18 ft. The pumping rate was gradually accelerated and after a 5-hr. total pumping time at a final pumping rate of 170 gpm. the drawdown was 44 ft. Fifteen minutes after stopping the pump, the water level was 141 ft.

Analysis of a sample (Lab. No. 117920) collected Apr. 19, 1949 after 4 1/2-hr. pumping showed this water to have a hardness of 14.2 gr. per gal., a residue of 498 ppm., and an iron content of 0.6 ppm.

Pumpage from June 21, 1947 to June 21, 1948 averaged 146,900 gpd.

LABORATORY NO. 112, 250

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.5		Silica	SiO_2	16.1	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	55.3	2.77	Chloride	Cl	25.0	0.71
Magnesium	Mg	26.1	2.15	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	2.1	0.12	Sulfate	SO_4	5.6	0.12
Sodium	Na	66.9	2.91	Alkalinity	(as $CaCO_3$)	356.	7.12
Color		0		Hardness	(as $CaCO_3$)	246.	4.92
Odor (at well)		H_2S		Residue		412.	
Turbidity		Tr.		Hydrogen Sulfide	H_2S	1.4	
Temperature		59.4° F.					

UNION
McHenry County
July 25, 1947

A public water supply was installed in 1912 by the village of Union (327).

Water was obtained from a dug well 16 ft. deep and 10-ft. in diameter located about 45 ft. south of Clark St. and 120 ft. west of Wayne St. (approximately 1550 ft. S. and 2500 ft. E. of the N. W. corner of Section 4, T. 43 N., R. 6 E.). The ground surface elevation is 840t ft.

The well penetrated water-bearing sand and gravel with the exception of a few feet of soil at the top. Water levels varied with the amount of rainfall. At times it was not more than 6 ft. below the ground surface and during a protracted dry period it was known to be 12 ft. below the ground surface. The rate of in-flow to the well, when measured for a short interval on Sept. 7, 1928, was at a rate of 90 gpm.

This well was the source of the public supply until 1935 when it was abandoned. It has been filled to the original ground surface.

Another well located on the same site about 30 ft. southeast of the old well was drilled in 1935 by P. E. Millis, Byron. An exact record of the well is not available, but all reports indicate that it is 192 ft. deep and cased with 12-in. pipe extending into rock at a depth of 150 ft.

The existing pump installation, made in 1935, is 70 ft. of 4 1/2-in. column pipe; 8-in., 4-stage Pomona turbine pump Serial No. M 960 rated at a capacity of 125 gpm. against a head of 70 ft.; the overall length of the pump is 32 1/8 in.; 10 ft. of 4 1/2-in. suction pipe; air line of unknown length; 5-hp. Westinghouse electric motor.

Analysis of a sample (Lab. No. 111,047) collected July 11, 1947 when pumping 20 min. at 125 gpm. showed this water to have a hardness of 12.2 gr. per gal., a residue of 280 ppm., and an iron content of 0.1 ppm.

Estimated pumpage is 12,500 gpd.

LABORATORY NO. 111,047

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	13.6	
Manganese	Mn	0.1		Fluoride	F	0.4	
Calcium	Ca	42.3	2.12	Chloride	Cl	2.0	0.06
Magnesium	Mg	25.3	2.08	Nitrate	NO_3	1.0	0.02
Ammonium	NH_4	0.9	0.05	Sulfate	SO_4	0.6	0.01
Sodium	Na	25.8	1.12	Alkalinity	(as $CaCO_3$)	264.	5.28
Turbidity		Tr.		Hardness	(as $CaCO_3$)	210.	4.20
Color		0		Residue		280.	
Odor		0		Free CO_2 (calc.)		22.	
Temperature 52.3° F.				pH = 7.5			

VALMEYER
Monroe County
Mar. 19, 1948

The village of Valmeyer (591) installed a public water supply in 1942.

Water is obtained from a well drilled in Jan. 1941 to a depth of 57 ft. by E. W. Franke, Batchtown, at a location 75 ft. north and 75 ft. west of the intersection of First and Maple St. (or approximately 150 ft. S. and 700 ft. W. of the N.E. corner of Section 9, T. 2 S., R. 11 W.). The ground surface elevation is 400± ft.

Correlated driller's log of well drilled in 1941 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Dry soil	5	5
Sandy loam, gray	25	30
Mud, gray	2	32
Sand and gravel	25	57

The. well is cased with 8-in. pipe from 3 1/2 ft. above the surface to a depth of 40 1/2 ft. Below the casing is a 10-ft. length of A. D. Cook screen, with the upper 5 ft. having No. 30 slot openings and the lower 5 ft. having No. 16 slots.

A production test was made by the State Water Survey on Feb. 3 and 4, 1941. For test purposes, the well was equipped with a horizontal centrifugal pump with the suction pipe extending inside the casing to a depth of 24 1/2 ft. below the ground surface. The well produced 150-152 gpm. for 24 hr., with a drawdown of 7 ft. from a non-pumping water level of 17 ft. below the ground surface. The water level rose to 17 ft. in 30 seconds after pumping stopped.

The pumping equipment consists of: 40 ft. of 5-in. column pipe; 8-in., 3-stage Peerless turbine pump No. 14046, rated at 150 gpm. against 70 ft. of head, when operating at 1800 rpm.; 10 ft. of 4-in. suction pipe; 5-hp. U. S. electric motor, operating at 1800 rpm.

Analysis of a sample (Lab. No. 113,886) collected Mar. 19, 1948 after 8-hr. pumping at 125 gpm., showed the water to have a hardness of 25.3 gr. per gal., a residue of 594 ppm., and an iron content of 6.8 ppm.

The water is aerated, filtered, softened and chlorinated.

Analysis of a sample (Lab. No. 114,106), collected Mar. 19, 1948 showed the treated water to have a hardness of 4.7 gr. per gal., a mineral content of 622 ppm., and an iron content of 0.2 ppm.

Metered pumpage averages 42,250 gpd.

LABORATORY NO. 113,886

	ppm.	epm.			ppm.	epm.
Iron (total) Fe	6.8		Silica	SiO_2	34.5	
Manganese Mn	0.4		Fluoride	F	0.2	
Calcium Ca	134.0	6.70	Chloride	Cl	91.0	2.57
Magnesium Mg	23.9	1.96	Nitrate	NO_3	2.3	0.04
Ammonium NH_4	Tr.	Tr.	Sulfate	SO_4	112.7	2.34
Sodium Na	39.8	1.73	Alkalinity (as $CaCO_3$)		272.	5.44
Turbidity	100		Hardness (as $CaCO_3$)		433.	8.66
Color	0		Residue		594.	
Odor	0		Free CO_2 (calc.)		67.	
Temperature 57.5° F.			pH = 7.0			

LABORATORY NO. 114,106

	ppm.	epm.			ppm.	epm.
Iron (total) Fe	0.2		Chloride	Cl	97.0	2.73
			Alkalinity (as $CaCO_3$)		284.	5.68
Turbidity	0		Hardness (as $CaCO_3$)		81.	1.62
Color	0		Total Mineral Content		622.	
Odor	Tr.		Free CO_2 (calc.)		33.	
Temperature 52.5° F.			pH = 7.35			

VAN ORIN
Bureau County
Sept. 9, 1947

A water supply for the village of Van Orin, unincorporated, (100) was installed in 1940 in the name of the Van Orin Water System, Inc. The consumers are the stockholders in the water company.

A well was drilled to a depth of 258 ft. by C. W. Varner, Dubuque, Iowa, and located about 300 ft. north of the Chicago, Burlington & Quincy R. R. and 100 ft. east of Main St. on Lot 4 in Block 2 (or approximately 1000 ft. S. and 130 ft. E. of the N. W. corner of Section 16, T. 18 N., R. 10 E.).

Sample-study log of well drilled in 1940 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Till	165	165
Silt and soil	10	175
Till	45	220
Sand and gravel	20	240
Gravel, slightly silty	10	250
Till	5	255
"Gravel"	1	256
"Clay"	2	258

The well is cased with 245 1/2 ft. of 6-in. pipe from 2 ft. above ground level to 243 1/2 ft. below a ground elevation of 873± ft. Below the casing a 12-ft. length of Johnson Everdur metal screen was set with the bottom at 254 ft., and a lead packer was placed between the top of the screen and the casing. The upper 9 ft. of the screen was reported to have No. 50 slot openings, and the lower 3 ft. had No. 30 slot openings.

The well was developed by surging and sand pumping for 45 hr. When the well had been completed, the driller reported the static water level to be 148 ft.; and after pumping 4 3/4 hr. at 39 gpm.,the drawdown was 8 ft. The pumping equipment consists of 160 ft. of 3 1/2-in. column pipe; 6-in. 22-stage Cook turbine pump, No. 4570, oil-lubricated and rated at 74 gpm. at 1735 rpm.; 20 ft. of 3 1/2-in. suction pipe; 5-hp., 1500 rpm. U. S. electric motor.

Consumption is estimated at 3000 gpd.

Analysis of a sample (Lab. No. 111,799) collected Sept. 9, 1947 after 4 3/4-hr. pumping, showed the water in this well to have a hardness of 14.1 gr. per gal., a residue of 310 ppm., and an iron content of 1.6 ppm.

The water is not treated.

LABORATORY NO. 111,799

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.6		Silica	SiO_2	24.9	
Manganese	Mn	0.0		Fluoride	F	0.5	
Calcium	Ca	55.1	2.75	Chloride	Cl	2.0	0.06
Magnesium	Mg	25.3	2.08	Nitrate	NO_3	0.3	Tr.
Ammonium	NH_4	0.6	0.03	Sulfate	SO_4	1.4	0.03
Sodium	Na	22.8	0.99	Alkalinity (as $CaCO_3$)		288.	5.76
Color		20		Hardness (as $CaCO_3$)		242.	4.84
Odor		Tr.		Residue		310.	
Turbidity		10-		Temperature 52.5° F.			

VARNA
Marshall County
June 3, 1947

A public water supply was installed by the village of Varna (383) in 1941.

In 1937 the village owned a dug well located on the west side of Walnut St. (approximately 350 ft. N. and 1900 ft. W. of the S. E. corner of Section 28, T. 30 N., R. 1 W.). This well is 6 ft. in diameter and 90 ft. deep. It is equipped with a Myers piston-type pump, with the pump set within 10 ft. of the bottom of the well.

In 1940 two new wells were drilled by Hayes & Sims, Champaign.

Well No. 1 is located in the north part of the village and is 99 ft. deep and cased with 6-in. pipe and with 5-ft. length of Johnson welded silicon brass screen, having No. 50 slot openings. This well is equipped with a Myers-Ejecto pump set at 90 ft. In Apr. 1940 a production test was made by the driller. The non-pumping water level was reported to be 45 ft. below the top of the casing. Water was pumped for 17 hr. at 15 gpm., and at 12 gpm. at the end of 17 hr. The drawdown was 49 ft. with the pumping water level at the top of the screen.

Well No. 2 is located on Front St. adjacent to the reservoir. The well is 95 ft. deep and is cased with 6-in. pipe and with 5 ft. of Johnson screen having No. 50 slot openings. The well is equipped with a Myers-Ejecto pump with the jet set within 10 ft. of the bottom of the well. Power is furnished by a 1-hp. electric motor.

A production test was made by the drillers when the well was completed. Water was pumped for 21 hr. at a rate of 12 and 10 gpm., and the pumping water level was at the top of the screen.

Analysis of a sample (Lab. No. 108,900) collected Jan. 13, 1947, showed the water in Well No. 2 to have a hardness of 17.5 gr. per gal., a residue of 532 ppm., and an iron content of 0.7 ppm.

Pumpage was estimated at 16,000 gpd.

On June 3, 1947 it was reported that: "The wells drilled in 1940 were never very good, and the yield has fallen off to the point where a severe water shortage exists. In the spring the village had water for only an hour or so per day. After the high school and grade school closed, the shortage was relieved somewhat as they used about 3,000 gpd. as compared to the normal village demand of 12 - 15,000 gpd.

"The North Well was acidized last fall. The acidizing procedure was not reported, but was said to have helped the well for a short time.

"A Mr. Packard, Washington, was drilling a hole about two blocks south of the railroad station. Shale was encountered at 107 ft. No water-bearing material was found in the drift, and it was expected to drill about 200 ft. in hopes of finding a little water."

LABORATORY NO. 108,900

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.7		Silica	SiO_2	24.0	
Manganese	Mn	Tr.		Fluoride	F	0.4	
Calcium	Ca	72.0	3.60	Chloride	Cl	6.0	.17
Magnesium	Mg	28.8	2.37	Nitrate	NO_3	0.3	Tr.
Ammonium	NH_4	0.6	.03	Sulfate	SO_4	125.9	2.62
Sodium	Na	80.7	3.51	Alkalinity (as $CaCO_3$)		336.	6.72
Color		0		Hardness (as $CaCO_3$)		299.	5.98
Odor		0		Residue		532.	
Turbidity		Tr.		Temperature 54.5° F.			

VILLA GROVE
Douglas County
June 26, 1948

A public water supply was installed in 1915 by the city of Villa Grove (2072).

Well No. 1 was drilled in 1915 to a depth of 629 ft. by Omar Kersey, Sullivan, and located at the rear of the city hall on Main St. (or approximately 450 ft. S. and 460 ft. W. of the N. E. corner of Section 10, T. 16 N., R. 9 E.). The elevation of the ground surface is 650± ft.

The well was reported to be cased with 12-in. pipe from the surface to 240 ft. and with 10-in. pipe from the surface to 410 ft. An 8-in. inner casing was set from the surface to 622 ft. In 1933, there was no evidence of a 12-in. casing but it was reported at the time that the casing had been repaired or renewed since the well was drilled.

When the well was completed, the static water level was 91 ft.

In May 1940, the hole was deepened to 645 ft. at 10-in. diameter. Rock was penetrated and the deepened portion was "shot" with ten quarts of nitro-glycerine. After this work, a production test was made. It was reported that after 6-hr. pumping at 600 gpm., the drawdown was 20 ft. from a water level of 91 ft. below the surface.

Well No. 1 is the sole source of supply and the pumping equipment consists of 110 ft. of 6-in. Byers extra heavy wi. column pipe; Fairbanks-Morse turbine pump, No. 8173, having an all bronze assembly 6 ft. in length; 20 ft. of 6-in. suction pipe; 25-hp. electric motor. The pump discharges 425 gpm. to the aerator against a pressure of 16 psi.

Analysis of a sample (Lab. No. 115,110) collected June 26, 1948 after 2-hr. pumping showed this water to have a hardness of 13.4 gr. per gal., a residue of 510 ppm., and an iron content of 0.1 ppm. Methane is present in a concentration of 5.0 cu. ft. per 1000 gal.

All water is aerated, softened and chlorinated. Analysis of a sample (Lab. No. 115,183) collected June 26, 1948 showed the treated water to have a hardness of 4.3 gr. per gal., a mineral content of 381 ppm., and an iron content of 0.12 ppm.

Well No. 2 was drilled in 1924 to a depth of 627 ft. by Ohio Drilling Co., Massillon, Ohio and located across the street to the east of the Well No. 1 (or approximately 505 ft. S. and 190 ft. W. of the N. E. corner of Section 10). The ground elevation is 646± ft.

The well was cased with 12-in. wi. pipe from the surface to 263 ft. and with 10-in. wi. pipe from 263 to 590 ft. below which the hole was 10 in. in diameter.

The pumping assembly consists of 100 ft. of 8-in. drop pipe; two-stroke Keystone Drilling Co. pump jack, pump head 33, Order No. 2522 rated at 270 gpm.; the length of the pump is 7 ft. 9 in. and the working barrel is 7 3/4 in. in diameter; 20 ft. of suction pipe; 20-hp. General Electric motor.

When the well was completed in 1924, the static water level was 90 ft. below the ground surface, and, when pumping at 300 gpm. although the drawdown could not be measured, it was estimated to be very small. A check of the pump speed was made on Aug. 3, 1933, from which the discharge was calculated at 202 gpm. When the existing pump was overhauled in Sept. 1942, the water level was 90 ft. below the pump base.

Well No. 2 is maintained as an emergency supply unit.

Analysis of a sample (Lab. No. 82219) collected Oct. 22, 1937 showed this water to have a hardness of 13.7 gr. per gal., a residue of 489 ppm., and an iron content of 2.8 ppm.

Pumpage is estimated to average 125,000 gpd.

LABORATORY NO. 115,183

	ppm.	epm.			ppm.	epm.
Iron (total) Fe	0.12		Fluoride	F	0.1	
			Chloride	Cl	95.0	2.68
Turbidity	0		Alkalinity	(as $CaCO_3$)	168.	3.36
Color	0		Hardness	(as $CaCO_3$)	74.	1.48
Odor	0		Total Mineral Content		381.	
Temperature 66.2° F.						

LABORATORY NO. 115,110

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	14.7	
Manganese	Mn	0.0		Fluoride	F	0.2	
Calcium	Ca	51.7	2.59	Chloride	Cl	79.0	2.23
Magnesium	Mg	24.5	2.01	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	0.5	0.03	Sulfate	SO_4	11.5	0.24
Sodium	Na	115.9	5.04	Alkalinity	(as $CaCO_3$)	360.	7.20
Turbidity		0		Hardness	(as $CaCO_3$)	230.	4.60
Color		0		Residue		510.	
Odor (at well)		H_2S		Free CO_2	(calc.)	34.	
Temperature 63.5° F.				pH = 7.4			

Correlated driller's log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Loam and Clay	98	98
Sand, some water	10	108
Clay	5	113
Gravel, some water	7	120
Clay	64	184
Pennsylvanian and Mississippian (Osage) systems		
Shale	24	208
Sand	24	232
Shale	211	443
Sand shell, salty water	4	447
Shale	83	530
Mississippian system		
Kinderhook group		
Shale	75	605
Devonian system		
Cedar Valley formation		
Sand	5	610
Sand, water bearing	13	623
Sand	4	627

VILLA PARK
Du Page County
July 29, 1949

The village of Villa Park (7236) originally obtained its public water supply from wells owned by private companies. The water supply for the southern and main part of the village and the area north of the Chicago & Northwestern Railway was owned by the Du Page County Water Works Co. This supply comprised a group of 3 wells located south of West Park Boulevard and east of Ardmore Ave. and a well located near the N. W. corner of Princeton Ave. and Third St. A small area in the northeast part of the village was supplied by a well owned by John R. Robertson which was located on N. Summit Ave. near Maple St.

The installation of a municipally owned public water supply was started in 1924. Two limestone wells were drilled by the J. P. Miller Artesian Well Co., Brookfield, at the southwest corner of Ardmore Ave. and St. Charles Road. These wells were placed in service in 1925 and served about 500 consumers at that time.

In 1928 arrangements were made to purchase water from wells to be drilled by S. B. Geiger & Co., Chicago, as a private venture. Two deep sandstone wells were drilled on Home Ave., west of Ardmore Ave., and completed by the end of 1931. They furnished a large part of the public water supply and were operated by the village.

On Dec. 1, 1938 all privately owned water mains and wells were acquired by the village. All water at that time was obtained from the Geiger wells.

The group of 3 wells constituting the source of the Du Page County Water Works Co. supply for the southern area were all limestone wells. The original well in this group was located about 100 ft. south of West Park Boulevard and 162 ft. east of Ardmore Ave. This well was the source of the water supply in 1918 and furnished 15,000 to 23,000 gpd. It was reported to have a depth of 150 ft. and to be cased to limestone at a depth of 58 ft. The well served as an emergency supply after 1919 and was abandoned in 1929.

The second well in this group, now known as village Well No. 3, was drilled to a depth of 285 ft. by Mr. Eckert in 1919. It is located about 139 ft. south of West Park Boulevard and 162 ft. east of Ardmore Ave. (approximately 2450 ft. S. and 200 ft. E. of the N. W. corner of Section 10, T. 39 N., R. 11 E.). The elevation of the ground surface is 702i ft. The well is reported to be cased to limestone with 8-in. pipe". Upon completion of the well it was equipped with a plunger pump having a cylinder setting of 60 ft. and a capacity of about 90 gpm.

The pump installation, made on Mar. 23, 1946, consisted of 140 ft. of 5-in. id. column pipe; 7-in., 5-stage Peerless turbine pump (utilizing old Sterling pump head S. 426) having a rated capacity of 200 gpm. against 260 ft. of head at 3600 rpm.; the overall length of the pump is 3 1/2 ft.; 10 ft. of 5-in. suction pipe; 140 ft. of 1/4-in. copper tubing air line; 20-hp. U. S. electric motor. In July 1949 a new Layne-Western turbine pump, No. 20255, was installed at a setting of 160 ft. and power furnished by a 50-hp. motor.-

When the Sterling turbine pump was pulled in Mar. 23, 1946, the well-depth was 214 ft. and the standing water level was 55 1/2 ft. below the pump base. On May 21, 1947, after 5-hr. pumping at 200 gpm., the water level was 114 ft. below the pump base.

In Apr. 1949, Wells No. 3 and 4 were given acid treatment under the direction of Layne-Western Co. After the treatment, the production rate from Well No. 3, with No. 4 pump in operation, was 257 gpm. When No. 4 pump was not operating, the production rate from Well No. 3 was 369 gpm. When not pumping in Well No. 3, the water level was 55 ft. and, when pumping, the water level was 137 ft.

Analysis of a sample (Lab. No. 110,370) collected May 21, 1947 after 6-hr. pumping showed this water to have a hardness of 24.7 gr. per gal., a mineral content of 473 ppm., and an iron content of 0.2 ppm.

The third well in the Southern group, now called village Well No. 4 was drilled in 1923 by J. D. Palmer to a depth of 251 ft. and located about 100 ft; south of West Park Boulevard and 150 ft. east of Ardmore Ave. The elevation of the ground surface is 702t ft.

This well was reported cased with 12-in. pipe to rock at a depth of 58 ft. In 1923, the non-pumping water level was 40 ft. below the ground surface. On Jan. 4, 1925 when equipped with a double stroke plunger pump having a cylinder setting of 70 ft. and operated at a rate of 185 gpm. the drawdown was not more than 18 in.

After the acid treatment had been applied to Well No. 4 in Apr. 1949, the pump discharge rate, with pump in No. 3 operating, was 176 gpm., and the water level 96 ft., or 46 ft. above the pump. After the pump had been stopped for 1 hr. the

water level was 60 ft. in Well No. 4. The pump in Well No. 3 was in operation at the time.

The existing pump installation is 140 ft. of 6-in. od. column pipe; 10-in., 5-stage Sterling turbine pump, No. S 913, having a rated capacity of 250 gpm. against 200 ft. of head at 1800 rpm.; the overall length of the pump is 4 1/2 ft.; a 5-in. strainer; 25-hp. U. S. electric motor.

The well is operated about 16 hr. daily.

Analysis of a sample (Lab. No. 110,371) collected May 21, 1947 after 2-hr. pumping at 250 gpm., showed this water to have a hardness of 25.5 gr. per gal., a residue of 478 ppm., and an iron content of 1.3 ppm.

The North Well, now called No. 5, was reported drilled about 1930, and located about 85 ft. north of Third St. and 155 ft. west of Princeton Ave. (approximately 2050 ft. S. and 650 ft. W. of the N. E. corner of Section 4). The elevation at the pump base is 753± ft.

When the pump was pulled in Jan., 1944, the well depth was 234 ft. and the water level was 34 ft. below the pump base.

The existing pump assembly, re-installed on Jan. 14, 1944, is 130 ft. of 6-in. od. column pipe; 10-in., 4-stage Sterling turbine pump, No. S2002, having a capacity of 230 gpm. against 180 ft. of head at 1800 rpm.; the overall length of the pump is 4 ft.; 30 ft. of 6-in. suction pipe and strainer; 135 ft. of air line; 25-hp. U. S. electric motor. When pumping at 230 gpm. against 25-lb. pressure, the drawdown was 8.6 ft.

This well has not been in regular service since May 1945, but is maintained as an emergency supply unit.

Analysis of a sample (Lab. No. 110,372) collected May 21, 1947 after 20-min. pumping at 200 gpm., showed this water to have a hardness of 21.3 gr. per gal., a total mineral content of 396 ppm., and an iron content of 0.5 ppm.

The small water supply system in the northeast part of the village which was owned and operated by John R. Robertson was acquired by the Du Page County Water Works Co. in 1921 and operated by them until 1924 when it was abandoned. The supply was obtained from a well located about 185 ft. south of Maple St. and 42 ft. west of N. Summit Ave. (approximately 1900 ft. N. and 1350 ft. E. of the S. W. corner of Section 3). This well was 4-in. diameter casing at the top and was reported having a depth of 125 ft. The pumping equipment and the water tank have been removed.

The 2 municipally owned wells drilled in 1924 at the southwest corner of St. Charles Road and Ardmore Ave. are no longer in service. They were abandoned as a source of supply about 1932 and are both capped with concrete.

The first well was drilled to a depth of 401 ft. and located about 100 ft. north of Home Ave. and 135 ft. west of Ardmore Ave. (approximately 170 ft. S. and 170 ft. W. of the N. E. corner of Section 9). The elevation at the surface of the ground is 695± ft. It was cased with 12-in. wi. pipe to limestone at a depth of 76 ft. Below the limestone, which extends to a depth of 256 ft., about 60 ft. of liner was placed in shale. After drilling had reached a depth of 200 ft. the well was tested and produced 60 gpm. After completion of the well when pumping at 200 gpm. the drawdown was 46 ft. from a non-pumping water level of 30 ft. below the ground surface.

The second well was drilled to a reported depth of 200 ft. at a distance of about 50 ft. southwest of the first well. It was cased with 12-in. pipe to limestone. After its completion a production of 250 gpm. was reported with a pumping water level of 67 ft.

These wells were equipped with plunger pumps and placed in service in 1925. From May 27, 1926 to Dec. 17, 1926 the combined pumpage averaged 200,000 gpd.

The two deep sandstone wells drilled by S. B. Geiger & Co. on Home Ave. have been the source of a considerable part of the public water supply and are still in service. The first of these wells, now called Well No. 1, is located about 20 ft. north of Home Ave. and 380 ft. west of Ardmore Ave. (approximately 250 ft. S. and 415 ft. W. of the N. E. corner of Section 9). The elevation of the top of the concrete pump base is 695.5 ft. The hole and casing record is shown in Table 1.

When the well was completed the water level was 42 ft. below the surface.

When the well had reached a depth of 1912 ft. in Nov. 1928, the village made arrangements to obtain water from it as the other wells were unable to supply the growing demand. The well was then equipped with a turbine pump rated at a

capacity of 800 gpm. and set at a depth of 420 ft. which was lowered 30 ft. just prior to Dec. 1, 1938.

TABLE 1

Hole Record

22-in.	from	0 to	76 ft.
20-in.	from	76 to	445 ft.
15-in.	from	445 to	1095 ft.
12-in.	from	1095 to	1165 ft.
10-in.	from	1165 to	1912 ft.

Casing Record

20-in. from 0 to 445 ft.

The existing pump installation is 450 ft. of 9-in. column pipe; 14-in., 14-stage Sterling turbine pump, No. 4557, having a rated capacity of 800 gpm. against 420 ft. of head at 1200 rpm.; the overall length of the pump is 14 ft.; 30 ft. of 9-in. suction pipe; 450 ft. of 1/4-in. air line (defective); 150-hp. Ideal electric motor.

This well has not been in regular service since 1942. The metered pumpage from Aug. 1, 1943 to Aug. 1, 1945 averaged 58,650 gpd. In June 1947 the operating efficiency of the turbine pump had declined 50% from its original rated capacity. In the summer of 1948, Well No. 1 was rehabilitated and cleaned out to a depth of 1400 ft. by Layne-Western Co., Chicago. On July 23, 1948 the water level was 214 ft. The old pump was installed and the well returned to service. In Sept. 1948 the pumping rate was about 600 gpm.

The second deep sandstone well, now called Well No. 2, is located about 18 ft. north of Home Ave. and 770 ft. west of Ardmore Ave. (approximately 250 ft. S. and 800 ft. W. of the N. E. corner of Section 9). The elevation of the top of the concrete pump base is 699.35 ft.

This well was drilled to a depth of 2125 ft. and completed in Aug. 1931. A standing water level of 64 ft. below the surface was reported when drilling reached a depth of 1980 ft.

The existing pump installation is 440 ft. of 9-in. column pipe; 14-in., 14-stage Sterling turbine pump, No. S 652, having a rated capacity of 800 gpm. against 420 ft. of head at 1200 rpm.; the overall length of the pump is 14 ft.; 30 ft. of 9-in. suction pipe; 440 ft. of 1/4-in. air line; 140-hp. Ideal electric motor.

The metered pumpage from Aug. 1, 1943 to Aug. 1, 1945 averaged 222,400 gpd.

Non-pumping water levels observed periodically since 1942 show a uniform recession from 330 ft. below the pump base on Sept. 1942 to 363 ft. on May 21, 1947. Pumping water levels observed in Feb., 1944 were 428 1/2 ft. below the pump base. All subsequent readings have been below the 440-ft. air line.

Analysis of a sample (Lab. No. 110,369) collected May 22, 1947 after 2 1/2-hr. pumping at 625 gpm. showed this water to have a hardness of 13.1 gr. per gal., a residue of 577 ppm., and an iron content of 0.4 ppm. The quality is not unusual for water from wells of this depth.

The total combined pumpage of all wells is estimated to average 572,000 gpd. of which about 42% is metered sandstone water and 58% is estimated limestone water. A fire at the A & P store in Apr. 1948 increased that month's pumpage by 2 million gallons.

The Wander Co. industrial plant in Villa Park is located between E. Kennilworth Ave. and the Chicago, Aurora and Elgin Railroad (approximately 820 ft. S. and 1550 ft. W. of the N. E. corner of Section 10).

LABORATORY NO. 110,371

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.3		Silica	SiO_2	21.4	
Manganese	Mn	0.0		Fluoride	F	0.2	
Calcium	Ca	102.3	5.12	Chloride	Cl	5.0	0.14
Magnesium	Mg	43.9	3.61	Nitrate	NO_3	2.1	0.03
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	85.8	1.78
Sodium	Na	6.0	0.26	Alkalinity	(as $CaCO_3$)	352.	7.04
Turbidity		30		Hardness	(as $CaCO_3$)	437.	8.73
Color		0		Residue		478.	
Odor		0		Free CO_2	(calc.)	14.	
Temperature 53° F.				pH = 6.8			

LABORATORY NO. 110,369

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.4		Silica	SiO_2	13.0	
Manganese	Mn	0.0		Fluoride	F	2.6	
Calcium	Ca	60.5	3.03	Chloride	Cl	99.0	2.79
Magnesium	Mg	17.7	1.45	Nitrate	NO_3	0.5	0.01
Ammonium	NH_4	0.3	0.02	Sulfate	SO_4	66.2	1.38
Sodium	Na	132.5	5.76	Alkalinity	(as $CaCO_3$)	304.	6.08
Turbidity		10		Hardness	(as $CaCO_3$)	224.	4.48
Color		0		Residue		577.	
Odor		0		Free CO_2 (calc.)		36.	
Temperature		62.5° F.		pH = 7.3			

Sample-study log of the Wander Co. industrial plant well furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Till	20	20
Gravel, silty	5	25
"Sand and gravel"	5	30
Sand, coarse, clean	5	35
Silurian system		
Niagaran - Alexandrian dolomites	122	157
Ordovician system		
Maquoketa shale and dolomite	219	376
Galena - Platteville dolomites	319	695
Glenwood sandstone and dolomite	10	705
St. Peter sandstone	160	865
Oneota dolomite, some sandstone, chert and shale	122	987
Cambrian system		
Trempealeau dolomite	126	1113
Franconia sandstone, some shale and dolomite	84	1197
Galesville sandstone		
Sandstone, partly dolomitic	83	1280
Sandstone, incoherent	90	1370
Sandstone, partly dolomitic	15	1385
Eau Claire formation		
Sandstone and dolomite, some shale	255	1640
Sandstone, partly dolomitic	127	1767
Mt. Simon sandstone	88	1855
Pre-Cambrian system		
Fond du Lac sandstone	65	1920

A public water supply was installed by the village of Viola (743) in 1915.

Water is obtained from a well drilled in 1915 by Sewell Well Co., St. Louis, and located at the pumping station site, at the northwest corner of Ninth and Sheppard St. (or approximately 800 ft. N. and 100 ft. W. of the S. E. corner of Section 15, T. 14 N., R. 2 W.).

The well was drilled to a depth of 1281 ft. below a ground surface elevation of 790± ft., and was cased as follows: 10-in. pipe from the surface to 398 ft.; 8-in. pipe from 368 to 1058 ft. below which the hole was 8 in. in diameter to 1.156 ft. and 6 in. in diameter from 1156 to 1281 ft.

It was reported that, upon completion of the well in Nov. 1915, the non-pumping water level was 175 ft. below the ground surface; and that during a 10-hr. period of pumping at a rate of 160 to 180 gpm., the water level was not drawn down below the pump cylinder.

In April 1925 the non-pumping water level was estimated at 197 ft.

In 1927 a new turbine pump assembly was installed with 250 ft. of 4 1/2-in. column pipe.

The following pumping equipment, installed in February 1946, is in service: 260 ft. of 4-in. column pipe; 6-in., 31-stage Fairbanks-Morse Pomona turbine pump rated at 60 gpm. against 384 ft. of head at 1760 rpm.; the overall length of the pump is 142 1/4 in.; 10 ft. of 4-in. suction pipe and a 20-in. length of 4-in. strainer; 15-hp. Westinghouse motor.

The water level, in February 1946 when the new pump was installed, was 242 ft. below the ground surface. The amount of drawdown was not reported.

Analysis of a sample (Lab. No. 108,243) collected November 7, 1946, showed this water to have a hardness of 12.3 gr. per gal., a residue of 1104 ppm., and an iron content of 0.1 ppm.

The water is not treated.

Pumpage is estimated at 20,000 to 25,000 gpd.

Correlated driller's log of well drilled in 1915 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Surface soil	15	15
Sand	27	42
Blue mud and fine sand	58	100
Pennsylvanian system		
Shale and some limestone	150	250
Devonian and Silurian systems		
Lime and shale	50	300
Lime	40	340
Shale	4	344
Limestone	106	450
Lime and shale	91	541
Limestone	109	650
Ordovician system		
Maquoketa formation		
Shale and limestone	200	850
Galena-Platteville formation		
Brown limestone	306	1156
St. Peter formation		
Sandstone	127	1283

LABORATORY NO. 108,243

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	13.0	
Manganese	Mn	0.0		Fluoride	F	2.4	
Calcium	Ca	50.4	2.52	Chloride	Cl	260.0	7.33
Magnesium	Mg	20.4	1.68	Nitrate	NO_3	0.2	Tr.
Ammonium	NH_4	1.7	0.10	Sulfate	SO_4	297.9	6.20
Sodium	Na	317.2	13.79	Alkalinity	(as $CaCO_3$)	228.	4.56
Color		0		Hardness	(as $CaCO_3$)	210.	4.20
Odor		0		Residue		1104.	
Turbidity		20					
Temperature		61.2° F.					

A water supply was installed by the village of Walnut (961) in 1896.

Water was first obtained from a well, called the North Well, drilled in 1896 and located at the pumping station on the south side of North St. and the east side of Second St. (or approximately 2100 ft. N. and 1100 ft. W. of the S. E. corner of Section 8, T. 18 N., R. 8 E.).

The well was 6 in. in diameter, and 230 ft. deep below a ground surface elevation of 711± ft. The well is equipped with a Deming pump head, a 4 1/4-in.Erb double-acting cylinder pump with 24-in. stroke and belt-connected to a 10-hp. Westinghouse Electric motor. The pump is set inapitabout 12 ft. deep below the ground surface.

In 1926 the well was repaired by F. C. Albrecht, Ohio. A new 2 1/2-in. 60 gauze screen, 25 ft. in length, and 28 ft. of 2 1/2-in. pipe were placed in the bottom of the well.

Analysis of a sample (Lab. No. 35616) collected Oct. 21, 1916 showed this water to have a hardness of 16.8 gr. per gal., a mineral content of 339 ppm., and an iron content of 5.0 ppm.

The well is maintained for emergency use and is seldom used.

In 1910, an 8-in. well was drilled about 16 ft. south of the first well. A coarse screen was installed, and later a fine screen was installed within the coarse screen. The screens became clogged, and the well was abandoned about 1914. In 1926, the wellhad been placed in service again.

Mr. Albrecht stated that the water-bearing formation ended at 240 ft. and the original casing had been placed so low that the water was shut off, and that the water that did enter the well came in around an ill-constructed packer. The well was "shot" with one stick of dynamite placed at a depth of 240 ft., two sticks at 233 ft., and one stick at 223 ft.

A new 3-in., 60 gauze screen, 30 ft. in length, and 19 1/2 ft. of 3-in. pipe were placed in the bottom of the well. After the repairs, the discharge was 40 gpm.

In 1938, this well was abandoned and has been covered over.

The third well, or old East Well, was drilled in 1914 or 1915 about 13 ft. south and 12 ft. east of the North Well, and was 6 in. in diameter, 230 ft. deep, and a 20-ft. Cook screen installed. The cylinder was wedged in the casing. The well was abandoned about 1917 or 1918 and has been covered over.

In 1918, a fourth well, now known as Well No. 2, was drilled to a depth of 247 ft. and located about 4 ft. nor.th of the old East Well. The well is equipped with an Aurora turbine pump, No. 29226, rated at 160 gpm. against a head of 230 ft. at 3500 rpm. Power is furnished by a 15-hp., 3600 rpm. U. S. electric motor.

Analysis of a sample (Lab. No. 111,477) collected Aug. 12, 1947, after 15-min. pumping, showed the water from Well No. 2 to have a hardness of 17.1 gr. per gal., a residue of 321 ppm., and an iron content of 4.4 ppm.

In 1936, a new well was drilled by Henry Albrecht and located about 15 ft. south of the Old East Well, which had been drilled about 1914 or 1915. The well is 272 ft. deep with the lower 83 ft. penetrating fine and coarse sand and was cased with 235 ft. of 8-in. and 10 ft. of 6-in. pipe. Below the casing, 25 ft. of 7 1/2-in. od. Johnson No. 10 slot, copper silicon screen was set. A rubber packer was placed between the 6 and 8-in. casings, and a 2-ft. bail plug was placed in the bottom of the screen.

The pumping installation consists of 160 ft. of 6-in. column pipe; a 7 1/2-in. od., 10-stage Aurora turbine pump, No. 8229, rated at 340 gpm. against 215 ft. of head at 1750 rpm.; the length of the pump is 6.9 ft.; 10 ft. of 6-in. suction pipe; 30-hp. U. S. electric motor.

On June 7, 1938, the non-pumping water level was 100 ft. below ground level, and the pump was being operated at 300 gpm. for about 3 hr. daily. The pump was overhauled in May, 1947, but the assembly was not changed. At that time, the water level was 110 ft. below the top of the well.

Analysis of a sample (Lab. No. 83697) collected June 7, 1938 showed this water to have a hardness of 17.5 gr. per gal., a residue of 336 ppm., and an iron content of 4.6 ppm.

Water from the wells is treated for iron removal.

Analysis of a sample (Lab. No. 111,476) collected Aug. 12, 1947, showed the treated water to have a hardness of 17.7 gr. per gal., a mineral content of 315 ppm., and an iron content of 0.17 ppm.

Pumpage is estimated to average 60,000 gpd.

LABORATORY NO. 111,477

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	4.4		Silica	SiO_2	35.2	
Manganese	Mn	0.1		Fluoride	F	0.2	
Calcium	Ca	71.7	3.59	Chloride	Cl	1.0	0.03
Magnesium	Mg	27.6	2.27	Nitrate	NO_3	0.9	0.01
Ammonium	NH_4	1.2	0.07	Sulfate	SO_4	0.0	0.0
Sodium	Na	6.2	0.27	Alkalinity (as $CaCO_3$)		308.	6.16
Turbidity		30		Hardness (as $CaCO_3$)		293.	5.86
Color		10		Residue		321.	
Odor		0		Temperature 53° F.			

LABORATORY NO. 111,476

		ppm.			ppm.
Iron (total)	Fe	0.17	Fluoride	F	0.1
Turbidity		0	Chloride	Cl	1.0
Color		0	Alkalinity (as $CaCO_3$)		296.
Odor		0	Hardness (as $CaCO_3$)		303.
			Total Mineral Content		315.

WARREN
Jo Daviess County
Jan. 10, 1947

A public water supply was installed by the village of Warren (1119) in 1895.

The source of the village supply is in 2 wells. Well No. 1 (north) was drilled in 1895 by the J. P. Miller Artesian Well Co., Brookfield, to a depth of 875 ft. below a ground surface elevation of 1008± ft. The well is located about 90 ft. north of Burnette Ave. and 150 ft. west of Cole St. (or approximately 2300 ft. S. and 150 ft. W. of the N. E. corner of Section 24, T. 29 N., R. 4 E.). The well was cased with 14-in. pipe into limestone and to a depth of 200 ft. with 181 ft. of 10-in. pipe.

The well was originally equipped with a deep well single-acting Pulling steam head pump with the cylinder wedged in the 6-in. casing at 165-ft. depth. In 1925 new casing was installed to rock at 20 ft.

The Keystone Driller Co. double-acting plunger pump installed in 1928 is still in place, but has not been used since June 18, 1944. It has a 7 1/2-in. diameter cylinder, with an 18-in. stroke, set at a depth of 180 ft. The pump was operated at a rate of 29 to 32 strokes per min., and powered by a 25-hp. Western Electric motor. This pump could be operated simultaneously with Well No. 2 at 20 strokes per mil. It is planned to repair the pump and put it in working condition so that Well No. 1 can be used as an emergency supply unit. In 1917 the non-pumping water level was reported to be at 45 ft., and in Mar. 1937 it was estimated to be 55 ft. below the top of the well.

Well No. 2 (south), located about 18 ft. southeast of Well No. 1, was drilled in 1901 by the J. P. Miller Artesian Well Co. to a depth of 700 ft. The well was equipped with a Jas. G. Pulling plunger pump set at 160 ft., and in 1937 was replaced by a 10-stage Worthington turbine pump, No. 966919, rated at 200 gpm. against 260 ft. of head; 198 ft. 10 in. of 8-in. column pipe and bowls; 31 1/2 ft. of 8,-in. suction pipe; the total overall length from the top of the column to the bottom of the suction pipe is 231 ft. 4 in.; 20-hp. General Electric motor.

In 1937 when the new pump was installed, it was discovered that the well would not produce enough water. The well was reamed to a 15-in. diameter to a depth of 580 ft. In attempting to deepen the well, a string of 8-in. tools was lost, and, during fishing operations and attempts to drill by the lost tools, a string of 6-in. tools was lost. The 8-in. tools were then recovered, but the smaller tools were abandoned in the well. There is now, a 16-in. diameter casing at the top, and an 8-in. liner is reported to be set between depths of 540 and 640 ft. The hole was too crooked to admit a 10-in. liner. The hole is 8 in. in diameter to 963 ft., the final depth.

In July 1940 the non-pumping water level was reported to be 102 ft. and a drawdown of 69 ft., without reporting the rate of pumping.

This well has been the source of the entire public supply since June 18, 1944.

Analysis of a sample (Lab. No. 108,582) collected Dec. 6, 1946 after 5-hr. pumping at 75 gpm., showed the water from Well No. 2 to have a hardness of 24.3 gr. per gal., a residue of 451 ppm., and an iron content of 0.1 ppm.

Pumpage is estimated to average 75,000 gpd.

LABORATORY NO. 108,582

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.1		Silica	SiO_2	17.9	
Manganese	Mn	0.0		Fluoride	F	0.2	
Calcium	Ca	82.8	4.14	Chloride	Cl	18.0	.51
Magnesium	Mg	51.1	4.20	Nitrate	NO_3	1.8	.03
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	65.0	1.35
Sodium	Na	6.2	0.27	Alkalinity	(as $CaCO_3$)	336.	6.72
Color		0		Hardness	(as $CaCO_3$)	417.	8.34
Odor		0		Residue		451.	
Turbidity		0		Free CO_2	(calc.)	70.	
Temperature		51.8° F.		pH = 7.1			

WARRENSBURG
Macon County
Aug. 30, 1948

A public water supply was installed by the village of Warrensburg (456) in 1935.

Three 6-in.test wells were drilled in 1935 by Johnson and Hinkle, Bloomington. A production test of Test Well No. 3 was made by the State Water Survey on Aug. 9, 1935 and a drawdown of 12 ft. was observed when pumping at a rate of 97 gpm.

A permanent well was completed to a depth of 118 ft. in Oct. 1935 at a location 4 ft. north of Test Well No. 3, near the northwest corner of the village (or approximately 57 ft. N. and 20 ft. W. of the S. E. corner of Section 10, T. 17 N., R. 1 E.).

The well was cased with 111 ft. of 12-in. pipe, and 7 ft. of 12-in. Cook screen, having No. 50 slot openings. The top of the casing was 15 in. above the ground surface elevation of 699± ft. A production test was made by the State Water Survey on Oct. 31, 1935. Before the test, the water level was 63 1/2 ft. below the top of the casing and after 8-hr. pumping at 158 gpm., the drawdown was 18 1/2 ft. On Dec. 11, 1937 the static water level was 58 ft. and when pumping at 120 gpm. the drawdown was 11 ft. On July 27, 1948, after 12-hr. non-pumping, the water level was 60 ft. below the pump base.

The pump installation, made in July 1948, consists of 90 ft. of 5-in. column pipe; 5-stage Peerless turbine pump, No. 50669, having an overall length of 4 ft. and rated at 200 gpm. against 125 ft. of head; 10 ft. of 5-in. suction pipe; 10-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 115,661) collected Aug. 23, 1948 after 1 1/3-hr. pumping at 120 gpm. showed the water to have a hardness of 19.7 gr. per gal., a residue of 468 ppm., and an iron content of 6.0 ppm. Methane gas is present in the water in a concentration of 5.6 cu. f t. per 1000 gal.

The water is aerated, filtered and softened.

Analysis of a sample (Lab. No. 115,789) collected Aug. 23, 1948, showed the treated water to have a hardness of 2.2 gr. per gal., a mineral content of 482 ppm., and an iron content of 0.45 ppm.

From Feb. 1, to Aug. 22, 1948 pumpage averaged 23,360 gpd. including the amount furnished Warrensburg Canning Co. during their corn-pack, and the Frozen Locker Plant.

LABORATORY NO. 115,661

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	6.0		Silica	SiO_2	24.9	
Manganese	Mn	0.0		Fluoride	F	0.3	
Calcium	Ca	78.6	3.93	Chloride	Cl	8.0	0.23
Magnesium	Mg	34.4	2.83	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	4.2	0.24	Sulfate	SO_4	0.0	0.00
Sodium	Na	48.5	2.11	Alkalinity	(as $CaCO_3$)	444.	8.88
Turbidity		40		Hardness	(as $CaCO_3$)	338.	6.76
Color		30		Residue		468.	
Odor		0		Temperature	55.1° F.		

LABORATORY NO. 115,789

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.45		Fluoride	F	0.2	
Turbidity		0		Chloride	Cl	8.0	0.23
Color		35		Alkalinity	(as $CaCO_3$)	452.	9.04
Odor		Tr.		Hardness	(as $CaCO_3$)	38.	0.76
Temperature	58.5° F.			Total Mineral Content		482.	

WASHBURN
Woodford County
Mar. 11, 1947

A public water supply was installed by the village of Washburn (937) in 1927.

At that time a well was drilled by H. W. Packard, Washburn, and located in the fire station on the east side of State Highway No. 89 (or approximately 2200 ft. S. and 1500 ft. E. of the N. W. corner of Section 1, T. 28 N., R. 2 W.). The well was drilled to a depth of 137 ft., and was cased with 12-in. pipe to 127 ft. A 10-ft. length of Cook screen was set below the casing. The slot openings in the screen were reported as follows: No. 20 slot in the upper 3 ft.; No. 25 slot in the next 3 ft.; and No. 30 slot in the lower 4 ft.

The elevation of the ground surface is 680± ft.

A Keystone Driller Co. 2-stroke deep-well cylinder pump is installed and belt-connected to a 20-hp. General Electric motor. The pump has an 18-in. stroke and is rated at 225 gpm.

When the well was completed, the water level was reported to be 15 ft. below the ground surface, and no drawdown was reported by the driller while pumping at a rate of 200 gpm., A few years ago when some repair work was being done on the tank, the pump was operated continuously for 95 hr. at a rate of 225 gpm. Water level was measured in a 4-in. test well located just east of the pump house, and the distance to water, after pumping, was 35 ft. below the top of the well, which was reported to be a drawdown of 5 ft.

The pump is operated automatically, starting when the pressure drops to 40 lb. and shutting off when the pressure reaches 47 lb.

Analysis of a sample (Lab. No. 109,512) collected Mar. 11, 1947, after 10-min. pumping, showed the water to have a hardness of 17.9 gr. per gal., a residue of 416 ppm., and an iron content of 1.8 ppm.

In the latter part of 1946 a 6-in. well was drilled by H. W. Packard, to a depth of 147 ft. and located just outside of the pumping station, about 25 ft. west of the present well. The pump is on order and will be set in the basement of the pumping station under the sidewalk.

Sample-study log of well drilled in 1946 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Silt and till	55	55
Sand and granule gravel	5	60
Till	5	65
Sand and granule gravel	5	70
Till	35	105
Sand and gravel	32	137

Pumpage is estimated at 100,000 gpd.

LABORATORY NO. 109,512

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.8		Silica	SiO_2	24.2	
Manganese	Mn	0.0		Fluoride	F	0.6	
Calcium	Ca	69.5	3.48	Chloride	Cl	17.0	0.48
Magnesium	Mg	32.3	2.66	Nitrate	NO_3	1.0	0.02
Ammonium	NH_4	2.4	0.13	Sulfate	SO_4	1.6	0.03
Sodium	Na	37.3	1.62	Alkalinity	(as $CaCO_3$)	368.	7.36
Color		0		Hardness	(as $CaCO_3$)	307.	6.14
Odor		0		Residue		416.	
Turbidity		20					
Temperature		54° F.					

The water works system was installed by the city of Washington (2456) in 1894.

Water was obtained from a well, dug many years before and located in the public square near the center of town (or approximately 600 ft. S.and 50 ft. E. of the N. W. corner of Section 24, T. 26 N., R. 3 W.). The well was 8 1/2 ft. in diameter and curbed with brick to a depth of 60 ft. A steel casing 35 ft. in length was placed with the bottom at 90 ft. The lower 12 ft. of the casing had 1/2-in. openings.

In 1921, a 24-hr. production test was made. Before the test, the water level was reported to be 40 ft. below the ground surface elevation of 765± ft. After 5-hr. pumping at 270 gpm., the water was drawn down 12 ft. where it remained throughout the test. In 1924, a short production test was reported at a pumping rate of 108 gpm.

This well is equipped with a Layne-Bowler turbine pump driven by a 40-hp. electric motor. There is 75 ft. of column pipe, and the pump is about 12 ft. in length.

About 1894 a second well was drilled about 300 ft. southeast of the dug well. It was 90 ft. deep and cased with 8-in. pipe to a depth of 80 ft. and with 10 ft. of Cook screen having No. 25 slot openings. The well is equipped with an A.D. Cook deep-well pump rated at 350 gpm. attached to 70 ft. of 6-in. drop pipe with 10 ft. of 4-in. suction pipe below the cylinder. The well was used only in emergency, and at present is used for filling truck tanks, etc.

In 1944, Well No. 3 was drilled by Chris Ebert, Washington, southeast of the dug well (or approximately 850 ft. S.and 188 ft. E. of the N.W. corner of Section 24, T. 26 N., R. 3 W.). A test hole was drilled to a depth of 372 ft. after which the well was completed to a depth of 334 ft. below the ground surface elevation of 758± ft.

The well was cased to 316 ft. with 12-in. pipe, with 20 ft. of 12-in. Johnson screen below the casing. The well is equipped with: 300 ft. of 6-in. column pipe; 7-stage Peerless turbine, No. 30475; 15 ft. of 6-in. suction pipe; 60-hp. General Electric motor.

Sample-study log of Well No. 3 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil, silt and till	83	83
Gravel	11	94
Till	69	163
Gravel	10	173
Silt and till	27	200
Gravel	18	218
Till	32	250
Sand and gravel	120	370
Pennsylvanian system		
Siltstone	5	375

When the well was completed, the non-pumping water level was 246 ft. below the surface. At present time the non-pumping water level is estimated at 240 ft. below the surface.

In 1944 another well was drilled by Chris Ebert and located about 10 ft. west of Well No. 3. It is 93 ft. deep and cased with 12-in. pipe. It is equipped with: 70 ft. of 4-in. column pipe; Sterling turbine pump, No. 1178, rated at 185 gpm.; the overall length of the pump is 12 ft.; a short suction pipe; 15-hp. motor. It is also equipped with an Amarillo Right Angle drive pulley so that in emergency it can be belt-driven by a tractor.

Analysis of a sample (Lab. No. 109,251), collected Feb. 15, 1947, showed the water from Well No. 3 to have a hardness of 16.9 gr. per gal., a residue of 299 ppm., and an iron content of 1.4 ppm.

Pumpage, in Jan. 1947, was estimated at. 100,000 gpd.

LABORATORY NO. 109.251

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.4		Silica	SiO_2	22.6	
Manganese	Mn	0.3		Fluoride	F	0.2	
Calcium	Ca	67.6	3.38	Chloride	Cl	2.0	0.06
Magnesium	Mg	29.4	2.42	Nitrate	NO_3	1.0	0.02
Ammonium	NH_4	0.9	0.05	Sulfate	SO_4	0.0	0.00
Sodium	Na	1.6	.07	Alkalinity	(as $CaCO_3$)	292.	5.84
Color		0		Hardness	(as $CaCO_3$)	290.	5.80
Odor (at well)		faint H_2S		Residue		299.	
Turbidity		Tr.					
Temperature		54.5° F.					

WATERMAN
DeKalb County
Oct. 1, 1947

A public water supply, installed by private interests, was in use for a period of about 10 years prior to the village installation in 1906.

The private installation consisted of a well about 100 ft. deep and 2 in. in diameter. It supplied about 20 houses and 5 hydrants principally for fire protection.

The village installation in 1906 consisted of a well drilled to a depth of 72 ft. by Frank F. Morse, and located about 70 ft. south of the center of the Chicago, Burlington & Quincy R. R. and 50 ft. east of the center of "D" St. (approximately 240 ft. N. and 1050 ft. W. of the S. E. corner of Section 16, T. 38 N., R. 4 E.). The well penetrated a gravel stratum from which it obtained water and was cased with 6-in. pipe with a screen at the bottom. The ground surface at the top of the well is 820t ft. A plunger pump was installed in a pit about 4 ft. deep having a cylinder setting of 30 ft. below the floor of the pump pit.

On Mar. 28, 1916 the non-pumping water level was 10 ft. below the floor of the pit and at that time the pump discharge was about 60 gpm. New casing and a new screen were reported installed about 1930.

In 1937 the following pump installation was reported in service: 50 ft. of 4-in. column pipe; 6-in., 14-stage Cook turbine. pump, No. 3051, having a rated capacity of 100 gpm. and an overall length of 66 in.; 52 ft. of air line (removed Oct. 15, 1946); 7 1/2-hp. U. S. electric motor.

On June 23, 1938 a non-pumping water level of 22 ft. and a pumping level of 37 ft. below the pump base were reported. The pump base is approximate ground level. The well is reported to have a capacity of 125 gpm. pumping to free discharge at ground level.

The column pipe of the Cook turbine pump was replaced in 1941 and also a new 4-in. Clayton Mark No. 18 slot screen 10 ft. in length was installed.

On Oct. 14, 1946 during continuous pumping, the water level was 40 ft. below the pump base; and when the pump was pulled for repairs on Oct. 15, 1946, the water level was 24 ft. after 8-hr. idle period.

Analysis of a sample (Lab. No. 112,080) collected Sept. 29, 1947 from a tap at the pump discharge after 6-hr. pumping at 80 gpm., showed this water to have a hardness of 20.9 gr. per gal., a total mineral content of 380 ppm., and an iron content of 1.4 ppm.

A new well was drilled to a depth of 400 ft. by the J. P. Miller Artesian Well Co., Brookfield, in Sept. 1946. It is located about 27 ft. east of the older village well.

Driller's log of well drilled in 1946 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Shale and gravel"	57	57
"Gravel"	23	80
"Shale"	42	122
Ordovician system		
Galena-Platteville formations		
"Limestone"	278	400

The well was cased with 10-in. gwi. drive pipe to a depth of 124 ft. below which the hole is 10 in. in diameter to the bottom.

During a test, when pumping at 112 gpm. the drawdown was 54 ft. below a non-pumping water level of 30 ft. from the top of the casing.

The existing pump installation was made on May 28, 1947 which is: 150 ft. of 5-in. column pipe; 7-in., 14-stage Peerless turbine pump, No. 33867, having a rated capacity of 150 gpm. against 274 ft. of head; the overall length of the pump is 7 ft. 8 3/8 in.; 30 ft. of 4-in. suction pipe; 157 ft. of 1/4-in. brass pipe air line; 15-hp. U. S. electric motor. A pumping test was made following the installation. While pumping at 165 gpm. against a head of 100 ft. above the pump discharge for 1 hr. the water level was 113 ft. below the pump base. The water level rose to 31 ft. below the pump base after 2 min. of shut-down.

Analysis of a sample (Lab. No. 112,084) collected Sept. 29, 1947 after 25-min. pumping at 165 gpm., showed this water to have a hardness of 17.2 gr. per gal., a residue of 307 ppm., and an iron content of 0.8 ppm.

The pumping water level was 115 ft. below the pump base after 30-min. pumping, and the water level was 30 1/2 ft. after 10 min. of idle period.

The average estimated pumpage is 65,000 gpd.

LABORATORY NO. 112,080

	ppm.	epm.			ppm.	epm.
Iron (total) Fe	1.4		Fluoride	F	0.2	
Turbidity	20		Chloride	Cl	6.0	0.17
Color	0		Alkalinity (as $CaCO_3$)		316.	6.32
Odor	0.		Hardness (as $CaCO_3$)		359.	7.18
Temperature 51° F.			Total Mineral Content		380.	
pH = 7.2			Free CO_2 (calc.)		54.	

LABORATORY NO. 112,084

	ppm.	epm.			ppm.	epm.
Iron (total) Fe	0.8		Silica	SiO_2	24.2	
Manganese Mn	Tr.		Fluoride	F	0.4	
Calcium Ca	56.4	2.82	Chloride	Cl	1.0	0.03
Magnesium Mg	37.7	3.10	Nitrate	NO_3	2.8	0.05
Ammonium NH_4	0.1	0.01	Sulfate	SO_4	4.1	0.09
Sodium Na	3.7	0.16	Alkalinity (as $CaCO_3$)		296.	5.92
Turbidity	10+		Hardness (as $CaCO_3$)		296.	5.93
Color	0		Residue		307.	
Odor	0		Free CO_2 (calc.)		28.	
Temperature 51° F.			pH = 7.45			

A public water supply was installed in 1892 by the city of Watseka (3744).

Water was obtained from 2 wells drilled, each to a depth of 150 ft., and located 20 ft. apart north and south at the pumping station, north of Cherry St. and midway between Third and Fourth St. (or approximately 890 ft. N. and 1180 ft. W. of the S. E. corner of Section 32, T. 27 N., R. 12 W.). The ground elevation is 632± ft.

One of the wells was cased with 6-in. pipe to a water-bearing stratum at a depth of 125 ft. and with 4-in. pipe from 125 to 150 ft. The other well was cased with 6-in. pipe to the full depth of 150 ft., a lower water-bearing stratum. Water, from the 125 and 150-ft. strata, entered the wells through small drilled holes in the casings.

Water was pumped from each well by a Gould 8 by 10-in. single-acting triplex pump set in a pit 20 ft. deep below ground level. In 1912, the non-pumping water level was 10 ft. below the pump base and, when pumping at 90 gpm. the drawdown was about 10 ft. In 1917, when the pump was being repaired, the water level raised above the bottom of the pit. During repairs in 1924, the water level was below the bottom of the pit, but may have been influenced by pumping in an industrial well about one block distant.

The north well has not been used for 10 years. It is still equipped with a Gould 8 by 10-in. suction pump but the electric motor has been disconnected.

The south well is maintained for emergency service, and is equipped with a Gould 9 by 12-in. triplex suction pump, No. 48299, belt-driven from a 30-hp. General Electric motor. When the pump is operated, the discharge rate is reported to be 200 gpm. under a vacuum of 20 in.

Well No. 3 was drilled in 1937 to a depth of 168 ft. 4 in. by John Bolliger and Sons, Fairbury, and located 60 ft. south of the old wells and 20 ft. north of Cherry St. The well was cased with 141 ft. 4 in. of 10-in. pipe and 27 ft. of 10-in. screen.

This well is the present source of supply. The pumping assembly consists of 120 ft. of 6-in. column pipe; 8-in., 9-stage Pomona turbine pump, No. SP 730; 10 ft. of 6-in. suction pipe; 30-hp., 1760 rpm. General Electric motor, No. 5407705.

On Apr. 21, 1938 the non-pumping water level was 16 ft. and when pumping at 350 gpm. the drawdown was 28 ft. The pump is now estimated to discharge at a rate of 450 gpm.

Analysis of a sample (Lab. No. 116,317) collected Nov. 1, 1948 after 2-hr. pumping, showed this water to have a hardness of 9.1 gr. per gal., a residue of 306 ppm., and an iron content of 0.8 ppm.

In 1944, Well No. 4 was drilled to a depth of 160 ft. by J. Bolliger and Sons, and located 60 ft. south of Walnut St. on the west side of Sixth St. extended, north of the Toledo, Peoria and Western R. R. right-of-way (or approximately 1140 ft. N. and 2 ft. W. of the S. E. corner of Section 32). The ground elevation is 632± ft.

Sample-study log of Well No. 4 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil, silt and till	85	85
Sand, and granule gravel	2	87
Till	43	130
Sand and gravel, clean	5	135
Sand, and gravel, slightly silty	10	145
Gravel	15	160

The well was cased with 130 ft. of 8-in. pipe and 30 ft. of Johnson screen, having No. 40 slot openings. The driller reported a static water level of 14 ft. and that water was pumped for 5 hr. at 520 gpm.

Well No. 4 has not been placed in service as yet, but the following pumping equipment is in place: 120 ft. of 6-in. column pipe; 8-in., 11-stage Pomona turbine pump, rated at 400 gpm. against 220 ft. of head; 10 ft. of 6-in. suction pipe; 130 ft. of 1/4-in. copper tubing air line; 30-hp. General Electric motor.

All water is chlorinated.

Pumpage is estimated to average 278,000

LABORATORY NO. 116,317

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.8		Silica	SiO_2	18.1	
Manganese	Mn	Tr.		Fluoride	F	0.4	
Calcium	Ca	39.9	2.00	Chloride	Cl	5.0	0.14
Magnesium	Mg	13.4	1.11	Nitrate	NO_3	0.3	0.01
Ammonium	NH_4	3.6	0.20	Sulfate	SO_4	9.3	0.19
Sodium	Na	66.0	2.87	Alkalinity (as $CaCO_3$)		292.	5.84
Turbidity		10		Hardness (as $CaCO_3$)		156.	3.11
Color		0		Residue		306.	
Odor		0		Free CO_2 (calc.)		24.	
Temperature 55° F.				pH = 7.5			

A public water supply was installed by the village of Wauconda (639) in 1920. Water for the public supply was first secured from a well drilled by A. B. Bell, St. Charles. It is located back of the village hall about 300 ft. south of Banks Lake (or approximately 1700 ft. N. and 250 ft. W. of the S. E. corner of Section 26, T. 44 N., R. 9 E.). The elevation of the pump house floor is 790± ft.

The well was reported finished in gravel at a depth of 132 ft. below the pump house floor or 102 ft. below the pump pit floor. It is cased the entire depth with 10-in. pipe ending at the bottom of the well in 20 ft. of screen. Upon completion of the well, it was reported that water was pumped at a rate of 200 gpm. without appreciably lowering the water level which was about 8 ft. below the bottom of the pit.

A Gould triplex 7-in. x 8-in. suction pump was installed in the bottom of the pit having 20 ft. of 4-in. suction pipe extending into the well. This pump was operated at speeds varying from 39 to 50 rpm. In the summer of 1934 when operating at the higher rate of speed, displacing about 200 gpm., the pump would knock after several hr. of operation; but when the speed was reduced to 39 rpm., displacing about 160 gpm., the pump operated smoothly.

By 1939 the capacity of the well had dropped to 25 gpm. The old screen was removed and a new 14-ft. brass tube strainer was installed. The well could not be developed, and its yield was limited to 25 gpm. The former sand and gravel water-bearing formations were found to be blocked with a fine silty material resembling powder when dried. This condition is reported to have occurred in many of the private sand and gravel wells in the area.

The well was rehabilitated and deepened to 230 ft. in 1939 by W. R. Boetsch, Crystal Lake. It was cased from the surface to a depth of 30 ft. with 12-in. pipe, with 10-in. casing between the depths of 30 and 110 ft., and with 8-in. casing from the surface to a depth of 220 ft. That part of the 8-in. casing above a depth of 105 ft. was later removed.

Production tests of both wells were made by the State Water Survey on Dec. 13, 1939. Both wells were pumped simultaneously for 5 1/4 hr. after the pump in No. 1 was operated alone. Water from No. 1 was pumped at a rate of 100 gpm. and from No. 2 at a rate of 280 gpm. At these rates, the drawdown was 41 1/2 ft. below a non-pumping water level of 39 ft. below the pump base in Well No. 1, and the drawdown in No. 2 was 41 ft. below a non-pumping water level of 38 1/2 ft. After No. 2 had been shut down for a period of 5 min., and the pumping in Well No. 1 was continued at the same rate, the water level in Well No. 2 had recovered 29 1/2 ft. The water level in Well No. 1 had recovered 30 ft. of the drawdown during the simultaneous operation after 10 min. of continued operation. The pumping rates in Well No. 1 were 7 1/2 hr. at 100 to 110 gpm.; 210 gpm. for 2 hr. and 270 gpm. for a final period of 2 hr. At the end of the 11 1/2-hr. test, the drawdown in No. 1 was 28 1/2 ft. below a non-pumping water level of 39 ft.

The following pump installation, made in 1939, is still in service: 100 ft. of 4 1/2-in. column pipe; 7-in., 9-stage American Well Works turbine pump, Shop No. 63221, rated at 100 gpm. against 215 ft. of head; 10 ft. of 5-in. suction pipe and strainer; 10-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 107,499), collected Aug. 26, 1946 after 25-min. pumping at 165 gpm., showed this water to have a hardness of 21.5 gr. per gal., a residue of 382 ppm., and an iron content of 1.3 ppm. The quality is similar to that obtained when the well was 132 ft. deep.

During 1937 the village attempted to increase the supply by constructing an additional well. A test well, 187 ft. deep, was drilled on lot 9, block 6, about 30 ft. northeast of Maple Ave. (or approximately 1350 ft. N. and 450 ft. W. of the S.E. corner of Section 26). The well was equipped with a 5-ft. length of 4-in. 60-gauze well point.

A 3-hr. production test was conducted on Mar. 10, 1937. While pumping at 30 gpm., the drawdown was 123 ft. below a non-pumping water level of 30 ft. below the surface, or a specific capacity of about 1/4 gpm. per ft. of drawdown. The well was abandoned.

A new well was drilled for the village by W. R. Boetsch and completed in Mar., 1939. It is located about 10 ft. southeast of the old well and is 257 ft. deep. The well is cased from the surface to limestone at 226 1/2 ft. with 12-in. Byers 53-lb. wi. pipe. From 226 1/2 ft. to the bottom, the hole is 12 in. in diameter.

A 24-hr. production test was conducted by the State Water Survey on May 28 and 29, 1939. Before the test, the water level was 36 ft. below the

top of the casing. After pumping for 2 hr. at 203 gpm., the drawdown was 22 1/2 ft., which remained stationary after 2 more hr. pumping at the. same rate. The rate of pumping was then increased to 318 gpm., and after 4 1/3 hr. at this rate, the drawdown was 44 ft., which remained stationary for 11 1/4 more hr. of pumping at the same rate. When the rate was increased to 400 gpm., the drawdown was 67 1/2 ft. after 2 1/2-hr. pumping, which remained fixed for the balance of the test period.

The following pump installation, made in 1940, is now in service: 100 ft. of 5-in. column pipe; 8-in., 8-stage American Well Works turbine pump rated at 300 gpm. against a head of 200 ft.; 10 ft. of 5-in. suction pipe and strainer; 25-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 107,500), collected Aug. 26, 1946 after 6-min. pumping at 365 gpm., showed this water to have a hardness of 21.2 gr. per gal., a residue of 379 ppm., and an iron content of 0.7 ppm. The quality was very similar to that obtained from the No. 1 well.

Both wells are in service and are pumped alternately. The average combined pumpage is 75,000 gpd. The water is not treated.

Sample-study log of well completed in Mar. 1939 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Glacial till	105	105
Gravel, sand and some clay	10	115
Sand and fine gravel, clean	80	195
Till	10	205
Sand, shaly	5	210
Silurian system		
Niagaran-Alexandrian dolomites, clayey at base	47	257

LABORATORY NO. 107,499

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.3		Silica	SiO_2	40.4	
Manganese	Mn	0.0		Fluoride	F	.4	
Calcium	Ca	68.1	3.41	Chloride	Cl	3.0	0.08
Magnesium	Mg	48.2	3.96	Nitrate	NO_3	0.4	0.01
Ammonium	NH_4	0.9	0.05	Sulfate	SO_4	12.8	0.27
Sodium	Na	1.4	0.06	Alkalinity (as $CaCO_3$)		356.	7.12
Turbidity		10		Hardness (as $CaCO_3$)		369.	7.37
Color		0		Residue		382.	
Odor (at well) slight H_2S				Free CO_2 (calc.)		46.	
Temperature 52.5° F.				pH = 7.3			

WAYNESVILLE
DeWitt County
Aug. 31, 1948

A public water supply was installed by the village of Waynesville (564) in 1895.

Water was obtained from 2 wells located at the pumping station on the south side of Fourth St. between Main and Isham St. (or approximately 770 ft. N. and 1100 ft. E. of the S. W. corner of Section 29, T. 21 N., R. 1 E.). The ground surface elevation is 724± ft.

Each well was drilled to a depth of 116 ft. and cased with 6-in. pipe to 102 ft. One of the wells was reported to have been drilled by J. P. Miller, Artesian Well Co., Brookfield.

Correlated driller's log furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil	5	5
Sand and gravel	20	25
Clay and hardpan	89	114
Sand and gravel	3	117
Sand and clay	?	?

In 1919, the water level in one well, while the other pump was operating, was 40 to 45 ft. below the top of the well. At that time the combined production of the two wells was less than 110 gpm.

In 1926 one of the wells was in service and the other had been abandoned. The casing was removed from the abandoned well and was reported to be in good condition, after more than 20 years service. In 1938, both wells had been filled in.

Analysis of a sample (Lab. No. 41607) collected Aug. 18, 1919, showed this water to have a hardness of 25.2 gr. per gal., a residue of 573 ppm., and an iron content of 1.8 ppm.

Well No. 3 was drilled in 1925 to a depth of 165 ft. and located north of Second St. between Malthy and Isham St. about 600 ft. distant from the old wells (or approximately 370 ft. N. and 1570 ft. E. of the S. W. corner of Section 29). The ground elevation is 725t ft.

The well was drilled through hard material and terminated in about 5 ft. of sand, and was cased with 8-in. pipe.

The pump assembly, installed Jan. 11, 1938, consists of 140 ft. of 4-in. column pipe; 6-in., 15-stage American Well Works turbine pump, No. 61370, rated at 60 gpm. at 1770 rpm., against a head of 220 ft.; the overall length of the pump is 6 ft. 7 3/4 in.; 10 ft. of 3 1/2-in. suction pipe; 7 1/2-hp. U. S. electric motor No. 161382.

In July, 1938, the non-pumping water level was 95 ft. below ground level, and on Aug. 27, 1948 the non-pumping water level was the same. The metered discharge rate averaged 57-58 gpm. Well No. 3 is the principal source of supply.

Analysis of a sample (Lab. No. 115,702) collected Aug. 27, 1948, after 3-hr. pumping at 57 gpm., showed this water to have a hardness of 26.6 gr. per gal., a residue of 634 ppm., and an iron content of 3.3 ppm.

Well No. 4 was drilled in 1934 to a depth of 125 ft. by Ira DeMent, Hallsville, and located at the old pumping station on Fourth St.

The well was cased with 113 ft. of 6-in. pipe and 12 ft. of 6-in. screen. The pumping equipment, installed about 1939, includes a 6-in. American Well Works turbine pump, No. 61935, rated at 50 gpm., against 105 ft. of head at 3470 rpm.; 5-hp. U. S. electric motor.

This well is maintained as an emergency supply unit. On Aug. 27, 1948, the altitude gauge on the air line read zero when neither pump, in Wells No. 3 or 4 was operating. The red hand on the gauge was set at 35 ft.

Pumpage is estimated to average 15,000 gpd.

LABORATORY NO. 115,702

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	3.3		Silica	SiO_2	28.3	
Manganese	Mn	0.0		Fluoride	F	0.2	
Calcium	Ca	95.6	4.78	Chloride	Cl	4.0	0.11
Magnesium	Mg	52.6	4.33	Nitrate	NO_3	0.2	Tr.
Ammonium	NH_4	4.3	0.24	Sulfate	SO_4	15.6	0.32
Sodium	Na	67.2	2.92	Alkalinity	(as $CaCO_3$)	592.	11.84
Turbidity		40.		Hardness	(as $CaCO_3$)	456.	9.11
Color		0		Residue		634.	
Odor		Tr.		Temperature	54.6° F.		

WEDRON
La Salle County
July 15, 1947

The village of Wedron (202) has no public water supply.

A well was drilled in 1944 by C.E. Woodruff, Ottawa, for the Wedron Housing project owned by the Wedron Silica Co. The well is located on the west side of Ottawa Road in the southeastern corner of the housing site (or approximately 1377 ft. S. and 2370 ft. W. of the N. E. corner of Section 9, T. 34 N. R. 4 E.).

The well is reported to be 150 ft. deep below a ground surface elevation of 545± ft., and is equipped with 80 ft. of column pipe; 6-in. American Well Works deep-well turbine pump, No. 70415, rated at 30 gpm. against 230 ft. of head; 5-hp. electric motor.

Pumpage is estimated at 2000 gpd.

Analysis of a sample (Lab. No. 111,092) collected July 15. 1947 from a pressure tank, showed the water in this well to have a hardness of 27.1 gr. per gal., a total mineral content of 490 ppm., and an iron content of 1.5 ppm.

In 1946 C.E. Woodruff, Ottawa, completed a well for the Wedron Silica Co. The well is located at the plant on the bank of the Fox River (or approximately 2320" ft. N. and 2320 ft. W. of the S. E. corner of Section 9). It is 242 ft. deep below a ground elevation of 500± ft. and is cased with 6-in. pipe from the surface to 150 ft. The annular space between the 10-in. hole and the 6-in. casing was filled with neat cement. Fifty-two sacks of cement were used.

Correlated driller's log of the Wedron Silica Co. well furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Drift	10	10
Ordovician system		
St. Peter formation		
Sandstone	102	112
Clay	20	132
Shakopee formation		
Limestone	33	165
New Richmond sandstone		
Sandstone	77	242

The well flows at an estimated rate of 50 gpm. On July 15, 1947, the gauge showed an artesian pressure of 7 psi.

The well is equipped with a 7-stage Peerless turbine pump, No. 33344, rated at 100 gpm. Power is furnished by a 5-hp., 1800 rpm. U. S. electric motor.

Analysis of a sample (Lab. No. 111,088) collected July 15, 1947 from the overflow pipe at the well, showed this water to have a hardness of 19.8 gr. per gal., a total mineral content of 356 ppm., and an iron content of 0.1 ppm.

Pumpage is estimated at 2000 gpd. Water for industrial use at the plant is obtained from the quarry, which is fed from springs.

LABORATORY NO. 111,092

	ppm.	epm.			ppm.	epm.
Iron (total)	Fe 1.5		Fluoride	F	0.1	
Turbidity	10-		Chloride	Cl	6.0	
Color	0		Sulfate	SO_4	146.9	
Odor	Tr.		Alkalinity	(as $CaCO_3$)	296.	
Temperature 54° F.			Hardness	(as $CaCO_3$)	465.	
			Total Mineral Content		490.	

LABORATORY NO. 111,088

	ppm.	epm.			ppm.	epm.
Iron (total)	Fe 0.1		Fluoride	F	0.2	
Turbidity	Tr.		Chloride	Cl	2.0	
Color	0		Sulfate	SO_4	1.9	
Odor	0		Alkalinity	(as $CaCO_3$)	340.	
Temperature 53.5° F.			Hardness	(as $CaCO_3$)	340.	
			Total Mineral Content		356.	

WELDON
DeWitt County
Feb. 28, 1949

A water supply was installed by the village of Weldon (521) in 1897.

A well which supplied water for an elevator was used by the village. About 1901 a well, 10 ft. in diameter, was dug to a depth of 42 ft. The wall of the dug portion was lined with brick and 3 drilled wells extended to various depths below the bottom of the dug well. The tops of the iron pipe casings were 3 or 4 ft. above the bottom of the dug portion. In 1916 one of the wells, reported to be 86 ft. deep, was the sole source of supply. At that time, the non-pumping water level was 23 ft. below the ground surface and with constant pumping the water level was drawn down 11 ft. The ground surface elevation at the well site is 718± ft.

The well caved in 1922 and was abandoned in 1923. It has been filled.

Analysis of a sample (Lab. No. 36121) collected Dec. 12, 1916, showed this water to have a hardness of 28.5 gr. per gal., a mineral content of 632 ppm., and an iron content of 1.5 ppm.

The test wells were drilled by E. H. Johnson & Son, Bloomington, in 1922, one at the site of the dug well and the other 300 ft. east. The test wells were 378 and 173 ft. deep. Little water was available and they were abandoned.

Correlated driller's log of one of the test wells drilled in 1922 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and clay, few thin sand streaks	298	298
Pennsylvanian system		
Soapstone	16	314
Shale	64	378

Well No. 1 was drilled in 1923 to a depth of 165 ft. by Ned Ross, Bloomington, and located 115 ft. north of the Illinois Central R. R. and 100 ft. west of Oak St., (or approximately 2600 ft. S. and 1830 ft. W. of the N. E. corner of Section 9, T. 19 N., R. 4 E.). Well No. 1 is about 150 ft. north and 160 ft. west of the old dug well. The bottom 10 ft. was in sand, very much coarser than in the test holes. The ground surface elevation is 725± ft. Well No. 1 was cased with 8-in. pipe with 12 ft. of screen at the bottom.

The pumping equipment includes 140 ft. of 6-in. pipe; Trahorn plunger pump having a 20-in. stroke and operated at 24 spm.; 5 3/4-in. Eureka cylinder, 7 ft. in length; 14 ft. of 3-in. suction pipe; the pump is gear-driven by a 15-hp. Westinghouse electric motor and is rated at 150 gpm. but discharges about 55 gpm. to the distribution system. On Feb. 28, 1949, it was reported that the old pump had been replaced by a jet pump, rated at 50 gpm.

In 1924, the non-pumping water level was 40 ft. and in Aug. 1947, after 2-days non-pumping, the water level was 60 ft. below the pump house floor.

Analysis of a sample (Lab. No. 115,683) collected Aug. 25, 1948 after 3-hr. pumping at 55 gpm. showed this water to have a hardness of 15.7 gr. per gal., a residue of 445 ppm., and an iron content of 1.8 ppm. Methane gas is present in a concentration of 8.5 cu. ft. per 1000 gal.

A 6-in. test hole was drilled in Aug. 1948 to a depth of 173 ft. by Layne-Western Co., Chicago, and located 25 ft. west of Well No. 1. Water-bearing coarse sand was encountered between depths of 155 and 165 ft.

Well No. 2 was completed to a depth of 164 ft. in Oct. 1948 by Layne-Western Co., Chicago, and located 37 ft. west of Well No. 1. The well was cased with 8-in. pipe from 2 ft. above to 154 ft. below ground level and with 12 ft. of 8-in. Layne shutter screen, with 10 ft. of the screen exposed to the aquifer.

A production test was made on Oct. 22, 1948, using State Water Survey calibrated measuring equipment. A temporary pump was used for the test. Before the test, and with no pumping in Well No. 1, the water level in Well No. 2 was 69.5 ft. below the top of the casing. The pumping was started at a rate of 21 gpm. and after 1 hr. the drawdown was 12 ft. The pumping rate was gradually accelerated and after 7 hr. the pumping rate was 60 gpm. and the drawdown was 58.5 ft. The pump in Well No. 1 was started and after 1-hr. additional pumping in Well No. 2 at a rate of 50 gpm. the drawdown was 55 ft. The actual drop in pumping level, due to simultaneous pumping in both wells, was 7 ft. Pumping was stopped and 15 minutes later, the water level in Well No. 2 was 77.5 ft.

Analysis of a sample (Lab. No. 116,220) collected Oct. 22, 1948 after 7-hr. pumping at 60 gpm. showed this water to have a hardness of

15.0 gr. per gal., a residue of 449 ppm., and an iron content of 2.4 ppm.

The pumping equipment, installed in Feb. 1949, consists of 130 ft. of 4-in. column pipe; 18-stage Layne and Bowler turbine pump, No. 19545, having an overall length of 7 ft. 9 in.; 137 ft. 9 in. of 1/4-in. air line; 10 ft. of tail pipe and strainer; 5-hp. electric motor.

Before the pump was installed the water level was 66 ft. below the pump base. After the pump installation, the pump was started and after 10-minutes pumping the drawdown was 36 ft.

Pumpage for the village supply is estimated to average 29,700 gpd.

LABORATORY NO. 115,683

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.8		Silica	SiO_2	22.8	
Manganese	Mn	0.0		Fluoride	F	0.5	
Calcium	Ca	68.1	3.41	Chloride	Cl	6.0	0.17
Magnesium	Mg	23.9	1.97	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	3.1	0.17	Sulfate	SO_4	0.0	0.00
Sodium	Na	62.1	2.70	Alkalinity	(as $CaCO_3$)	404.	8.08
Turbidity		15		Hardness	(as $CaCO_3$)	269.	5.38
Color		25		Residue		445.	
Odor		0		Temperature	55.3° F.		

A public water supply was installed by the City of Wenona (967) in 1895.

At that time a well was drilled to a depth of 1857 ft. and was located about one-half block west of the main business district (or approximately 1450 ft. S. and 900 ft. W. of the N. E. corner of Section 24, T. 30 N., R. 1 E.). Ground surface elevation is 695± ft. The hole and casing diameter record is shown in Table 1.

TABLE 1

Hole Record

6-in. from 496 to 1114 ft.
4-in. from 1114 to 1857 ft.

Casing Record

12-in. casing from 0 to 110 ft.
9-in. casing from 110 to 496 ft.

The well was originally equipped with a Downey double-acting deep-well pump with a 5 3/4-in. by 24-in. cylinder attached to 252 ft. of 6-in. drop pipe, below which was 20 ft. of 4-in. suction pipe.

In Mar. 1915 the non-pumping water level was 125 ft. below the surface, and in Dec. 1916 the water level was 152 ft. For several months it was necessary to pump continuously in order to supply a demand ranging from 32,000 gpd. in May to 62,000 gpd. in Oct. In Oct. 1922 a production test was made by the State Water Survey. Before the test started, the water level was 156 ft.; and after pumping 4 1/2 hr. at 100 gpm., the water was drawn down 92 ft. After pumping was stopped, the water level returned to 156 ft. in 4 3/4 hr.

In May 1930 the non-pumping water level was 160 ft., and the water was drawn down 100 ft. while pumping at 65 gpm. Due to the fact that at different times during previous years two pump cylinders had been lost in the well, the pump rods were breaking frequently, minor cave-ins were causing murky water, and the lowering of the pump gave only temporary relief to the demand which was progressively increasing, an attempt was made to supplement the supply.

The well has been capped and abandoned but not filled in.

In 1930 a well was dug for the city to a depth of 50 ft. by Mike Ebert, Washington, and located near the deep well. After a few months the dug well caved in. A tubular well was then drilled on Spencer St. about 600 ft. west and 1950 ft. south of the deep well. The well was 50 ft. deep and cased with 6-in. pipe to the top of the sand at 47 ft. The sand was screened with 6-in. perforated pipe. A 4-in. Pomona turbine pump was installed rated at 50 gpm. against the elevated tank pressure. The non-pumping water level was reported to be 28 ft. below the surface, and the drawdown was estimated to be 14 ft.

In Mar. 1935 the 50-ft. well was supplying about 2/3 of the entire city demand. The non-pumping water level in the deep well was then at 165 ft., and the deep well was furnishing not over 65-75 gpm.

The 50-ft. well has been capped and abandoned.

A well was drilled in 1937 by Jos. Egerer, Milwaukee, Wis., to a depth of 1865 ft. and located 50 ft. north of the old deep well (or approximately 1400 ft. S. and 900 ft. W. of the N. E. corner of Section 24).

Sample-study log of well drilled in 1937 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Till and brown mud"	50	50
"Muddy gravel"	20	70
Pennsylvanian system		
Shale, thin beds of limestone, coal and sandstone	564	634
Silurian system		
Niagaran-Alexandrian series		
Dolomite, partly shaley	336	970
Dolomite	175	1145
Siltstone and sandstone	10	1155
Ordovician system		
Maquoketa shale, some limestone and dolomite	170	1325
Galena-Platteville limestone, few thin shale and dolomite beds	380	1705
Glenwood dolomite, shale and sandstone	10	1715
St. Peter sandstone	140	1855

The well was cased with 12-in. pipe from the surface to 346 ft. and with 8-in. pipe from one foot above to 1350 1/2 ft. below the surface.

The pump assembly consists of 200 ft. of 4-

in. column pipe; 18-stage Pomona turbine pump, No. SP 596, rated at 60 gpm.; the overall length of the pump is 9 ft.; 10 ft. of 4-in. suction pipe; 7 1/2-hp. Westinghouse electric motor.

On May 11-12, 1937 a production test was made under the supervision of the State Water Survey. Before the test, the water level was 191 ft. below the top of the casing; and after pumping 23 hr. at rates of 24 to 27 gpm., the drawdown was 107 ft. In Aug. 1937 it was reported that the pumping rate was about 50 gpm. In Jan. 1947 the non-pumping water level was estimated at 180 ft.

Analysis of a sample (Lab. No. 108,901) collected Jan. 13, 1947, showed this water to have a hardness of 14.9 gr. per gal., a mineral content of 1437 ppm., and an iron content of 1.5 ppm. Previous and later samples were noted to be of similar mineral composition but had a temperature of 73° F. The character appears to be largely typical for water from the St. Peter sandstone.

The pumpage was estimated at 60,000 gpd.

Test-well, No. 1-47, was completed to a depth of 62 ft. in Feb. 1947 by Layne-Western Co., Chicago, and located 50 ft. S. and 1320 ft. W. of the N. E. corner of Section 25. The ground elevation is 695± ft. The test -well was located about 10 ft. from test-hole No. 5-47 and 350 ft. from test-hole 4-47.

Test-well No. 1-47 was cased with 8-in. pipe from ground surface to 45 ft. and with 6-in. pipe from 1 ft. above to 55 ft. below ground level. A 6-in. Keystone wirewound screen was set from 55 to 61 ft. The screen had No. 30 slot openings. A production test was made on Feb. 10, 1947 using State Water Survey calibrated measuring equipment. Pumping was started at a rate of about 45 gpm., but broke suction almost immediately. The discharge valve was throttled to 25 gpm., giving a fairly steady flow, with the water level at the bottom of the pump suction, 55 ft. below ground level. After 2 1/2-hr. pumping the drawdown was 43 ft. from a non-pumping water level of 12 ft. below ground level. Two minutes after stopping the pump the water level was 12.75 ft.

Well No. 5 was completed to a depth of 61 ft. in Oct. 1947 by Layne-Western Co. and located 17 ft. south of test-well No. 1-47. The driller reported that sand and gravel were encountered from 48 to 61 ft. The well was gravel-packed with 20-in. od. outer casing from 2 ft. above to 53 ft. below ground level and 10-in. id. inner casing from 2 ft. above to 51 ft. 8 in. below ground level. Below the 6-in. casing was 10 ft. 1 in. of 10-in. id. Layne No. 6 Everdur bronze shutter screen. The bottom 2.5 ft. of screen was a 10-in. by 17-in. cone section with cutting shoe. A 6-in. concrete plug was poured in the bottom of the screen. About 8 or 9 cu. yd. of 1/8-in. by 3/8-in. gravel gradations was used to pack outside the screen and fill the annular space between the casings.

A production test was made on Oct. 9, 1947 using State Water Survey calibrated measuring equipment. Water level observations were made in test-well No. 1-47. Pumping was at a fairly constant rate of 98 to 95 gpm. but equilibrium could not be maintained.

Analysis of a sample (Lab. No. 112,134) collected Oct. 9, 1947 after 7-hr. pumping at 95 gpm. showed this water to have a hardness of 26.7 gr. per gal., a mineral content of 816 ppm., and an iron content of 1.8 ppm.

LABORATORY NO. 108,901

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.5		Silica	SiO_2	14.8	
Manganese	Mn	0.0		Fluoride	F	1.4	
Calcium	Ca	61.0	3.05	Chloride	Cl	490.0	13.82
Magnesium	Mg	25.1	2.07	Nitrate	NO_3	0.6	.01
Ammonium	NH_4	1.7	.10	Sulfate	SO_4	253.4	5.27
Sodium	Na	438.8	19.08	Alkalinity (as $CaCO_3$)		260.	5.20
Color		0		Hardness (as $CaCO_3$)		256.	5.12
Odor		0		Residue		1437.	
Turbidity		10		Temperature 70° F.			

WEST BROOKLYN
Lee County
Mar. 19, 1948

The village of West Brooklyn (185) installed a public water supply about 1898.

Water was originally obtained from a well drilled in 1898 to a depth of 385 ft. by Ulrick Bros., Lee Center, and located near the southwest corner of Third and Johnson St. (or approximately 2640 ft. S. and 675 ft. E. of the N. W. corner of Section 8,T. 37 N., R. 1 E.). The surface elevation is 983t ft. The well was cased with 5-in. pipe from the surface to about 280 ft. and 3 1/2 -in. pipe from 280 to 385 ft. A screen was placed at the bottom in sand and gravel.

In 1903, the well was overhauled by the American Well Works Co. because of the entrance of sand into the well. While the well was being repaired in 1913, the pump rods were broken. The well was abandoned with the pump left in the well. The non-pumping water level at that time was reported to be about 150 ft. below the ground surface.

In 1913, following the accident in the village well, a well was put into service at Farmers Cooperative Elevator Co. located on the east side of First St. between the Chicago, Burlington & Quincy R. R. tracks and Johnson St. (or about 1650 ft. S. and 50 ft. E. of the N. W. corner of Section 8). The well is 3 in. in diameter and 375 ft. deep. In 1917 the non-pumping level was reported to be 60 ft. below the ground surface.

Water is pumped by an American Well Works 2-in. by 24-in. cylinder pump operating with an 8-in. stroke at 35 spm., attached to 285 ft. of 1 1/2-in. column pipe and belt-driven by a 10-hp. Wagner electric motor No. 806134. The pump is operated from 8 A. M. to 4 P. M.

Analysis of a sample (Lab. No. 113,201) collected Jan. 19, 1948 after 1-hr. pumping, showed the water from this well to have a hardness of 16.5 gr. per gal., a residue of 319 ppm., and an iron content of 1.5 ppm.

The village also obtains water from a well drilled to a depth of 358 ft. in 1915-1916 by Freidenhall and Morey, Aurora, and located 3 ft. from the old village well in the pumping station. Originally, the casing was 8 in. in diameter to a depth of 290 ft. and 6 in. in diameter from 260 ft. to the bottom with a perforated pipe placed in the bottom of the well. It was reported that the well terminated in a layer of gravel. In 1918, the non-pumping water level was 217 ft.

In 1937, Henry Albrecht, Ohio, repaired the well, deepened it to 370 ft. and installed new casing and screen. The hole and casing were reported as shown in Table 1.

TABLE 1

Hole Record

8-in. from surface to 290 ft.
6-in. from 290 ft. to bottom.

Casing Record

8-in. from surface to 280 ft.
6-in. from surface to 260 ft.
4-in. from 257 to 305 ft.
2-in. from 256 to 314 ft.
2-in. screen (60 mesh) from 314 to 334 ft.
1 1/4-in. screen (60 mesh) from 332 to 350 ft.

Rubber packers were used throughout.

Following the repairs, the following pump assembly was installed: 253 ft. of 3-in. column pipe; 4 3/4-in. by 24-in. American Well Works cylinder pump rated at 30 gpm. operating at 15 spm.; 15-hp. Wagner electric motor, operating at 1140 rpm.

On June 29, 1937, the non-pumping water level was reported to be 128 ft. below the top of the casing.

Analysis of a sample (Lab. No. 113,202) collected Jan. 19, 1948, showed water from this well to have a hardness of 17.2 gr.per gal., a residue of 338 ppm., and an iron content of 1.6 ppm. Methane gas is known to be present in a high concentration in the water from this well.

Well No. 3 was completed to a depth of 650 ft. for the village in Feb. 1948 by Dunbar Drilling Co., Delta, Ohio, and located 45 ft. east of Well No. 1 (or approximately 2640 ft. S. and 720 ft. E. of the N. W. corner of Section 8).

A test was made by the driller on Feb. 29, 1948 using a test turbine pump set at 299 ft. and 317 ft. of air line. Before the test, the water level was 229 ft. below the top of the casing. After 8 1/2-hr. pumping at 159 gpm., the drawdown was 50 ft. After 12-hr. pumping at 100 gpm., the drawdown was 33 ft. and 15 min. after stopping the pump, at the end of the test, the water level returned to 1 1/2 ft. below the original static level.

Permanent pumping equipment is not installed.

Analysis of a sample (Lab. No. 113,672) collected Feb. 29, 1948 after 4-hr. pumping at 145 gpm., showed this water to have a hardness of 15.9 gr. per gal., a residue of 295 ppm., and an iron content of 5.5 ppm.

Pumpage is estimated at 15,000 gpd.

The hole and casing record is as shown in Table 2.

TABLE 2

Hole Record

10-in. from 0 to 492 ft.
8-in. from 492 to 650 ft.

Casing Record

10-in. from 0 to 492 ft.

LABORATORY NO. 113,202

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.6		Silica	SiO_2	27.1	
Manganese	Mn	Tr.		Fluoride	F	0.3	
Calcium	Ca	71.7	3.59	Chloride	Cl	1.0	0.03
Magnesium	Mg	27.7	2.28	Nitrate	NO_3	Tr.	Tr.
Ammonium	NH_4	1.1	0.06	Sulfate	SO_4	0.0	0.00
Sodium	Na	18.9	0.82	Alkalinity (as $CaCO_3$)		336.	6.72
Turbidity		20±		Hardness (as $CaCO_3$)		294.	5.87
Color		0		Residue		338.	
Odor		0					

Sample-study log of Well No. 3 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and till	109	109
Sand and gravel, silty and clayey	31	140
Till	181	321
Sand and granule gravel, silty and clayey	28	349
Till	58	407
Sand and granule, silty and clayey	10	417
Sand and gravel, clean	3	420
Sand, clayey	6	426
Soil	6	432
Sand and granule gravel, silty	15	447
Till	19	466
Sand, slightly silty	18	484
Clay	3	487
Sand and gravel	3	490
Ordovician system		
St. Peter formation		
Sandstone, incoherent	17	507
Sandstone, silty and clayey, thin shale bed at base	143	650

LABORATORY NO. 113,672

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	5.5		Silica	SiO_2	14.8	
Manganese	Mn	Tr.		Fluoride	F	0.3	
Calcium	Ca	55.4	2.77	Chloride	Cl	2.0	0.06
Magnesium	Mg	32.5	2.68	Nitrate	NO_3	0.2	Tr.
Sodium	Na	14.0	0.61	Sulfate	SO_4	3.7	0.08
Turbidity		35.		Alkalinity	(as $CaCO_3$)	296.	5.92
Color		0		Hardness	(as $CaCO_3$)	273.	5.45
Odor		0		Residue		295.	

A public water supply was installed by the city of West Chicago (3355) in 1896.

The supply is obtained from 2 drilled wells, respectively 875 ft. and 322 ft. in depth. These wells are spaced 37 ft. apart and are located about 100 ft. south of McConnell Ave. and 220 ft. west of Fremont St. (approximately 30 ft. N. and 600 ft. W. of the S. E. corner of Section 4, T. 39 N., R. 9 E.).

The deeper well, now called Well No. 1, was drilled in 1896 by the J. P. Miller Artesian Well Co., Brookfield, and cased with 12-in. pipe to limestone at a depth of 98 ft. below which the hole is 8-in. diameter. The elevation of the pump base is 774.0 ft.

It was originally equipped with plunger pumps and during a test made in 1922 with a cylinder setting of 90 ft. the pump delivered 265 gpm. for an hour after almost continuous service.

The existing pump installation, made in Aug. 1943, is: 130 ft. of 5-in. column pipe; 8-in., 9-stage American Well Works turbine pump, No. 69186, having a rated capacity of 500 gpm. against 127 ft. of head; 10 ft. of 5-in. suction pipe; 130 ft. of 1/4 -in. gi. air line; 20-hp. General Electric motor.

Water levels have been reported in ft. below the pump base.

Date	Non-pumping ft.	Pumping ft.	Pumping Rate gpm.
1897	44		
1904	47		
1915	50		
1920	70		
1925	76		
1930	90	102 (?)	500
1941	96	114+	500
1947	115	118	500

Analysis of a sample (Lab. No. 110,474) collected May 28, 1947 from the end of the discharge pipe in the reservoir after 2-hr. pumping at 500 gpm. showed this water to have a hardness of 23.5 gr. per gal., a residue of 478 ppm., and an iron content of 0.7 ppm. The quality is largely typical for water from the limestone in this vicinity.

The shallow well, now called Well No. 2, was drilled in 1908. It is located 37 ft. southeast of Well No. 1 and is reported cased with 12-in. wi. pipe to limestone at a depth of 89 ft. below which the hole was finished 8-in. diameter in limestone. The elevation of the pump base is 773.8 ft.

In the spring of 1922 when the well was equipped with a plunger pump having a cylinder setting of 85 ft. the yield was 165 gpm. Well No. 1 was shut down during the test.

In 1923, this well was equipped with a 500 gpm. turbine pump and the operation of the identical units was alternated.

Observations of water levels in both wells made over a period of years indicated identical levels and influences between the wells. However, in the spring of 1947, a wide disparity in water levels was observed and the influence between the 2 wells was no longer detected. On May 26, 1947, the non-pumping water level in Well No. 2 was 82 ft. below the pump base and on June 26, 1947 after 1-hr. pumping at 500 gpm. the pumping water level was 100 ft.

The existing pump installation, made in 1944, is: 130 ft. of 5-in. column pipe; 8-in., 9-stage American Well Works turbine pump, No. 70032, having a rated capacity of 500 gpm. against 127 ft. of head; 10 ft. of 5-in. suction pipe; 130 ft. of 1/4-in. gi. air line; 25-hp. General Electric motor.

Analysis of a sample (Lab. No. 110,809) collected June 26, 1947, from the end of the discharge pipe in the reservoir after 1-hr. pumping at 500 gpm. showed this water to have a hardness of 28.3 gr. per gal., a residue of 600 ppm., and an iron content of 1.4 ppm.

Water pumped from either well is chlorinated.

Pumpage is estimated to average 400,000 gpd. with a minimum of 300,000 gpd.

LABORATORY NO. 110,474

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.7		Silica	SiO_2	19.2	
Manganese	Mn	0.0		Fluoride	F	0.5	
Calcium	Ca	86.4	4.32	Chloride	Cl	20.0	0.56
Magnesium	Mg	45.5	3.74	Nitrate	NO_3	0.3	Tr.
Ammonium	NH_4	0.5	0.03	Sulfate	SO_4	111.5	2.32
Sodium	Na	16.3	0.71	Alkalinity	(as $CaCO_3$)	296.	5.92
Turbidity		10		Hardness	(as $CaCO_3$)	403.	8.06
Color		0		Residue		478.	
Odor		0					
Temperature		51.2° F.					

LABORATORY NO. 110,809

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.4		Silica	SiO_2	17.3	
Manganese	Mn	0.0		Fluoride	F	0.5	
Calcium	Ca	105.4	5.27	Chloride	Cl	38.0	1.07
Magnesium	Mg	54.4	4.47	Nitrate	NO_3	1.0	0.02
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	158.0	3.29
Sodium	Na	20.2	0.88	Alkalinity	(as $CaCO_3$)	312.	6.24
Turbidity		5		Hardness	(as $CaCO_3$)	487.	9.74
Color		0		Residue		600.	
Odor		Tr.					
Temperature		51.6° F.					

WEST DUNDEE
Kane County
Sept. 9, 1947

A public water supply was installed by the village of West Dundee (1831) in 1895.

Water is obtained from springs located at the foot of hillside slopes in East Dundee northeast of the intersection of highway Routes 63 and 72.

The outflow of these springs is from gravel and is collected in a line of sewer pipe laid with open joints. The original installation consisted of about 400 ft. of tile laid at depths of 12 to 15 ft. below the ground surface starting about 50 ft. E. of highway 63 and continuing east and then following the slope of "East Hill" to the north. The yield became too small to supply the public demand by 1922 and about 400 ft. of additional tile were laid at depths of 4 to 8 ft. following the east right-of-way of highway 63. This line of tile and the line from the old supply discharge into a manhole located about 300 ft. northeast of the intersection of Routes 63 and 72 and 50 ft. east of Route 63 (or approximately 1000 ft. N. and 2000 ft. E. of the S. W. corner of Section 23, T. 42 N., R. 8 E.). From the manhole a pipe is laid to the concrete reservoir. An overflow pipe is provided at the manhole.

The water flows from the reservoir by gravity through a 10-in. pipe to the pumping station on the west bank of the Fox River about 200 ft. south of Route 72.

An estimate of the average rate of flow from the springs to the reservoir was obtained on Aug. 18 and 19, 1947 when pumping was stopped. The reservoir filled from a depth of 14 to 4 ft. in 8 hr. time, or at an average rate of 370 gpm.

Except during excessive periods of withdrawal from the reservoir, the springs flow to waste from the manhole shortly after pumping has stopped.

Analysis of a sample (Lab. No. 111,399) collected Aug. 4, 1947 from the sand trap above the manhole when there was no flow to waste from the manhole, showed this water to have a hardness of 20.0 gr. per gal., a residue of 387 ppm., and a trace of iron.

All water for the public supply is chlorinated at the pumping station.

Metered pumpage, for the calendar years of, 1942 to 1946, inclusive, averaged 174,750 gpd. Pumpage for Aug. 1947 averaged 305,130 gpd. with 2 peak days of 414,000 gal. each.

LABORATORY NO. 111,399

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	Tr.		Silica	SiO_2	20.7	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	73.7	3.69	Chloride	Cl	9.0	0.25
Magnesium	Mg	38.3	3.15	Nitrate	NO_3	15.1	0.24
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	72.4	1.51
Sodium	Na	2.8	0.12	Alkalinity	(as $CaCO_3$)	248.	4.96
Turbidity		0		Hardness	(as $CaCO_3$)	342.	6.84
Color		0		Residue		387.	
Odor		0		Free CO_2 (calc.)		5.	
Temperature 51° F.				pH = 8.1			

Water works were established in Western Springs (4856) about 1895 when several springs in a low swampy area near the southwestern limits of the village were developed as a source of supply.

These springs became inadequate to meet the public supply and were abandoned in 1914 when a well, 2046 ft. deep, was completed near the springs. This well furnished the public supply until 1924 when it was abandoned due to the hardness and mineral qualities of its water.

A second well, now called No. 1, 385 ft. deep, was drilled in 1924 by S. B. Geiger, Chicago. It is located on Wolf Rd. on the south side of the Chicago, Burlington & Quincy R. R. tracks (or approximately 1900 ft. N. and 100 ft. E. of the S. W. corner of Section 5, T. 38 N., R. 12 E.). The ground elevation is 670± ft.

This well is reported to be cased with 16-in. od. pipe to a depth of 60 ft. below which the hole is 15 1/2 in. in diameter.

When the well was completed, water was pumped for 24 hr., and the yield increased from 200 to 800 gpm. The drawdown was 11 ft. from a non-pumping water level of 40 ft. below the top of casing. Subsequent non-pumping water levels were reported as follows: 49 ft. on Sept. 5, 1927; 58 1/2 ft. on Jan. 9, 1931; 56 ft. in May 1942. A pumping water level of 80 ft. was reported in Oct. 1942. The production rate was reported to be 680 gpm. on May 22, 1940 and about 550 gpm. on May 6, 1946.

The pumping equipment, installed in June 1947, consists of 116 ft. of 8-in. column pipe; 12-in., 4-stage Layne-Bowler turbine pump, Shop No. 3316, having an overall length of 4 ft. and rated at 500 gpm.; 142 1/2 ft. of air line; 20 ft. of 6-in. suction pipe; 25-hp. Howell electric motor. This pump was reported to have delivered 600 gpm. against 13 ft. of head. The pump base is in a pit about 4 ft. below the surface of the ground. The pump, removed in June 1947, replaced a 6-stage turbine which had been installed in 1931. The older pump was rated at 500 gpm. against 160 ft. of head.

Analysis of a sample (Lab. No. 106,409) collected from the pump discharge on May 6, 1946 after 3 1/2-hr. pumping at 550 gpm., showed the water from this well to have a hardness of 64.5 gr. per gal., a residue of 1374 ppm., and an iron content of 2.9 ppm.

The well is still in service and has been the source of a large part of the public water supply since its construction.

Attempts were made in 1928 and 1929 to develop an additional source of water with a softer quality. One test hole was drilled on Hillgrove St. 2 blocks west of the water tower and approximately 100 ft. north of the Chicago, Burlington & Quincy R. R. (or approximately 1600 ft. N. and 2200 ft. E. of the S. W. corner of Section 6) at a ground elevation of 662± ft.

The hole was drilled into rock at a depth of 82 ft. after sand was encountered between depths of 56 and 67 ft. A well, of the gravel well type, was developed by Mr. Bowler near the site of the test hole.

The well had a 30-in. diameter casing from the surface to a depth of 32 ft.; a 16-in. screen between depths of 32 and 45 ft.; and a 10-in. diameter screen between depths of 45 and 60 ft. A report dated Sept. 30, 1929 stated that by continuous pumping, or by forcing water back into the well, or other methods of development, failed to show any large amount of water in the sand and gravel. After 2 or 3 weeks work a sudden flow of water appeared, which was estimated to be 800 to 1000 gpm. The analysis indicated that the water originated in the limestone and, from a mineral standpoint, did not constitute a satisfactory public supply.

A fourth well, now called No. 2, was drilled by D. L. Showalter, Western Springs, in 1930 to a depth of 313 ft. It is located in the northeast corner of Johnson and Hillgrove Ave. (or approximately 2150 ft. N. and 400 ft. E. of the S.W. corner of Section 5) on ground having an elevation of 674± ft.

This well is reported to be cased to limestone at a depth of 35 ft. with 15-in. pipe below which the hole is 15 in. in diameter.

After completion of the well, the production was reported to be 500 gpm. with a drawdown of 22 1/2 ft. from a water level of 61 1/2 ft. below the top of the well. The specific capacity of the well remained at 22 gpm. per ft. of drawdown for all rates of discharge between 200 and 500 'gpm.

In 1931 it was reported that the non-pumping water level in Well No. 2 was lowered 5 ft. when the pump in Well No. 1 was operating at a rate of 500 gpm.

Correlated driller's log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
No log	16	16
Clay, yellow, some gravel	19	35
Silurian system		
Niagaran-Alexandrian series		
Limestone, soft water very milky	40	75
Limestone, soft, blue clay from 100' to 102'	70	145
Limestone, harder, water dirty	10	155
Limestone	50	205
Limestone, water very milky	5	210
Limestone	103	313

Subsequent water levels below the pump base, which is about 7 ft. below the original ground surface, have been reported as in Table 1.

TABLE 1

Date	Non-Pumping (ft.)	Pumping (ft.)
1942	52	
1943	53 - 60	74 - 83
1944	60 - 68	83 - 92
1945	67 - 73 1/2	90 - 94 1/2
1946 to Apr. 29	67 - 71 1/2	90 - 94 1/2
1948 Oct. 18	75	

Well No. 2 is equipped with 127 ft. of 8-in. column pipe; 12 3-stage Layne turbine pump having a rated capacity of 500 gpm. against 135 ft. of head; 131 1/2 ft. of airline; 10 ft. of 6-in. suction pipe; 25-hp. Howell electric motor. On Oct. 18, 1948 a new installation was being made consisting of 120 ft. of 7-in. column pipe; 8 1/2-in., 3-stage Layne turbine pump; 120 ft. of airline; 20 ft. of suction pipe. The old Howell motor would be retained.

Analysis of a sample (Lab. No. 106,372) collected from the pump discharge on May 1, 1946 after 3 1/3-hr pumping at 500 gpm., showed this water to have a hardness of 56 gr. per gal., a total mineral content of 1041 ppm., and an iron content of 2.8 ppm. This water is of similar quality to that obtained from the 317-ft. and 375-ft. wells and is typical for waters from this depth in this vicinity.

This well is still in active service and is now housed in the basement of the treatment plant which was completed and placed in operation during the early part of 1932. The water treatment consists of softening, iron removal, and chlorination.

A sample (Lab. No. 106,433) of treated water was collected from a tap in the treating plant at 11:45 a.m. on May 1, 1946. The hardness of this sample was found to be 11.4 gr. per gal. A chlorine residual of 1.0 was recorded.

The average combined metered pumpage for the years 1943, 1944, and 1945 was 411,400 gpd., which varied from an average winter pumpage of 399,510 gpd. to an average summer pumpage of 435,860 gpd.

LABORATORY NO. 106,409

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.9		Silica	SiO_2	19.8	
Manganese	Mn	0.2		Fluoride	F	0.3	
Calcium	Ca	274.3	13.72	Chloride	Cl	18.0	0.51
Magnesium	Mg	102.2	8.41	Nitrate	NO_3	0.0	0.00
Ammonium	NH_4	0.5	0.02	Sulfate	SO_4	672.2	14.00
Sodium	Na	8.1	0.35	Alkalinity (as $CaCO_3$)		400.0	8.00
Color		0		Hardness (as $CaCO_3$)		1107.0	22.14
Odor		0		Residue		1374.	
Turbidity		20		Free CO_2 (calc.)		167.	
Temperature		51.6° F.		pH = 6.8			

LABORATORY NO. 106,372

	ppm.		ppm.
Iron (total)	2.8		
		Chloride Cl	15.0
Turbidity	20	Alkalinity (as $CaCO_3$)	396.
Color	0	Hardness (as $CaCO_3$)	961.
Odor	Tr.	Total Mineral Content	1041.
Temperature 51.3° F.			

LABORATORY NO. 106,433

	ppm.		ppm.
Iron (total) Fe	0.0		
		Chloride Cl	20.0
Turbidity	0	Alkalinity (as $CaCO_3$)	56.
		Hardness (as $CaCO_3$)	195.
Odor	M	Total Mineral Content	978.
Temperature 55.0° F.			

The village of Westfield (678) installed a public water supply in 1913.

Water was originally obtained from Well No. 1, drilled in 1913 to a depth of 155 ft. and located at the southeast corner of Washington and Walnut St. (or approximately 1800 ft. N. and 50 ft. E. of the S. W. corner of Section 29, T. 12 N., R. 14 *W.).* The ground surface elevation is 750t ft.

This well is cased to sandstone at a depth of about 40 ft.

It was reported in 1919 that the non-pumping water level was about 45 ft. below the ground surface, and that the well yielded about 9 gpm. The pump was operated for about 2 hr. then rested 1 or 2 hr. In 1921, the non-pumping water level was 60 ft. It was reported that the well was not used in 1928. A test was made about 1939. Equilibrium conditions were not reached, but after 1 3/4-hr. pumping at a rate of 18.7 gpm. the drawdown was more than 53 ft. below the non-pumping water level of 60 ft. below the ground surface.

The pumping equipment, installed in 1944, consists of an Aurora Pump Co. turbine pump, No. 25484, having a rated capacity of 30 gpm. against 180 ft. of head and 50 gpm. against 150 ft. of head; an 18-in. strainer the bottom of which is 2 ft. above the bottom of the well; 3-hp. U. S. electric motor.

Analysis of a sample (Lab. No. 114,981) collected June 8, 1948 showed the water to have a hardness of 5.2 gr. per gal., a residue of 287 ppm., and an iron content of 0.4 ppm.

The sample was collected from the overflow of the top tray at the aerator. Well No. 1 is in operation about 12 hr. daily delivering an estimated rate of 8 gpm. the present capacity of the well.

Well No. 2 was constructed in 1920 by Richard Thomas at a location on the north side of Mill Creek about 0.35 mile north of Well No. 1 and on the west side of North Washington St. (or approximately 1700 ft. S. and 100 ft. W. of the N. E. corner of Section 30). The ground surface elevation is 700± ft.

The well was constructed under the supervision of G. M. Collins, Street Commissioner. At the top of the well is a reservoir 19 1/2 ft. in diameter and 19 ft. deep. At the bottom of the reservoir is a well dug 10 ft. in diameter to a depth of 31 ft. below the ground surface. Two holes were drilled in the bottom, with the hole to the west 140 ft. total depth, and the hole to the east 72 ft. total depth. The westerly hole was cased with 10-in. pipe from the top of the 10-ft. diameter section of the well to a total depth of 30 ft. below the ground surface; with 8-in. pipe from 30 to 70 ft.; and with 6-in. pipe from 70 to 140 ft. The casing in the easterly hole is 10 in. in diameter from the top of the 10 ft. section of the well to a total depth of 30 ft., and with 8-in. pipe from 30 to 72 ft. It was reported that the westerly hole yielded no water.

Correlated driller's log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Loam and clay	27	27
Sand	60	87

The well is equipped with a Burks centrifugal pump driven by a 3-hp. Wagner electric motor.

In 1923, this well was estimated to produce about 8500 gpd. In 1928, it was reported that the pump was operated about 50 minutes per day. In the spring of 1947, the well was cleaned out and now serves as an auxiliary supply unit. The well is in service several times each week.

Analysis of a sample (Lab. No. 81638) collected July 16, 1937 showed the water to have a hardness of 16.5 gr. per gal., a residue of 392 ppm., and an iron content of 3.2 ppm.

An electrical earth resistivity survey was made by the State Geological Survey in Mar., 1940. The survey covered areas within the village limits, chiefly in the southwest part of the village. Several test holes were drilled within the village limits in 1940.

Test Well No. 2, located 50 ft. east of Village Well No. 2 was drilled by Hayes and Sims, Champaign. The driller estimated a production of 25 gpm. The well was not developed.

Test Well No. 3 was drilled by Hayes and Sims, and is located 30 ft. south of Village Well No. 1. The driller estimated a yield of 20 gpm., but the well was abandoned because of undue interference with Village Well No. 1. The casing was pulled and the hole filled. It is now covered

by the municipal building.

Well No. 3 was drilled to a depth of 150 ft. by Cost and Phillips, Westfield, and is located at the site of Test Hole No. 5 about 200 ft. west of Village Well No. 1.

This well is cased with 10-in. pipe to a depth of 96 ft., and the hole is open below that depth. Two 50-lb. charges of 60% dynamite were exploded in the sandstone formation) one at a depth of 108 ft. and one at a depth of 132 ft. '

Pumping equipment is installed as follows: 120 ft. of 3-in. column pipe; 6-in., 12-stage Pomona turbine pump No. SW 828; 6 ft. overall length, rated at 50 gpm.; 12 ft. of 3 1/2-in. suction pipe; 2-hp. Westinghouse electric motor. There is no air line installed.

A production test was made by the State Water Survey on May 6, 1940. Equilibrium conditions were not obtained, but after 5-hr. 52-min. pumping, the production had decreased from 24 to 12 gpm., and the water level was drawn below the bottom of the suction pipe at a depth of 138 ft. The non-pumping water level at the time of the test was 72 ft. below the top of the casing.

The pump is in operation 24 hr. daily.

Analysis of a sample (Lab. No. 114,982) collected June 8, 1948 after continuous pumping at 12 gpm., showed the water to have a hardness of 5.6 gr. per gal., a residue of 282 ppm., and an iron content of 2.5 ppm.

Pumpage is estimated to average 23,000 gpd.

LABORATORY NO. 114,982

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.5		Silica	SiO_2	13.7	
Manganese	Mn	0.0		Fluoride	F	0.9	
Calcium	Ca	18.1	0.91	Chloride	Cl	7.0	0.20
Magnesium	Mg	12.1	1.00	Nitrate	NO_3	Tr.	Tr.
Ammonium	NH_4	1.3	0.07	Sulfate	SO_4	0.4	0.01
Sodium	Na	80.7	3.51	Alkalinity (as $CaCO_3$)		264.	5.28
Turbidity		10		Hardness (as $CaCO_3$)		96.	1.91
Color		0		Residue		282.	
Odor		Tr.		Free CO_2 (calc.)		4.	
Temperature 57° F.				pH = 8.2			

WESTMONT
Du Page County
June 18, 1947

A public water supply for the village of Westmont (3044) was originally installed in 1921 by the A. T. Mcintosh Co.

Water was obtained from a well drilled to a depth of 840 ft. and located about 35 ft. south of E. Burlington Ave. and 35 ft. east of N. Linden St. (approximately 2400 ft. S. and 450 ft. E. of the N. W. corner of Section 10, T. 38 N., R. 11 E.).

The elevation of the ground surface was 755± ft. The well was drilled by Goodfellow & Co., Chicago, and reported to be cased with 8-in. steel pipe to rock at a depth of 152 ft. and 6-in. steel pipe between depths of 152 and 512 ft. From 512 ft. to the bottom the hole diameter was 6 in.

The well was equipped with an air lift having 20 ft. of 3-in. and 471 ft. of 2 1/2 -in. eduction pipe, and 491 ft. of 1 1/2-in. air line. In Feb. 1924, the non-pumping water level was below 225 ft. and when pumping at 55 gpm. the water level was approximately 275 ft. below the surface.

This well was in service until Sept., '1926. It has been abandoned and is sealed and covered by concrete floor of the treating plant.

Another well, called Cass Ave. Well, was completed in Aug. 1926. It was drilled as a private venture by Layne and Bowler, Chicago, and water was purchased by the village until 1934 when the well was acquired by the village. The well is located about 400 ft. south of Chicago Ave. and 70 ft. west of Cass Ave. (approximately 500 ft. S. and 100 ft. W. of the N. E. corner of Section 9). The elevation of the ground surface is 752± ft.

This well was drilled to a depth of 313 ft. and cased with 16-in.od. pipe to limestone at a depth of 120 ft. and a 15-in. hole to the bottom. The driller's log showed a penetration of 120 ft. of drift formation followed by 190 ft. of limestone and 3 ft. of shale at the bottom.

The non-pumping water level was 100 ft. below the surface and the production was 1000 gpm., on test, when the well was finished. On May 23, 1927, the flow meter showed a production rate of 660 gpm. Pump repairs were made in 1938 and the following installation was made: 118 ft. 10 in. of 12-in. column pipe; 15-in., 8-stage Layne turbine pump, No. 4117, having a rated capacity of 600 gpm. against 205 ft. of head at 1200 rpm.; the overall length of the pump is 6 ft. 2 in.; 20 ft. of 6-in. suction pipe; 50-hp. Fairbanks - Morse electric motor.

On Nov. 12, 1938 the non-pumping water level was 101 ft. below the pump base and the drawdown was 14 in. after 3-hr. pumping at 600 gpm.

Water is pumped directly to the distribution mains and the well has not been in regular service since the water softening plant was put in operation in 1942. The use of the well is limited to emergency operations.

Well No. 3 was drilled for the village to a depth of 302 ft. in 1935 by the Milaeger Drilling Co., Milwaukee, Wis., and located about 35 ft. north of 55th St. and 15 ft. west of Wilmette St. (approximately 70 ft. N. and 1275 ft. E. of the S. W. corner of Section 10). The elevation of the ground surface is 760± ft.

Sample-study log of Well No. 3 furnished by State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Silt and glacial till	85	85
Gravel, clean	30	115
Glacial till	20	135
Silurian system		
Niagaran-Alexandrian dolomite	167	302

The well was cased with 17-in. od. pipe to a depth of 162 1/2 ft. below which the hole was 16-in. diameter to the bottom.

On July 24, 1935, pumping was started at a rate of about 400 gpm. but this rate rapidly decreased to the extent that after 10 min. of pumping the rate was about 35 gpm. During this period the drawdown was 119 ft. from a non-pumping water level 119 1/2 ft. below the surface.

The well casing was then slotted with 38 eight-in. slots between depths of 145 and 159 ft. to admit water from the upper creviced limestone formation.

A production test was made on July 14-15, 1936 by the State Water Survey. After pumping at a uniform rate of 320 gpm. for 24 hr. the drawdown was 28 ft. from a non-pumping water level of 121 1/2 ft. below the pump base.

The existing pump installation, completed on June 5, 1947, is: 160 ft. of 6-in. column pipe;

10-in., 8-stage American Well Works turbine pump, No. 60095, having a rated capacity of 250 gpm. against 280 ft. of head; the overall length of the pump is 6 1/2 ft.; 30 ft. of 6-in. suction pipe; 160 ft. of 1/4-in. copper tubing air line; 25-hp. U. S. electric motor.

On May 26, 1947 the water level was 119 1/2 ft. below the pump base after a 3-day idle period.

On June 6, 1947, after 30-min. pumping at 250 gpm., the water level was 143 ft. below the pump base. After a 25-min. rest period, the non-pumping water level was 122 1/2 ft.

Analysis of a sample (Lab. No. 110,352) collected May 19, 1947 after 5-hr. pumping at 230 gpm. showed this water to have a hardness of 29.2 gr. per gal., a residue of 620 ppm., and an iron content of 1.5 ppm.

All water from the wells is treated for iron removal and softened.

Analysis of a sample (Lab. No. 110,884) collected May 19, 1947 showed the treated water to have a hardness of 1.5 gr. per gal., a total mineral content of 610 ppm., and an iron content of 0.3 ppm.

From Aug. 1, 1944 to Aug. 1, 1945 the metered pumpage averaged 146,500 gpd. which varied from a winter minimum average of 138,000 to a summer maximum average of 154,000 gpd.

LABORATORY NO. 110,352

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.5		Silica	SiO_2	22.6	
Manganese	Mn	0.0		Fluoride	F	0.4	
Calcium	Ca	138.6	6.93	Chloride	Cl	3.0	0.08
Magnesium	Mg	37.3	3.07	Nitrate	NO_3	0.3	Tr.
Ammonium	NH_4	0.8	0.04	Sulfate	SO_4	177.7	3.70
Sodium	Na	27.1	1.18	Alkalinity (as $CaCO_3$)		372.	7.44
Turbidity		30		Hardness (as $CaCO_3$)		500.	10.00
Color		0		Residue		620.	
Odor		0		Free CO_2 (calc.)		59.	
Temperature 51.8° F.				pH = 7.2			

WHEATON
Du Page County
June 24, 1947

Waterworks were originally installed by the city of Wheaton (7389) about 1890.

Water was obtained from 2 wells spaced about 20 ft. apart and located on the plant site at the southwest corner of Liberty Drive and Reber St. (approximately 1.770 ft. N. and 1800 ft. E. of the S. W. corner of Section 16, T. 39 N., R. 10 E.).

Each well was 10 in. in diameter and 175 ft. deep. They penetrated about 110 ft. of drift formation and 65 ft. of limestone. A shaft 5 ft. in diameter and 34 ft. deep was constructed be-t-ween the 2 wells from which connections were made to the wells through tunnels. Two centri-fugal pumps, each of 630 gpm. capacity, were in-stalled in the bottom of the shaft and water was pumped by suction lift. The non-pumping water level in Aug. 1917 was about 26 ft. below a ground surface elevation of approximately 743i ft. The pumping level was 40 ft. lower.

These wells were the source of the entire public supply until 1930. The pumps were re-moved from the shaft, and the north well, called No. 1, was abandoned. The south well, called No. 2 was equipped with a turbine pump having a rated capacity of 900 gpm. which was set at a depth 112 ft. below a base elevation of 748.7 ft.

The existing pump installation made in Jan. 1945 is: 112 ft. of 7-in. column pipe; 10-in., 7-stage Layne turbine pump, No. 5774, having a rated capacity of 900 gpm. against 125 ft. of head; the overall length of the pump is 5 ft. 10 in.; 30 ft. of 6-in. suction pipe; 112 ft. of 1/2-in. air line; 40-hp. U. S. electric motor.

On Oct. 3, 1946, the non-pumping water level when all wells were idle was 47 ft. below the pump base. On May 28, 1947, when Well No. 3 was in operation, the non-pumping water level was 52 ft.

Well No. 3 was drilled in 1930 by Thorpe Bros. Well Co. and located 15 ft. north and 25 ft. west of the northwest corner of Reber St. and Willow Ave. (approximately 1650 ft. N. and 1850 ft. E. of the S. W. corner of Section 16). The elevation of the existing pump base is 739.3 ft. The well was drilled to a depth of 184 ft.

A 38-in. steel casing extends from 3 ft. be-low the ground surface to a depth of about 55 ft. The top of this casing is embedded in the con-crete pump foundation while the bottom overlaps a 24-in. casing which extends between depths of 47 and 57 ft. A 24-in. metal screen (gravel packed) was placed between depths of 57 and 81 ft., and 24-in. blank pipe between depths of 81 and 89 ft. A 20-in. casing extends from a depth of 84 ft. to a seat in the top of the limestone at a depth of 113 1/2 ft. The annular space between the 20-in. and 24-in. pipes was sealed with con-crete between depths of 84 and 89 ft. Below the 20-in. casing the hole was 16 in. in diameter to 167 ft. and 12 in. from 167 ft. to the bottom.

A capacity test was made upon completion of the well on Feb. 26, 1930. When pumping at 1040 gpm. the drawdown was 85 1/2 ft. from a non-pumping water level of 32 ft. below the ground surface.

The existing pump installation, made in 1940, is: 107 1/2 ft. of 10-in. column pipe; 14-in., 5-stage Peerless turbine pump having a rated ca-pacity of 1000 gpm. against 126 ft. of head; the overall length of the pump is 5 ft. 6 in.; 10 ft. of 8-in. suction pipe; 113 ft. of 1/4-in. air line; 50-hp. General Electric motor.

On Oct. 3, 1946 the non-pumping water level was 37 ft. below the pump base when all wells were idle.

Analysis of a sample (Lab. No. 110,473) col-lected May 28, 1947 after 3-hr. pumping at 1040 gpm. showed this water to have a hardness of 19.6 gr. per gal., a residue of 405 ppm., and an iron content of 0.5 ppm. A slight degree of aeration at the reservoir reduces the H_2S content.

Well No. 4 was drilled to a depth of 35b ft. by Layne-Western Co., Chicago, in 1946 and located about 40 ft. south of Liberty Drive and 25 ft. east of Cross St. (approximately 1830 ft. N. and 1700 ft. E. of the S. W. corner of Section 16). The elevation of the temporary pump base is 744.9 ft.

Correlated driller's log of Well No. 4 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil and clay	114	114
Sand, fine	2	116
Silurian system		
Niagaran ~ Alexandrian series		
Limestone	64	180
Ordovician system		
Maquoketa formation		
Limestone	90	270
Limestone, shale breaks	20	290
Limestone	46	336

The well was cased with 18 5/8-in. od. pipe to limestone below which the hole was finished 15 in. in diameter to the bottom.

A production test was made by the State Water Survey on Oct. 31, 1946 between 10 A. M. and 5:45 P. M. During this period the test pump was shut down 3 times for intervals of 3, 45, and 5 min. due to motor trouble, and Wells No. 2 and No. 3 were pumped intermittently. When pumping at rates of 840 to 985 gpm. the drawdown was about 36 1/2 ft. from a non-pumping water level of 43 1/2 ft. below the pump base when Wells No. 2 and No. 3 were non-operative. Interference from Wells No. 2 and No. 3 when each is pumped simultaneously at a rate of 1000 gpm. increased the drawdown in Well No. 4 from 5 to 10 ft.

On May 28, 1947, the well had not been equipped for pumping but the following pumping equipment was on order: 150 ft. of 10-in. column pipe; 12-in.,4-stage Layne turbine pump designed for a rated capacity of 1500 gpm. against 150 ft. of head at 1750 rpm.; 10 ft. of 10-in. suction pipe; 160 ft. of 1/4-in. copper tubing air line; 75-hp. General Electric motor.

The combined metered pumpage from Aug. 1, 1943 to Aug. 1, 1945 averaged 715,400 gpd., which varied from a winter minimum average of 685,000 to a summer maximum average of 851,000 gpd.

LABORATORY NO. 110,473

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.5		Silica	SiO_2	23.8	
Manganese	Mn	0.0		Fluoride	F	0.3	
Calcium	Ca	70.9	3.55	Chloride	Cl	3.0	0.08
Magnesium	Mg	38.5	3.17	Nitrate	NO_3	0.5	0.01
Ammonium	NH_4	0.4	0.02	Sulfate	SO_4	81.9	1.70
Sodium	Na	11.3	0.49	Alkalinity (as $CaCO_3$)		272.	5.44
Turbidity		10-		Hardness (as $CaCO_3$)		336.	6.72
Color		0		Residue		405.	
Odor (at well)		H_2S		Free CO_2 (calc.)		45.	
Temperature 51.5° F.				pH = 7.2			

WHEATON FARMS
Du Page County
June 9, 1947

Wheaton Farms (unincorporated) is an Arthur F. Mcintosh Co. subdivision located about one mile north of Wheaton. A public water supply was installed under the ownership of the Suburban Water Co. Water is furnished to 65 houses.

Water is obtained from a well drilled to a depth of 321 ft. and located about 320 ft. south of Geneva Rd. and 320 ft. east of President St. (or approximately 350 ft. S. and 350 ft. E. of the N. W. corner of Section 10, T. 39 N., R. 10 E.). The ground surface elevation is 770± ft. The well was cased with 6-in. pipe to limestone, below which the hole diameter was 6 in.

The pump installation, made in August 1936, consists of 130 ft. of 3-in. od. column pipe; 6-in., 16-stage Pomona turbine pump, No. N 3356, having an overall length of 80 in., and a rated capacity of 40 gpm. against 180 ft. of head at 1750 rpm.; 100 ft. of 1/4-in. gi. air line; 5-hp. General Electric motor. A new pump, identical with the old, was on hand for replacement in June 1947.

Analysis of a sample (Lab. No. 110,604) collected June 9, 1947 after 3-min. pumping at 40 gpm. showed this water to have a hardness of 21.5 gr. per gal., a residue of 456 ppm., and an iron content of 1.2 ppm.

Pumpage is estimated to average 8000 gpd.

LABORATORY NO. 110,604

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.2		Silica	SiO_2	25.1	
Manganese	Mn	0.0		Fluoride	F	0.3	
Calcium	Ca	82.9	4.14	Chloride	Cl	6.0	0.16
Magnesium	Mg	39.2	3.22	Nitrate	NO_3	2.5	1.25
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	141.3	2.94
Sodium	Na	15.2	0.66	Alkalinity (as $CaCO_3$)		244.	4.88
Turbidity		Tr.		Hardness (as $CaCO_3$)		369.	7.38
Color		0		Residue		456.	
Odor		0		Free CO_2 (calc.)		17.	
Temperature 50.5° F.							

WHEELING
Cook Co'unty
Apr. 20, 1946

A public water supply was placed in service by the village of Wheeling (550) in Mar. 1927.

Water for the public supply is obtained from a well located at the southwest corner of Milwaukee Ave. and Center St. (or approximately 180 ft. S. and 60 ft. E. of the N. W. corner of Section 12, T. 42 N., R. 12 E.). The elevation of the ground surface is 647± ft.

The well was drilled by F. M. Gray, Jr., Chicago, in Dec. 1926, to a depth of 200 ft.

Sample-study log of well drilled in 1926 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay and till	60	60
Silurian system		
Niagaran-Alexandrian dolomites	140	200

It is cased with 12-in. wrought-iron pipe to a depth of 100 ft. below which the bore is 10 in. in diameter. After completion of the well, water was pumped at a rate of 150 gpm. The resultant drawdown was 20 ft. from a non-pumping water level of 15 ft. below the pump base.

The well is still equipped with the same double-acting Luitweiler pump and 10-hp. Fairbanks-Morse electric motor as installed in 1927. The pump has a 6 3/4-in. diameter cylinder placed 80 ft. below the pump house floor and is operated with a 15-in. stroke at 27 rpm., a displacement of 125 gpm. The water is not treated.

Analysis of a sample (Lab. No. 106,248) collected Apr. 19, 1946 at the pump discharge after 6 1/2-hr. pumping at a rate considerably less than original capacity, showed this water to have a hardness of 14.4 gr. per gal., a residue of 460 ppm., and an iron content of 0.1 ppm. A sample collected in 1928 was of similar character but of 9.2 gr. per gal. hardness. A slight odor of hydrogen sulfide was reported at the time of collection of both samples. This quality of water is not unusual for waters from this depth in this vicinity.

LABORATORY NO. 106,248

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	16.0	
Manganese	Mn	Tr.		Fluoride	F	0.5	
Calcium	Ca	44.2	2.21	Chloride	Cl	7.0	.20
Magnesium	Mg	33.2	2.73	Nitrate	NO_3	1.0	.02
Ammonium	NH_4	0.4	.02	Sulfate	SO_4	178.9	3.72
Sodium	Na	63.0	2.74	Alkalinity (as $CaCO_3$)		188.	3.76
Color		0		Hardness (as $CaCO_3$)		247.	4.94
Odor		M		Residue		460.	
Turbidity		0		Temperature 52.7° F.			

WHITE PINES FOREST
STATE PARK
Ogle County
Nov. 21, 1947

White Pines Forest State Park (formerly Ogle County Pine Forest Park) obtains water from 2 wells.

Well No. 1 was drilled in 1930 to a depth of 300 ft. by W. A. Eatinger, Polo, and located on the west side of Pine Creek, about 600 ft. south of the Chicago, Burlington, and Quiney R. R. (or approximately 2500 ft. N. and 1000 ft. E. of the S. W. corner of Section 9, T. 23 N., R. 9 E.). The surface elevation is 740t ft.

Sample-study log of Well No. 1 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil	10	10
Sand and gravel	25	35
Ordovician system		
Galena-Platteville dolomites	140	175
Glenwood shale and some dolomite	40	215
St. Peter sandstone	85	300

The well is cased with 8-in. pipe from the surface to 27 ft. and 6-in. pipe from surface to 175 ft. The hole is 6 in. in diameter from 175 to 300 ft.

The well is equipped as follows: 140 ft. of 3 1/2-in. column pipe; Kewanee Private Utilities cylinder pump, No. 15637, Type H 34 J, having a-10-in. stroke operating at 30 spm.; 10 ft. of 3-in. suction pipe; 2-hp. General Electric motor.

Analysis of a sample (Lab. No. 73520) collected Sept. 19, 1933, showed this water to have a hardness of 19.0 gr. per gal., a residue of 333 ppm., and an iron content of 2.4 ppm.

Pumpage is estimated to average 500 gpd.

Well No. 2 was drilled in 1935 to. a depth of 450 ft. by C. W. Varner, Dubuque, Iowa, and located at the north end of the park club house (or approximately 1900 ft. N. and 2500 ft. W. of the S. E. corner of Section 9).

The hole and casing record are shown in Table 1.

TABLE 1

Hole Record

8-in. from surface to 250 ft.
6-in. from 250 to 450 ft.

Casing Record

6-in. from surface to 250 ft.

The well is equipped as follows: 100 ft. of 3 1/2-in. column pipe; 6-in. 10-stage low capacity Pomona pump, No. SR-605, rated at 50 gpm. against 120 ft. of head; 10 ft. of 3 1/2-in. suction pipe and strainer; 100 ft. of 1/4-in. air line; 3-hp. Westinghouse motor operating at 1760 rpm.

The pump is set in a pit 12 ft. deep.

In 1937, C. W. Varner made a production test and reported that, when pumping at 65 gpm., the drawdown was 7 ft. from a non-pumping level of 80 ft.

Analysis of a sample (Lab. No. 112,652) collected from a service tap near the well on Nov. 21, 1947 after 1-hr. pumping at 65 gpm., showed this water to have a hardness of 14.8 gr. per gal., a residue of 277 ppm., and an iron content of 0.2 ppm.

Pumpage is estimated to average 10,000 gpd.

LABORATORY NO. 112,652

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	17.3	
Manganese	Mn	Tr.		Fluoride	F	0.1	
Calcium	Ca	59.9	3.00	Chloride	Cl	2.0	0.06
Magnesium	Mg	25.3	2.08	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	22.2	0.46
Sodium	Na	9.2	0.40	Alkalinity (as $CaCO_3$)		248.	4.96
Turbidity		Tr.		Hardness (as $CaCO_3$)		254.	5.08
Color		0		Residue		277.	
Odor		Tr.					

WILLIAMSFIELD
Knox County
Apr. 7, 1947

A public water supply was installed by the village of Williamsfield (470) in 1939.

The location of Well No. 1 was determined from an electrical earth resistivity survey made in 1938 by the State Geological Survey. After the survey, 32 auger holes and 4 test wells were bored and drilled in the valley flat and along the allevial terraces on the south side of Spoon River just east of State Highway No. 180. The well was constructed by Sewell Well Co., St. Louis, Mo., in the flood plain of Spoon River, about 1 1/2 mile north of Williamsfield (or approximately 1150 ft. S. and 2750 ft. E. of the N. W. corner of Section 14, T. 11 N., R. 4 E.). The well was dug 10 ft. square to a depth of 19.1 ft.

A concrete slab of 1 ft. thickness was cast with the bottom of the slab at 19.1 ft. below the surface. An 8-in. circular brick wall, 6 ft. in diameter, was built up from the top of the slab to a height of 10.8 ft. The brick was laid without mortar up to 8.1 ft., and the top 2.7 ft. of brick was laid in mortar. The annular space between the brick wall and the excavation was filled with washed gravel to an elevation of 9.5 ft. above the top of the concrete slab, and 1.3 ft. layer of clay was placed on top of the gravel. The elevation of the top of the brick is 587 ft.

The pumping equipment consists of 6-in., 6-stage Pomona LC turbine pump, No. SU 1898; 5-hp. Westinghouse motor rated at 1735 rpm. The pump is evidently set near the bottom of the well, and to be operated at a rate of 13 gpm. It is stated that when pumping at a higher rate, the well is pumped dry.

In July 1939, just after the well was completed but before the permanent pumping equipment had been installed, a production test was made under the supervision of the State Water Survey. Before the test started the water level was 0.75 ft. above the top of the brick wall; and after pumping for 27 1/2 hr. at 15 gpm., the drawdown was 7.55 ft., a specific capacity of 2 gpm. per ft. of drawdown.

On Nov. 21, 1945 it was reported that it was necessary to operate the pump 14 or 15 hr. per day to supply 12,000 gal.

Analysis of a sample (Lab. No. 109,848) collected Apr. 7, 1947, showed this water to have a hardness of 23.2 gr. per gal., a residue of 479 ppm., and an iron content of 0.1 ppm.

Due to insufficiency of the water supply, an electrical earth resistivity survey was made by the State Geological Survey in the immediate vicinity of Williamsfield in Sept. 1945. As a result, Well No. 2 was drilled at the northwest corner of Gale St. and Chicago Ave. (or approximately 2240 ft. N. and 1650 ft. E. of the S. W. corner of Section 23).

The well was drilled by Varner Well Drilling Co., Dubuque, Iowa, in Sept. 1946 to a depth of 887 ft. The elevation of the ground at this location is 710± ft.

The following casing and hole diameter record was reported by the driller: 12-in. id. casing from surface to 98 1/2 ft.;. 8-in. id. casing from surface to 595 ft.; 8-in. open hole from 595 to 887 ft.

The 8-in. casing was cemented in, using 227 sacks.

After completion of the well, a production test was made by the State Water Survey. For test purposes, a turbine pump assembly was used, consisting of: 230 ft. of column pipe; overall length of pump was 9 ft.; 15 ft. of suction pipe.

On Sept. 19, 1946 due to mechanical failure of the gasoline engine, pumping was terminated after 2 hr. at a rate of 165 gpm. Water levels could not be observed during the test because of a break in the air line. On Sept. 21, water was pumped at a rate of 230 gpm. for 5 1/2 hr., and at 315 gpm. for 1 hr. Pumping was again terminated because of mechanical trouble, but during the test, the pump did not break suction. After the pump assembly was removed from the well, the water level on Sept. 24 was measured at 186 1/2 ft. below the top of the casing.

Analysis of a sample (Lab. No. 107,735), collected Sept. 21, 1946 after 5 1/2-hr. pumping at 315 gpm., showed this water to have a hardness of 4.9 gr. per gal., a residue of 1882 ppm., and an iron content of 5.4 ppm. Strong H_2S odor at the well.

Permanent pumping equipment is not yet available for installation in Well No. 2.

A softening unit was installed but had not been in use for 3 months.

Pumpage is estimated at 17,000 gpd.

LABORATORY NO. 109,848

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	19.9	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	100.6	5.03	Chloride	Cl	53.0	1.49
Magnesium	Mg	35.6	2.91	Nitrate	NO_3	46.7	23.35
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	65.2	1.35
Sodium	Na	8.3	.36	Alkalinity	(as $CaCO_3$)	236.	4.72
Turbidity		Tr.		Hardness	(as $CaCO_3$)	398.	7.96
Color		0		Residue		479.	
Odor		0					
Temperature		51.5° F.					

Sample study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Soil, loess, clay and glacial till	35	35
Sand and granule gravel, clayey	5	40
Till	30	70
Sand and granule gravel, silty	11	81
Pennsylvanian system		
Shale, limestone, siltstone and compact sandstone	299	380
Mississippian system		
Burlington chert	4	384
Kinderhook shale	191	575
Devonian system		
Cedar Valley limestone, some dolomite at top	70	645
Wapsipinicon limestone	25	670
Silurian system		
Niagaran dolomite	205	875
Ordovician system		
Maquoketa shale and limestone	12	887

WILLIAMSVILLE
Sangamon County
Aug. 21, 1948

The village of Williamsville (649) installed a public water supply in 1936.

In the search for a suitable source of supply, more than 20 test wells were drilled in 1933 and 1935. In Apr., 1935, the State Geological Survey made an electrical earth resistivity survey in the vicinity of Williamsville.

Test Well No. 8 was located about 2000 ft. S. and 600 ft. W. of the N.E. corner of Section 4, T. 17 N., R. 4 W. The ground surface elevation is 590± ft.

The well was 26 ft. deep, and was equipped with an 8-in. Johnson screen, having No. 40 slot openings.

A production test was made by the State Water Survey on July 8, 1935. The well produced 11.5 gpm. with a drawdown of 8 ft. below the non-pumping water level of 10 ft. below the ground surface.

Analysis of a sample (Lab. No. 76263) collected July 3, 1935, showed the water to have a hardness of 19.2 gr. per gal., a residue of 380 ppm., and an iron content of 4.0 ppm.

Test Well No. 9 (or A9a) was drilled in 1935, and was located about 3 miles northwest of the village (or approximately 300 ft. N. and 2600 ft. E. of the S. W. corner of Section 23, T. 18 N., R. 4 W.). The ground surface elevation is 600± ft.

The test well was 6 in. in diameter and 43 ft. deep. A 6-in., Cook screen having No. 20 slot openings was installed between the depths of 32 and 43 ft.

A production test was made by the State Water Survey on July 26, 1935. The well yielded 17 gpm. with a drawdown of 30 ft. from a non-pumping water level of 4 1/2 ft. below the ground surface.

Analysis of a sample (Lab. No. 76387) collected July 26, 1935, showed the water to have a hardness of 19.8 gr. per gal., a residue of 350 ppm., and a trace of iron.

Test Well No. 13 (or A13) was drilled in 1935 and is located approximately 2320 ft. S. and 1900 ft. E. of the N. W. corner of Section 3, T. 17 N., R. 4 W. The ground surface elevation is 570± ft.

The well was 8 in. in diameter, 28 1/2 ft. deep, and was equipped with an 8-in. Johnson screen, installed between the depths of 19 1/2 and 28 1/2 ft. The screen had No. 40 slot openings.

A production test was made by the State Water Survey on Aug. 24, 1935. The well produced 47 gpm. with a drawdown of 19 ft. from a non-pumping water level of 9 ft. 2 in. below the ground level.

Analysis of a sample (Lab. No. 76529) collected on Aug. 24, 1935, showed the water to have a hardness of 21.2 gr. per gal., a residue of 397 ppm., and an iron content of 3.0 ppm.

The finished municipal well was drilled in 1935 by L. R. Burt, Elwin, and is located 22 ft. north of Test Well No. 13, or 2280 ft. S. and 1970 ft. E. of the N. W. corner of Section 3.

Correlated driller's log of well drilled in 1935 furnished by the State Geological Survey:

Formation	Thickness ft.	Thickness in.	Depth ft.	Depth in.
Pleistocene system				
Soil	18		18	
Sand	10		28	
Sand and gravel	3	6	31	6

The well is 30 ft. 4 in. deep, and is of the gravel-walled type. The 26-in. outer casing extends to a depth of 21 ft., and the 12-in. inner casing extends to 22 ft. Between 22 ft. and 30 ft. 4 in., a 12-in. Cook wire-wound screen is installed. The screen has 3/15-in. slot openings.

A production test was made by the State Water Survey on Oct. 18, 1935. After 8-hr. pumping at 50-57 gpm. the drawdown was 9 ft. from a non-pumping water level of 12 ft. 6 in. below the ground surface.

Pumping equipment consists of 24 ft. of 4-in. column pipe; 7-in. od., 10-stage Fairbanks-Morse turbine pump, No. 29368, rated at 50 gpm. against 50 ft. of head at 1800 rpm.; 17 ft. of 3/8-in. air line; 7 1/2-hp. Fairbanks-Morse electric motor, No. 318050 operating at 1740 rpm. full load.

It was reported in 1938 that the pump was operated about 3 hr. daily at a rate of 40 gpm. On Aug. 16, 1948 the air line altitude gauge read 12 ft. after a 12-hr. non-pumping period. The pump discharge is throttled to about 40 gpm.

Analysis of a sample (Lab. No. 108,197) collected Sept. 26, 1946 after 8-hr. pumping showed the water to have a hardness of 21.2 gr.per gal., a residue of 405 ppm., and an iron content of 0.4 ppm.

Pumpage is estimated to average 15,000 gpd.

LABORATORY NO. 108,197

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.4		Silica	SiO_2	16.9	
Manganese	Mn	0.1		Fluoride	F	0.2	
Calcium	Ca	85.7	4.29	Chloride	Cl	3.0	.08
Magnesium	Mg	36.3	2.98	Sulfate	SO_4	84.3	1.75
Ammonium	NH_4	0.1	.01	Nitrate	NO_3	0.1	Tr.
Sodium	Na	1.6	.07	Alkalinity	(as $CaCO_3$)	276.	5.52
Turbidity		Tr.		Hardness	(as $CaCO_3$)	364.	
Color		0		Residue		405.	
Odor		0					

WILLISVILLE
Perry County
Mar. 11, 1948

The village of Willisville (781) obtains water from a well drilled in 1940 to a depth of 550 ft. by Glen Clark, Fredericktown, Mo., and located near the northwest corner of the intersection of North Park and Williams St., (or approximately 340 ft. S. and 425 ft. E. of the N. W. corner of Section 30, T. 6 S., R. 4 W.). The ground elevation at the well site is 500± ft.

Correlated driller's log of well drilled in 1940 by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay	20	20
Pennsylvanian system		
Shale, limestone, and thin coal beds	65	85
Sand, gray	55	140
Shale, limestone, some sand, and thin coal beds	185	325
Sand, white	105	430
Limestone and shale	50	480
Sand, white	55	535
Sand, white, and shale	5	540
Mississippian system (?)		
Chester series (?)		
Limestone, gray	10	550

A production test was made by the State Water Survey on Mar. 20, 1940. When pumping at a rate of 40 gpm. the drawdown was more than 212 ft. from the non-pumping water level of 130 1/3 ft. below the top of the casing.

Pumping equipment was installed as follows: 330 ft. of 3 1/2-in. column pipe; 6-in., 29-stage Pomona turbine pump No. SW441, 11 ft. 4 5/8-in. overall length and rated at 50 gpm. against 375 ft. of head; 15 ft. of 3 1/2-in. suction pipe; 10-hp. Westinghouse electric motor No. 3439.

In 1946, it was reported that undesirable water was entering the well. This water was believed to be coming from abandoned mine workings close to the well and at a depth of 86 ft. There are 2 abandoned deep wells in close proximity to the well site, one a mine well and the other a railroad well.

The hole and casing record is shown in Table 1.

TABLE 1

Hole Record

11-in. from surface to 23 ft.
10-in. from 23 to 87 ft.
8-in. from 87 to 350 ft.
6-in. from 350 to 490 ft.
4 3/4-in. from 490 to 550 ft.

- Casing Record

10-in. pipe from surface to 23 ft.
8-in. pipe from surface to 83 ft.

In Mar. 1948, pumping periods averaged 10-12 hr. daily and pumping is continuous during summer months.

Analysis of a sample (Lab. No. 87478) collected Mar. 20, 1940, showed the water to have a hardness of 12.1 gr. per gal., a residue of 359 ppm., and an iron content of 1.3 ppm.

Analysis of a sample (Lab. No. 113,696) collected Mar. 4, 1948 after 10-hr. pumping at 25 gpm., showed this water to have a hardness of 10.7 gr. per gal., a residue of 291 ppm., and an iron content of 0.4 ppm.

A chlorinator was installed in 1943, when there were indications of contamination.

Pumpage is estimated to average 14,000 gpd.

LABORATORY NO. 113,696

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.4		Silica	SiO_2	14.3	
Manganese	Mn	Tr.		Fluoride	F	0.1	
Calcium	Ca	52.0	2.60	Chloride	Cl	12.0	0.34
Magnesium	Mg	12.8	1.05	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	0.6	0.03	Sulfate	SO_4	10.1	0.21
Sodium	Na	43.9	1.91	Alkalinity (as $CaCO_3$)		252.	5.04
Turbidity		Tr.		Hardness (as $CaCO_3$)		183.	3.65
Color		0		Residue		291.	
Odor		0		Free CO_2 (calc.)		19.	
Temperature 63° F.				pH = 7.5			

WILMINGTON
Will County
Sept. 19, 1947

The city of Wilmington (1921) installed a public water supply about 1892. It was used principally for sprinkling and fire protection purposes. Water was pumped directly from the Kankakee River. Private wells furnished all residential and business demands until 1918 when the public ground water supply was installed. The water works plant at the river was abandoned.

The initial well supply was obtained from a well, now called Well No. 1, drilled to a depth of 710 ft. by J. W. Hensley & Co. The well is located 104 ft. south of the center line of Jackson St. and 90 ft. west of the center line of Main St. (or approximately 1200 ft. N. and 1400 ft. E. of the S.W. corner of Section 25, T. 33 N., R. 9 E.). The elevation at the ground surface is 545± ft.

The well is reported to be cased with 12-in. pipe from the surface to 21 ft. where it is sealed in place with cement and followed by 189 ft. of 10-in. casing.

The water level when the well was completed was 17 ft. below the ground surface. A production of 250 gpm. was reported when first pumped by air lift.

This well furnished the entire public water supply until 1937 when Well No. 2 was placed in service. Well No. 1 was out of service until 1940 when it was equipped with a turbine pump set at a depth of 200 ft. and having a rated capacity of 300 gpm. During the summer of 1942, it furnished all the water for the public supply.

The following pump installation, made in Mar. 1943, is still in service: 300 ft. of 6-in. od. genuine wi. column pipe; 8-in., 21-stage Pomona turbine pump rated at a capacity of 300 gpm. against a head of 438 ft.; the overall length of the pump is 10 ft. 8 in.; 300 ft. of air line; 30 ft. of 6-in. id. suction pipe; 40-hp. General Electric motor.

A 24-hr. production test was conducted on Mar. 5 and 6, 1943. Water was pumped at an average rate of 310 gpm. Approximate equilibrium was obtained with a drawdown of 122 ft. from a water level of 118 ft. below the pump base. During the test, the pump in Well No. 2, located at a distance of 46 ft., was operated for 1-hr. intervals at 705 gpm., and an additional lowering of not more than 5 ft. in the water level of Well No. 1 was observed.

Analysis of a sample (Lab. No. 95478), collected Mar. 6, 1943 after 24-hr. pumping at a rate of 295 to 315 gpm., showed the water in Well No. 1 to have a. total hardness of 24.6 gr. per gal., a residue of 1183 ppm., and an iron content of 0.2 ppm. The chloride concentration was 170 ppm. after 15-min. pumping and 270 ppm. after 24-hr. pumping.

During 1946 water was pumped only once a week to maintain the equipment for emergency purposes.

Well No. 2 was drilled to a depth of 1566 ft. in 1936 by C. W. Varner, Dubuque, Iowa. The well is located 92 ft. south and 46 ft. west of the intersection of Jackson and Main St. (or approximately 1025 ft. N. and 1375 ft. E. of the S. W. corner of Section 25). The elevation of the surface of the ground is 545± ft.

The well is reported to be cased with 12 1/2-in. diameter pipe from the surface to a depth of 23 ft. and with 10-in. diameter pipe from the surface to a depth of 218 ft., below which the hole is 10 in. in diameter.

At the time of completion of the well, the water level was 59 ft. below the top of the casing; and when pumping at 485 gpm., the water level was lowered 6 1/2 ft. In 1940 the non-pumping water level was 67 ft. below the pump base. By the summer of 1942 the pumping water level was drawn down to the suction opening, which was about 141 ft., and the well was seldom used.

The following pump installation, made in Nov. 1942, is still in service: 300 ft. of 7-in. column pipe; 10-in., 14-stage Peerless turbine pump, No. 16733, rated at a capacity of 550 gpm. against 438 ft. of head; the overall length of the pump is 10 ft.; 300 ft. of air line; 30 ft. of 8-in. suction pipe; 75-hp. General Electric motor.

A production test was made in Nov. 1942. After 24-hr. pumping at an average rate of 800 gpm. the drawdown was 16 ft. from a water level of 124 ft. below the pump base, or a specific capacity of 50 gpm. per ft. of drawdown.

Analysis of a sample (Lab. No. 107,910), collected Oct. 9, 1946 after 1-hr. and 20-min. pumping at 620 gpm., showed the water from Well No. 2 to have a total hardness of 25.6 gr. per gal., a residue of 1188 ppm., and an iron content of 0.1 ppm. This quality is similar to that of a sample collected in 1938 and typical for water from the sandstones in this vicinity.

In 1936 this well was the source of the entire public water supply and also furnished water to 2 Federal Housing Projects having 250 houses each. The average meter pumpage from Aug. 18 to Sept. 20, 1947 was 710,000 gpd. for a population of 3000. The mains in the Federal Housing Projects are in bad repair.

All water for the public supply has been chlorinated since the summer of 1943.

Sample-study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Soil, clay and soft lime shells"	9	9
"Sand and gravel"	11	20
Ordovician system		
Maquoketa formation		
Limestone	70	90
Shale, some limestone	57	147
Galena-Platteville limestone and dolomite	365	512
Glenwood sandstone, partly dolomitic	13	525
St. Peter formation		
Sandstone, incoherent	150	675
Sandstone, shale, chert	7	682
Shakopee dolomite, thin shale bed at top	73	755
New Richmond sandstone, dolomite	13	768
Oneota dolomite, thin beds of sandstone	277	1045
Cambrian system		
Trempealeau dolomite	218	1263
Franconia sandstone, dolomite, thin beds of shale	137	1400
Galesville formation		
Sandstone and dolomite	100	1500
Sandstone, incoherent	35	1535
Sandstone, partly dolomitic	31	1566

LABORATORY NO. 107,910

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.1		Silica	SiO_2	11.9	
Manganese	Mn	Tr.		Fluoride	F	1.2	
Calcium	Ca	110.2	5.51	Chloride	Cl	295.0	8.32
Magnesium	Mg	39.7	3.27	Nitrate	NO_3	0.7	.01
Ammonium	NH_4	1.0	.06	Sulfate	SO_4	322.9	6.72
Sodium	Na	251.4	10.93	Alkalinity (as $CaCO_3$)		236.	472.
Turbidity		0		Hardness (as $CaCO_3$)		439.	478.
Color		0		Residue		1188.	
Odor		0		Free CO_2 (calc.)		25.9	
Temperature		59.5° F.		pH = 7.35			

The city of Winchester (1651) installed a public water supply in 1914.

Several test wells were drilled and tested in the vicinity of Winchester prior to 1913, but little water was obtained. In 1913, a test well was drilled on the Grout farm about 1 mile south of town (or approximately 600 ft. east of the S.W. corner of Section 33, T. 14 N., R. 12 W.). The well was drilled to a depth of 42 ft. below a ground surface elevation of 480t ft.

Correlated driller's log of the Grout farm test well furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay, soils at top and bottom	29	29
Sand and gravel	3	32
Sand with pieces of preserved wood	10	42

The well was 6 in. in diameter and was equipped with a short section of Cook screen. The yield was reported to average 30 gpm. with a drawdown of about 15 ft. from a non-pumping water level of 7 or 8 ft. below the ground surface.

Another test well was constructed on the Perkins farm (approximately 1700 ft. N. and 1800 ft. W. of the S. E. corner of Section 33). This well was a 12-in. by 8-in. gravel-packed well completed at a depth of 28 ft. The yield was reported to average 55 gpm. during 50-hr. pumping with a drawdown of about 13 ft. from a non-pumping water level of 9 ft. below the ground surface.

It was reported that the iron content of the water was about 15 ppm., and no further development work was done in this area.

Water for the public supply is obtained from 3 wells located on the Grout farm near the test well drilled in 1913 (or approximately 550 ft. N. and 650 ft. E. of the S. W. corner of Section 33). The wells are spaced 100 ft. apart in an east-west line, and are numbered from east to west. A house is constructed over each pump with the floor about 4 ft. above ground level and the pump base about 4 ft. above floor level, elevation 488i ft.

The East Well, now called Well No. 1, was constructed in 1923 by C. P. Hudson, Jacksonville. The well is 68 ft. deep from the base of the pump. A 12-ft. length of 8-in. screen was installed in the bottom of the well but proved unsatisfactory and was replaced by a 12-ft. length of Cook screen, having No. 12 slot openings. The original screen was re-installed above the Cook screen.

The pumping equipment consists of: 50 ft. of 5-in. column pipe; 8-in., 4-stage American Well Works turbine pump No. 71462, having 2 ft. 11 3/4-in. overall length and rated at 112 gpm. against 118 ft. of head, operating at 1750 rpm.; 10 ft. of 5-in. suction pipe; 50 ft. of air line; 5-hp. General Electric motor No. 5343221 operating at 1735 rpm.

The well was given an acid treatment by Dowell, Inc., Jan. 6-7, 1948. Due to the poor condition of the pump it was not possible to determine the effect of the treatment.

Analysis of a sample (Lab. No. 82359) collected Nov. 13, 1937 showed the water to have a hardness of 21.1 gr. per gal., a residue of 455 ppm., and an iron content of 10.0 ppm.

Wells No. 2 and No. 3 were drilled in 1914, and were identical in construction, with a 12-in. outer casing and an 8-in. inner casing, each extending from the surface to 49 ft. and with an 8-in. Johnson brass screen installed from 49 to 62 ft. below ground level. A gravel envelope was placed around each screen and sand and clay were tamped in above the gravel pack.

When completed, Well No. 2 was reported to yield 50 gpm. In 1926, sand caused much wear on the cylinder pump. The non-pumping water level was 12 ft. below ground level.

The pumping equipment consists of: 50 ft. of 5-in. column pipe; 8-in., 4-stage American Well Works turbine pump, No. 53786, having an overall length of 2 ft. 11 3/4 in. and rated at 112 gpm. against 98 ft. of head at 1750 rpm.; 50 ft. of air line; 10 ft. of 5-in. suction line; 5-hp. General Electric motor, No. 5343219, operating at 1735 rpm.

In Dec. 1947, it was reported that, when pumping at an average rate of 75 gpm. from Wells No. 1 and 3, the non-pumping water level in No. 2 was 33.0 ft. below the pump base. After a 14-hr. quiet period in the 3 wells, the water level in No. 2 was 22.0 ft. The well was given an acid treatment by Dowell Inc., Jan. 6-7, 1948. It was reported that the capacity was apparently increased.

Well No. 3, or West Well, was reported to have produced 50 gpm. after completion when tested by the engineers. In 1926, the non-pumping water level was reported to be about 12 ft. below the ground surface.

The pumping equipment is identical with that in Well No. 2. including an 8-in., 4-stage American Well Works turbine pump, No. 62445, rated at 50 gpm., against 118 ft. of head at 1750 rpm.; 5-hp. General Electric motor, No. 5343228 operating at 1735 rpm.

The well was treated with acid by Dowell, Inc., on Jan. 6-7, 1948. It was reported that the treatment increased the capacity of the well approximately 50%. It was reported that following acid treatments the combined production of Well No. 2 and 3 was approximately 100 gpm.

Analysis of a sample (Lab. No. 113,118) collected Jan. 7, 1948, showed the water to have a hardness of 23.7 gr. per gal., a residue of 485 ppm., and an iron content of 6.4 ppm.

The 3 pumps are operated simultaneously with the discharge valves on pumps of Wells No. 2 and 3 fully opened and on No. 1 partially closed. The non-pumping levels vary. In dry seasons, pumping cannot be continuous in excess of 3-hr. periods.

Analysis of a sample (Lab. No. 113,693) collected Mar. 5, 1948 showed the water from Well No. 3 to have a hardness of 20.1 gr. per gal., a residue of 367 ppm., and an iron content of 2.9 ppm.

The water is aerated, softened and chlorinated.

Analysis of a sample (Lab. No. 113,694) showed the treated water to have a hardness of 4.2 gr. per gal., a mineral content of 117 ppm., and an iron content of 0.31 ppm.

Pumpage is estimated to average 65,000 gpd.

The city's present source of water supply is limited. Consideration is being given to utilizing White Oak Spring, which has been estimated to yield about 600,000 gpd. The spring is located one mile south of the city wells.

LABORATORY NO. 113,693

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	2.9		Silica	SiO_2	22.6	
Manganese	Mn	0.1		Fluoride	F	0.3	
Calcium	Ca	82.2	4.11	Chloride	Cl	9.0	0.25
Magnesium	Mg	33.9	2.78	Nitrate	NO_3	0.3	Tr.
Ammonium	NH_4	0.9	0.05	Sulfate	SO_4	19.5	0.41
Sodium	Na	8.3	0.36	Alkalinity	(as $CaCO_3$)	332.	6.64
Turbidity		30		Hardness	(as $CaCO_3$)	345.	6.89
Color		0		Residue		367.	
Odor		0					
Temperature		55° F.					

LABORATORY NO. 113,694

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.31		Fluoride	F	0.3	
				Chloride	Cl	9.0	0.25
Turbidity		0		Alkalinity	(as $CaCO_3$)	80.	1.60
Color		0		Hardness	(as $CaCO_3$)	72.	1.44
Odor		0		Total Mineral Content		117.	

WINDSOR
Shelby County
July 5, 1948

The city of Windsor (1005) installed a public water supply in 1935.

Prior to 1935, the city owned two 2-in. wells, each 130t ft. deep. One well has been plugged with concrete but the other is open and can be used. A yield of 5 gpm. was reported.

In 1934 and 1935, an extensive program of test drilling was carried out in the city and vicinity, after an electrical earth resistivity survey was made by the State Geological Survey.

Test Well No. 11 was drilled in 1934 by William Merwin, for James and Shinn, Mattoon, and was located 20 ft. south of the existing 2-in. well near the southeast corner of the intersection of Virginia Ave. and Pine St. (or approximately 1000 ft. N. and 2300 ft. E. of the S. W. corner of Section 36, T. 12 N., R. 5 E.). The ground surface elevation at the site is 708± ft.

The well was 6 in. in diameter, 34 ft. deep, and was reported to have encountered water-bearing sand between the depths of 117 and 134 ft. This formation was screened from 126 to 134 ft. with a 4-in. well point equipped with wire gauze having openings about 1/8-in. square.

A production test was made by the State Water Survey on Dec. 29, 1934. The well produced about 50 gpm. for 2 1/2 hr. with a drawdown of 42.6 ft. from a non-pumping water level of 24 ft. below the ground surface.

A second production test was made by the State Water Survey on Jan. 11, 1935. The 4-in. well point had been replaced by a Johnson screen, having No. 20 slot openings and exposed between the depths of 121 1/2 and 133 ft. The well produced 34.5 gpm. with a drawdown of 84.1 ft. from a non-pumping level of 24 ft.

Test Well No. 11 has been plugged but it is proposed to drill a new well at the site and 12-in. casing has been delivered.

Analysis of a sample (Lab. No. 75,526) collected Dec. 29, 1934, showed the water to have a hardness of 12.2 gr. per gal., a residue of 590 ppm., and an iron content of 3.0 ppm.

Test Well No. 6, the Chambers Well, was located about 1 mile south of the city (approximately 50 ft. S. and 1300 ft. E. of the N. W. corner of Section 12, T. 11 N., R. 5 E.). The ground surface elevation is 705± ft.

Correlated driller's log of Test Well No. 6 furnished by the State Geological Survey:

Formation	Thickness ft.	Thickness in.	Depth ft.	Depth in.
Pleistocene system				
Clay	60		60	
Sand and hardpan	25		85	
Gravel	13	6	98	6
Clay		6	99	

The well was 98.5 ft. deep, and was cased with 6-in. pipe and 9 ft. 8 in. of 6-in. A. D. Cook well screen, having No. 100 slot openings.

A production test was made by the State Water Survey on Feb. 12, 1935. For test purposes, a belt-driven turbine pump was used with the bottom of the suction pipe set at a depth of 96.5 ft. The well produced 91 gpm. with a drawdown of 18.2 ft. from a non-pumping water level of 64.5 ft. below the ground surface.

The permanent village well was drilled in 1934 by W. L. Thorne, Des Plaines, and located at the site of Test Well No. 6. The well was completed at a depth of 100 ft. 10 in. below the pump base, and is of the gravel-walled type. The 26-in. outer casing extends to a depth of 89 ft. 4 in., and the 12-in. inner casing to a depth of 89 ft. A 12-in. Armco-Iron well screen, with 3/16-in. slot openings, is attached to the lower end of the inner casing.

The pumping equipment consists of 89 1/2 ft. of 5-in. column pipe; 7-in., 10-stage Fairbanks-Morse deep-well turbine pump, No. 28310, having an overall length of 6 ft. and rated at 75 gpm.; 3 ft. 6 in. of suction pipe; 96 ft. of 1/4-in. air line; 20-hp. Fairbanks-Morse electric motor.

A production test was made by the State Water Survey on Sept. 11, 1935. The well produced 100 gpm. for 4 3/4 hr. with a drawdown of between 29 and 35 1/2 ft. from a non-pumping water level of 63 1/2 ft. below the pump base.

About 1938, the pump was operated about 1 hr. per day. In Oct. 1947, the non-pumping water level was 80 ft. after a 12-hr. quiet period, and recently the water level was reported to be 10 ft. above the bottom of the air line. On June 29, 1948, after 9-hr. pumping at an estimated rate of 45 gpm. the pumping water level was below the bottom of the air line.

Analysis of a sample (Lab. No. 115,143) col-

lected June 29, 1948 after 10-hr. pumping, showed the water to have a hardness of 19.3 gr.per gal., a residue of 573 ppm., and an iron content of 5.4 ppm. Methane gas is present in the water in a concentration of 7.5 cu. ft. per 1000 gal.

The water is aerated, filtered and chlorinated.

Pumpage is estimated to average 36,000 gpd.

LABORATORY NO. 115,143

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	5.4		Silica	SiO_2	28.7	
Manganese	Mn	0.0		Fluoride	F	0.2	
Calcium	Ca	71.7	3.59	Chloride	Cl	3.0	0.08
Magnesium	Mg	36.7	3.02	Nitrate	NO_3	0.2	Tr.
Ammonium	NH_4	13.4	0.75	Sulfate	SO_4	0.0	0.00
Sodium	Na	90.2	3.92	Alkalinity	(as $CaCO_3$)	560.	11.20
Turbidity		40		Hardness	(as $CaCO_3$)	331.	6.61
Color		40		Residue		573.	
Odor		0		Free CO_2 (calc.)		177.	
Temperature 55.7° F.				pH = 6.9			

WINFIELD
Du Page County
June 25, 1947

A public water supply was installed by the village of Winfield (567) in 1927.

Water is obtained from a well drilled to a depth of 200 ft. by John Diebold, West Chicago, in 1926 and located about 25 ft. south of Franklin St. and 500 ft. west of Main St. (approximately 180 ft. S. and 1450 ft. E. of the N. W. corner of Section 13, T. 39. N., R. 9 E.). The elevation of the ground surface is 720± ft. The well was cased with 8-in. pipe from the surface to a depth of 78 ft. below which the hole was finished 8 in. in diameter to the bottom. A non-pumping water level of 6 ft. below the surface was reported on June 12, 1939.

The following pump installation is in service: a Kewanee triplex suction pump, Type 75 N, No. 13372, having 3-in. plungers and 16-in. stroke, is belt driven by a 7 1/2-hp. Howell electric motor. The pump when operated at a speed of 50 spm. has a theoretical displacement of 75 gpm.

In Oct., 1945, the non-pumping water level was reported to be 8 ft. below the pump base after a 1-hr. idle period. When pumping at the rated capacity there was no appreciable drawdown.

Analysis of a sample (Lab. No. 110,476) collected May 29, 1947 after 15-min. pumping at 75 gpm. showed this water to have a hardness of 35.6 gr. per gal., a residue of 755 ppm., and an iron content of 1.2 ppm.

The water has been chlorinated since Oct. 8, 1944.

The average pumpage during the past year was 23,800 gpd.

LABORATORY NO. 110,476

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.2		Silica	SiO_2	22.8	
Manganese	Mn	Tr.		Fluoride	F	0.2	
Calcium	Ca	130.3	6.52	Chloride	Cl	24.0	0.68
Magnesium	Mg	69.2	5.68	Nitrate	NO_3	0.4	0.01
Ammonium	NH_4	0.3	0.02	Sulfate	SO_4	250.5	5.21
Sodium	Na	18.4	0.80	Alkalinity	(as $CaCO_3$)	356.	7.12
Turbidity		20±		Hardness	(as $CaCO_3$)	610.	12.20
Color		0		Residue		755.	
Odor		0		Free CO_2	(calc.)	152.	
Temperature		50.7° F.		pH = 6.7			

WINSLOW
Stephenson County
Nov. 12, 1947

The village of Winslow (379) installed a public water supply in 1916.

Water was originally obtained from a well drilled in 1916 to a depth of 200 ft. and located in an abandoned quarry near the center of the village on a hillside near Indian Creek.

The hole and casing record is shown in Table 1.

TABLE 1

Hole Record

10-in. from surface through limestone at about 40 ft.
8-in. to bottom at 200 ft.

Casing Record

8-in. casing from surface through limestone at about 40 ft.
Cement poured around outside of casing.

On May 10, 1917 after 2-hr. pumping, the drawdown was 2 ft. from a non-pumping water level of 16 ft.

Analysis of a sample (Lab. No. 40031) collected Aug. 22, 1918 showed water from this well to have a hardness of 17.3 gr. per gal., a residue of 315 ppm., and no iron content.

After an unsuccessful attempt was made to concrete grout around the outside of the casing to seal off surface water, the well was capped and abandoned.

Anew well was completed to a depth of 355 ft. for the village in Nov. 1927by P.E. Millis, Byron and located about 20 ft. northwest from the old well (or approximately 1250 ft. N. and 950 ft. W. of the S. E. corner of Section 22, T. 29 N., R. 6 E.). It is approximately 30 ft. north of Hubbard St. and 330 ft. west of Highway No. 73, Sewall St. The ground surface elevation at the well-site is 780± ft.

Concrete was poured into the annular space outside the 12-in. casing.

Water is pumped by a single-acting Gould triplex pump, which formerly pumped water from the old well. The pump is connected to the well by means of a 4-in. suction line running out through the side of the pump house. Power is furnished by a 10-hp. Howell motor.

Correlated driller's log of well completed in 1927 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Ordovician system		
Platteville formation		
Limestone	65	65
St. Peter formation		
Sandstone	65	130
Limestone shell	2	132
Sandstone	108	240
Sandstone, shale and limestone (probably chert)	59	299
Oneota formation		
Limestone	46	345
Sandstone, water	3	348
Limestone crevices, water flowing strong	7	355

The hole and casing record is shown in Table 2.

TABLE 2

Hole Record

16-in. from surface to 100 ft.
12-in. from 100 to 288 ft.
10-in. from 288 to 355 ft.

Casing and Liner Record

12-in. steel casing from surface to 100 ft.
10-in. steel liner from 225 to 288 ft. through caving formations

When completed in 1927 the free flow was about 500 gpm. In 1935, the free flow was 420 gpm. Pumping was at a rate of 200 gpm.

In Nov. 1947 the well overflowed into the nearby creek and when the pump was operating, the overflow was reduced to about one half. When the pump was not operating, the overflow was estimated to be 444 gpm. which, local officials stated, was stronger than in 1934-1936.

Analysis of a sample (Lab. No. 112,584) collected Nov. 12, 1947 after 3-hr. pumping at 200 gpm., showed this water to have a hardness of 18.5 gr. per gal., a residue of 311 ppm., and an iron content of 0.1 ppm.

The water is not treated. Pumpage is 20,000 gpd.

LABORATORY NO. 112,584

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	15.3	
Manganese	Mn	0.0		Fluoride	F	00.1	
Calcium	Ca	61.2	3.06	Chloride	Cl	2.0	0.06
Magnesium	Mg	40.0	3.29	Nitrate	NO_3	Tr.	Tr.
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	15.0	0.31
Sodium	Na	2.3	0.10	Alkalinity (as $CaCO_3$)		304.	6.08
Turbidity		Tr.		Hardness (as $CaCO_3$)		318.	6.35
Color		0		Residue		311.	
Odor (at well)		H_2S		Temperature 52.4° F.			

A public water supply was installed by the village of Winthrop Harbor (785) in 1908.

The initial supply was obtained from a well drilled about 1908 to a depth of 200 ft. and cased to rock with 3-in. diameter pipe. The well flowed when it was drilled. The depth to water below the floor level was 12 ft. in 1912 and 22 ft. in 1922. This well was abandoned as a source of supply shortly after another well was drilled 19 ft. west.

The second well, now called Well No. 1, and drilled in 1912, is located about 120 ft. north of Main St. and 150 ft. west of Sheridan Road (or approximately 1135 ft. S. and 480 ft. E. of the N. W. corner of Section 10, T. 46 N., R. 12 E.). The elevation of the ground surface is 640i ft. The well is 159 ft. deep and cased with 6-in. pipe to a depth of 90 ft. where rock was encountered.

In 1922, the well was equipped with a plunger pump having a displacement of 37 gpm. A test was made on Nov. 17, 1922 to determine the effect of pumping in the 6-in. well on the water level in the 3-in. abandoned well. Pumping from this well, after the pump had been idle for an hr. lowered the water level in the abandoned well 14 1/2 ft. in 1 hr. and 15 1/2 ft. in 2 hr. to a depth of 38 ft. below the floor level. The pump was then stopped, and the water level recovered 13 ft. in 10 min. and 15 1/2 ft. in 40 min. when it was at a depth of 22 1/2 ft., the same as at the beginning of the test. This well is still in service and is equipped with a Johnston turbine pump, Serial No. 7417, and a 5-hp. United States electric motor.

During the summer of 1946, water was pumped every other day for a period of 24 hr. It was pumped directly into the distribution system against a pressure of 45 psi. at an estimated discharge rate of 40 gpm., averaging 28,800 gpd.

Analysis of a sample (Lab. No. 107,585), collected on Sept. 4, 1946 after 5-hr. pumping at an estimated rate of 40 gpm., showed the water to have a total hardness of 5.5 gr. per gal., a residue of 262 ppm., and an iron content of 0.2 ppm. The pump was delivering considerable intrained air.

A third well, now called Well No. 2, was drilled to a depth of 957 ft. by W. L. Thorne, Des Plaines, and completed Sept. 22, 1926. It is located about 1500 ft. S. and 250 ft. W. of the N. E. corner of Section 9). The elevation of the ground surface is 650± ft.

The hole and casing record shown in Table 1 was furnished by the driller.

TABLE 1

Hole Record

12-in. from surface to 632 ft.
10-in. from 632 to 952 ft.

Casing Record

12-in. from surface to 152 ft. 10 in.
10-in. liner from 278 to 632 ft.

Some water was found in the limestone, but the sandstone was tight and hard with not much water. When the well was completed, the water level was 39 ft. below the surface; and when pumped at a rate of 75 gpm., the water level was lowered to a depth of 225 ft. below the surface.

The well was equipped with a Keystone Driller Co. double-acting plunger pump having a 7 3/4-in. diameter cylinder and 18-in. stroke set at a depth of 250 ft. Later the cylinder was set at 300 ft.

By the summer of 1944, the well could not be pumped for a longer period than 2 hr. without running dry. It was then operated as an emergency well. In Apr. 1946, a new pump installation was made consisting of a Peerless Hi-Lift SerialNo. 33041, having a 2 1/2-in. od. discharge pipe and powered by a 3-hp. U.S. electric motor.

A sample (Lab. No. 107,586) was collected after 78 1/2 hr. of pumping at a rate of 20 gpm. *A* temperature of 51.2 F. and a pH of 7.5 were observed.

The fourth well, now called Well No. 3, was drilled to a depth of 1015 ft. by W. J. Fulton Engineering Co., Waukegan, in 1943. It is located about 160 ft. north of Main St. and 275 ft. east of Sheridan Road (or approximately 1100 ft. S. and 900 ft. E. of the N. W. corner of Section 10). The elevation of the ground surface is 630± ft.

When the well was completed, water was pumped for a period of 8 hr. at a rate of 60 gpm. The drawdown was 174 ft. below a non-pumping water level of 36 ft. below the pump base.

The well is equipped with the following pump installation: 3 1/2-in. od. discharge pipe; Johnston turbine pump, Serial No. 873 7; 15-hp. U. S. electric motor.

Correlated driller's log of Well No. 3 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Drift	116	116
Silurian system		
Niagaran-Alexandrian series		
Limestone	244	360
Ordovician system		
Maquoketa, Galena-Platteville and Glenwood formations		
Shale and limestone	570	930
St. Peter formation		
Sandstone	85	1015

Analysis of a sample (Lab. No. 107,587), collected on Sept. 5, 1946 after 22 1/2-hr. pumping at an estimated rate of 60 gpm., showed this water to have a total hardness of 14.8 gr. per gal., a residue of 439 ppm., and an iron content of 0.8 ppm.

The hole and casing record is as shown in Table 2.

TABLE 2

Hole Record

8-in. from surface to 680 ft.
6-in. from 680 to 1015 ft.

Casing Record

8-in. steel pipe from surface to 118 ft.
6-in. liner from 365 to 680 ft.

During the summer of 1946, a total of 225 services were supplied with water, and the combined estimated pumpage averaged 60,000 gpd. Pumping operations were as follows: In Well No. 1 continuously; Well No. 2 every other day for 24 hr.; and Well No. 3 served as an auxiliary supply unit to build up pressure when the other 2 pumps were unable to supply the demand.

LABORATORY NO. 107,585

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	20.4	
Manganese	Mn	0.0		Fluoride	F	0.9	
Calcium	Ca	23.1	1.16	Chloride	Cl	7.0	0.20
Magnesium	Mg	9.0	0.74	Nitrate	NO_3	2.3	0.04
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	56.4	1.17
Sodium	Na	54.7	2.38	Alkalinity	(as $CaCO_3$)	144.	2.88
Turbidity		0		Hardness	(as $CaCO_3$)	95.	1.90
Color		0		Residue		262.	
Odor		0		Free CO_2 (calc.)		38	
Temperature 51.7° F.				pH = 7.5			

WITT
Montgomery County
Aug. 5, 1948

A public water supply was installed by the city of Witt (1490) in 1921.

In 1918, six test wells were drilled by Geo. Welter, Towanda, and located in the bottom land along East Fork of Shoal Creek, about 1/2 mi. north and one mi. east of the New York Central R. R. crossing in the city. A production test was made in Test Well No. 6, on May 31, 1918. The well was 6 in. in diameter and 39 ft. deep. Before the test the static water level was 6 ft. below ground level and after 5-days pumping at 70 gpm. the drawdown was 8 ft. Two observation wells were located 9 and 20 ft. from the test well and, while pumping in the test well, the water levels were 8 ft. and 7 ft. 3 in. respectively.

In 1921, two wells were drilled at the location of Test Well No. 6, about 400 ft. N. and 530 ft. E. of the S. W. corner of Section 33, T. 10 N., R. 2 W. The wells are 18 ft. apart, under the pumping station, which is a cylindrical concrete structure 25 ft. in diameter and 10 ft. deep, with the well extending 10 ft. above a ground level elevation of 650± ft.

The wells were drilled 39 ft. deep and were cased with 10-in. pipe to 20 ft., below which was placed a 15-ft. screen. Water is pumped at a rate of 200 gpm. by either of 2 Dayton-Dick Co. centrifugal pumps, each run by a 30-hp. Century motor.

Analysis of a sample (Lab. No. 115,293) collected July 16, 1948 after 30-min. pumping at 200 gpm. showed this water to have a hardness of 14.9 gr. per gal., a residue of 388 ppm., and an iron content of 5.3 ppm.

Pumpage is estimated to average 18,000 gpd.

LABORATORY NO. 115,293

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	5.3		Silica	SiO_2	25.9	
Manganese	Mn	0.2		Fluoride	F	0.2	
Calcium	Ca	69.3	3.47	Chloride	Cl	15.0	0.42
Magnesium	Mg	20.0	1.64	Nitrate	NO_3	Tr.	Tr.
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	60.7	1.26
Sodium	Na	44.2	1.92	Alkalinity	(as $CaCO_3$)	268.	5.36
Turbidity		10		Hardness	(as $CaCO_3$)	256.	5.11
Color		0		Residue		388.	
Odor		Tr.		Free CO_2	(calc.)	60.	
Temperature 55° F.				pH = 7.05			

WOODHULL
Henry County
Feb. 25, 1948

A water supply was installed by the village of Woodhull (638) in 1902.

At that time a well was drilled south of the Chicago, Burlington & Quincy R. R. tracks and on the east side of Division St. (or approximately 1235 ft. S. and 2285 ft. E. of the N. W. corner of Section 30, T. 14 N., R. 2 E.). The well was drilled by J. P. Miller Artesian Well Co., Brookfield, to a depth of 1394 ft. below a ground surface elevation of 821± ft. The diameters of the bore hole were 12 in. to a depth of 150 ft.; 8 in. from 150 to 400 ft.; and 6-in. from 400 ft. to the bottom of the well.

The well was cased with 10-in. pipe to a depth of 183 ft. and with 250 ft. of 6 1/4-in. pipe with the bottom at a depth of 531 ft. The well is equipped with a John H. McGowan deep-well pump; and in June 1943 it was reported that the cylinder setting was at 281 ft. below the ground surface.

In 1903 the non-pumping water level was 120 ft. below the ground surface. In Dec. 1946 the pump was being removed for repairs or replacement.

Analysis of a sample (Lab. No. 35467) collected Oct. 9, 1916, showed this water to have a hardness of 9.8 gr. per gal., a mineral content of 928 ppm., and an iron content of 0.6 ppm.

Well No. 2 was drilled in 1925 by the J. P. Miller Artesian Well Co. It is located 33 ft. north of the old well and is 1369 ft. deep.

The well is cased with 10-in. pipe to a depth of 159 1/2 ft., and with 8-in. pipe from 156 1/2 ft. to 609 ft. Below the 8-in. casing the bore hole is 8 in. in diameter. A layer of coal was reported between 260 and 263 ft.

The well is equipped with an American Well Works double-acting cylinder pump with 24-in. stroke and rated at 100 gpm.; the 5 3/4-in. diameter cylinder is attached to 360 ft. of 6-in. drop pipe. The cylinder has been lowered 53 ft. since its original setting. Power is furnished by a 15-hp. electric motor.

In Nov. 1926 the non-pumping water level was reported to be 248 ft. below the surface, and in June 1943 it was reported to be about 300 ft.

Analysis of a sample (Lab. No. 108,504) showed the water from Well No. 2 to have a hardness of 9.0 gr. per gal., a residue of 895 ppm., and an iron content of 0.6 ppm.

Pumpage is estimated to average 15,000 gal. per day.

Sample-study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Glacial drift	100	100
Pennsylvanian system		
Shale, some sandstone and coal	270	370
Mississippian system		
Kinderhook shale	30	400
Devonian system		
Cedar Valley limestone, dolomite at top	85	485
Wapsipinicon limestone	40	525
Silurian system		
Niagaran - Alexandrian dolomites	225	750
Ordovician system		
Maquoketa shale, some dolomite	215	965
Galena-Platteville dolomites	303	1268
St. Peter sandstone	101	1369

LABORATORY NO. 108,504

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	.6		Silica	SiO_2	11.9	
Manganese	Mn	0.0		Fluoride	F	2.6	
Calcium	Ca	35.5	1.78	Chloride	Cl	144.0	4.06
Magnesium	Mg	16.1	1.32	Nitrate	NO_3	1.1	.02
Ammonium	NH_4	1.4	.08	Sulfate	SO_4	235.9	4.91
Sodium	Na	268.0	11.65	Alkalinity	(as $CaCO_3$)	292.	5.84
Color		0		Hardness	(as $CaCO_3$)	155.	2.10
Odor		0		Residue		895.	
Turbidity		20					
Temperature		60.5° F.					

WOODLAND
Iroquois County
Nov. 19, 1948

A public water supply was installed in 1904 by the village of Woodland (334).

At that time a well was drilled to a depth of about 130 ft. and cased with 6-in. pipe. The supply from this well was very small in 1939 and the old triplex suction pump was worn out. The well was plugged and abandoned.

In 1939, Well No. 2 was drilled to a depth of 107 ft. by John Bolliger and Sons, Fairbury, and located 16 ft. south of the old well, on the north side of Main St., 150 ft. east of the Chicago and Eastern Illinois R. R. (or approximately 50 ft. N. and 1000 ft. W. of the S. E. corner of Section 20, T. 26 N., R. 12 W.). The ground elevation is 645± ft.

The well was cased with 6-in. pipe to 97 ft. and with 10 ft. of Cook screen.

On June 6, 1939, the non-pumping water level was 20 ft. below the surface and when pumping at an estimated rate of 160 gpm. the drawdown was 25 1/2 ft.

Well No. 2 was abandoned after Well No. 4 was placed in service. The Pomona turbine was removed and installed in Well No. 4. The productive capacity of Well No. 2 declined. The well was given an acid treatment and the capacity increased for several months after which it diminished to such an extent that, while pumping, water was discharged for 3-minute periods. When the screen was removed, it was in good condition, and very little sand was found in the bottom of the well.

Analysis of a sample (Lab. No. 85768) collected June 6, 1939 showed this water to have a hardness of 21.7 gr. per gal., a residue of 488 ppm., and an iron content of 0.8 ppm.

Wells No. 3 and 4 were drilled in 1945 by John Bolliger.

Well No. 3 was located 3 ft. north of Well No. 2. Drilling was stopped at a depth of 118 ft. when a boulder was encountered. The production rate was 40 gpm. The 6-in. casing was removed to Well No. 4.

Well No. 4 was drilled to a depth of 122 ft. and located about 2 blocks south of Well No. 2 or 20 ft. south of Mill St. and 75 ft. east of the Chicago and Eastern Illinois R. R. right-of-way (approximately 800 ft. S. and 1000 ft. W. of the N. E. corner of Section 29)1

Well No. 4 was cased with 10-in. pipe and 6 ft. of 8-in. Johnson screen, having No. 50 slot openings. The bottom of the screen was set at 122 ft. When the well was completed, the static water level was within one ft. of the ground surface elevation of 645t ft. The driller reported pumping for 3 hr. at a rate of 250 gpm.

The pumping equipment consists of 60 ft. of 4 1/2-in. column pipe; 6-in., 16-stage Pomona turbine pump, No. S. U. 230, having an overall length of 6 ft. 3 in. and rated at 100 gpm. against 140 ft. of head; 10 ft. of 4 1/2-in. suction pipe; no air line; 5-hp., 1735 rpm. Westinghouse electric motor No. 6139.

The pump discharge has been decreasing gradually since Apr. 1948 making it necessary to operate the pump the greater part of each day. Some sand is now discharged. Some suppositions are: (a) worn impeller blades or holes in column pipe; (b) sand clogging as in Well No. 2.

Analysis of a sample (Lab. No. 116,472) collected Nov. 15, 1948 showed this water to have a hardness of 23.3 gr. per gal., a residue of 498 ppm., and an iron content of 0.5 ppm.

Pumpage is estimated to average 9000 gpd.

LABORATORY NO. 116,472

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.5		Silica	SiO_2	19.9	
Manganese	Mn	Tr.		Fluoride	F	0.3	
Calcium	Ca	96.8	4.84	Chloride	Cl	10.0	0.28
Magnesium	Mg	38.2	3.14	Nitrate	NO_3	2.1	0.03
Ammonium	NH_4	7.9	0.44	Sulfate	SO_4	33.7	0.70
Sodium	Na	39.3	1.71	Alkalinity	(as $CaCO_3$)	456.	9.12
Turbidity		3		Hardness	(as $CaCO_3$)	399.	7.98
Color		0		Residue		498.	
Odor		0		pH = 7.5			

A public water supply was installed in 1912 by the city of Wood River (8197). The city constructed the distribution system and purchased water from the Standard Oil Co.

In 1912, the Standard Oil Co. operated fifteen 12-in. tubular wells drilled to depths of 90 to 95 ft., and penetrating about 65 ft. of water-bearing sand and gravel at the bottom. The wells were spaced 35 to 100 ft. apart and each well was fitted with a 20-ft. length of Johnson strainer at the bottom. In 1912, the non-pumping water level was 26 ft. below a ground level of 430t ft. Pumping was not required at full capacity. When pumping at about 370 gpm. (or 8 mgd.) the drawdown was about 11 ft.

In 1916 all of the old wells had been abandoned and water was being obtained from nine 16-in. wells, from 110 to 140 ft. in depth. The yield of each well was reported to be about one mgd. The non-pumping water level was 26 ft. below ground level and the pumping level about 40 ft.

Nearly all wells in use in 1918 were 20 in. in diameter and about 110 ft. deep. During a test one well was reported to yield 2100 gpm. The total production, at that time, was estimated at 25 mgd.

In 1923, about one-half of the water supply was obtained from thirteen 24-in. wells, each one about 112 ft. deep and each well fitted with a 30-ft. length of 18-in. Johnson screen having No. 30 slot openings.

Due to clogging of screens the life of the wells had averaged about 4 years, after which the yield was practically nil.

The balance of the water supply, in 1923, was obtained from the Mississippi River. It was reported that about 8 mgd. was obtained from wells and 12 mgd. from the river. Water level in the wells was 35 ft. below ground level, three hours after pumping had stopped.

Analysis of a sample (Lab. No. 49979) collected from the well supply Aug. 22, 1923, showed the water to have a hardness of 15.0 gr.per gal., a mineral content of 362 ppm., and an iron content of 0.4 ppm.

In 1930, the city of Wood River discontinued the practice of buying water and Wells No. 1 and 2 were constructed for the city by Thorpe Concrete Well Co., Alton, and located at the waterworks plant site on the east side of Fourteenth St. between Madison and Ferguson St.

Well No. 1, located on the westerly or Fourteenth St. side of the property, was 109.7 ft. deep and cased with 26-in. id. concrete pipe, with 76.2 ft. of porous concrete pipe strainer at the bottom. Well No. 1 has been abandoned.

Well No. 2 was located 60 ft. north of Well No. 1, (or approximately 800 ft. S. and 300 ft. E. of the N. W. corner of Section 26, T. 5 N., R. 9 W.).

Sample-study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Thickness in.	Depth ft.	Depth in.
Pleistocene system				
Sand, clayey	7		7	
Sand	41		48	
Silt	2	6	50	6
Sand and gravel	13		63	6
Sand	6		69	6
Sand, some clay	5	6	75	
Sand	28	6	103	6

Well No. 2 was cased with 26-in. id. concrete pipe, with 75 ft. of porous concrete pipe strainer at the bottom. On Jan. 12, 1934, the non-pumping water level was 36 ft. 2 in. below the top of the well and after 4-hr. pumping at 1000 gpm. the drawdown was 9 ft. Well No. 2 was abandoned in 1937.

Wells No. 3 and 4 were constructed in 1937 by Thorpe and located along the Madison St. side of the waterworks property, with Well No. 3, 150 ft. east of Well No. 4. Each well was 113 1/2 ft. deep and was cased with 26-in. id. concrete pipe with 73 1/2 ft. of porous concrete pipe strainer at the bottom. On June 23, 1937, the non-pumping water level was 40 ft. below ground level elevation 438± ft. Well No. 3 has been abandoned and Well No. 4 is maintained for emergency but is seldom used.

Subsequently Wells 5, 6, 7 and 8 were drilled along the south and west sides of the property by Thorpe Well Co., Alton. The well depths ranged from 110 to 114 ft. and the casings were 26-in. id. concrete pipe. Wells No. 5 to 8 inclusive have been abandoned.

Wells No. 4, 9, 10, 12 and 13 now furnish the public supply.

Well No. 9 was drilled to a depth of about 112

ft. by Thorpe and was cased with 26-in. id. concrete pipe with porous concrete pipe strainers. The pumping equipment consists of 90 ft. of 5-in. column pipe; 6-in., 8-stage Pomona turbine pump; 10 ft. of 5-in. suction pipe; 20-hp., 1760 rpm. General Electric motor, No. 5448170.

The pump discharge rate is 185 gpm., and the drawdown is 23 ft.

Well No. 10 was drilled in 1943 to a depth of 116 ft. by H. L. Watson, East St. Louis, and located near the southeast corner of the property, or 30 ft. north and 270 ft. east of the intersection of Fourteenth and Madison St. The well was cased with 12-in. id. pipe from 1 1/2 ft. above to 77 ft. below ground level, and with 40 ft. of 11 1/4-in. od. Johnson Armco-iron wire-wound screen to the bottom. The screen had No. 14-25 slot openings.

On Apr. 7-8, 1943, a production test was made by the State Water Survey. Before the test, the static water level was 49.0 ft. below the top of the casing, and after 1-hr. pumping at 570 gpm. the drawdown was 9.0 ft. After a 1-hr. shutdown, the water level returned to within 1 ft. of the starting level, and then after 5 1/2-hr. pumping at 730 gpm. the drawdown was 12.0 ft. Observations of water levels in wells 4, 8 and 9 revealed that interference between wells, while measurable, was not large enough to affect the pumping capacity of any well at the time.

The pump assembly, installed in 1943, consists of 70 ft. of 7 1/4-in. id. column pipe; 8-in., 7-stage Pomona turbine pump, No. N-2014, rated at 800 gpm. at 100 ft. of head; the overall length of the pump is 5.0 ft.; 25 ft. of 6-in. suction pipe; 94.1 ft. of 1/4-in. air line; 40-hp., 1760 rpm. Westinghouse electric motor.

Well No. 10 has been given acid treatment with results reported to be satisfactory.

Analysis of a sample (Lab. No. 116,712) collected Dec. 10, 1948 showed the water to have a hardness of 14.3" gr. per gal., a residue of 304 ppm., and an iron content of 0.4 ppm.

All water is chlorinated but not otherwise treated.

Well No. 11 was completed in Apr. 1943 to a depth of 111 1/2 ft. by H. L. Watson, and located 80 ft. north of Well No. 10. The well was cased with 12-in. id. pipe from 1 1/2 ft. above to 82 1/2 ft. below ground level, and with 30 ft. of 11 1/4-in. od. Cook Armco-iron wire-wound screen, having No. 20-25 slot openings.

On Apr. 28, 1943, a production test was made by the State Water Survey. Before the test the water level was 47.7 ft. below the top of the casing and after 8-hr. pumping at 402 gpm. the drawdown was 6.0 ft. Two hours after the shutdown, the water level returned to the starting level. Water level observations made in Wells 4,8, 9 and 10 indicated that interference between wells was not significant at normal pumping rates.

The pumping equipment in Well No. 11, installed in 1943, consisted of 90 ft. of 6-in. column pipe; 6-in. 12-stage Pomona turbine pump, No. 581694, rated at 250 gpm., the overall length of the pump is 6.75 ft., 89.7 ft. of 1/4-in. air line; 20-hp. 1760 rpm. electric motor.

Analysis of a sample (Lab. No. 96026) collected Apr. 28, 1943 showed this water to have a hardness of 17.1 gr. per gal., a residue of 350 ppm., and an iron content of 0.8 ppm.

Well No. 11 became clogged with iron deposit and an acid treatment was given at the same time as Well No. 10. The result was not satisfactory and Well No. 11 has been abandoned.

Well No. 12 was drilled in 1945 to a depth of 114 ft. by H. L. Watson and located on the east side of Fourteenth St. in the northwest corner of the water works property. The well was cased with 12-in. id. pipe with 34 ft. of 12-in. id. Johnson screen. The top 8 ft. of the screen has No. 20 slot openings; the next 12 ft. has No. 50 slots and the lower 14 ft. has No. 16 slots. When the well was completed, the static water level was 37 ft. below ground level.

The pumping equipment consists of 85 ft. of 6-in. column pipe; 10-in., 7-stage Pomona turbine pump, rated at 500 gpm; about two feet of suction pipe with strainer; 10-hp. 1800 rpm., U. S. electric motor, No. 416169.

Well No. 13 was drilled in 1947 to a depth of 111 ft. 8 in. by H. L. Watson and located 300 ft. east of Well No. 10. The well was cased with 16-in. pipe with 37 ft. 1 in. of Johnson screen having No. 20 slot openings.

The pumping equipment consists of 90 ft. of 8-in. column pipe; 12-in., 6-stage Fairbanks-Morse turbine pump, No. SH 143, rated at 800 gpm.; 10 ft. of 6rin. suction pipe; 75-hp., 1765

rpm. General Electric motor, No. VD 6710440.

When the well was completed, it was reported that after two hours pumping at 760 gpm. the drawdown was 11 ft. and, in another test, when pumping at 1050 gpm., for an unreported length of time the drawdown was 14 1/2 ft. Non-pumping water levels were not reported.

The pumps are usually operated two at a time and as No. 9 and No. 12, No. 9 and No. 10. In summer months No. 13 is operated with either No. 9, 10 or 12.

Pumpage is estimated to average 690,000 gpd.

LABORATORY NO. 116,712

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.4		Silica	SiO_2	27.4	
Manganese	Mn	0.2		Fluoride	F	0.3	
Calcium	Ca	64.2	3.21	Chloride	Cl	5.0	0.14
Magnesium	Mg	20.6	1.70	Nitrate	NO_3	0.6	0.01
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	65.2	1.36
Sodium	Na	2.8	0.12	Alkalinity (as $CaCO_3$)		176.	3.52
Turbidity		5		Hardness (as $CaCO_3$)		246.	4.91
Color		0		Residue		304.	
Odor		0		Temperature 57.5° F.			

Water works were originally installed by the city of Woodstock (6123) in 1894. They have always been owned and operated by the city, and numerous extensions and additions have been made since that time.

The initial supply was obtained from a well drilled to a depth of 1014 ft. A second well was drilled to a depth of 956 ft. in 1899-1900 which was later deepened to 2072 ft. in 1908. A third well was drilled in 1906 or 1907 to a reported depth of 1191 ft.

Correlated driller's log of the third well furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Clay, sand and gravel	212	212
Silurian system		
Niagaran-Alexandrian series		
Limestone	16	228
Shale (probably dolomite)	34	262
Ordovician system		
Maquoketa formation		
Shale	60	322
Limestone	60	382
Shale	27	409
Galena-Platteville and Glenwood formations		
Limestone	376	785
St. Peter formation		
Sandstone	145	930
Shale or marl, red	43	973
Cambrian system		
Trempealeau formation		
Limestone	20	993
Franconia formation		
Sandstone	65	1058
Limestone, sandy	30	1088
Galesville formation		
Sandstone	103	1191

These 3 wells were located on the municipal plant site at the southwest intersection of First and Wheeler St. The wells were drilled by the J. P. Miller Artesian Well Co., Brookfield, and were cased with 10 and 12-in. pipe at the top, ending in 5-in. diameter holes at the bottom. Their combined production, in 1911, was reported to be 400 gpm. They were abandoned sometime in 1921 because of poor yield and are now capped and sealed.

Because of a threatened shortage of water in 1912, two sand and gravel wells were drilled and a second pumping station was erected on the north side of McHenry Ave. about 4400 ft. northeast of the first pumping station. The wells were spaced about 15 ft. apart and were 85 ft. deep, 10 in. in diameter and were equipped with Cook screens 18 ft. long. Their combined production, in 1914, was reported to be 500,000 gpd. These wells furnished a part of the public water supply until Dec. 20, 1920. They were abandoned in 1921 because of a reduction in their productive capacities and because of plunger pump difficulties caused by infiltration of fine sand through the screens. There was also some objection to the quality of the water due to seepage of surface water.

In 1920-1921, two sand and gravel wells were drilled by the Layne and Bowler Co., Chicago, on the municipal site at the southwest corner of First and Wheeler St. (approximately 3000 ft. S. and 1000 ft. E. of the N. W. corner of Section 5, T. 44 N., R. 7 E.). The elevation of the ground surface at the wells is 915± ft. Each well was drilled 30 in. in diameter by the rotary process, the screen and 24-in. casing were then set and the annular space outside the screen was filled with gravel 1/2 to 1 in. in diameter. The north well (called No. 1) is 196 ft. deep. A record of the casing and screen installations furnished by the driller is given in Table 1.

TABLE 1

24-in. casing from surface to 95 ft. 10 in.
24-in. 6-opening screen between 95 ft. 10 in. and 100 ft. 10 in.
24-in. casing between 100 ft. 10 in. and 110 ft. 10 in.
24-in. 6-opening screen between 110 ft. 10 in. and 135 ft. 10 in.
24-in. perforated casing between 130 ft. 10 in. and 145 ft. 10 in.
13-in. casing between 130 ft. and 147 ft. 7 in.
13-in. 6-opening screen between 147 ft. 7 in. and 196 ft.
1-in. 6-opening shutter plug 12 in. x 10 in. x 60 in. at the bottom.

After completion of the well, a production test was made on Feb. 4, 1921. After pumping at an average rate of 648 gpm. for 10 hr., the drawdown was 37 1/2 ft. below a non-pumping water level of 49 1/2 ft. below the surface.

The following pump installation, made in 1935, was pulled, overhauled, and re-installed in 1945: 125 1/2 ft. of 8-in. column pipe; 15-in., 3-stage Layne turbine pump (No. 7235) rated at

1200 gpm. against 130 ft. of head; the overall length of the pump is 4 1/2 ft.; 30-ft. of 10-in. suction pipe with a 2-ft. strainer; 140 ft. of air line; 50-hp. Westinghouse electric motor.

This well serves as an alternate unit in the supply of raw water to the treating plant.

The south well (called No. 2) was drilled to a depth of 206 ft. 9 in. '

A record of the casing and screen installation furnished by the driller is given in Table 2.

TABLE 2

24-in. casing from 1 ft. 6 in. above ground surface to 107 ft. 8 in.
24-in. 6-opening screen between 107 ft. 8 in. and 112 ft. 7 in.
24-in. casing between 112 ft. 7 in. and 122 ft. 4 in.
24-in. 6-opening screen between 122 ft. 4 in. and 141 ft. 10 in.
24-in. casing between 141 ft. 10 in. and 161 ft. 4 in.
24-in. 6-opening screen between 161 ft. 4 in. and 166 ft. 3 in.
13-in. casing between 158 ft. and 167 ft. 9 in.
13-in. 6-opening screen between 167 ft. 9 in. and 206 ft. 9 in.
1-in. 6-opening shutter plug 12 in. x 10 in. x 60 in. at the bottom.

Upon completion of the well, a production test was made on Jan. 9, 1921. After pumping at an average rate of 877 gpm. for 10 hr., the drawdown was 39 1/2 ft. below a non-pumping water level of 49 1/2 ft. below the surface.

A non-pumping water level of 57 ft. below the pump base, and drawdowns of 46 ft. and 44 ft. respectively, when pumping at rates of 1000 and 850 gpm., were reported in 1945.

Well No. 2 was used as an auxiliary unit in July, 1947 and was operated about 2 hr. daily during 5 days of the week.

The following pump installation, made in 1935, was pulled, overhauled, and re-installed in 1945: 125 1/2 ft. of 8-in. column pipe; 15-in., 3-stage Layne turbine pump (No. 7234) rated at a capacity of 1200 gpm. against 130 ft. of head; the overall length of the pump is 4 1/2 ft.; 30 ft. of 10-in. suction pipe with a 2-ft. strainer; 140 ft. of air line; 50-hp. Westinghouse electric motor.

Well No. 3 was drilled to a depth of 198 ft. by the Layne-Western Co., Chicago, in 1939. It is located about 125 ft. southeast of Well No. 2.

The well is of the gravel-packed type having 150 ft. of 30-in. outer casing, 150 ft. of 18-in. inner casing, and 50 ft. of 18-in. Layne shutter screen. Water is obtained from a deposit of sand, gravel and boulders between depths of 148 and 198 ft.

Correlated driller's log of Well No. 3 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Cinders and fill	9	9
Sand and gravel, yellow	13	22
Sand, gravel, and clay	36	58
Gravel	7	65
Clay, gravel, and boulders	83	148
Sand, gravel, and boulders	50	198

Upon completion of the well, it was reported that the drawdown was 68 ft. below a non-pumping water level of 55 ft. below the surface, when pumping at 1440 gpm. On Sept. 6, 1939, after pumping for several days at 1175 gpm., the water level was 91 ft. below the surface. On Sept. 7, 1939, the water level was 56 1/2 ft. after an idle period of 1 1/2 hr.

The following pump installation was made in Sept. 1939: 140 ft. of 10-in. column pipe; 15-in., 5-stage Layne turbine pump (No. 9586) rated at a capacity of 1350 gpm. against 165 ft. of head; the overall length of the pump is 6 ft. 4 in.; 10 ft. of 10-in. suction pipe; 146 ft. 4 in. of air line; 75-hp. Westinghouse electric motor.

Well No. 3 was supplying the treating plant with raw water during July, 1947. It was operating 23 hr. daily during 5 days a week and delivered about 1150 gpm. to the plant.

Analysis of a sample (Lab. No. 111,019) collected July 10, 1947, from a tap on the discharge pipe 300 ft. from Well No. 3, after 12-hr. pumping at 1100 gpm., showed this water to have a total hardness of 21.5 gr. per gal., a residue of 382 ppm., and an iron content of 1.3 ppm.

All water is chlorinated, softened and treated for iron removal.

Analysis of a sample (Lab. No. 112,417) collected July 10, 1947, showed the treated water, after chlorination, to have a total hardness of 4.4 gr. per gal., a total mineral content of 102 ppm., and an iron content of 0.1 ppm.

During the month of June 1947, the total quantity pumped to the plant and treated was 42,291,200 gal., an average of 1.4 mgd.

LABORATORY NO. 111,019

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	1.3		Silica	SiO_2	30.5	
Manganese	Mn	Tr.		Fluoride	F	0.3	
Calcium	Ca	78.0	3.90	Chloride	Cl	4.0	0.11
Magnesium	Mg	42.2	3.47	Nitrate	NO_3	1.1	0.02
Ammonium	NH_4	1.8	0.10	Sulfate	SO_4	8.0	0.17
Sodium	Na	0.7	0.03	Alkalinity	(as $CaCO_3$)	360.	7.20
Turbidity		10		Hardness	(as $CaCO_3$)	369.	7.37
Color		0		Residue		382.	
Odor		0		Free CO_2 (calc.)		34.	
Temperature		51.2° F.		pH = 7.45			

LABORATORY NO. 112,417

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Fluoride	F	0.3	
				Chloride	Cl	3.0	0.08
Turbidity		Tr.		Alkalinity	(as $CaCO_3$)	70.	1.40
Color		0		Hardness	(as $CaCO_3$)	75.	1.50
Odor		0		Total Mineral Content		102.	
Temperature		54.5° F.					
				Free CO_2 (calc.)		Tr.	
				pH = 9.6			

WORDEN
Madison County
Nov. 22, 1948

A public water supply was partially installed in 1947 by the village of Worden (1264).

A well was drilled by Calhoun Drilling Co., Batchtown, and located about 2 miles west of town, in Cahokia Creek bottoms (or approximately 1200 ft. N. and 1200 ft. W. of the S. E. corner of Section 28, T. 6 N., R. 7 W.). The elevation of the ground surface is 498i ft.

Correlated driller's log of well drilled in 1947 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Loam	20	20
Gravel and sand, dirty	10	30
Sand, some gravel	8	38
Loam and clay	27	65
Gravel, dirty	1	66
Drift	4	70
Pennsylvanian system		
Shale	5	75
Limestone	3	78

The completed well was located at the site of a 6-in. test hole 78 ft. deep which, in a 6-hr. production test, had yielded 62 gpm. with a drawdown of 29 ft. from a static water level of 8 ft. below ground level.

In finishing the well, the 6-in. casing was removed and replaced by 8-in. casing from the ground surface to 46 1/2 ft., below which was an 8-ft. exposed length of Cook brass screen, having No. 40 slot opening's. The bottom of the screen was set at about 54 ft. and the top of the 8-in. casing was 8 ft. above ground level.

On Oct. 23, 1947 a production test was made by. the State Water Survey. Before the test, the water level was 12.1 ft. below ground. After 3-hr. pumping at 86 gpm. the drawdown was 28.9 ft. and after 1-hr. additional pumping at 65 gpm. the drawdown was 21.3 ft. One hour after shutdown of the pump, the water level was 12.1 ft.

Temporary pumping equipment was used for the test. The well has been capped. Attempts are being made to complete the water system.

Analysis of a sample (Lab. No. 112,303) collected Oct. 23, 1947 after 7-hr. pumping showed this water to have a hardness of 10.2 gr. per gal., a total mineral content of 221 ppm., and an iron content of 33.6 ppm. The high iron content is probably due to the pressure of considerable turbidity.

LABORATORY NO. 112,303

	ppm.	epm.			ppm.	epm.
Iron (total)	Fe 33.6		Chloride	Cl	8.0	0.23
Turbidity	100+++		Sulfate	SO_4	2.3	0.05
Color	0		Alkalinity	(as $CaCO_3$)	184.	3.68
Odor	0		Hardness	(as $CaCO_3$)	175.	3.50
Temperature 55.1° F.			Total Mineral Content		221.	

WYANET
Bureau County
Sept. 10, 1947

A public water supply was installed by the village of Wyanet (868) in 1916.

At that time, a well was drilled by Hawkins and Olds, Wyanet and located in the west side of the pumping station at Locust St. and Main St. (or approximately 150 ft. N. and 1000 ft. E. of the S.W. corner of Section 16, T. 16 N., R. 8 E.).

The well was drilled to a depth of 218 ft., the lower 28 ft. penetrating water-bearing sand. The well was cased with 195 ft. of 8-in. wrought iron pipe; with a 10-ft. length of Johnson screen wedged to the bottom of the casing. The ground surface elevation at the well is 658± ft.

During construction of the well, it was reported that when the drilling penetrated sand at 180-ft. depth, the water level raised to 90 ft.

The pumping installation consists of a 5 3/4-in. Keystone Driller cylinder pump attached to 150 ft. of 6-in. drop pipe and belt-driven by a 15-hp. Wagner Electric motor. The pump operates with an 18-in. stroke at a speed of about 30 1/2 rpm. In 1917 the driller made a 9-hr. production test, and when pumping at 32 strokes per min., the discharge was 120 gpm. The non-pumping water level on Aug. 3, 1922 was 90 ft. below the top of the well.

Analysis of a sample (Lab. No. 83694) collected June 6, 1938, showed this water to have a hardness of 20.9 gr. per gal., a residue of 392 ppm., and an iron content of 0.08 ppm.

This well is maintained for emergency and is used only for backwashing the filters. Water can be pumped from the well directly into the distribution system.

In Mar. 1946, Henry Albrecht, Ohio, drilled another well about 15 ft. south of the old well. This well is 225 ft. deep and is cased with 197 ft. of 8-in. pipe and 20 ft. of 8-in. Cook wire-wound screen with No. 12 slot openings. Samples on file at the pumping station show sand between depths of 185 and 220 ft.

Driller's and sample-study log of well drilled in Mar. 1946 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
"Soil and clay, yellow and blue"	25	25
"Sand"	30	55
"Clay, blue, very tough"	25	80
Sand, clean	2	82
"Clay, blue, and sand"	18	100
"Sand"	15	115
"Clay, blue, and narrow sand layers"	25	140
Sand, slightly silty	5	145
"Clay" and sand	15	160
Sand, clean	30	190
"Sand, fine to coarse"	15	205
Sand, slightly silty	15	220
"Sand, fine to coarse"	5	225

The pump assembly consists of 140 ft. of 4-in. column pipe; 7 5/8-in., 6-stage, oil-lubricated Cook turbine pump, No. 7978, rated at 160 gpm. against a head of 106 ft.; the overall length of the pump is 36 5/8-in.; 140 ft. of 1/4-in. air line; 10 ft. of 4-in. suction pipe; 7 1/2-hp. U. S. motor.

When the well was completed, the static water level was 91 ft. and after pumping at 160 gpm. for 3 hr. the drawdown was 5 ft.

Analysis of a sample (Lab. No. 111,809) collected Sept. 10,1947 after pumping 1 hr., showed the water in this well to have a hardness of 21.4 gr. per gal., a residue of 414 ppm., and an iron content of 6.0 ppm.

The water is treated for iron removal.

Analysis of a sample (Lab. No. 111,810) collected Sept. 10, 1947, showed the treated water to have a hardness of 24.2 gr. per gal., a mineral content of 440 ppm., and an iron content of 0.1 ppm.

Pumpage is estimated at 60,000 gpd.

LABORATORY NO. 111,809

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	6.0		Silica	SiO_2	32.6	
Manganese	Mn	0.6		Fluoride	F	0.5	
Calcium	Ca	87.3	4.37	Chloride	Cl	7.0	0.20
Magnesium	Mg	36.0	2.96	Nitrate	NO_3	0.6	0.01
Ammonium	NH_4	2.8	0.16	Sulfate	SO_4	1.9	0.04
Sodium	Na	15.6	0.68	Alkalinity (as $CaCO_3$)		396.	7.92
Turbidity		20±		Hardness (as $CaCO_3$)		367.	7.33
Color		35		Residue		414.	
Odor		M		Temperature 53° F.			

LABORATORY NO. 111.810

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Fluoride	F	0.5	
Turbidity		0		Chloride	Cl	6.0	0.17
Color		20		Alkalinity (as $CaCO_3$)		388.	7.76
Odor		0		Hardness (as $CaCO_3$)		415.	8.30
				Total Mineral Content		440.	

A public water supply was installed by the city of Wyoming (1360) in 1902.

At that time a well, now called Well No. 1, was drilled on city-owned property just east of the business district (or approximately 50 ft. S. and 900 ft. E. of the N. W. corner of Section 1, T. 12 N., R. 6 E.). The well was drilled by Mr. Dean, Galva, to a depth of 1557 ft. The hole and casing record was reported as given in Table 1.

TABLE 1

Hole Record

12-in. from 0 to 242 ft.
9-in. from 242 to 765 ft.
8-in. from 765 to 1557 ft.

Casing Record

10-in. casing from 0 to 242 ft.
5-in. casing from 242 to 765 ft.
6-in. casing from 765 to 1197 ft.

The well was originally equipped with an American Well Works double-acting deep-well pump with an 8-in. diameter cylinder set at a depth of 130 ft. and 20 ft. of suction pipe attached below the cylinder. When the well was completed in 1902, the non-pumping water level was reported to be 85 ft. below the ground surface, which is 705± ft.

The water level was not lowered during a 10-hr. production test with the pump operating at 200 gpm.

In 1930 a turbine pump was installed, and in 1942 an additional 20 ft. of column pipe. The pumping assembly now consists of 190 ft. of 6-in. column pipe; 8-stage Pomona turbine pump, No. G-7558; 190 ft. of air line; 30-hp. electric motor.

Water levels for this well have been reported in ft. below ground level, as given in Table 2.

Analysis of a sample (Lab. No. 109,136) collected Feb. 6, 1946 after 1 1/2-hr. pumping at 370 gpm., showed the water in Well No. 1 to have a hardness of 10.6 gr. per gal., a residue of 1136 ppm., and an iron content of 0.1 ppm.

Well No. 2 was drilled to a depth of 1400 ft. in Apr. 1947 by Varner Well Drilling Co., Dubuque, Iowa. The well is located 56 ft. south of Well No. 1.

The hole and casing diameter record is shown in Table 3.

TABLE 3

Hole Record

19-in. from 390 to 941 ft.
15-in. from 941 to 1045 ft.
12-in. from 1045 to 1400 ft.

Casing Record

24-in. from surface to 193 ft. 8 in.
20-in. from surface to 390 ft.

A 12-in. liner was set between depths of 930 and 1049 ft.

A production test was made on Apr. 17, 1947 by the State Water Survey. For test purposes a deep-well turbine pump was set at 270 ft. and operated from an electric motor. The air line was 268 1/2 ft. long. Prior to starting the test, the pump in Well No. 1 had been shut down for two hours in. order to measure the influence of pumping in Well No. 2. After five-hours pumping at 380 gpm. in Well No. 2, with no pumping in Well No. 1, the drawdown was 16 ft. below a water level of 172 ft. At the same time the water level in Well No. 1 was lowered 2 ft. The pump in Well No. 1 was then started, and after two-hours continued pumping at 380 gpm. in Well No. 2, the drawdown in No. 2 was 19 ft. and in Well No. 1 the drawdown was 12 ft.

Analysis of a sample (Lab. No. 109,978) collected Apr. 17, 1947 after 3-hr. pumping at 360 gpm., showed the water from Well No. 2 to have a hardness of 11.4 gr. per gal., a mineral content of 1161 ppm., and an iron content of 3.1 ppm. The water was somewhat turbid and contained much gas. A previous analysis showed the fluoride content to be 1.8 ppm.

Pumpage is estimated at 80,000 gpd.

TABLE 2

Year	Non-Pumping Level ft.	Pumping Rate gpm.	Drawdown ft.
1902	85	200	0
1915	85	200	0
1919	117		
1938	130		
1940	153		
1942	156		
1943	158	300	2.25
Apr. 1947	163 (?) (length of air line-assumed)		

LABORATORY NO. 109,136

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	14.2	
Manganese	Mn	0.0		Fluoride	F	2.4	
Calcium	Ca	42.8	2.14	Chloride	Cl	270.0	7.61
Magnesium	Mg	18.1	1.49	Nitrate	NO_3	0.6	.01
Ammonium	NH_4	1.7	.10	Sulfate	SO_4	303.4	6.31
Sodium	Na	341.3	14.84	Alkalinity (as $CaCO_3$)		232.	4.64
Turbidity		0		Hardness (as $CaCO_3$)		182.	3.64
Color		0		Residue		1136.	
Odor (at well)		H_2S		Free CO_2 (calc.)		14.	
Temperature 66.4° F.				pH = 7.6			

LABORATORY NO. 109,978

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	3.1		Silica	SiO_2	12.7	
Manganese	Mn	0.1		Fluoride	F	1.8	
Calcium	Ca	45.8	2.29	Chloride	Cl	270.0	7.61
Magnesium	Mg	19.9	1.63	Nitrate	NO_3	0.7	.01
Ammonium	NH_4	1.6	.09	Sulfate	SO_4	303.6	6.32
Sodium	Na	338.8	14.73	Alkalinity (as $CaCO_3$)		240.	4.80
Turbidity		20		Hardness (as $CaCO_3$)		196.	3.92
Color		0		Residue		1161.	
Odor		0		Temperature 65.5° F.			

Sample-study log of Well No. 2 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Loess, soils at top and bottom	20	20
Till and clay	155	175
Soil and till	15	190
Sand, with granule gravel at base, clean	10	200
Sand and granule gravel, silty	5	205
Till	5	210
Pennsylvanian system		
Shale, thin sandstone bed	145	355
Sandstone, silty, incoherent	25	380
Shale and sandstone	21	401
Mississippian system		
Kinderhook shale	134	535
Devonian system		
Cedar Valley dolomite and limestone	50	585
Wapsipinicon limestone, dolomite, and thin sandstone bed at base	51	636
Silurian system		
Niagaran-Alexandrian series		
Dolomite, little crevice clay	54	690
Dolomite	100	790
Dolomite, little crevice clay	85	875
Dolomite, thin siltstone bed at base	58	933
Ordovician system		
Maquoketa shale and dolomite	191	1124
Galena-Platteville dolomites	276	1400

YATES CITY
Knox County
Apr. 2, 1947

A public water supply was installed by the village of Yates City (576) in 1940.

An electrical earth resistivity survey was made by the State Geological Survey in Mar. 1940. After some test drilling, a well was drilled by Varner Well Drilling Co., Dubuque, Iowa, at a location about 1 mile due east of the village (or approximately 2600 ft. S. and 200 ft. W. of the N. E. corner of Section 12, T. 9 N., R. 4 E.). The well was drilled to a depth of 94 ft. below a ground surface elevation of 640± ft.

Sample-study log of Test Hole No. 1, located at site of Well No. 1, furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Loess and glacial till	55	55
Sand and granule gravel, silty	15	70
Sand, yellow, clean	5	75
Sand and granule gravel, silty	10	85
Pennsylvanian system		
Siltstone and shale	10	95
Sandstone, shaly, brown	5	100

The well is cased with 8-in. pipe from the surface to 74 ft. A Johnson welded screen is set with the bottom at 94 ft., and the lower 8 ft. is in shale. The screen slot openings are as follows: The top 2 ft. has No. 24 slot; the next 5 ft. has No. 44; the next 10 ft. has No. 34; and the bottom 3 ft. has No. 70 slot openings.

After the well was completed, a production test was made under the supervision of the State Water Survey. Before the test started, the water level was measured at 66.8 ft. below the top of the casing, which was 1.1 ft. above the ground surface. After pumping 5 hr. at 100 gpm., the drawdown was 2 ft. Before the test, the water level in a 6-in. test hole, 10 ft. northwest of the well, was 68.2 ft.; and after 5-hr. pumping in the well, the water in the test hole was drawn down 0.7 ft. The test hole has been cased with 6-in. pipe and is held in reserve but not yet equipped with a pump.

The pumping installation in the well consists of 60 ft. of 5-in. column pipe; 6-in., 10-stage, oil lubricated, Fairbanks-Morse turbine pump, No. 10294, rated at 125 gpm. against 133 ft. of head; 70 ft. of air line; 10 ft. of suction pipe; 7 1/2-hp. Fairbanks-Morse electric motor.

Analysis of a sample (Lab. No. 109,798) collected Apr. 2, 1947 directly from the well showed this water to have a hardness of 17.9 gr. per gal., a residue of 329 ppm., and a trace of iron.

A zeolite softening unit is in use and some of the softened water is mixed with raw water from the well before entering the distribution system. A sample (Lab. No. 109,795) of blended water collected Apr. 2, 1947 was found to have a hardness of 2 gr. per gal., a mineral content of 339 ppm., and an iron content of 0.12 ppm.

Pumpage is estimated to average 20,000 gpd.

LABORATORY NO. 109,798

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	Tr.		Silica	SiO_2	21.8	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	74.8	3.74	Chloride	Cl	6.0	0.17
Magnesium	Mg	29.2	2.40	Nitrate	NO_3	16.5	0.27
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	32.5	0.68
Sodium	Na	0.5	0.02	Alkalinity (as $CaCO_3$)		252.	5.04
Color		0		Hardness (as $CaCO_3$)		307.	6.14
Odor		Tr.		Residue		329.	
Turbidity		10					
Temperature		53.8° F.					

LABORATORY NO. 109,795

	ppm.	epm.			ppm.	epm.
Iron (total) Fe	0.12		Fluoride	F	0.3	
			Chloride	Cl	6.0	
Turbidity	10		Alkalinity (as $CaCO_3$)		264.	
Color	0		Hardness (as $CaCO_3$)		37.	
Odor	0		Total Mineral Content		339.	

Waterworks were first installed by the village of Yorkville (562) in 1886.

The water supply was obtained from springs located on a hillside about 6000 ft. south of Hydraulic Ave. and 2000 ft. east of highway Route 47 (approximately 2400 ft. N. and 1400 ft. E. of the S. W. corner of Section 4, T. 36 N., R. 7 E.). Water was collected by lines of tile laid about 3 ft. below the ground surface and discharged into a collecting reservoir located at the site of the springs from which it flowed through a 6-in. pipe line to the village distribution system. In 1909 another collecting reservoir was built at the site of the old one and water was pumped to a storage reservoir located on the hillside about 700 ft. southwest at 40 ft. higher elevation. In 1917 it was estimated that the springs furnished 24,000 gpd. In 1928 about 1/2 of the public water supply was obtained from the springs.

The springs and pumping equipment are still maintained as a source of emergency supply. From Apr. 4 to Aug. 18, 1946 they furnished the entire public supply but were unable to supply all demands during the latter part of Aug. because of a prolonged drought.

Analysis of a sample (Lab. No. 112,160) collected Oct. 9, 1947 from the spring house showed this water to have a hardness of 25.2 gr. per gal., a residue of 467 ppm., and an iron content of 0.1 ppm.

A well was drilled in 1923 and located about 155 ft. west of Bridge St. and 150 ft. south of Hydraulic Ave. (approximately 2000 ft. S. and 200 ft. W. of the N. E. corner of Section 32, T. 37 N., R. 7 E.). The well was drilled by B. L. Palmer, Aurora, to a reported depth of 590 ft.

Correlated driller's log of well drilled in 1923 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Glacial drift	10	10
Ordovician system		
Maquoketa formation		
Shale, blue, little water	70	80
Galena-Platteville formations		
Limestone, some water, small flow with gradual increase in last 75 feet	330	410
St. Peter formation		
Sandstone, flow gradually increased all through formation except last 15 feet	180	590

The ground surface elevation at the well is 584± ft. The well was reported to have a diameter of 8 in. to a depth of 125 ft. below which it was 6 in. in diameter to the bottom. The free flow from the well was about 18 gpm. until Mar. 1938, when the free flow ceased.

The pump which was installed in 1936 was pulled on Apr. 4 and re-installed on Aug. 18, 1946. The existing installation consists of 120 ft. of 4-in. id. column pipe; 6-in., 13-stage Fairbanks-Morse turbine pump, Factory No. 31735, rated at 100 gpm. against 135 ft. of head and having an overall length of 63 3/4 in.; an air line of 120 ft. assumed length; 7 1/2-hp. Fairbanks-Morse electric motor. This unit delivered 161 gpm. to the ground storage reservoir on Aug. 18, 1938 at a pump speed of 1800 rpm. In Oct. 1947, it was reported to discharge 150 gpm. to the reservoir at the well site.

The well was rehabilitated between Apr. 4, and Aug. 18, 1946. It was reamed as a larger hole and "shot" at 2 levels in the St. Peter sandstone. The hole and casing diameters are given in Table 1.

TABLE 1

Hole Record

10-in. from 0 to 12 ft.
8-in. from 12 to 420 ft.
6-in. from 420 to 590 ft.

Casing Record

10-in. from 0 to 12 ft.
8-in. from 0 to 80 ft.

Annular space of 8-in. casing was cement grouted.

The distance to water below the pump base measured 10 ft. on Apr. 5, 1946 after the well had been idle one day and was the same on Aug. 17, 1946 after the well had been rehabilitated. On Oct. 9, 1947 after 3 1/2-hr. pumping at 150 gpm. the pumping water level was 92 ft. below the pump base.

Analysis of a sample (Lab. No. 112,158) collected Oct. 9, 1947 after 3 1/2-hr, pumping at 150 gpm. showed this water to have a hardness of 15.3 gr. per gal., a residue of 339 ppm., and an iron content of 0.2 ppm.

All water is chlorinated at the spring house pump when used for the public supply.

Pumpage averages 90,000 gpd.

LABORATORY NO. 112,160

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	18.6	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	92.8	4.64	Chloride	Cl	6.0	0.17
Magnesium	Mg	49.1	4.04	Nitrate	NO_3	10.8	0.17
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	97.7	2.03
Sodium	Na	3.9	0.17	Alkalinity (as $CaCO_3$)		324.	6.48
Turbidity		Tr.		Hardness (as $CaCO_3$)		434.	8.68
Color		0.		Residue		467.	
Odor		0.		Free CO_2 (calc.)		33.	
Temperature 52.2° F.				pH = 7.4			

LABORATORY NO. 112,158

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.2		Silica	SiO_2	13.2	
Manganese	Mn	0.0		Fluoride	F	0.5	
Calcium	Ca	60.4	3.02	Chloride	Cl	9.0	0.25
Magnesium	Mg	27.1	2.23	Nitrate	NO_3	2.7	0.04
Ammonium	NH_4	Tr.	Tr.	Sulfate	SO_4	34.4	0.71
Sodium	Na	21.9	0.95	Alkalinity (as $CaCO_3$)		260.	5.20
Turbidity		Tr.		Hardness (as $CaCO_3$)		263.	5.25
Color		0		Residue		339.	
Odor		0		Free CO_2 (calc.)		38.	
Temperature 53.6° F.				pH = 7.25			

A public water supply system was installed by the city of Zion (6555) in 1926.

The initial water supply was obtained from a well drilled to a depth of 1025 ft. by Layne and Bowler and completed in 1926. It is located about 100 ft. south of 27th St. and 100 ft. west of Elisha Ave. (or approximately 1120 ft. N. and 510 ft. W. of the S. E. corner of Section 21, T. 46 N., R. 12 E.).

The second well in the public water supply is a limestone well drilled to a depth of 220 ft. It is located about 195 ft. south of 27th St. at the southwest corner of Lebanon and Gravriel Ave. (or approximately 1000 ft. N. and 1500 ft. E. of the S. W. corner of Section 21, T. 46 N., R. 12 E.). The elevation of the pump base is 651± ft. The capacity of this well is limited to about 50 gpm., and it became necessary to provide for an additional supply in 1935.

A third well was drilled to a depth of 995 ft. by the J. P. Miller Artesian Well Co., Brookfield, and completed in May, 1935. It is located on city-owned property at the northwest corner of Sheridan Road and 29th St. (or approximately 78 ft. N. and 137 ft. W. of the S. E. corner of Section 21). The elevation of the pump house floor is 629 ft.

These wells constitute the existing public water supply and are pumped daily.

The hole and casing record is shown in Table 1.

TABLE 1

Hole Record

15-in. from 163 to 313 ft.
12-in. from 575 1/2 to 1025 1/2 ft.

Casing Record

16-in. od. from 0 to 163 ft.
12-in. from 313 to 575 1/2 ft.

When the well reached a depth of 221 ft., a production of 25 gpm. was obtained with the bailer. The non-pumping water level was 90 ft. below the surface until the well reached a depth of 900 ft. Thereafter, the water level became gradually higher as the drilling became deeper. When the well was completed, the water level was 12 ft. below the surface. The 16-in. casing was slotted at the gravel section or between 105 and 130 ft. It was reported that the well was "shot" in the St. Peter sandstone.

Upon completion of the well, water was pumped for 4 hr. and 22 min. at an average rate of 414 gpm. During a 48-hr. test, a turbine pump set at a depth of 250 ft. drew air when pumping at 250 gpm. When the turbine was lowered to a 300-ft. setting in Apr., 1927, a production of 402 gpm. was obtained. The non-pumping water level at this time was 34 ft. below the pump house floor which has an elevation of 632.98 ft.

In the fall of 1943, the Varner Well Drilling Co., Dubuque, Iowa, extended the depth of the well to 1100 ft. and "shot" the St. Peter sandstone at depths of 925, 950, 970, and 985 ft. The extension of the well below the St. Peter sandstone was intended to provide a collecting basin for loose sand after the hole was cleaned. A section of 16-in. od. casing was welded to the top which brings the top of the casing 13 in. above the floor, or to elevation 634.06. After the well was cleaned out, an 18-hr. production test was made. An initial production of 670 gpm. decreased to a final production of 412 gpm. with a drawdown of 285 ft. below a non-pumping water level of 65 ft. below the pump house floor. In Sept. 1943, before the above work was done, the non-pumping water level was 90 ft.

The following new pump installation, made in Jan. 1944, is still in service: 350 ft. of 6-in. column pipe; 10-in., 13-stage Layne turbine pump rated at 400 gpm. against 475 ft. of head; the overall length of the pump is 9 ft. 7 in.; 350 ft. of air line; 10 ft. of 6-in. suction pipe with a 6-in. cone strainer; 60-hp. U. S. electric motor.

On Aug. 10, 1944, the water level was 254 ft. below the pump base after 1 hr. of pumping.

Analysis of a sample (Lab. No. 107,588) collected Sept. 6, 1946 after pumping 4 1/2 hr. at 400 gpm., showed the water to have a hardness of 18.7 gr. per gal., a residue of 520 ppm., and an iron content of 0.9 ppm.

This well is the principal producing unit in the public water supply.

Well No. 2, drilled in 1932, is reported to have a depth of 220 ft. and to be cased from the surface to rock with 160 ft. of 10-in. pipe. The hole is 8-in. in diameter from the casing to the bottom. A 24-hr. production test was conducted on Sept. 5, 1932. After pumping at 80 gpm. for 1 1/2 hr., the pump broke suction. The rate of

pumping was decreased to 50 gpm. for the remaining period of the test at the end of which the drawdown was 105 ft. below a non-pumping water level of 12 ft. below the pump base. By 1943, the production had dropped to 30 gpm., and the pump frequently broke suction.

The well was acidized in May, 1944. After an idle period of 30 days, a non-pumping water level of 18 ft. below the pump base was reported, and, when pumping was resumed, it produced 65 gpm. Continuous pumping at this rate could not be sustained without breaking suction; and it was reduced to a rate of 50 gpm. During 1946, the rate was further reduced to 40 gpm., and at this rate frequently broke suction in the summer of 1946.

The well is equipped with 119 ft. of 6-in. column pipe; 8-in., 10-stage Layne turbine pump rated at 50. gpm. against 254 ft. of head; the overall length of the pump is 7 ft. 9 in.; 30 ft. of 4-in. suction pipe; 15-hp. General Electric motor.

Water is pumped for 24 hr. a day from this well and is of a quality preferred to that from the other wells.

Analysis of a sample (Lab. No. 107,589) collected Sept. 6, 1946 after continuous pumping at 40 gpm., showed the water from Well No. 2 to have a hardness of 4.4 gr. per gal., a residue of 354 ppm., and an iron content of 0.1 ppm.

Sample-study log of Well No. 3 furnished by the State Geological Survey:

Formation	Thickness ft.	Depth ft.
Pleistocene system		
Glacial till	125	125
"Sand and gravel, very little water"	5	130
Till	16	146
"Sand"	1	147
Silurian system		
Niagaran-Alexandrian dolomites	183	330
Ordovician system		
Maquoketa shale, some dolomite	230	560
Galena-Platteville dolomites	303	863
Glenwood dolomite and sandstone, thin bed of shale	37	900
St. Peter formation		
Sandstone	80	980
Conglomerate of chert and sand, shale at base	15	995

The well is cased with 12 1/2-in. od. pipe from the surface to a depth of 147 ft. where it is seated in the limestone. Below the casing, the hole is 12 in. in diameter to a depth of 564 ft. A 10-in. liner was installed between the depths of 310 and 564 ft. The hole is 10 in. in diameter from the bottom of the liner to the bottom of the well at 995 ft.

It is reported that the well was originally "shot" in the St. Peter sandstone at depths of 993, 960, and 925 ft.

After completion of the well, a 24-hr. production test was conducted on May 15 and 16, 1935. The non-pumping water level before the test was 33 ft. below the surface. The production and drawdown were reported:

125 gpm. with a drawdown of 182 ft.
150 gpm. with a drawdown of 217 ft.
175 gpm. with a drawdown of 252 ft.
200 gpm. with a drawdown of 302 ft.

In Nov. and Dec. 1942, the Varner Well Drilling Co. extended the depth of the well by drilling a 9 5/8-in. hole from 995 to 1023 ft. The well was also "shot" at the depths of 915, 945, and 980 ft. After cleaning out, an 18-hr. production test was conducted on Dec. 15 and 16, 1942. The initial production of 360 gpm. decreased to a stabilized production of 268 gpm. after 12-hr. pumping and held constant for the remainder of the test period. The drawdown was 165 ft. from a non-pumping water level of 57 ft. below the pump base.

The following pumping equipment was reinstalled and is still in service: 300 ft. of 7 5/8-in. od. heavy column pipe; 10-in., 14-stage Peerless turbine pump rated at 300 gpm. against 390 ft. of head; 302 ft. of air line; 35 ft. of 7-in. suction pipe; 60-hp. U. S. electric motor.

On Aug. 10, 1944, the following water levels were reported: A non-pumping level of 75 ft. after a 12-hr. idle period and a pumping level of 277 ft. after 2 hr. of pumping.

Analysis of a sample (Lab. No. 100,977) collected Aug. 10, 1944 after 2 hr. of pumping at 350 gpm., showed the water from this well to have a hardness of 19.0 gr. per gal., a residue of 573 ppm., and an iron content of 0.5 ppm.

This well was not pumped extensively during 1946 and is considered as an auxiliary supply unit.

The pumpage from Wells No. 1 and No. 3, based on previous records, will average 256,000 gpd. and will vary from a winter minimum average of 192,000 gpd. to a summer maximum average of 300,000 gpd. The pumpage from Well No. 2 is not metered but is estimated to average 57,600 gpd.

The water from Wells No. 1 and No. 3 is zeolite softened.

LABORATORY NO. 107,588

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.9		Silica	SiO_2	11.6	
Manganese	Mn	0.0		Fluoride	F	1.6	
Calcium	Ca	92.0	4.60	Chloride	Cl	23.0	0.65
Magnesium	Mg	21.7	1.79	Nitrate	NO_3	0.5	0.01
Ammonium	NH_4	0.1	0.01	Sulfate	SO_4	151.0	3.14
Sodium	Na	56.1	2.44	Alkalinity (as $CaCO_3$)		252.	5.04
Turbidity		10-		Hardness (as $CaCO_3$)		320.	6.39
Color		Tr.		Residue		520.	
Odor		0		Free CO_2 (calc.)		39.	
Temperature		59.4° F.		pH = 7.2			

LABORATORY NO. 107,589

		ppm.	epm.			ppm.	epm.
Iron (total)	Fe	0.1		Silica	SiO_2	17.4	
Manganese	Mn	0.0		Fluoride	F	1.0	
Calcium	Ca	15.0	0.75	Chloride	Cl	30.0	0.85
Magnesium	Mg	9.2	0.75	Nitrate	NO_3	0.1	Tr.
Ammonium	NH_4	0.2	0.01	Sulfate	SO_4	112.3	2.34
Sodium	Na	93.8	4.08	Alkalinity (as $CaCO_3$)		120.	2.40
Turbidity		Tr.		Hardness (as $CaCO_3$)		75.	1.50
Color		0		Residue		354.	
Odor		M		Free CO_2 (calc.)		2.	
Temperature		51.2° F.		pH = 8.2			

Nos. 1-9	Out of print.	
No. 10.	Chemical and Biological Survey of the Waters of Illinois. Report for 1912. 198 pp., 19 cuts.	
No. 11.	Chemical and Biological Survey of the Waters of Illinois. Report for 1913. 473 pp., 106 cuts.	
No. 12.	Chemical and Biological Survey of the Waters of Illinois. Report for 1914. 261 pp., 32 cuts.	
No. 13.	Chemical and Biological Survey of the Waters of Illinois. Report for 1915. 381 pp., 36 cuts.	
No. 14.	Chemical and Biological Survey of the Waters of Illinois. Report for 1916. 922 pp., 40 cuts.	
No. 15.	Chemical and Biological Survey of the Waters of Illinois. Report for 1917. 136 pp., 8 cuts.	
No. 16.	Chemical and Biological Survey of the Waters of Illinois. Report for 1918 and 1919. 280 pp., 36 cuts.	
No. 17.	Index to Bulletins 1-16. 1921. 17 pp.	
No. 18.	Activated Sludge Studies. 1920-22. 150 pp., 31 cuts. OUT OF PRINT.	
No. 19.	Solubility and Rate of Solution of Gases. Bibliography. 1924. 49 pp.	
No. 20.	Comparison of Chemical and Bacteriological Examinations made on the Illinois River During a Season of Low Water and a Season of High Water. 1923-1924.	
	A Preliminary Notice of a Survey of the Sources of Pollution of the Streams of Illinois. 1924. 59 pp., 8 cuts.	0.25
No. 21.	Public Ground Water Supplies in Illinois. 1925. 710 pp., 11 cuts	1.00
	Supplement I, 1938, 378 pp.	.75
	Supplement II, 1940, 44 pp.	.30
No. 22.	Investigations of Chemical Reactions Involved in Water Purification. 1920-1925. 130 pp. 17 cuts. .	0.50
No. 23.	The Disposal of the Sewage of the Sanitary District of Chicago. 1927. 195 pp. 30 cuts	1.00
No. 24.	Pollution of Streams in Illinois. 1927. 35 pp., 21 watershed maps	.25
No. 25.	Bioprecipitation Studies, 1921-1927. 94 pp., 27 cuts	.50
No. 26.	Depth of Sewage Filters and Degree of Purification. 1928. 100 pp., 19 cuts.	.50
No. 27.	A Study of Factors Affecting the Efficiency and Design of Farm Septic Tanks. 1927. 45 pp., 25 cuts	.50

BULLETINS OF THE STATE WATER SURVEY, continued

No. 28.	Illinois River Studies, 1925-1928. 127 pp., 15 cuts	0.75
No. 29.	Studies on Two-Stage Sludge Digestion, 1928-1929. 92 pp., 27 cuts	.50
No. 30.	Laboratory Studies of Sludge Digestion. 84 pp., 5 cuts	.50
No. 31.	Preliminary Data on Surface Water Resources, 1937. 157 pp.	.50
No. 32.	Anaerobic Fermentations. 1939. 193 pp., 25 cuts	.75
No. 33.	Water Resources in Peoria-Pekin District, 1940. 114 pp.	.35
No. 34.	Sandstone Water Supplies of the Joliet Area, 1941. 128 pp.	.35
No. 35.	Ground Water Supplies of the Chicago-Joliet-Chicago Heights Area, 1943. 285 pp.	1.00
No. 36.	Ground Water Supplies in Northern Cook and Northern DuPage Counties. 1945. 119 pp.	.75
No. 37.	The Causes and Effects of Sedimentation in Lake Decatur. 1947. 62 pp.	.60
No. 38.	Hydrology of Five Illinois Water Supply Reservoirs. 1948. 260 pp.	1.50
No. 39.	Groundwater in the Peoria Region, 1950, (in press).	