BULLETIN NO. 21
SUPPLEMENT II

1940

SUPPLEMENT II

TO

BULLETIN 21

ISSUED BY

STATE WATER SURVEY DIVISION

A. M. BUSWELL, Chief

URBANA, ILLINOIS

ORGANIZATION

STATE OF ILLINOIS
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PREFACE TO BULLETIN 21, SUPPLEMENT SERIES

In 1925 this Division published a compilation and summary of data on water supplies which it had accumulated in its files over a period of thirty years. This publication was entitled "Bulletin 21, Public Ground Water Supplies in Illinois" and included data on wells, well yields, material penetrated in drilling and chemical analyses of water from the various sources. The report covered 398 municipal well water supplies and listed 99 municipalities that obtained water from surface sources. It comprised some 710 pages.

At the time of the issue of Bulletin 21 we planned to make subsequent additions in the form of supplements rather than to revise the entire publication to include the new data. With this plan in mind a large edition (2500 copies) of Bulletin 21 was issued.

The page numbers in supplements are continuous with those of the original bulletin and water supplies are listed alphabetically under the name of the town or city. In looking up information on a given supply the reader will refer to the latest supplement. Following the name of the town will be the population as of 1930, next a page reference to the data on that supply given in earlier volumes in the series, then follows a summary of data collected on the supply since the last previous publication in the series.

In preparing Supplement II an attempt has been made to bring the information on all supplies up to date about October 1939. This has not been possible in all cases. We shall welcome corrections or additions. The number of municipalities w?? public water supplies is now about 639, an increase of 14 since the issuance of Supplement Number I. These consist of 465 well water supplies and 174 surface water supplies. During the year two municipalities which formerly had well supplies changed over to surface water supplies. A brief note on the occurrence of high chloride waters and the effect of barometric pressure on the measurement of well levels is included.

In checking changes and in extensions to public ground water supplies much assistance has been given by the Chief Sanitary Engineer of the Department of Public Health and his assistants. The publication "Data on Illinois Public AVater Supplies" prepared by the State Department of Public Health has been freely used in preparing this material. Well logs and geologic data have been furnished by the State Geological Survey.

Municipal officials, employees of municipalities, well drillers, and engineers who have made investigation of water supplies have kindly given us much valuable information. There have been so many changes in personnel of officials and persons employed by them that it is impossible to give credit here to each one excepting in the case of well drillers. When data are given in regard to a well the name of the driller is given when known.

Every engineer employed by the State Water Survey since it was organized has had a part in the collection of data which appears in this bulletin, and every chemist of the survey has had a part in the collection of data or in the analyses of waters.

A. M. BUSWELL, *Chief.*

NOTE ON THE EFFECT OF BAROMETRIC PRESSURE ON OBSERVED GROUND WATER LEVELS

It is generally conceded that in the drift well area of the State, particularly in the central part, the recharge of ground water reservoirs is accomplished by the percolation of local rain and snow water. In order to obtain some idea of the time required to accomplish this a water level recorder was installed on August 22, 1939, in an abandoned well at the old plant site of the Smith Ice Company in north Urbana and a continuous record made since that date is now available. The water level is constantly fluctuating and within the observed period a maximum difference in level of 2.45 feet has been recorded.

It appears that the operation of the wells which furnish the public water supply of Champaign-Urbana is responsible for some of this movement, the nearest well of the water company being about 1,650 feet distant and the center of three separate well groups about 2,000 feet distant.

A state of drought has existed throughout the fall and winter. In fact, there have been no sustained periods of excess rain since 1930, hence no appreciable recharge or rise in ground water levels has been possible in wells of this depth. The five-month record indicates a loss in water level of about a half foot.

The increased demand on the water company wells is reflected in the lower water levels about the first of September and after the Christmas holidays when students and faculty return from the vacation periods. Similarly a rise is noted during vacation periods.

It likewise has been noted that barometric pressure appears to be responsible for some fluctuation as the plotted profile of barometric pressure follows closely the water level profile.

The study was primarily undertaken to see if rainy periods would bring about a noticeable recharge or a rise in the ground water levels. To date there has been no rain of appreciable amount and the recorded water level on January 29, 1940, was about 0.5 of a foot below the stage on August 22, 1939. Records extending over a year or more should be collected before any conclusions can be drawn.

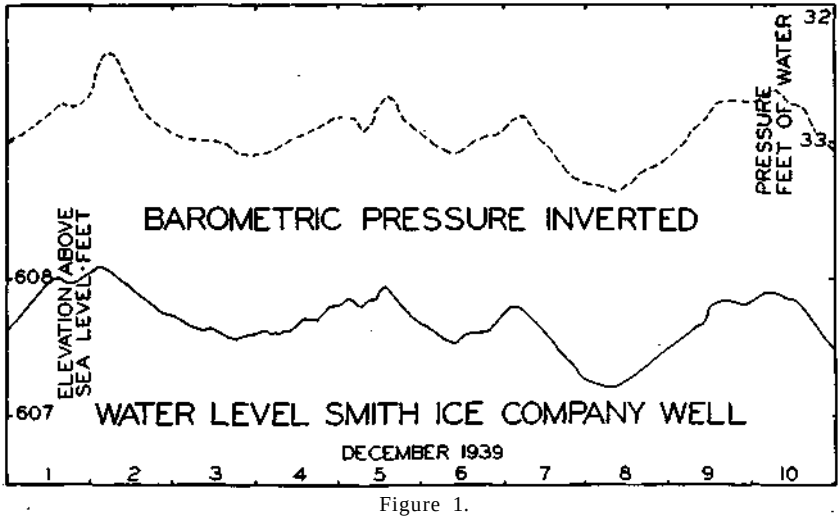

Figure 1.

ZONE OF HIGH CHLORIDE WATERS

Preliminary results of a State-wide corrosion survey in Illinois indicated that most pump corrosion occurred in supplies having a high chloride content. It became pertinent to discover the source of these supplies.

Although a frequency curve indicated that 70 parts per million was the dividing line between the common occurrence and unusual, the limit of 150 parts per million was chosen since the data collected indicated that the corrosion was prevalent in supplies of this chloride concentration. Also it was evident on locating these supplies that with few exceptions all were located in the southern portion of the rock well zone in the State as exemplified in the figure.

Of the 58 supplies having high chloride, six were outside this area. Of the 52 remaining, it was found that 40 obtained all or part of their water from the St. Peter sandstone. Four, Galesburg, Kewanee," Oglesby and Peru, cased off the St. Peter aquifer and went to the Galesville (Dresbach) in the Cambrian system. Another, East Moline, did likewise, but only went to the Jordan sandstone in the Cambrian system. Five supplies, Minooka, Coal City, Little York, Milan and Saunemin, used limestone water and two, Hennepin and Danforth, had no log record.

Three of the six supplies not in this area, Lyons, Riverside and Elmhurst, were in the Des Plaines Elver valley and obtained part of their water from the St. Peter sandstone. The other three were in the southern half of the State, two, Trenton and New Baden, obtaining water from rock wells and one, Newman, from sand and gravel.

The hardness in all but eight of the 58 is greater than 125 parts per million and the iron content of all but 15 is greater than 0.2 parts per million.

Chemical quality of the water from the Galesville aquifer is not to be considered exceptionally better or worse than that from the St. Peter sandstone. A comparative study of chloride and hardness at four' supplies is given in the following table.

	Chlorides.			Hardness.		
	St. Peter.	Mixed.	Galesville.	St. Peter.	Mixed.	Galesville.
Kewanee	350	560	600	260	340	400
Galesburg	160	180		400	240	
Peru	210	210		250	330	
Oglesby	320		260	220		310

The figures given are approximate and not too reliable. Several factors are to be considered. First, the data under the columns marked "Galesville" are from wells in which the St. Peter sandstone aquifer has been cased off. There apparently is always some doubt as to the degree of success in this process.

Second, the rate of pumping and the hydrostatic pressure of the various aquifers not cased off will have a decided effect on the quality of water received. For example, take the case of a well in which only two sandstone aquifers are open. If the hydrostatic pressure of the lower aquifer is less than that of the upper the water obtained will be from the upper aquifer, so long as the rate of pumping does not lower the hydrostatic pressure to or below that of the lower aquifer. As pressure in the lower aquifer approaches and becomes greater than that of the upper aquifer water from it will begin to move and the water issuing from the well will be a mixture of the waters from both veins. The duration of the pumping period will be an important factor in bringing about this change.

Third, if, on the other hand, the hydrostatic pressure of the lower aquifer greatly exceeds that of the upper, it is evident that the water from the lower strata will force its way back into the upper aquifer. In such event, it can be seen that on starting to pump the water obtained will be that of the lower aquifer but may later change according to the pumping level and the new equilibrium set up between the aquifers. Changes in these conditions of equilibrium take place over years of operation. A condition of equilibrium at the time the well is new may conceivably be different a few years later.

Four analyses of water from one well (1123 feet) at Atkinson have yielded sulfate contents of 312, 46, 28, and 148 parts per million.

Since the factors affecting the ultimate quality of the water obtained from several aquifers cannot be controlled and since the complete pumping data (time of pumping, capacity of pump, and capacity of the various aquifers) are not available, it is evident that only approximate or tentative conclusions can be drawn from the data in the above table. One conclusion appears consistent. At best the Galesville water is but slightly better than the poor quality St. Peter water.

The population supplied by the high chloride waters in the specific area noted is 136,000. If all municipalities having public water supplies in this area, were included. the municipal population would total 192,000 (exclusive of Eock Island, Moline, Peoria, and Peoria Heights). The low chloride supplies in this area are from the relatively nonprolific sand and gravel deposits and supply only such small towns as have a low demand for water.

The location of these high chloride supplies is shown in Figure 2 and the chloride content, hardness and iron content is shown in the following table.

City.	Chloride.	Hardness.	Iron.
Aledo	150	224-350	0.2
Alexis	135	292	0.8
Alpha	255	215	0.2
Atkinson	479	240	1.2
Avon	266	870	trace
Bradford	471	291	0.4
Buda	463	247	0.4
Bureau	730	52	0.0
Bushnell	416	444	0.8
Cambridge	180	188	0.6
Canton	855	300	1.2
Carbon Hill	280	442	0.3
Cedar Point	295	222	0.2
Chenoa	550	240	0.0
Coal City	259	511	2.8
Cuba	392	745	0.8
Cullom	1077	137	0.8
Danforth	184	163	0.6
De Pue	323	218	0.3
East Moline	206	303.5	0.2
Elmhurst	149	273	0.2
Elmwood	196	366	0.2
Farmington	295	275	0.8
Galesburg	180	242.5	0.4
Glasford	451	270	0.4
Galva	156	74	0.6
Granville	305	260	1.2
Hennepin	1000	35	1.0
Ipava	825	630	0.1
Kewanee	560	278	0.6
Kinsman	170	307	1.0
Knoxville	365	360	0.6
Little York	232	95	0.4
Lyons	180	264	0.4
Milan	172	227	0.3
Minooka	267	169	0.4
Minonk	981	260	0.3
New Baden	355	19	0.1
Newman	361	softened	softened
North Utica	166	384	2.0
Odell	723	91.5	2.0
Oglesby	262	311	0.9
Peru	242	262	0.2
Princeville	210	394	1.0
Ransom	281	255	0.3
Riverside	160	249	0.2
Saunemin	1150	106	1.0
Silvis	650	440	0.4
Spring Valley	198	256	0.2
Standard	340	194	1.4
Toluca	750	214	0.4
Toulon	240	160	0.2
Trenton	260	70	0.8
Viola	273	227	1.1
Wenona	460	272	4.0
Wilmington	279	428	1.1
Woodhull	162	168	0.6
Wvoming	215	149	0.1

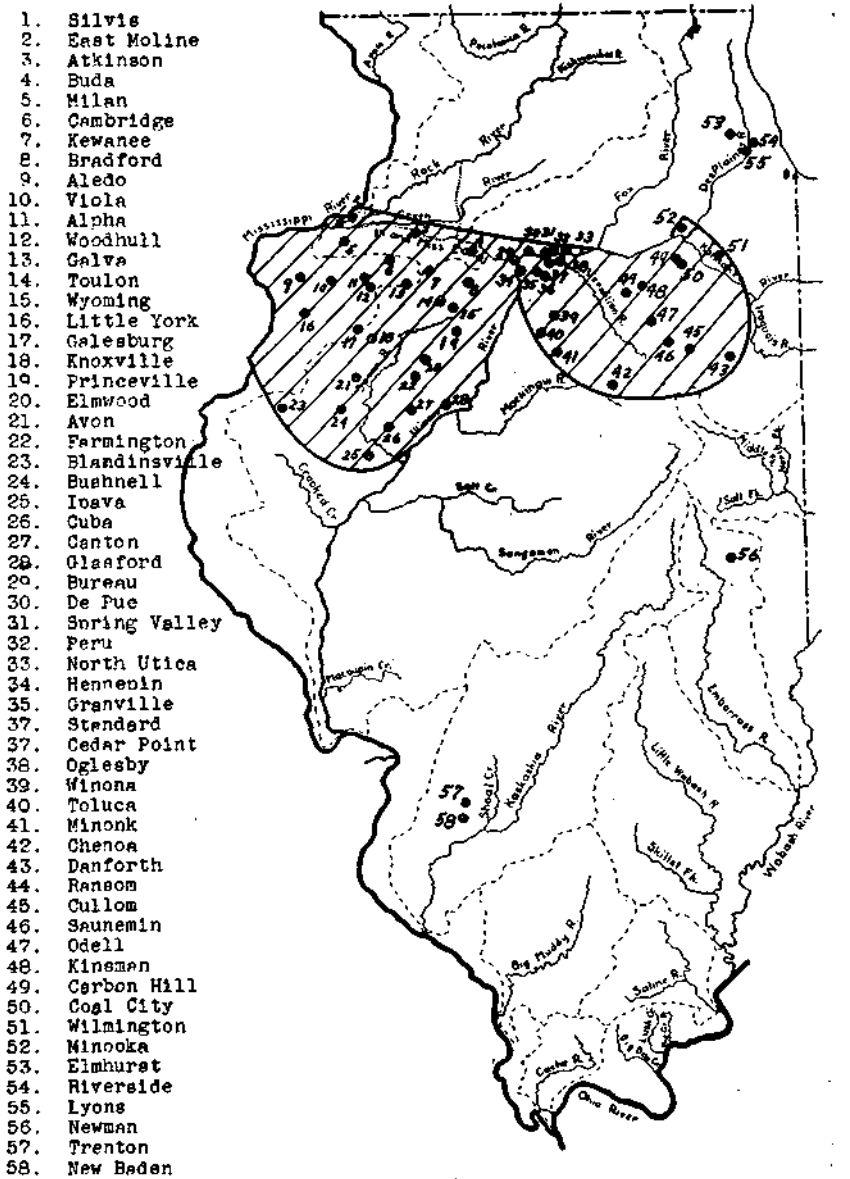

Figure 2. Zone of High Chloride Waters.

ADDISON (916) (p. 712). No record of change.

AMBOY (1972) (p. 715). Well number 2 was tested in 1939 by the State Water Survey. The water level was at a depth of 26 feet when not pumping and was lowered 62 feet by pumping at a rate of 265 gallons per minute. The results of this 1939 production test should be taken as authoritative and the results previously reported on page 715 of Supplement I should be disregarded, as it has been determined more recently that the measurements to water levels made at that time were in error.

The Amboy Milk Products Company well, situated on somewhat lower ground a short distance from the city well, was drilled in 1938 by C. W. Varner of Dubuque, Iowa. It is 1120 feet deep, 12 inches in diameter at the bottom, and cased with 12-inch pipe to a depth of 80 feet.

The water level was at a depth of 3 feet when not pumping and was lowered approximately 133 feet by pumping at a rate of 560 gallons per minute.

Water from the milk company well was similar in quality to water from the city well. The former had a total residue of 376, a total hardness of 372, and a content of iron of 0.7 parts per million, as shown by the analysis of sample number 85118, collected February 16, 1939.

Analysis of Sample Number 85118 from Milk Company Well.

Determinations Made.		Pts. per million.	Hypothetical Combinations.		Pts. per million.	Grs. per gallon.
Iron	Fe		Sodium Nitrate	$NaNO_3$	0.8	0.05
(filtered)		0.7	Sodium Sulfate	Na_2SO_4	4.3	0.25
(unfiltered)		2.1	Ammonium Sulfate	$(NH_4)2SO_4$	1.9	0.11
Manganese	Mn	0.0	Magnesium Sulfate	$MgSO_4$	3.0	0.17
Silica	SiO_2	13.5	Magnesium Carbonate	$MgCO_3$	133.6	7.78
Turbidity		10.0	Calcium Carbonate	$CaCO_3$	212.1	12.39
Color		0.0	Iron Oxide	Fe_2O_3	0.7	0.04
Odor		0.0	Silica	SiO2	13.5	0.79
Calcium	Ca	84.6				
Magnesium	Mg	39.1	Total		369.9	21.58
Sodium	Na	1.6				
Ammonium	NH4	0.5				
Sulfate	SO_4	6.6				
Nitrate	NO_3	0.4				
Chloride	Cl	0.0				
Alkalinity as $CaCO_2$						
Phenolphthalein		0.0				
Methyl Orange		370.0				
Residue		376.0				
Total Hardness		372.0				
Free CO_2		12.0				
pH = 7.0						

In 1939 a water treatment plant was installed by the city.

AUEORA (46,589) (p. 729). No record of change.

AVA (615). Ava is located in the northwest part of Jackson County on the watershed of Kinkaid Creek, a tributary of Big Muddy River.

The public water supply system was installed in 1938, water being obtained from a well 8 inches in diameter and 55 feet deep which was constructed in 1907. This well was leased for 99 years from the Randolph Milling Company. A treatment plant and elevated tank are located on property adjacent to the mill. The deep well pump is the property of the city, but the milling company operates the pump and treatment plant under contract for the city.

The well pump is a 6-inch Fairbanks-Morse deep well turbine, the assembly of which consists of 300 feet of 4-inch column pipe, 37 stages of impellers, and 20 feet of suction pipe. The pump is rated at 50 gallons per minute against a head of 315 feet and is direct connected to a $7^1/_2$-horsepower Fairbanks-Morse electric motor.

From the well the water passes over a three-tray coke aerator into a 3000-gallon storage basin. The aerated water is pumped from the settling basin by an electric motor-driven Fairbanks-Morse centrifugal pump rated at 30 gallons per minute through the International Filter Company pressure filter and zeolite softening unit. The finished water is stored in a 47,000-gallon clear well.

A Fairbanks-Morse centrifugal pump rated at 425 gallons per minute, direct-connected to a 15-horsepower Fairbanks-Morse electric motor delivers water from the clear well into the distribution system. The 30,000-gallon elevated tank floats on the line.

In July, 1939, there were approximately 115 service connections. The minimum rate for water is $1.50 per month for 3000 gallons.

The water from the well had a total residue of 654, a total hardness of 496, and an iron content of 2.4 parts per million, as shown by the analysis of sample number 75864, collected March 30, 1935.

Analysis of Sample Number 75864 from the City Well.

Determinations Made.		Pts. per million.	Hypothetical Combinations.		Pts. per million.	Grs. per gallon.
Iron	Fe		Sodium Nitrate	$NaNO_3$	1.7	.10
(filtered)		0.0	Sodium Chloride	NaCl	19.9	1.16
(unfiltered)		2.4	Sodium Sulfate	Na_2SO_4	116.5	6.79
Manganese	Mn	0.0	Ammonium Sulfate	$(NH_4SO_4$	2.0	.12
Silica	SiO_2	8.0	Magnesium Sulfate	$MgSO_4$	168.5	9.82
Turbidity		20.0	Magnesium Carbonate	$MgCO_3$	79.6	4.64
Calcium	Ca	104.6	Calcium Carbonate	$CaCO_3$	261.6	15.24
Magnesium	Mg	57.0	Iron Oxide	Fe_2O_3	0.0	0.00
Ammonium	NH_4	0.6	Manganese Oxide	MnO	0.0	0.00
Sodium	Na	46.0	Silica	SiO_2	8.0	.47
Sulfate	SO_4	216.7				
Nitrate	NO_3	1.2	Total		657.8	38.34
Chloride	Cl	12.0				
Alkalinity as $CaCO_3$						
Phenolphthalein		10.0				
Methyl Orange		356.0				
Residue		654.0				
Total Hardness		496.0				

AVON (799) (p. 731). No record of change.

BARTLETT (504) (p. 734). No record of change.

BELLWOOD (4991) (p. 736). The well described on page 73G was drilled in connection with a contract whereby William Cater agreed to furnish water for the village for a number of years. In 1936 the well was purchased by the village. It was "shot" and cleaned by C. W. Varner of Dubuque, Iowa. It is reported that the charges of explosive were light and very little sand was removed. The well was originally equipped with a Byron Jackson turbine pump driven by a 200-horsepower electric motor. The original pump head and motor are still in use, but the remainder of the pump is now a product of A. D. Cook, Inc., and consists of 480 feet of 10-inch column pipe, 15 stages of 15-inch bowls, and 30 feet of 10-inch suction pipe.

Both the "Cater" well and the original village well are in use. Water is discharged to a 500,000-gallon reservoir located near the "Cater" well. It is then pumped to the system by a Byron Jackson centrifugal pump, rated at 1000 gallons per minute and driven by a 60-horsepower Ideal electric motor, or by an Economy centrifugal pump, rated at 750 gallons per minute and driven by a 50-horsepower Howell electric motor. A 200,000-gallon elevated steel tank has replaced the original tank.

All water is chlorinated before being pumped to the distribution system. In 1939 there were about 1250 metered service connections and the average daily pumpage was 800,000 gallons.

BERKELEY (779) (p. 743). No record of change.

BURNHAM (994) (p. 758). No record of change.

CALUMET CITY (12,298) (p. 760). No record of change.

CALUMET PARK (1429) (p. 760). No record of change.

CARLINVILLE (4144) (p. 761). The raw water supply of the city of Carlinville is now obtained from an impounding reservoir on Honey Creek. The water is treated before entering the distribution system.

CARRIER MILLS (2140). The raw water supply of the village of Carrier Mills is obtained from a branch of South Fork of Saline River. The water is pumped from the creek to a storage reservoir. It is treated before entering the distribution system. The plant was installed during 1938.

CARROLLTON (2075) (p. 762). No record of change.

CHICAGO HEIGHTS (22,321) (p. 771). Water for the public supply is usually obtained from wells 11 and 14 and is discharged into a 2,100,000-gallon reservoir. From this large reservoir the water flows to a 67,000-gallon reservoir and is then pumped to the distribution system by three American centrifugal pumps, rated at 1740, 2550, and 3400 gallons per minute and driven by 60, 100, and 150-horsepower electric motors, respectively. In case of emergency an American centrifugal pump, rated at 2250 gallons per minute and driven by a 150-horsepower gasoline engine, can be used.

If necessary, water can be pumped from wells 15 and 16 to the reservoir or from wells 12, 13 and 17 to the distribution system. Well number 17 is the 1832-foot well, but is seldom used.

The service pumps are no longer placed in pits. The Holly and De Laval pumps have been abandoned. A new Layne turbine pump has been placed in well number 11, but the other deep well pumps are the same as previously described. The new pump consists of 120 feet of 10-inch column pipe and a 4-stage, 12-inch bowl assembly $4^1/_2$ feet long. The pump is rated at 1500 gallons per minute and is direct-connected to a 60-horsepower electric motor.

The depth to water is measured daily, as described on pages 136 and 137. The depth to water level was fairly constant for a long time until June 1, 1936, when it was 58 feet 8 inches. After that date a more or less steady drop was observed until a maximum reading of 108 feet was noted on December 1, 1937. The water then rose gradually to 85 feet on August 1, 1938, dropped to 102 feet on March 1. 1939, and on June 1, 1939, had risen to 98 feet.

The average daily consumption in June, 1939, was slightly over 2,000,000 gallons. There are more than 3500 metered service connections.

DANVEKS (601) (p. 786). Due to a decrease in capacity of the wells described on page 164 it was necessary to drill a new well in 1939. The new well was located a few feet west of the old wells and was 416 feet deep and 6 inches in diameter. It was equipped with a 20-foot length of 6-inch, number 15-slot Johnson silicon red brass welded screen, but only 18 feet of the screen is exposed to the water-bearing sand and gravel deposit.

A production test of the well was conducted by the State Water Survey. The water level was $284^1/_2$ feet below the surface before pumping and was lowered 12 feet by pumping at a rate of 104 gallons per minute. Gas was discharged with the water in a quantity sufficient to burn continuously. A number of gas wells are in use in the village, furnishing enough gas to heat private homes.

The temperature of the water was 56° P. The water had a total residue of 650, a total hardness of 272, and a content of iron of 2.4 parts per million, as shown by the analysis of sample number 86532, collected October 16, 1939.

The well was crooked and was to be abandoned and replaced by an 8-inch well.

Analysis of Sample Number 86532 from Well 416 Feet Deep.

Determinations Made.		Pts. per million.
Iron	Fe	
(filtered at well)		2.4
(unfiltered)		2.6
Manganese	Mn	0.0
Silica	SiO_2	22.0
Turbidity		10.0
Color		55.0
Odor		0.0
Calcium	Ca	63.0
Magnesium	Mg	27.8
Ammonium	NH_4	9.0
Sodium	Na	151.8
Sulfate	SO_4	0.0
Nitrate	NO_3	1.2
Chloride	Cl	54.0
Alkalinity as $CaCO_3$		
Phenolphthalein		0.0
Methyl Orange		550.0
Residue		650.0
Total Hardness		272.0
Free CO_2		24.0

pH = 7.3

Hypothetical Combinations.		Pts. per million.	Grs. per gallon.
Sodium Nitrate	$NaNO_3$	1.7	0.10
Sodium Chloride	NaCl	88.9	5.18
Sodium Carbonate	$Na2CO_3$	268.2	15.64
Ammonium Carbonate	$(NH_4)2CO_3$	24.0	1.40
Magnesium Carbonate	$MgCO_3$	96.5	5.63
Calcium Carbonate	$CaCO_3$	157.6	9.18
Iron Oxide	Fe_2O_3	2.4	0.14
Silica	SiO_2	22.0	1.28
Total		661.3	38.55

DES PLAINES (8798) (p. 792). The well drilled by William Cater was purchased by the city in 1935 and now furnishes all water for the public supply.

A treatment plant was constructed in 1936. It is of the lime-soda type. All water is aerated, softened, and chlorinated before being pumped to the distribution system. The plant is located near the Cater well at the western city limits.

There are two 600,000-gallon reservoirs at the treatment plant and a 150,000-gallon elevated tank in the business district. Water is pumped from the reservoirs to the system by any of three American centrifugal pumps. Two are rated at 700 gallons per minute each and are driven by 40-horsepower electric motors. The third is rated at 1000 gallons per minute and is driven by a 75-horsepower gasoline engine.

Average daily pumpage in winter is 525,000 gallons, while the maximum daily pumpage in summer is 700,000 gallons.

DOWNERS GEOVE (8977) (p. 795). In 1939 all water for the public supply was obtained from the well on Lee Avenue and the well at the corner of Park Avenue and Summitt Street. The Kelly well was abandoned in 1927 and the American Water Corporation well on Park Avenue in 1929.

The Lee Avenue well is equipped with a 3-stage, 20-inch Aurora turbine pump having 96 feet of 10-inch column pipe and 30 feet of 10-inch suction pipe. The pump is rated at 750 gallons per minute against a head of 250 feet at a speed of 1150 revolutions per minute. It is driven by a 100-horsepower electric motor.

EDINBUEG (799). Edinburg is located in the northwest part of Christian County on the watershed basin of South Fork of Sangamon River, a tributary of Illinois Eiver.

In an attempt to find a well water supply the village in 1938 drilled 16 test wells, varying in depth from 40 feet to 87 feet.

The well from which the public supply is obtained is located on the west bank of South Pork of Sangamon Eiver, about two miles west of the village limits. It is a gravel-walled type well, 30 feet deep, with an outer casing 16 inches in diameter and an inner casing 8 inches in diameter. A 10-foot length of 8-inch stainless steel screen is installed between depths of 20 feet and 30 feet.

At the time the production test was made in May,. 1939, the static water level was 10 feet below the top of the casing and about two feet above river level. The water level in the well was lowered 9.5 feet by pumping at a rate of 35 gallons per minute.

Water from the well had a total residue of 200, a total hardness of 141 and an iron content of 1.7 parts per million, as shown by the analysis of sample number 85650, collected May 9, 1939.

Analysis of Sample Number 85650 from Village Well.

Determinations Made.

		Pts. per million.
Iron	Fe	
(filtered)		0.5
(unfiltered)		1.7
Manganese	Mn	0.0
Silica	SiO_2	12.0
Turbidity		5.0
Color		0.0
Odor		0.0
Calcium	Ca	36.6
Magnesium	Mg	12.0
Ammonium	NH_4	0.1
Sodium	Na	6.0
Sulfate	SO_4	40.8
Nitrate	NO_3	8.9
Chloride	Cl	5.0
Alkalinity as $CaCO_3$		
Phenolphthalein		0.0
Methyl Orange		98.0
Residue		200.0
Total Hardness		141.0
Free CO		23-25.0
p H = 6 . 5		

Hypothetical Combinations.

		Pts. per million.	Grs. per gallon.
Sodium Nitrate	$NaNO_3$	11.9	0.69
Sodium Chloride	NaCl	7.0	0.41
Ammonium Chloride	NH_4C1	0.5	0.03
Magnesium Chloride	MgCU	0.5	0.03
Magnesium Sulfate	$MgSO_4$	51.2	2.99
Magnesium Carbonate	$MgCO_3$	5.5	0.32
Calcium Carbonate	$CaCO_3$	91.6	5.34
Iron Oxide	Fe_2O_3	0.7	0.04
Silica	SiO_2	12.0	0.70
Total		180.9	10.55

EDWABDSVILLE (6235) (p. 804). Well number 2 described on page 804 failed during the summer of 1939 and was abandoned.

A new well was drilled about 75 feet south of well number 1 by Harold Watson of East St. Louis. It is 111% feet deep and is cased with 70% feet of 16-inch casing and 40% feet of 15-inch Johnson Everdur welded screen. The screen openings are number 30 slot. When the well was completed the static water level was reported to be 27 feet below the surface and the drawdown 7 feet when pumping at a rate of 1350 gallons per minute.

The new well is equipped with a Pomona deep well turbine pump the assembly of which consists of 60 feet of 9-inch column pipe, two stages of 12-inch bowls having an over-all length of $2^1/_2$ feet, and 15 feet of 9-inch suction pipe. The pump is direct-connected to a 40-horsepower electric motor.

Another well was to be constructed about 100 feet south of the new well.

ELIZABETHTOWN (488) (p. 810). No record of change.

ELMHURST (14,055) (p. 810). When well number 1 was drilled in 1915 it is reported that a cave was encountered at a depth of 525 feet which drained the water away. This cave was cased off with 97 feet of 10-inch liner. In 1936 this liner was removed and the well cleaned. A new pump was installed and the well was pumped at a rate of 600 gallons per minute.

Well number 2 was repaired in 1935. A bridge at a depth of 1300 feet was removed and the well was shot and cleaned. The yield was increased from 550 to 1000 gallons per minute.

Well number 3 was repaired and deepened in 1933. It is now 2221 feet deep. A bridge was removed and a 6-inch 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 feet. The well had been out of service for several years and had yielded less than 150 gallons per minute. After the repair work was completed the yield was 1100 gallons per minute.

Well number 4 has always yielded salt water. In 1937 and 1938 attempts to improve the quality of the water were made by plugging the well. It was shot at depths of 1810, 1360 and 1300 feet, thus filling the well to 2130 feet. Concrete was placed above the sand to a depth of 2100 feet. After considerable pumping, analyses indicated that the salt content was quite high. The pump was removed and the well shot at 900 and 800 feet. The well bridged at 900 feet and the static level rose to a point 85 feet below the surface. Upon breaking this bridge another bridge was encountered at 1200 feet and the static level dropped to 325 feet. This is reported to be the lowest static level ever experienced in any of the village wells. Upon breaking the bridge at 1200 feet the static water level rose to 255 feet. The well was then plugged to 1985 feet. Tests showed that the salt content increased with continued pumping, as did the temperature. When pumping at a rate of 960 gallons per minute for a period of $4^1/_2$ hours the chloride content of the water increased from 205 to 640 parts per million while the temperature of the water increased from 62 to 64° F. The well was then plugged to 1500 feet with similar results. If the well is not pumped for several days it can be pumped for one day with very little salt water being obtained. However, on the second day the salt content and the temperature of the water will increase steadily.

In 1939 plans were being made to abandon well number 4 and drill a new well at York Eoad near the Chicago, Aurora and Elgin Railroad.

ELMWOOD PARK (11,270) (p. 813). No record of change.

FARMINGTON (2,269) (p. 820). The McGowan triplex pump has been replaced with a single-stage American Marsh centrifugal pump rated at 200 gallons per minute and driven by a 15-horsepower electric motor.

The capacity of the concrete reservoir is 100,000 gallons and that of the elevated tank is 50,000 gallons. In December 1938 the average daily pumpage was 50,000 gallons.

FLOSSMOOE (808) (p. 822). All the wells which have furnished water for the public supply have been owned by the village since 1929. In 1939 all water was obtained from the so-called Merrick well in the northeastern part of the village. Illinois Central well number 2 is used only in case of emergency, while well number 3 has not been used since 1934.

The Merrick well is equipped with a 12-inch American turbine pump having 80 feet of column pipe and 20 feet of 8-inch suction pipe. The pump is rated at 350 gallons per minute when pumping against a head of 231 feet and is direct-connected to a 40-horsepower Howell electric motor which operates at a full load speed of 1140 revolutions per minute.

Storage is provided by a 75,000-gallon elevated tank located near the Merrick well and a 100,000-gallon elevated tank located near the older wells. In 1939 there were 285 metered service connections and the average daily pumpage was 100,000 gallons.

GARDNER (869). Gardner is located in the southeastern part of Grundy County on the drainage area of Mazon River, a tributary of Illinois River. Dug wells from 25 to 30 feet deep and wells into rock from 75 to 175 feet deep are in use throughout the village as sources of private supplies.

In 1925 and 1939 attempts were made to install a public water supply system. A well was drilled in 1925 by M. T. Peterson of Madison, Wisconsin. It was located in Lot 8, Block 17, and was 972 feet deep with a diameter of 8 inches at the bottom. Casing consisted of 290 feet of 10-inch pipe and over 500 feet of 8-inch pipe placed with the top near the bottom of the 10-inch pipe. The 8-inch pipe is reported to have shut off some sulfur water.

The water level was at a depth of 61.7 feet when not pumping and was lowered to 176 feet when pumping at a rate of 21 gallons per minute. At another time the water level was lowered to 285 feet when pumping at a rate of 48 gallons per minute.

The temperature of the water was 55° F. The water had a total residue of 980, a total hardness of 98, and a content of iron of 0.8 parts per million as shown by the analysis of sample number 61868, collected May 29, 1928.

In 1939 a 6-inch test well was drilled by C. S. Cumming of Gardner at a location in the eastern part of the village on the west side of U. S. Highway 66. The well is 173 feet deep and the 6-inch casing extends from the surface to a depth of $61^1/_2$ feet.

The water level was at a depth of 14 feet when not pumping. After pumping for 40 minutes at a rate of 50 gallons per minute the water level was lowered to a depth of $53^1/_2$ feet. With the level maintained at this depth the rate of production decreased until it was 32 gallons per minute at the end of 5 hours pumping.

The temperature of the water was 54° F. The water had a total residue of 564, a total hardness of 53, and a content of iron of 4.0 parts per million as shown by the analysis of sample number 85960. collected July 5, 1939.

A second test of this well was made two months later. At this time the static level was at a depth of 15 feet. The pumping rate of 55 to 59 gallons per minute was maintained for 22 hours and at the end of this period the water level had lowered to a depth of 116 feet.

Analysis of Sample Number 61868 from Well 972 Feet Deep.

Determinations Made.		Pts. per million.
Iron	Fe	0.8
Manganese	Mn	0.0
Turbidity		10.0
Calcium	Ca	20.4
Magnesium	Mg	11.5
Ammonium	NH_4	0.6
Sodium	Na	337.5
Sulfate	SO_4	109.2
Nitrate	NO_3	1.1
Chloride	Cl	280.0
Alkalinity as $CaCO_3$		
Phenolphthalein		18.0
Methyl Orange		324.0
Residue		980.0
Total Hardness		98.4

Hypothetical Combinations.		Pts. per million.	Grs. per gallon.
Sodium Nitrate	$NaNO_3$	1.4	.08
Sodium Chloride	NaCl	461.6	27.00
Sodium Sulfate	Na_2SO_4	161.4	9.44
Sodium Carbonate	Na_2CO_3	237.9	13.91
Ammonium Carbonate	$(NH_4CO_3$	1.6	.09
Magnesium Carbonate	$MgCO_3$	39.8	2.33
Calcium Carbonate	$CaCO_3$	50.8	2.97
Silica	SiO_2	10.0	.58
Iron Oxide	Fe_2O_3	1.1	.06
Manganese Oxide	MnO	0.0	.00
Total		965.6	56.46

Analysis of Sample Number 85960 from Well 173 Feet Deep.

Determinations Made.		Pts. per million.
Iron	Fe	
(filtered at well)		4.0
(unfiltered)		14.8
Manganese	Mn	0.2
Silica	SiO_2	16.0
Turbidity		120.0
Color		0.0
Odor		0.0
Calcium	Ca	13.3
Magnesium	Mg	4.9
Ammonium	NH_4	1.0
Sodium	Na	193.4
Sulfate	SO_4	0.8
Nitrate	NO_3	3.4
Chloride	Cl	70.0
Alkalinity as $CaCO_3$		
Phenolphthalein		6.0
Methyl Orange		374.0
Residue		564.0
Total Hardness		53.0
Free CO_2		5.0
pH = 8.0		

Hypothetical Combinations.		rts. per million.	Grs. per gallon.
Sodium Nitrate	$NaNO_3$	4.3	0.25
Sodium Chloride	NaCl	115.0	6.70
Sodium Sulfate	Na_2SO_4	1.4	0.08
Sodium Carbonate	Na_2CO_3	337.6	19.68
Ammonium Carbonate	$(NH_4)_2CO_3$	2.4	0.14
Magnesium Carbonate	$MgCO_3$	16.5	0.96
Calcium Carbonate	$CaCO_3$	33.0	1.92
Iron Oxide	Fe_2O_3	5.7	0.33
Manganese Oxide	MnO	0.3	0.02
Silica	SiO_2	16.0	0.93
Total		532.2	31.01

GENEVA (4607) (p. 836). No record of change.

GIBSON CITY (2163) (p. 840). The State Water Survey made a production test of the well on 13th Street on May 8, 1939. The water level was 12.8 feet below the top of the well casing when not pumping and when pumping at rates of 380. 505 and 605 gallons per minute the water level was lowered to depths of 33, $38\frac{1}{2}$ and $46\frac{1}{2}$ feet, respectively.

In August 1939 the city drilled a test hole on 13th Street about one block west of the existing well. The log of the test hole, as prepared by the State Geological Survey after the study of sample cuttings, is as follows:

	Thickness in feet.	Depth in feet.
Pleistocene system		
Wisconsin glacial drift		
Clay, calcareous, brown	10	10
Till, calcareous, brownish gray	11	21
Sand, silty, gray, very fine to coarse	9	30
Sand, clean, gray, very fine	5	35
Sand, clean, gray, very fine, some coarse	10	45
Sand, clean, gray, fine to medium; gravel, fine	5	50
Sand, clean, gray, fine	5	55
Sand, very silty, gray, medium to coarse	6	61
Till, calcareous, gray	at	61

Samples between 35 and 50 feet are the cleanest and coarsest. The water had a total residue of 346.0, a total hardness of 224.5, and an iron content of 14.8 parts per million as shown by the analysis of sample number 86117, collected with a bailer on August 14, 1939.

Analysis of Sample Number S6117 from Test Hole on 13th Street.

Determinations Made.		Pts. per million.	Hypothetical Combinations.		Pts. per million.	Grs. per gallon.
Iron	Fe		Sodium Nitrate	$NaNO_3$	1.7	0.10
(filtered)		0.8	Sodium Chloride	NaCl	8.2	0.4S
(unfiltered)		14.8	Sodium Sulfate	Na_2SO_4	62.6	3.65
Manganese	Mn	0.0	Sodium Carbonate	Na_2CO_3	33.4	1.95
Silica	SiO_2	11.0	Ammonium Carbonate	$(NH_4).CO_3$	1.9	0.11
Turbidity		30.0	Magnesium Carbonate	$MgCO_3$	114.9	6.70
Color		0.0	Calcium Carbonate	$CaCO_3$	88.0	5.13
Odor		0.0	IronOxide	Fe_2O_3	1.1	0.06
Calcium	Ca	35.3	Silica	SiO_2	11.0	0.64
Magnesium	Mg	33.2				
Ammonium	NH_4	0.8	Total		322.8	18.82
Sodium	Na	38.4				
Sulfate	SO_4	42.2				
Nitrate	$N0_3$	1.2				
Chloride	Cl	5.0				
Alkalinity as $CaCO_3$						
Phenolphthalein		0.0				
Methyl Orange		258.0				
Residue		346.0				
Total Hardness		224.5				

GLEN CAEBON (1340). Glen Carbon is located in the southwestern part of Madison County about one mile east of the Mississippi

River valley. Many dug wells from 15 to 45 feet deep are in use. These are all reported to be reliable wells.

In 1939 an attempt was made to install a public water supply system. A dug well 10 feet in diameter and curbed with porous concrete was constructed in the ball park in the valley of Judy's Branch. It reached a depth of 33 feet, penetrating blue mud all the way. A small auger hole drilled to a depth of 60 feet failed to disclose any important water-bearing material.

An electrical earth resistivity survey indicated that no important water-bearing sand or gravel deposit would be found in this valley, but that such a deposit probably would be found at the eastern edge of the American Bottoms near the mouth of Judy's Branch.

The State Water Survey conducted a production test on two test pits on August 31, 1939. One pit was originally constructed as a mine ventilating shaft in 1890 but construction was abandoned when the shaft flooded at a depth of 40 feet. The shaft is located within the village limits about 100 feet northerly of the center line of the Litchfield and Madison railroad tracks. The mine used it as a source of supply for wash water and residents carried water from it when their shallow wells failed. The test indicated that this shaft would produce about 6 gallons per minute.

The water had a total residue of 966, a total hardness of 747.5, and an iron content of 0.2 parts per million as shown by the analysis of sample number 86250, collected August 31, 1939. The water had a temperature of 56° F.

Analysis of Sample Number S6250 from Ventilating Shaft.

Determinations Made.		Pts. per million.
Iron	Fe	
(filtered at well)		0.2
(unfiltered)		0.3
Manganese	Mn	0.0
Silica	SiO_2	30.0
Turbidity		3.0
Color		0.0
Odor		0.0
Calcium	Ca	151.2
Magnesium	Mg	89.9
Ammonium	NH_4	trace
Sodium	Na	34.7
Sulfate	SO_4	312.0
Nitrate	NO_3	48.2
Chloride	Cl	41.0
Alkalinity as $CaCO_3$		
Phenolphthalein		0.0
Methyl Orange		402.0
Residue		966.0
Total Hardness		747.5

Hypothetical Combinations.		Pts. per million.	Grs. per gallon.
Sodium Nitrate	$NaNO_3$	66.3	3.86
Sodium Chloride	NaCl	42.7	2.49
Magnesium Chloride	$MgCl_2$	20.5	1.20
Magnesium Sulfate	$MgSO_4$	390.0	22.74
Magnesium Carbonate	$MgCO_3$	20.2	1.18
Calcium Carbonate	$CaCO_3$	378.3	22.05
Iron Oxide	Fe_2O_3	0.3	0.02
Silica	SiO_2	30.0	1.75
Total		948.3	55.29

The second pit completed by the village was located about 340 feet northeasterly of the old ventilating shaft and was 26 feet deep. This pit was curbed with timber and the inside dimensions were approximately 5.75 feet by 5.75 feet. The test indicated that this well could furnish about 10 gallons per minute. The pit penetrated soil and

yellow clay to a depth of 12 feet, clay with sand and boulders from 12 feet to 18 feet, and sandy and gravelly clay with boulders from 18 feet to 26 feet. An auger hole drilled in the bottom of the pit penetrated hard tough shale from 26 feet to 49 feet and soft gravelly clay with water between 49 feet and 51 feet.

The water had a total residue of 400, a total hardness of 343.5 parts per million, and no iron as shown by the analysis of sample number 86252, collected on August 31, 1939. The temperature of the water was 60° F.

Analysis of Sample Number 86252 from Test Pit 26 Feet Deep.

Determinations Made.		Pts. per million.	Hypothetical Combinations.		Pts. per million.	Grs. per gallon.
Iron	Fe		Sodium Nitrate	$NaNO_3$	15.3	0.89
(filtered)		0.0	Sodium Chloride	NaCl	4.1	0.24
(unfiltered)		0.8	Magnesium Chloride	$MgCl_2$	3.3	0.19
Manganese	Mn	0.0	Magnesium Sulfate	$MgSO_4$	86.7	5.05
Silica	SiO_2	28.0	Magnesium Carbonate	$MgCO_3$	66.3	3.88
Turbidity		10.0	Calcium Carbonate	$CaCO_3$	189.7	11.06
Color		0.0	Silica	SiO_2	28.0	1.63
Odor		0.0				
Calcium	Ca	75.8	Total		393.4	22.94
Magnesium	Mg	37.5				
Ammonium	NH_4	trace				
Sodium	Na	5.8				
Sulfate	SO_4	69.4				
Nitrate	NO_3	11.1				
Chloride	Cl	5.0				
Alkalinity as $CaCO_3$						
Phenolphthalein		0.0				
Methyl Orange		268.0				
Residue		400.0				
Total Hardness		343.5				

GLENVIEW (1886) (p. 843). Since July 29, 1938 all water for the public supply has been filtered lake water purchased from the Village of Wilmette. The pump has been removed from well number 1 but well number 2 is still equipped with a Layne turbine pump and could be used in case of emergency.

GEAFTON (1026) (p. 844). No record of change.

GEAYVILLE (1904) (p. 846). No record of change.

GBEENFIELD (1038) (p. 847). A change in water quality was reported on page 848. An investigation revealed that this was caused by brine from the treatment plant being discharged too near the wall. The brine outlet was moved to a more distant point. Since then the quality of the raw water has been similar to that shown by the analysis of sample number 77450.

GREENUP (1062) (p. 849). A new well was drilled for the village in 1938 by Joseph Heth of Jewett, Illinois. This well is located on the west side of Embarrass Eiver and north of State Highway 121.

It is 28 feet deep, of the gravel-wall type with 16-inch inner casing and 36-inch outer casing. A 16-inch Cook screen is exposed between depths of 17½ and 25½ feet, with 2½ feet of blank pipe below the screen. The screen openings are number 80 slot. The annular space between the two casings is filled with pieces of limestone as large as hickory nuts.

Material penetrated by the well is reported to be as follows: soil 19 feet, gravel 6½ feet, fine sand 2½ feet. Several auger holes have been drilled in the river valley and the results of these tests indicate that this log is typical for all points within a radius of more than 100 feet.

A production test of this well was conducted by the State Water Survey in 1939. The water level was at a depth of 12 feet when not pumping and was lowered 11.4 feet by pumping at a rate of 155 gallons per minute.

The water had a total residue of 293, a total hardness of 242.5, and a content of iron of 0.1 parts per million as shown by the analysis of sample number 86073, collected July 25, 1939. The temperature of the water was 54° P.

At the time the production test was made the well had not been put in service although it was equipped with a Cook turbine pump driven by a 25-horsepower electric motor. The older infiltration wells were incapable of furnishing more than one-third of the water needed.

Analysis of Sample Number 86073 from Village Well.

Determinations Made.		Pts. per million.
Iron	Fe	
(filtered)		trace
(unfiltered)		0.1
Manganese	Mn	0.0
Silica	SiO_2	18.0
Turbidity		0.0
Color		0.0
Odor		0.0
Calcium	Ca	57.8
Magnesium	Mg	23.9
Ammonium	NH_4	trace
Sodium	Na	1.1
Sulfate	SO_4	27.0
Nitrate	NO_3	4.6
Chloride	Cl	4.0
Alkalinity as $CaCO_3$		
Phenolphthalein		0.0
Methyl Orange		208.0
Residue		293.0
Total Hardness		242.5
Free CO_2		12.0
pH = 7.3		

Hypothetical Combinations.		Pts. per million.	Grs. per gallon.
Sodium Nitrate	$NaNO_3$	4.3	0.25
Magnesium Nitrate	$Mg(NO_3)_2$	1.5	0.09
Magnesium Chloride	$MgCl_2$	5.3	0.31
Magnesium Sulfate	$MgSO_4$	33.7	1.96
Magnesium Carbonate	$MgCO_3$	52.5	3.06
Calcium Carbonate	$CaCO_3$	144.7	8.44
Silica	SiO_2	18.0	1.05
Total		260.0	15.16

HINSDALE (6923) (p. 865). No record of change.

HOMEE (918). Homer is located in the southeastern part of Champaign County on the drainage area of Salt Fork, a tributary of Vermilion Eiver.

Many dug wells and a few drilled wells furnished private supplies, water-bearing sand and gravel deposits being reported at depths of 15, 30 and 85 feet.

A public water supply system was installed in 1939, the water being obtained from a well 72 feet deep constructed by the Layne Western Company at a site in the southwestern part of the village. The well is of the gravel wall filter type with 40 feet of 16-inch outer casing and 72 feet of 8-inch inner casing and screen. Sections of Layne shutter screen are set in the line of inner casing between depths of 49½ and 59½ feet and 67 and 72 feet.

At the time of the official production test, which was made by the State Water Survey, the static water level was found to be 12 feet below the surface, and levels of 34. 40 and 47 feet were observed with pumping rates of 74, 80 and 105 gallons per minute respectively.

The well is equipped with a Layne deep well turbine pump the assembly of which consists of 50 feet of 4-inch column pipe, three stages of 8-inch bowls having an over-all length of 3 feet, and 10' feet of 4-inch suction pipe. The pump is direct-connected to a 5-horsepower electric motor.

The raw water from the well has a total residue of 404, a total hardness of 217, and an iron content of 0.44 parts per million as shown by the analysis of sample number 85973, collected July 8, 1939. The water is aerated and filtered before being pumped to the distribution system.

Analysis of Sample Number 85973 from the Village Well.

Determinations Made.		Pts. per million.	Hypothetical Combinations.		Pts. per million.	Grs. per gallon.
Iron	Fe		Sodium Nitrate	$NaNO_3$	4.3	0.25
(filtered)		0.4	Sodium Chloride	NaCl	21.6	1.26
(unfiltered)		17.6	Sodium Carbonate	Na_2CO_3	124.0	7.23
Manganese	Mn	0.1	Magnesium Carbonate	$MgCO_3$	74.6	4.35
Silica	SiO_2	22.0	Calcium Carbonate	$CaCO_3$	128.7	7.50
Turbidity		75.0	Iron Oxide	Fe_2O_3	0.6	0.03
Color		23.0	Manganese Oxide	MnO	0.2	0.01
Odor		0.0	Silica	SiO_2	22.0	1.28
Calcium	Ca	51.4				
Magnesium	Mg	21.5	Total		376.0	21.91
Ammonium	NH_4	trace				
Sodium	Na	63.5				
Sulfate	SO_4	0.0				
Nitrate	NO_3	2.8				
Chloride	Cl	13.0				
Alkalinity as $CaCO_3$						
Phenolphthalein		0.0				
Methyl Orange		334.0				
Residue		404.0				
Total Hardness		217.0				
Free CO_2		14.0				

HOMEWOOD (3227) (p. 867). Well number 1 is now equipped with a 7-stage, 8-inch Pomona turbine pump having 110 feet of 6-ineh column pipe and 10 feet of 6-inch suction pipe. The pump is rated at 300 gallons per minute against a head of 110 feet and is driven bv a 15-horsepower electric motor.

In 1939 there were over 900 metered service connections and the daily pumpage was about 240,000 gallons.

ITASCA (594) (p. 871). No reported change.

JEESEYVILLE (4309) (p. 873). No record of change.

JONESBORO (1241) (p. 876). No record of change.

KEWANEE (17,093) (p. 881). A new well known as number 3, drilled for the city in 1939 by Mileager and Smyth of Chicago, is located on the west side of Madison Avenue, in the northern part of the city, not far from the original pumping station.

When the well had reached a depth of 1442 feet the St. Peter sandstone was shot with a total of 2000 pounds of dynamite and on May 29, 1939, the State Water Survey made a short production test. Static water level was found to be 272*"feet below the surface and with a maximum production of about 125 gallons per minute a drawdown of 103 feet took place.

The water had a total residue of 997, a total hardness of 212, and an iron content of 27 parts per million, as shown by the analysis of sample number 85744, collected on May 26, 1939.

Because of the low capacity as indicated by the test, drilling was continued to a final depth of 2484 feet. As completed the well is cased with 16-inch pipe to a depth of 469. feet and with 12-inch pipe between depths of 445 and 1014 feet. A 10-inch liner set between depths of 1337 and 1525 feet is perforated between depths of 1355 and 1430 feet to permit entrance of water from the St. Peter sandstone.

A 24-hour production test, conducted by the State Water Survey on August 30-31, 1939, indicated a drawdown of 92.2 feet below a

Analysis of Sample Number 85744 from Well Number 3 When 1442 Feet Deep.

Determinations Made.

		Pts. per million.
Iron	Fe	
(filtered)		27.0
(unfiltered)		31.6
Manganese	Mn	0.0
Silica	SiO_2	15.0
Turbidity		550.0
Color		0.0
Odor		0.0
Calcium	Ca	50.2
Magnesium	Mg	21.1
Ammonium	NH_4	12.9
Sodium	Na	265.0
Sulfate	SO_4	162.6
Nitrate	NO_3	57.5
Chloride	Cl	65.0
Alkalinity as $CaCO_3$		
Phenolphthalein		0.0
Methyl Orange		516.0
Residue		997.0
Total Hardness		212.0

Hypothetical Combinations.

		Pts. per million.	Grs. per gallon.
Sodium Nitrate	$NaNO_3$	79.0	4.60
Sodium Chloride	NaCl	107.0	6.24
Sodium Sulfate	Na_2SO_4	240.0	13.99
Sodium Carbonate	Na_2CO_3	285.0	16.62
Ammonium Carbonate	$(NH_4)_2CO_3$	34.1	1.99
Magnesium Carbonate	$MgCO_3$	73.0	4.25
Calcium Carbonate	$CaCO_3$	125.5	7.32
Iron Oxide	Fe_2O_3	38.6	2.25
Silica	SiO_2	15.0	0.87
Total		997.2	58.13

Analysis of Sample Number 86245 from Well Number 3, When Completed to a Depth of 2484 Feet.

Determinations Made.		Hypothetical Combinations.			
	Pts. per million.			Pts. per million.	Grs. per gallon.
Iron . . . . . Fe		Sodium Nitrate . . . . . $NaNO_3$		1.7	0.10
(filtered at well) . .	0.4	Sodium Chloride . . . . . NaCl		923.1	53.81
(unfiltered)	0.6	Sodium Sulfate . . . . . Na_2SO_4		306.0	17.84
Manganese . . Mn	0.0	Ammonium Sulfate . . . . $(NH_4)_2SO_4$		6.6	0.38
Silica . . . . . SiO_2	9.5	Magnesium Sulfate . . . . $MgSO_4$		91.5	5.28
Turbidity	3.0	Magnesium Carbonate . . $MgCO_3$		47.3	2.76
Color	0.0	Calcium Carbonate . . . . $CaCO_3$		212.0	12.36
Odor	0.0	Iron Oxide . . . . . Fe_2O_3		0.5	0.03
Magnesium . . Mg	32.1	Silica . . . . . SiO_2		9.5	0.55
Calcium . . . . Ca	84.8				
Ammonium . . NH_4	1.9	Total		1598.7	93.11
Sodium . . . . Na	462.9				
Sulfate . . . . . SO_4	285.0				
Nitrate . . . . . NO_3	1.2				
Chloride Cl	560.0				
Alkalinity as $CaCO_3$					
Phenolphthalein . .	0.0				
Methyl Orange . . .	268.0				
Residue	1600.0				
Total Hardness	344.4				
Free CO_2	16.0				
pH = 7.5					

static water level of 273.8 feet when pumping at a rate of 655 gallons per minute. The temperature of the water was 70° F. A definite odor of hydrogen sulfide was noticeable.

Water from the finished well had a total residue of 1600. a total hardness of 344.4 and an iron content of 0.40 parts per million, as shown by the analysis of sample number 86245. collected August 30. 1939.

Water from well number 2, 2438 feet deep, had a total residue of 1669, and a total hardness of 396 parts per million, without iron, as shown by the analysis of sample number 83975, collected July 28, 1938.

KINDERHOOK (318). Kinderhook is located in the northwestern part of Pike County, at the eastern edge of the flood plain of Mississippi Eiver. Most residences on high ground have dug wells less than 40 feet deep, which are uniformly reliable for household purposes. Wells on low ground are dug or driven wells about 35 feet deep and all are very reliable. In 1939 a public water supply was being installed by the village.

A test well was constructed on the flood plain of the river on the west side of Harper Street, about 400 feet south of the Wabash Railway. It was a 2-inch well point 3 feet long set at the bottom of an auger hole 30 feet deep. The well was pumped by suction at the rate of 20 gallons per minute and the drawdown in holes 20 feet away was negligible. The static water level was about 25 feet below the surface. A permanent well will probably be constructed at this location.

The temperature of the water was 58° F. The water had a total residue of 287, and a total hardness of 192.5 parts per million, without iron, as shown by the analysis of sample number 86823. collected in November, 1939.

Analysis of Sample Number 86823 from Test Well.

Determinations Made.		Pts. per million.	Hypothetical Combinations.		Pts. per million.	Grs. per gallon.
Iron	Fe		Sodium Nitrate	$NaNO_3$	45.9	2.68
(filtered at well)		0.0	Ammonium Chloride	NH_4C1	0.5	0.03
(unfiltered)		0.2	Magnesium Chloride	$MgCl_2$	18.1	1.05
Manganese	Mn	0.0	Magnesium Sulfate	$MgSO_4$	57.2	3.33
Silica	SiO_2	20.5	Calcium Sulfate	$CaSO_4$	19.1	1.11
Turbidity		3.0	Calcium Carbonate	$CaCOs$	112.1	6.53
Color		0.0	Silica	SiO_2	20.5	1.20
Odor		0.0				
Calcium	Ca	50.4	Total		273.4	15.93
Magnesium	Mg	16.2				
Ammonium	NH_4	0.1				
Sodium	Na	12.4				
Sulfate	SO_4	59.0				
Nitrate	NO_3	33.6				
Chloride	Cl	14.0				
Alkalinity as $CaCO_3$						
Phenolphthalein		0.0				
Methyl Orange		112.0				
Residue		287.0				
Total Hardness		192.5				
Free CO_2 (by test)		40.0				
Free CO_2 (calc)		132.0				
pH = 6.2						

LA HAEPE (1175) (p. 891). Until 1939 the well described on page 326 served as the source of the public water supply. In that year a new well was drilled about 90 feet south of the older one by D. E. Edwards of West Branch, Iowa. The new well is 95 feet deep, 8 inches

Analysis of Sample Number 86440 from Well 95 Feet Deep.

Determinations Made.		Pts. per million.	Hypothetical Combinations.		Pts. per million.	Grs. per gallon.
Iron	Fe		Sodium Nitrate	$NaNO_3$	0.9	0.05
(filtered at well)		7.1	Sodium Chloride	NaCl	19.8	1.16
(unfiltered)		8.0	Ammonium Chloride	NH4Cl	2.1	0.12
Manganese	Mn	0.1	Magnesium Chloride	$MgCl_2$	3.3	0.19
Turbidity		15	Magnesium Sulfate	$MgSO_4$	24.6	1.44
Color		0	Magnesium Carbonate	$MgCO_3$	88.0	5.14
Odor		0	Calcium Carbonate	$CaCOs$	247.5	14 42
Silica	SiO_2	19.0	Iron Oxide	Fe_2O_3	7.1	0.41
Calcium	Ca	99.0	Manganese Oxide	MnO	0.1	0.01
Magnesium	Mg	31.3	Silica	SiO_2	19.0	1.11
Ammonium	NH_4	0.8				
Sodium	Na	8.0	Total		412.4	24 05
Sulfate	SO_4	19.7				
Nitrate	NO_3	0.8				
Chloride	Cl	16.0				
Alkalinity as $CaCO_3$						
Phenolphthalein		0.0				
Methyl Orange		352.0				
Residue		434.0				
Total Hardness		376.0				
Free CO_2 (bv test)		22.0				
Free CO_2 (calc.)		23.0				
pH = 7.0						

Hydrogen Sulfide—none.

in diameter, and equipped with a 10-foot length of 8-inch Johnson Everdur welded screen having 9 feet of number 50 slot openings.

The official production test was conducted by the State Water Survey. Before pumping the water level was approximately 42 feet below the ground surface and was lowered 27 feet by pumping at a rate of 160 gallons per minute. During this test the water level in the old well was lowered approximately 7 feet.

The temperature of the water was $54^1/_2$° F. The water had a total residue of 434, a total hardness of 376, and a content of iron of 7.1 parts per million, as shown by the analysis of sample number 86440, collected October 3, 1939.

LAKE VILLA (487) (p. 891). The well described on page 892 was repaired in 1939 by E. E. Milaeger of Milwaukee because of the large amount of fine sand that was continuously pumped.

A 20-foot length of 4-inch, number 40-slot Johnson steel screen was placed inside the 8-inch screen. The top of the smaller screen is at a depth of $137^1/_2$ feet, the bottom is sealed, and there is a tight seal between the top and the 10-inch casing. The annular space between the two screens is filled with gravel particles as large as a grain of wheat.

A production test of the repaired well was conducted by the State Water Survey. The water level was at a depth of 46 feet when not pumping and was lowered $33^1/_2$ feet by pumping at a rate of 85 gallons per minute. At this rate the amount of sand pumped was not objectionable.

LOMBARD (6197) (p. 907). Well number 1 described on page 365 is used only in case of emergency. It is equipped with a 5-stage, 5-inch American turbine pump having 63 feet of column pipe and no suction pipe. The pump is direct-connected to a 15-horsepower electric motor. Static water level is 10 feet and the drawdown is 21 feet when pumping at a rate of 465 gallons per minute.

Well number 2 usually furnishes all the water used. It is equipped with a 14-stage, 12-inch American turbine pump driven by a 75-horsepower electric motor. In 1934 and again in 1938 it was necessary to install a new bowl assembly. The pump installation includes 384 feet of column pipe and 40 feet of suction pipe. Water from this well contains hydrogen sulfide in objectionable quantities.

Water is pumped from either well over an aerator to a 600,000-gallon reservoir built in 1938. In the same year a new 250,000-gallon elevated steel tank was erected in the southern part of the village. The old 60,000-gallon elevated tank is still in use. Water is pumped from the reservoir to the distribution system by either of two American centrifugal pumps, rated at 1400 and 500 gallons per minute and driven by 75 and 40-horsepower electric motors, respectively. The larger pump is seldom used.

In 1939 there were 1790 metered service connections and the average daily pumpage was 425,000 gallons.

MAHOMET (729). Mahomet is located in the western part of Champaign County on the west bank of Sangamon River.

Many private wells in the village obtain water from sand and gravel at depths of 60 to 70 feet. A second sand deposit is reported at depths of 100 to 115 feet, while a third deposit is reported between depths of 200 and 230 feet. In 1939 a public water supply was being installed by the village.

Water for the public supply will be obtained from a well located near the intersection of Vine and Dunbar Streets near the business district. The well was drilled in 1939 by Hayes and Sims of Champaign, Illinois, and is 94 feet deep and 8 inches in diameter. It is equipped with a 10-foot length of 8-inch Johnson red brass welded screen. The upper half of the screen has number 18 slots and the lower half has number 20 slots.

The official production test of the well was conducted by the State Water Survey. The water level was $46\frac{1}{2}$ feet below the ground surface before pumping and was lowered $12\frac{1}{4}$ feet by pumping at a rate of 230 gallons per minute.

The temperature of the water was 54° F. The water had a total residue of 591, a total hardness of 496.5, and a content of iron of 1.9 parts per million, as shown by the analysis of sample number 86382, collected September 27, 1939.

Analysis of Sample Number 86382 from Village Well.

Determinations Made.		Pts. per million.
Iron	Fe	
(filtered)		1.9
(unfiltered)		2.7
Manganese	Mn	0.1
Silica	SiO_2	16.0
Turbidity		18.0
Color		0.0
Odor		0.0
Calcium	Ca	115.0
Magnesium	Mg	51.0
Ammonium	NH_4	trace
Sodium	Na	16.6
Sulfate	SO4	120.5
Nitrate	NO_3	1.2
Chloride	Cl	24.0
Alkalinity as $CaCO_3$		
Phenolphthalein		0.0
Methyl Orange		372.0
Residue		591.0
Total Hardness		496.5
Free CO_2		22.0
pH = 7.0		

Hypothetical Combinations.		Pts. per million.	Grs. per gallon.
Sodium Nitrate	$NaNO_3$	1.7	0.10
Sodium Chloride	NaCl	39.1	2.28
Sodium Sulfate	Na_2SO_4	2.3	0.13
Magnesium Sulfate	$MgSO_4$	149.7	8.73
Magnesium Carbonate	$MgCO_3$	71.2	4.15
Calcium Carbonate	$CaCO_3$	287.5	16.75
Iron Oxide	Fe_2O_3	2.7	0.16
Manganese Oxide	MnO	0.1	0.01
Silica	SiO_2	16.0	0.93
Total		570.3	33.24

MATTOON (14,631) (p. 923). The capacity of the wells near Dorans has shown a steady decline since they were constructed. Late in 1939 a new drilling program was started by the city. A well was drilled by E. C. Baker of Sigel, Illinois, at a point north of the Illinois Central Tracks and on a line with South Twelfth Street extended.

This well was 56 feet deep, 10 inches in diameter, and equipped with 8 feet of number 80-slot Johnson Everdur welded screen. During a production test conducted by the State Water Survey this well produced 40 gallons per minute with a drawdown of $7^3/_4$ feet from a static level 42 feet below the ground surface.

A program of test well drilling is planned on the city property near the village of Dorans, some four miles north of the city.

MIDLOTHIAN (1775) (p. 929). All water for the public supply is from Lake Michigan, purchased from the City of Blue Island.

Formerly there were three separate water systems in the area which now comprises the village. Each was served by a different well.

The Gardens Water Association well was 80 feet deep and located about 200 feet south of 147th Street and one-half block east of 43rd Avenue. This well served an area west of Crawford Avenue between 147th and 151st Streets.

The Eobertson well was 80 feet deep and located about 130 feet south of 149th Street, between Avers and Springfield Avenues. It served an area east of Crawford Avenue and south of 147th Street. Later it was necessary to drill a new well, 130 feet deep, at 148th Place and the Eock Island right-of-way. This new well is reported to have furnished excellent water for some time, but suddenly iron and hydrogen sulfide appeared in the water. This change is reported to have taken place overnight following a severe electrical storm.

The Mcintosh well mentioned on page 929 served an area north of 147th Street. It is located at the southeast corner of Central Park Avenue and Abbotsford Eoad and was drilled by P. E. Millis of Byron, Illinois. A record of material penetrated by this well is as follows:

	Thickness in feet.	Depth in feet.
Blue clay	6	6
Quicksand	9	15
Sand and boulders	8	23
Shelly lime rock	6	29
Bedrock	71	100
Brown lime	80	180
White chalky lime	50	230
Brown hard lime	130	360
Slate	15	375
Brown lime	20	395
Brown shale	115	510
Broken lime and shale	13	523
White lime	72	595
Brown hard lime	75	670
Blue-white lime	55	725
Shale breaks	35	760
White lime	50	810

The well is cased from the surface to a depth of 32 feet with 10-inch pipe and from 344 to 527 feet with 8-inch pipe. When not pumping the water level was $5^1/_2$ feet below the ground surface and when pumping at a rate of 175 gallons per minute the water level was 65 feet below the ground surface.

The Mcintosh well was formerly equipped with an American turbine pump having a capacity of 150 gallons per minute. This pump has been removed and the top of the well plugged with concrete. All other wells have been abandoned.

All wells and mains are now owned by the village and the various systems are interconnected. A new booster station has been constructed at the southwest corner of 143rd Street and Kedzie Avenue. Two Yeomans centrifugal pumps, rated at 150 and 225 gallons per minute and driven by 10 and 15-horsepower electric motors, respectively, are used. Storage is provided by a 75,000-gallon elevated steel tank, which was formerly part of the Mcintosh system and is located near the Mcintosh well.

In 1939 there were 560 metered service connections and the average daily pumpage was 60,000 gallons.

MILLEDGEVILLE (807) (p. 931). In 1939 the east well failed and was abandoned and a new well was drilled 10 feet further east by Davis and Lingle of Preston, Iowa. It is 437 feet deep and 10 inches in diameter, and is cased with 20 feet of 12-inch pipe and 32 feet of 10-inch pipe. Cement grout was placed between the two pipes, both of which terminate at the ground surface.

The water level was at a depth of 115 feet when not pumping.

The well is equipped with a 25-stage, 6-inch Fairbanks-Morse turbine pump, consisting of 250 feet of column pipe, 11 feet 5 inches of bowls, and 30 feet of suction pipe. The pump is driven by a 20-horsepower electric motor.

The water had a total residue of 323 and a total hardness of 318 parts per million without iron, as shown by the analysis of sample number 86366, collected September 19, 1939.

Analysis of Sample Number 86366 from Well 437 Feet Deep.

Determinations Made.		Pts. per million.	Hypothetical Combinations.		Pts. per million.	Grs. per gallon.
Iron	Fe		Sodium Nitrate	NaNOa	3.4	0.20
(filtered)		0.0	Sodium Sulfate	Na_2SO_4	7.1	0.41
(unfiltered)		trace	Ammonium Sulfate	$(NH_4)_2SO_4$	0.7	0.04
Manganese	Mn	0.0	Magnesium Sulfate	$MgSO_4$	12.0	0.70
Silica	SiO_2	14.5	Magnesium Carbonate	$MgCO_3$	113.5	6.62
Turbidity		2.0	Calcium Carbonate	$CaCO_3$	174.0	10.15
Color		0.0	Silica	SiO_2	14.5	0.85
Odor		0.0				
Calcium	Ca	69.3	Total		325.2	18.97
Magnesium	Mg	35.2				
Ammonium	NH_4	0.1				
Sodium	Na	3.2				
Sulfate	SO_4	15.0				
Nitrate	NO_3	2.3				
Chloride	Cl	0.0				
Alkalinity as $CaCO_3$						
Phenolphthalein		0.0				
Methyl Orange		308.0				
Residue		323.0				
Total Hardness		318.0				

MILLSTADT (1014) (p. 931). On August 11. 1938, the State Water Survey made a production test on the municipal well at Millstadt. At that time it was necessary to operate the pump 24 hours per day because of the intermittent discharge which indicated that the water level, when pumping, was lowered to a point 10 to 15 feet below the pump bowls. The maximum instantaneous rate of discharge was 55 gallons per minute and the 24-hour average rate of discharge was probably 10 to 12 gallons per minute. The static water level was reported in August, 1936, to be 193 feet below the ground surface.

The Sewell Well Company of St. Louis, Missouri, drilled a new well for the village early in 1939 at a site in the northwest corner of the public square, at the intersection of Oak and Monroe Streets. The following log was prepared by the State Geological Survey from a study of the sample cuttings.

	Thickness in feet.	Depth in feet.
Pleistocene system—		
Glacial drift	40	40
Pennsylvanian system—		
Shale and limestone	50	90
Mississippian system—		
Chester series—		
Golconda-Cypress-Paint Creek formations		
Shale, thin limestones and sandstones	77	167
Bethel sandstone, compact	2S	195
Renault formation—		
Shale, green and red, weak	47	242
Aux Vases sandstone		
Sandstone, brown to white porous, oil show	38	280
Sandstone, white fine to coarse, porous	15	295
Sandstone, very fine, compact, grading to shale, gray	9	304
Iowa series—		
St. Genevieve, St. Louis, and Salem limestone, compact	311	615

This well was originally finished at a depth of 350 feet and cased to a depth of 272 feet with 8-inch pipe. Water was encountered in the top of the Aux Vases sandstone at a depth of 242 feet.

With a pump setting of 350 feet the well produced only 10 gallons per minute. The casing was then pulled back and suspended with the bottom at a depth of 253 feet. A good yield was obtained for about 18 minutes and then ceased. Drilling was then continued to a depth of 615 feet.

MORRISONVILLE (968) (p. 939). No record of change.

MORTON (1501) (p. 940). Well number 2 was repaired in 1938 by Chris Ebert of Washington, Illinois. The well was originally reported to be 230 feet deep and it was thought that the screen was set at the bottom of the glacial drift. However, during repairs, a new stratum of gravel was discovered below a thin layer of hardpan. The latest report indicates that the well was deepened 8 feet and that it is

now 232 feet deep. A new Johnson welded screen was installed. It is 8 inches in diameter and 20 feet long with 18 feet of openings. The lower portion has number 25 slots while the upper portion has number 16 slots.

An official production test of the repaired well was made by the State Water Survey. The water level was at a depth of 184 feet when not pumping and was lowered 10 feet when pumping at the rate of 300 gallons per minute.

The well was to be equipped with a turbine pump rated at 200 gallons per minute and driven by an electric motor. The improvement program also included the installation of a zeolite softener and a diesel-driven generator to furnish power for pumping.

The temperature of the water was 55° F. The water had a total residue of 470, a total hardness of 330.5, and a content of iron of 3.4 parts per million as shown by the analysis of sample number 84812, collected December 14, 1938.

Analysis of Sample Number 84812 from Village Well Number 2.

Determinations Made.		Pts. per million.
Iron	Fe	
(filtered)		3.4
(unfiltered)		3.4
Manganese	Mn	0.0
Silica	SiO_2	14.5
Chloride	Cl	16.0
Turbidity		20.0
Color		0.0
Odor		0.0
Calcium	Ca	67.9
Magnesium	Mg	39.2
Ammonium	NH_4	3.0
Sodium	Na	45.3
Sulfate	SO_4	0.0
Nitrate	NO_3	1.2
Alkalinity as $CaCO_3$		
Phenolphthalein		0.0
Methyl Orange		414.0
Residue		470.0
Total Hardness		330.5
Free CO_2		24.0
pH = 7.4		

Hypothetical Combinations.		Pts. per million.	Grs. per gallon.
Sodium Nitrate	$NaNO_3$	1.7	0.09
Sodium Chloride	NaCl	26.3	1.53
Sodium Carbonate	Na_2CO_3	79.5	4.64
Ammonium Carbonate	$(NH_4)_2CO_3$	8.2	0.48
Magnesium Carbonate	$MgCO_3$	135.7	7.92
Calcium Carbonate	$CaCO_3$	169.8	9.90
Iron Oxide	Fe_2O_3	4.9	0.29
Silica	SiO_2	14.5	0.85
Total		440.6	25.70

MOUNT PROSPECT (1225) (pp. 449, 943). Water for the public supply is obtained from the well described on page 449 and from a second well completed in 1927 located approximately 2000 feet northwesterly from well number 1.

The second well is reported to be 210 feet deep and to terminate in limestone with a diameter at the bottom of 10 inches. Twelve-inch casing extends from the surface to a depth of 110 feet where it is seated on the rock. It is equipped with a. Keystone deep well cylinder pump, the bottom of the 7¾ -inch by 7-foot cylinder being set at a depth of 140 feet. The pump delivers 100 gallons per minute with a drawdown of 40 feet below a static water level of 30 feet.

The older well was equipped in 1937 with a Pomona deep well turbine pump, the assembly of which consists of 140 feet of $4^1/_2$-inch column pipe and 25 stages of $5^1/_2$-inch bowls having an over-all length of 9 feet 10 inches. There is no suction pipe below the bowls. The turbine pump is rated at 140 gallons per minute against a head of 270 feet.

NAPERVILLE (5118) (p. 945). Three wells at the old pumping station on Jackson Street between Main and Webster Streets are described on pages 460-461. These wells are equipped with air lifts and can be used in case of emergency though they have not been used for several years. Well number 4 is not in use. In 1939 all water was obtained from wells 5 and 6 and was aerated and filtered before entering the distribution system. A 500,000-gallon elevated steel tank is located at the corner of Loomis Street and Fifth Avenue.

OAKWOOD (537). Oakwood is located in the central part of Vermilion County on the drainage area of Salt Fork, a tributary of Vermilion Eiver. Most wells over 100 feet deep yield water of poor quality while some wells less than 50 feet deep yield highly mineralized water.

The public water supply, installed in 1939, is obtained from a well. located in the northeastern part of the village, drilled in 1938 by Layne-Western Company. The well is 71 feet deep and of the gravel-packed type. The 15-inch outer casing extends to a depth of 55 feet and the 7-inch inner casing to 56 feet. A 15-foot length of 7-inch Layne shutter screen is installed on the lower end of the 7-inch casing.

The official production test was conducted by the State Water Survey. The water level was at a depth of $11^1/_2$ feet when not pumping

Analysis of Sample Number 84867 from Village Well.

Determinations Made.		Pts. per million.
Iron	Fe	
(filtered)		3.6
(unfiltered)		4.4
Manganese	Mn	0.0
Silica	SiO_2	10.5
Turbidity		15.0
Color		0.0
Odor		0.0
Calcium	Ca	63.8
Magnesium	Mg	30.4
Ammonium	NH_4	1.9
Sodium	Na	71.1
Sulfate	SO_4	1.0
Nitrate	NO_3	0.6
Chloride	Cl	49.0
Alkalinity as $CaCO_3$		
Phenolphthalein		0.0
Methyl Orange		374.0
Residue		447.0
Total Hardness		284.5
Free CO_2		12.0
pH = 7.4		

Hypothetical Combinations.		Pts. per million.	Grs. per gallon.
Sodium Nitrate	$NaNO_3$	0.9	0.05
Sodium Chloride	NaCl	80.0	4.66
Sodium Sulfate	$NaSO_4$	1.4	0.08
Sodium Carbonate	Na_2CO_3	89.0	5.19
Ammonium Carbonate	$(NH_4CO_3$	5.3	0.31
Magnesium Carbonate	$MgCO_3$	105.3	6.14
Calcium Carbonate	CaCOs	159.5	9.30
IronOxide	Fe_2O_3	5.1	0.30
Silica	SiO_2	10.5	0.61
Total		457.0	26.64

and at a depth of 58 feet when pumping at a rate of 39 gallons per minute.

The temperature of the water was 55° F. The water had a total residue of 447, a total hardness of 284.5, and a content of iron of 3.6 parts per million as shown by the analysis of sample number 84867, collected December 29, 1938.

PHILO (512). Philo is located in the southern part of Champaign County on a ridge between the drainage areas of Embarrass River and Salt Pork, a tributary of Vermilion River. Some wells obtain water from a deposit of sand and gravel below a depth of 125 feet.

In 1939 a public water supply system was being installed. Water was to be obtained from a well located in the business district at the northeast corner of Harrison and Washington Streets. The well was drilled in 1939 by Woollen Bros, of Wapella and is 81 feet deep, 10 inches in diameter, and equipped with a 5-foot length of number 50-slot Cook screen.

The official production test was made by the State Water Survey. The water level was at a depth of 33 feet when not pumping. After pumping for ten hours the pumping rate was 49 gallons per minute and the depth to water was more than 65 feet. After a rest period of more than 36 hours the water level was at a depth of 37 feet.

The water had a total residue of 370, a total hardness of 296.5, and a content of iron of 5.2 parts per million as shown by the analysis of sample number 85230, collected March 6, 1939.

Analysis of Sample Number 85230 from Village Well.

Determinations Made.		Pts. per million.
Iron	Fe	
(filtered)		0.0
(unaltered)		5.2
Manganese	Mn	0.0
Silica	SiO_2	13.5
Turbidity		15.0
Color		0.0
Odor		0.0
Calcium	Ca	60.2
Magnesium	Mg	35.5
Ammonium	NH_4	0.5
Sodium	Na	20.9
Sulfate	SO_4	30.7
Nitrate	NO_3	0.5
Chloride	Cl	7.0
Alkalinity as $CaCO_3$		
Phenolphthalein		0.0
Methyl Orange		301.0
Residue		370.0
Total Hardness		296.5

Hypothetical Combinations.		Pts. per million.	Grs. per gallon.
Sodium Nitrate	$NaNO_3$	0.9	0.05
Sodium Chloride	NaCl	11.7	0.68
Sodium Sulfate	Na_2SO_4	45.5	2.65
Sodium Carbonate	Na_2CO_3	3.2	0.19
Ammonium Carbonate	$(NH_4)_2CO_3$	1.4	0.08
Magnesium Carbonate	$MgCO_3$	123.2	7.18
Calcium Carbonate	$CaCO_s$	150.5	8.77
Silica	SiO_2	13.5	0.79
Total		349.9	20.39

RAMSEY (807) (p. 987). In October 1938 all water was being obtained from well number 2 located near the site of test well number 3 west of the railroad.

Well number 2 was drilled in 1938 by E. C. Baker of Sigel and is 157 feet deep. A 22-inch casing extends to a depth of 148 feet, an 8-inch liner from 137 to 147 feet, and an 8-inch number 60-slot Johnson welded screen from 147 to 157 feet. There is no seal between the 8-inch and 22-inch pipes, but the annular space between the two is filled with gravel below a depth of 138 feet.

A production test of the well was conducted by the State Water Survey. Static water level was found at a depth of $88^1/_2$ feet. When pumping at a rate of 13 gallons per minute the water level was lowered below a depth of 132 feet.

The well is equipped with the Cook turbine pump formerly installed in the original well and described on page 987.

The temperature of the water was 58° P. The quality was similar to that of water from test well number 3 as shown on page 988.

In 1939 water was being obtained from both wells 1 and 2. Number 1 was equipped with a small Goulds deep well cylinder pump driven by a 3-horsepower gasoline engine. The cylinder was attached to 129 feet of drop pipe and the pumping rate was about 5 gallons per minute. Most of the water was obtained from this well.

RANTOUL (1555) (p. 991). Well number 7, drilled in 1939 by John Bolliger and Sons of Fairbury, Illinois, is located about 75 feet west of well number 6. It is 137 feet deep and equipped with 115 feet of 10-inch casing below which is 22 feet of 10-inch Cook screen.

A production test of this well was conducted by the State Water Survey. The water level was at a depth of 64 feet when not pumping and was lowered 2G feet by pumping at a rate of 445 gallons per minute.

Analysis of Sample Number 86826 from City Well Number 7

Determinations Made.

		Pts. per million.
Iron	Fe	
(Eiltered)		1.9
(unfiltered)		2.2
Manganese	Mn	0.0
Silica	SiO_2	18.0
Turbidity		25.0
Color		0.0
Odor		0.0
Calcium	Ca	71.5
Magnesium	Mg	35.5
Ammonium	NH4	1.5
Sodium	Na	0.9
Sulfate	SO_4	0.0
Nitrate	NO_3	1.0
Chloride	Cl	0.0
Alkalinity as $CaCO_3$		
Phenolphthalein		0.0
Methyl Orange		330.0
Residue		330.0
Total Hardness		324.5
Free CO_2 (by test)		14.0
Free CO_2 (calc)		24.0
pH = 7.4		

Hypothetical Combinations.

		Pts. per million.	Grs. per gallon.
Sodium Nitrate	$NaNO_3$	0.8	0.05
Sodium Carbonate	Na_2CO_3	1.6	0.09
Ammonium Carbonate	$(NH_4)_2CO_3$	3.8	0.22
Magnesium Carbonate	$MgCO_3$	123.1	7.17
Calcium Carbonate	$CaCO_3$	178.6	10.41
Iron Oxide	Fe_2O_3	2.7	0.16
Silica	SiO_2	18.0	1.05
Total		328.6	19.15

The water had a total residue of 330, a total hardness of 324.5, and a content of iron of 1.9 parts per million as shown by the analysis of sample number 86826, collected December 5, 1939.

RIDGWAY (930). Eidgway is located in the north central part of Gallatin County on the drainage area of North Fork, Saline Eiver, a tributary of Ohio Eiver. Most of the private wells are of the drive point type and range in depth from 16 to 90 feet. Three water-bearing veins of sand and gravel are reported to underlie the village. The first vein is penetrated between 16 and 20 feet, the second between 35 and 45 feet and the third between 80 and 100 feet.

The village started to install a public water supply system in 1938 and a, well was drilled in October of that year at a site in front of the village hall. The well is 10 inches in diameter and 85 feet deep, has a 10-foot length of number 80-slot Johnson Everdur screen in the bottom below the casing. Some water was encountered between depths of 10 and 25 feet. Gravel was found at a depth of 70 feet and sand at 80 feet. Below 80 feet the sand was progressively finer and the well was completed at a depth of 85 feet. At the time of the production test, on November 10, 1938, by the State AVater Survey the static water level was 17 feet below the ground surface and the water level was lowered 24 feet when pumping at a rate of 292 gallons per minute. The temperature of the water was 58° F.

The water had a total residue of 353, a total hardness of 297.5 and an iron content of 4.9 parts per million as shown by the analysis of sample number 84620, collected on November 10, 1938.

Analysis of Sample Number 84620 from Village Well.

Determinations Made.		Pts. per million.	Hypothetical Combinations.		Pts. per million.	Grs. per gallon.
Iron	Fe		Sodium Nitrate	$NaNO_3$	0.8	0.05
(filtered)		1.5	Sodium Chloride	NaCl	8.2	0.48
(unfiltered)		4.9	Sodium Carbonate	Na_2CO_3	46.6	2.72
Manganese	Mn	0.0	Ammonium Carbonate	$(NH_4)_2CO_3$	6.2	0.36
Silica	SiO_2	12.5	Magnesium Carbonate	$MgCO_3$	114.7	6.68
Turbidity		15.0	Calcium Carbonate	$CaCO_3$	161.6	9.42
Color		0.0	IronOxide	Fe_2O_3	2.1	0.12
Odor		0.0	Silica	SiO_2	12.5	0.73
Calcium	Ca	64.7				
Magnesium	Mg	33.1	Total		352.7	20.56
Ammonium	NH_4	2.3				
Sodium	Na	23.1				
Sulfate	SO_4	0.0				
Nitrate	NO_3	0.8				
Chloride	Cl	5.0				
Alkalinity as $CaCO_3$						
Phenolphthalein		0.0				
Methyl Orange		348.0				
Residue		353.0				
Total Hardness		297.5				
Free	CO_2	7.0				
pH = 7.4						

ROCHELLE (3785) (p. 1002). No record of change.

ROODHOUSE (2621) (p. 1007). No record of change.

ROSELLE (807) (p. 1007). No record of change.

ROSICLARE (1794) (p. 1009). No record of change.

RUSHVILLE (2388) (p. 1011). The test wells mentioned on page 1011 consisted of four 2-inch well points located along an east-west line with an over-all distance between the two end points of about 85 feet. The depth was less than 30 feet and the four wells were pumped simultaneously by suction. A production test conducted by the State Water Survey indicated that more than 100 gallons per minute could be pumped in this manner. In 1939 plans were being made to develop a permanent supply at this location.

The temperature of the water was 58° P. The water had a total residue of 344, a total hardness of 295, and a content of iron of 0.08 parts per million as shown by the analysis of sample number 84639, collected November 15, 1939.

Analysis of Sample Number 84639 from Test Wells.

Determinations Made.		Pts. per million.
Iron	Fe	
(filtered)		0.08
(unfiltered)		0.10
Manganese	Mn	0.16
Silica	SiO_2	16.0
Turbidity		5.0
Color		0.0
Odor		0.0
Calcium	Ca	67.7
Magnesium	Mg	30.7
Ammonium	NH_4	trace
Sodium	Na	5.7
Sulfate	SO,	33.1
Nitrate	NO_3	31.9
Chloride	Cl	11.0
Alkalinity as $CaCO_3$		
Phenolphthalein		0.0
Methyl Orange		232.0
Eesidue		344.0
Total Hardness		295.0
FreeCO_2		12.0
pH = 7.2		

Hypothetical Combinations.		Pts. per million.	Grs. per gallon.
Sodium Nitrate	$NaNO_3$	21.3	1.24
Magnesium Nitrate	$Mg(NO_3)_2$	19.3	1.13
Magnesium Chloride	$MgCl_2$	14.8	0.86
Magnesium Sulfate	$MgSO_4$	41.5	2.42
Magnesium Carbonate	$MgCO_3$	53.2	3.10
Calcium Carbonate	$CaCO_3$	169.0	9.85
Iron Oxide	Fe_2O_3	0.1	0.01
Manganese Oxide	MnO	0.2	0.01
Silica	SiO_2	16.0	0.93
Total		335.4	19.55

SCHILLEE PARK (709) (p. 1020). Since December of 1938 all water for the public supply has been Lake Michigan water purchased from the city of Chicago. The well described on page 590 is still equipped with the Luitwieler pump, but is not in use.

SHAWNEETOWN (1440) (p. 1022). The new town site of Shawneetown is situated on high ground some three miles westerly of the original town site.

In an attempt to develop a public water supply from wells within the town site, three wells were drilled in the area set aside for industrial development. In none of these wells was there evidence of an adequate water supply.

The first well was drilled 6 inches in diameter and 85 feet deep. It was equipped with a deep-well cylinder pump rated at approximately 8 gallons per minute. The pump cylinder was set at a depth of 81 feet. Water from this well had a total residue of 364, a total hardness of 361, and a content of iron of 1.0 parts per million as shown by the analysis of sample number 84462, collected on October 18, 1938. The temperature of the water was 59° F.

The second well was drilled at a point 120 feet southwest of the first well. It was 6 inches in diameter and 105 feet deep. Static water level was 45 feet below the ground surface. The temperature of the water was 55° P. Water from this well had a total residue of 340 and a total hardness of 343 parts per million as shown by the analysis of sample number 84618, collected on November 9, 1938. This sample was collected with a bailer and undoubtedly is not a representative sample. This well was never used.

The third well was drilled at a point about 80 feet northeast of the first well. It was drilled 6 inches in diameter, and 223 feet deep. The static water level is about 43 feet below the ground surface and the temperature of the water is 65° F. The well is equipped with a deep well cylinder pump rated at approximately 8 gallons per minute. The cylinder is set at a depth of 152 feet. The pump is driven by a 3-horse-power electric motor.

This well is used to supply water to the refugee camp located at the new town site and for construction purposes. The average daily usage is about 3000 gallons.

The water had a total residue of 379, a total hardness of 274.5, and an iron content of 0.8 parts per million as shown by the analysis of sample number 84825.

Analysis of Sample Number 84825 from Temporary Well 223 Feet Deep.

Determinations Made.

		Pts. per million.
Iron	Fe	
(filtered)		0.1
(unfiltered)		0.8
Manganese	Mn	0.0
Silica	SiO_2	19.5
Turbidity		5.0
Color		0.0
Odor		0.0
Calcium	Ca	66.4
Magnesium	Mg	26.4
Ammonium	NH_4	1.1
Sodium	Na	40.7
Sulfate	SO_4	0.0
Nitrate	NO_3	1.3
Chloride	Cl	5.0
Alkalinity as $CaCO_3$		
Phenolphthalein		0.0
Methyl Orange		358.0
Residue		379.0
Total Hardness		274.5

Hypothetical Combinations.

		Pts. per million.	Grs. per gallon
Sodium Nitrate	$NaNO_3$	1.7	0.10
Sodium Chloride	NaCl	8.2	0.48
Sodium Carbonate	Na_2CO_3	85.3	4.97
Ammonium Carbonate	$(NH_4)_2CO_3$	2.9	0.17
Magnesium Carbonate	$MgCO_3$	91.5	5.34
Calcium Carbonate	$CaCO_3$	166.2	9.69
Iron Oxide	Fe_2O_3	0.1	0.01
Silica	SiO_2	19.5	1.14
Total		375.4	21.90

The State Geological Survey made an electrical earth resistivity survey of the town site and adjacent area in the latter part of 1939.

This survey indicated that the most favorable location for a well was in the N.W. $^1/_4$ of the N.E. $^1/_4$ of Sec. 36, T. 9 S., E. 9 E. This is in the valley flat adjacent to the Louisville and Nashville Eailroad tracks, about one mile southeast of the southeast corner of the town site. Test wells will be drilled in this area.

SHEFFIELD (941) (p. 1023). A production test of the $67^1/_2$-foot well described on page 1023 was conducted on October 4, 1939, by the State Water Survey. At that time the water level was lowered $8^1/_2$ feet by pumping at a rate of 147 gallons per minute. The static water level was about $31^1/_2$ feet below the pump base.

In 1939 the water was harder and more highly mineralized than as reported on page 1023. Analysis of sample number 86441, collected October 4, 1939, showed the water to have a total residue of 677, a total hardness of 552.5, and a content of iron of 0.2 parts per million. The temperature of the water' was 54° F.

Analysis of Sample Number 86441 from Well $67^1/_2$ Feet Deep.

Determinations Made.		Pts. per million.	Hypothetical Combinations.		Pts. per million.	Grs. per gallon.
Iron	Fe		Sodium Nitrate	$NaNO_3$	0.9	0.05
(filtered)		0.2	Sodium Chloride	NaCl	36.2	2.11
(unfiltered)		1.6	Sodium Sulfate	Na_2SO_4	2.1	0.12
Manganese	Mn	0.0	Ammonium Sulfate	$(NH_4SO_4$	3.3	0.19
Silica	SiO_2	18.0	Magnesium Sulfate	$MgSO_4$	183.0	10.68
Turbidity		8.0	Magnesium Carbonate	$MgCO_3$	91.5	5.33
Color		0.0	Calcium Carbonate	$CaCO_3$	291.5	17.00
Odor		0.0	Iron Oxide	Fe_2O_3	0.2	0.01
Calcium	Ca	116.5	Silica	SiO_2	18.0	1.05
Magnesium	Mg	63.6				
Ammonium	NH_4	0.9	Total		626.7	36.54
Sodium	Na	15.2				
Sulfate	SO_4	150.0				
Nitrate	NO_3	0.8				
Chloride	Cl	22.0				
Alkalinity as $CaCO_3$						
Phenolphthalein		0.0				
Methyl Orange		400.0				
Residue		677.0				
Total Hardness		552.5				

SIDNEY (539). Sidney is located in the southeastern part of Champaign County on the drainage area of Salt Fork, a tributary of Vermilion Eiver. The many private wells in use obtain water from sand and gravel at depths not exceeding 100 feet.

In 1939 a public water supply was being installed by the village. Water for the public supply will be obtained from a well located east of David Street and south of the Wabash Eailroad track. The well, drilled in 1939 by Guy McElwee of Sidney, is 48 feet deep and 6 inches in diameter. A 10-foot length of Cook brass well screen was installed below the casing, the lower 8-foot portion of which has number 14-slot openings.

The official production test of the well was conducted by the State Water Survey. The water level was 22 feet below the top of the well casing before pumping and was lowered $11^1/_2$ feet by pumping at a rate of 30 gallons per minute.

The temperature of the water was 55° P. The water had a total residue of 423, a total hardness of 217, and a content of iron of 1.0 parts per million, as shown by the analysis of sample number 86197, collected August 15, 1939.

Analysis of Sample Number 86197 from Village Well.

Determinations Made.		Pts. per million.	Hypothetical Combinations.		Pts. per million.	Grs. per gallon.
Iron	Fe		Sodium Nitrate	$NaNO_3$	1.7	0.10
(filtered)		1.0	Sodium Chloride	NaCl	24.6	1.43
(unfiltered)		1.3	Sodium Carbonate	Na_2CO_3	161.6	9.42
Manganese	Mn	0.0	Ammonium Carbonate	$(NH_4)_2CO_3$	2.4	0.14
Silica	SiO_2	18.0	Magnesium Carbonate	$MgCO_3$	69.9	4.08
Turbidity		15.0	Calcium Carbonate	$CaCO_3$	134.1	7.82
Odor		0.0	Iron Oxide	Fe_2O_3	1.4	0.08
Color		0.0	Silica	SiO_2	18.0	1.05
Calcium	Ca	53.7				
Magnesium	Mg	20.2	Total		413.7	24.12
Ammonium	NH_4	1.0				
Sodium	Na	80.3				
Sulfate	SO_4	0.0				
Nitrate	NO_3	0.9				
Chloride	Cl	15.0				
Alkalinity as $CaCO_3$						
Phenolphthalein		0.0				
Methyl Orange		372.0				
Residue		423.0				
Total Hardness		217.0				
CO_2		18.0				
pH = 7.4						

SOUTH CHICAGO HEIGHTS (1691) (p. 1028). In 1939 water was obtained from the well described on page 607. This well is now equipped with an air lift pump. One of the pressure tanks is used as a receiving reservoir, from which water is pumped to the other tank by a small Dayton-Dowd centrifugal pump driven by an electric motor. Air is furnished by a Sullivan compressor, belt-driven by a 20-horsepower electric motor.

It is necessary to operate the air lift continuously in summer. In addition some water is purchased from Steger. Water can also be obtained from Chicago Heights in case of emergency.

SOUTH ELGIN (745). South Elgin is located in the east central part of Kane County, on the banks of Pox Eiver. A public water supply was installed by the village in 1938-1939.

Water for the public supply is obtained from a well located on high ground on the west side of the river, where the ground surface elevatien is approximately 750 feet above sea level. The well, drilled by the W. L. Thorne Company of Des Plaines, was finished in 1938 at a depth of 1250 feet with a diameter of 6 inches at the bottom. It is cased with

12-inch pipe to a depth of 59 feet, with 10-inch pipe from 49½ to 265 feet, with 8-inch pipe from 589½ to 650 feet, and with 6-inch pipe from 626½ to 685 feet.

The official production test of the well was conducted by the State Water Survey in 1938. At that time the static water level was 142 feet below the top of the casing, which was about 3 feet above ground surface. The water level was lowered 45½ feet by pumping at a rate of 322 gallons per minute.

The well is equipped with an 8-stage, 7-inch American turbine pump having 180 feet of 4½-inch column pipe, 6½ feet of bowl assembly, and 10 feet of 5-inch suction pipe. The pump is rated at 100 gallons per minute against a head of 185 feet and is driven by a 7½-horsepower electric motor. Water is pumped from the well to a water treatment plant. Treatment consists of iron removal and softening by the zeolite method. The treated water is pumped to the distribution system by a single-stage American horizontal centrifugal pump rated at 100 gallons per minute against a head of 120 feet and driven by a 5-horsepower electric motor.

The temperature of the water was 55½° F. The water had a total residue of 343, a total hardness of 293.5, and a content of iron of 0.3 parts per million, as shown by the analysis of sample number 83327. collected April 14, 1938.

Analysis of Sample Number 83327 from Village Well.

Determinations Made.		Pts. per million.	Hypothetical Combinations.		Pts. per million.	Grs. per gallon.
Iron	Fe		Sodium Nitrate	$NaNO_3$	1.7	0.10
(filtered)		0.3	Sodium Sulfate	Na_2SO_4	13.5	0.79
(unfiltered)		0.8	Sodium Carbonate	Na_2CO_3	31.8	1.85
Manganese	Mn	0.0	Ammonium Carbonate	$(NH_4CO_3$	1.4	0.08
Silica	SiO_2	19.0	Magnesium Carbonate	$MgCO_3$	94.6	5.52
Turbidity		13.0	Calcium Carbonate	$CaCO_3$	166.1	9.70
Color		0.0	Iron Oxide	Fe_2O_3	0.4	0.02
Odor		0.0	Silica	SiO_2	19.0	1.11
Calcium	Ca	66.4				
Magnesium	Mg	27.3	Total		328.5	19.17
Ammonium	NH_4	0.6				
Sodium	Na	18.6				
Sulfate	SO_4	9.3				
Nitrate	NO_3	1.1				
Chloride	Cl	0.0				
Alkalinity as $CaCO_3$						
Phenolphthalein		0.0				
Methyl Orange		310.0				
Residue		343.0				
Total Hardness		293.5				
Free	CO_2	18.0				

STILLMAN VALLEY (348). Stillman Valley is located in the northern part of Ogle County, on the drainage area of Stillman Creek, a tributary of Rock River. A number of shallow private wells obtain water from sand and gravel deposits.

A public water supply was installed by the village in 1938 and was put in service the following January.

Water for the public supply is obtained from a well, located in Memorial Park at the corner of Spruce and Roosevelt Streets, drilled in 1938 by C. W. Varner of Dubuque, Iowa. It is cased with 10 feet of 15-inch pipe, $59^1/_4$ feet of 12-inch pipe, and $161^1/_3$ feet of 8-inch pipe. The diameter of the bore hole was 12 inches to a depth of 160 feet and 8 inches below that depth to the bottom of the well at 300 feet.

A record of material penetrated, as furnished by the driller, is as follows:

	Thickness in feet.	Depth in feet.
Sand and gravel	25	25
Limestone, gray	5	30
Sand and gravel	5	35
Limestone, gray	5	40
Sand and gravel	15	55
Limestone	60	115
Shale	5	120
Lime	15	135
Shale and blue lime	18	153
Sandstone	147	300

The production test, conducted and reported by the driller, shows that the water level was at a depth of 30 feet when not pumping and was lowered $108^1/_2$ feet when pumping at a rate of 352 gallons per minute.

The well is equipped with a 20-stage, 6-inch Fairbanks-Morse turbine pump having 150 feet of 4-inch column pipe and 20 feet of 5-inch suction pipe. The pump is rated at 100 gallons per minute against a head of 250 feet and is driven by a 10-horsepower electric motor.

Water is pumped from the well directly to the distribution system, to which is connected a 30,000-gallon elevated wood tank. In August of 1939 there were 57 metered service connections.

STBONGHURST (734) (p. 1037). The well described on page 1037 was repaired during the winter of 1938-9. It is now $67^1/_2$ feet deep and is cased to the bottom with 10-inch pipe which is slotted between depths of 40 and 65½ feet. The bottom of this pipe is set on a concrete plug two feet thick. A 12-inch casing extends to a depth of 45% feet and the annular space between the two pipes is filled with cement grout. The well is located on the east side of State Highway Number 94, just south of the village limits.

The official production test was conducted by the State Water Survey after repairs were completed: The static water level was 25 feet below the top of the casing and the drawdown was 16 feet after pumping for 24 hours at a rate of 42 gallons per minute.

The water had a total residue of 339, a total hardness of 305, and a content of iron of 2.2 parts per million, as shown by the analysis of sample number 84964, collected January 17, 1939. A later analysis showed an iron content of 0.08 parts per million. The water is treated in an iron removal and zeolite softening plant before being pumped to the distribution system.

Analysis of Sample Number 84964 from Well $67^1/_2$ Feet Deep.

Determinations Made.		Pts. per million.	Hypothetical Combinations.		Pts. per million.	Grs. per gallon.
Iron	Fe		Sodium Nitrate	$NaNO_3$	1.7	0.10
(filtered)		2.2	Sodium Carbonate	Na_2CO_3	37.1	2.16
(unfiltered)		2.6	Ammonium Carbonate	$(NH_4)_2CO_3$	2.9	0.17
Manganese	Mn	0.0	Magnesium Carbonate	$MgCO_3$	103.3	6.02
Silica	SiO_2	12.5	Calcium Carbonate	$CaCO_3$	182.6	10.64
Turbidity		20.0	Iron Oxide	Fe_2O_3	2.2	0.13
Color		0.0	Silica	SiO_2	12.5	0.73
Odor		0.0				
Calcium	Ca	73.1	Total		342.3	19.95
Magnesium	Mg	29.8				
Ammonium	NH_4	1.1				
Sodium	Na	16.6				
Sulfate	SO_4	0.0				
Nitrate	NO_3	1.2				
Chloride	Cl	0.0				
Alkalinity as $CaCO_3$						
Phenolphthalein		0.0				
Methyl Orange		343.0				
Residue		339.0				
Total Hardness		305.0				
Free CO_2		14.0				
pH = 7.2						

THORNTON (1012) (p. 1041). The well drilled in 1923 does not produce much water. When the pump is started the rate is 140 gallons per minute, but after about thirty minutes operation the rate drops to 50 gallons per minute and the pump breaks suction.

The well drilled in 1928 furnishes most of the water needed. Water from this well is chlorinated. The pumping equipment consists of the original Byron Jackson pump head and Ideal electric motor, with the column pipe and bowls replaced by a Pomona assembly. The length of the 5-inch column pipe is 300 feet. Two bowl assemblies are used. A 36-stage assembly of $5^1/_2$-inch bowls, 163 inches long, is attached to the bottom of the column pipe and a 6-stage assembly of 7 7/16-inch bowls, 44 inches long, is located near the top of the well. A 10-foot length of $41^1/_2$-inch suction pipe is attached to the lower bowl assembly. The pump is rated at 100 gallons per minute against a head of 440 feet,

VILLA PARK (6220) (p. 1055). Since December 1, 1938, all mains and all wells which furnished water for the public supply have been owned and controlled by the village. All water is now obtained from the wells drilled by S. B. Geiger. The two private systems have now been connected to the village system. The shallow wells which furnished water for the private systems have been abandoned.

In 1939 there were 2000 metered service connections and the average daily pumpage was 550,000 gallons.

WAUCONDA (554) (p. 1064). A new well, drilled for the village by W. R. Boetsch of Crystal Lake in 1939, is located about 15 feet

south of the well described on page 668. It is 257 feet deep, 12 inches in diameter, and cased with 12-inch pipe to a depth of $22^1/_2$ feet.

A record of material penetrated by the well is as follows:

	Thickness in feet.	Depth in feet.
Till and clay	105	105
Gravel	10	115
Sand	80	195
Till	10	205
Sand	5	210
Niagaran dolomite	47	257

The official production test was conducted by the State Water Survey. The static water level was at a depth of 36 feet. The depth to water was 58½, 80½ and 103½ feet when pumping at rates of 203, 318 and 400 gallons per minute, respectively.

The temperature of the water was 53° F. The water had a total residue of 359, a total hardness of 356, and a content of iron of 0.08 parts per million, as shown by the analysis of sample number 85396, collected March 29, 1939.

After this new well was placed in service well number 1 was deepened by Mr. Boetsch. It is now 230 feet deep and is cased with 12-inch pipe to a depth of 30 feet, with 10-inch pipe from 30 to 110 feet, and with 8-inch pipe from the surface to 220 feet. That part of the 8-inch pipe above a depth of 105 feet will probably be removed.

Simultaneous production tests of the two wells were conducted by the State Water Survey. The static water level was approximately 38 feet below the pump house floor and the drawdown was $41^1/_2$ feet when the pumping rates were 100 and 280 gallons per minute for wells one

Analysis of Sample Number 86932 from Well Number 1.

Determinations Made.		Pts. per million.
Iron	Fe	
(filtered)		0.2
(unfiltered)		0.5
Manganese	Mn	0.0
Silica	SiO_2	26.0
Turbidity		trace
Color		0.0
Odor (at well)		H_2S
Calcium	Ca	66.4
Magnesium	Mg	48.3
Ammonium	NH_4	0.4
Sodium	Na	6.9
Sulfate	SO_4	11.5
Nitrate	NO_3	1.3
Chloride	Cl	3.0
Alkalinity as $CaCO_3$		
Phenolphthalein		0.0
Methyl Orange		362.0
Residue		388.0
Total Hardness		364.0
Free CO_2 (by test)		16.0
Frae CO_2(calc.)		28.0
p H = 7.4		

Hypothetical Combinations.		Pts. per million.	Grs. per gallon.
Sodium Nitrate	$NaNO_3$	1.7	0.10
Sodium Chloride	NaCl	4.7	0.27
Sodium Sulfate	Na_2SO_4	14.2	0.83
Ammonium Sulfate	$(NH_4)_2SO_4$	1.3	0.08
Magnesium Sulfate	$MgSO_4$	1.2	0.07
Magnesium Carbonate	$MgCO_3$	166.1	9.68
Calcium Carbonate	$CaCO_3$	166.1	9.68
Iron Oxide	Fe_2O_3	0.3	0.02
Silica	SiO_2	26.0	1.51
Total		381.6	22.24

Analysis of Sample Number 85396 from Well Number 2.

Determinations Made.		Pts. per million.
Iron	Fe	
(filtered at well)		0.08
(unfiltered)		0.7
Manganese	Mn	0.0
Silica	SiO_2	24.0
Turbidity		12.0
Color		0.0
Odor		0.0
Calcium	Ca	65.0
Magnesium	Mg	46.8
Ammonium	NH_4	0.3
Sodium	Na	1.6
Sulfate	SO_4	8.2
Nitrate	NO_3	5.1
Chloride	Cl	1.0
Alkalinity as $CaCO_3$		
Phenolphthalein		0.0
Methyl Orange		346.0
Residue		359.0
Total Hardness		356.0
Free	CO_2	10.0
pH = 7.3		

Hypothetical Combinations.		Pts. per million.	Grs. per gallon.
Sodium Nitrate	$NaNO_3$	6.0	0.35
Ammonium Nitrate	NH_4NO_3	0.8	0.05
Magnesium Chloride	$MgCl_2$	1.4	0.08
Magnesium Sulfate	$MgSO_4$	10.2	0.59
Magnesium Carbonate	$MgCO_3$	154.8	9.03
Calcium Carbonate	$CaCO_3$	162.6	9.48
Iron Oxide	Fe_2O_3	0.1	0.01
Silica	SiO_2	24.0	1.40
Total		359.9	20.99

and two, respectively. Since the wells are close together and penetrate creviced limestone the water level in both wells is at practically the same elevation.

When well number 1 was pumped alone the water level was lowered $9^1/_2$, 20 and $28^1/_2$ feet at pumping rates of 110, 210 and 270 gallons per minute, respectively.

AVater from these wells contains a small amount of hydrogen sulfide. The temperature of the water from well number 1 was 54° F. The water had a total residue of 388, a total hardness of 364, and a content of iron of 0.2 parts per million, as shown by the analysis of sample number 86932, collected December 13, 1939.

WAVERLY (1390). A public water supply system was installed by the city in 1938. The raw water supply is obtained from an impounding reservoir on Woods Creek. The water is treated before entering the distribution system.

WEST CHICAGO (3477) (p. 1068). No record of change.

WESTMONT (2733) (p. 1071). The well drilled in 1926 is reported to be 313 feet deep and cased to rock at a depth of 120 feet with 16-inch pipe. Below the casing the open hole is 15 inches in diameter. Water is obtained from Niagaran limestone which was found to be 190 feet thick at the well site.

On test the well produced 1000 gallons per minute. It is equipped with an 8-stage, 15-inch Layne turbine pump having 119 feet of 12-inch column pipe and 20 feet of suction pipe. The pumping rate is 600 gallons per minute and the well is used about $3^1/_2$ hours daily every

other week. The well on 55th Street is pumped about 6 hours daily at a rate of 250 gallons per minute when the Cass Street well is not in use.

WHEATON (7258) (p. 1073). In 1939 all water was obtained from well number 2, 175 feet deep, and well number 3, 184 feet deep. Well number 1, or the north well in the pumping station, had been abandoned.

Well number 2 is now equipped with a 7-stage, 10-inch Layne turbine pump having 112 feet of 7-inch column pipe and 30 feet of 6-inch suction pipe. The pump, rated at 900 gallons per minute, is driven by a 40-horsepower electric motor.

Water is pumped from either well to the reservoir mentioned on page 1073. Prom the reservoir it is pumped to the distribution system by any of three American centrifugal pumps driven by electric motors.

The average daily pumpage in 1939 was 800,000 gallons. Wells 2 and 3 are used during alternate weeks.

WINDSOR (927) (p. 1077). The source of water is as reported on page 1077. In 1939 an iron and gas removal plant was built. The water is now aerated and filtered before entering the distribution system.

WINFIELD (445) (p. 1078). The well described on page 1078 was drilled in 1926 by John Diebold of West Chicago. It is located in the western part of the village on the east side of West Branch of DuPage Eiver. It is 200 feet deep, 8 inches in diameter, and cased with 78 feet of 8-inch pipe.

The static water level is reported to be 6 feet below the ground surface. The well is equipped with a Kewanee triplex pump, rated at 75 gallons per minute, driven by a $7\frac{1}{2}$-horsepower electric motor.

WOODSTOCK (5471) (p. 1083). Well number 3, constructed in 1939 by Layne Western Company of Chicago, is located about 125 feet southeast of the 206-foot well described on page 702, and is of the gravel-walled type with 150 feet of 30-inch outer casing, 150 feet of 18-inch inner casing, and 50 feet of 18-inch Layne shutter screen. Water is obtained from a deposit of sand, gravel and boulders between depths of 148 and 198 feet.

The water level was at a depth of 55 feet when not pumping and was lowered to 123 feet by pumping at the rate of 1440 gallons per minute. After the well had been in use for several days the water level was lowered to a depth of 91 feet by pumping at the rate of 1175 gallons per minute for six hours. During a rest period of $2\frac{1}{2}$ hours the water level rose to a depth of $56\frac{1}{2}$ feet.

The well is equipped with a 5-stage, 15-inch Layne turbine pump consisting of 140 feet of 10-inch column pipe, $6\frac{1}{3}$ feet of bowl assembly, and 10 feet of 10-inch suction pipe. The pump is driven by a 75-horsepower electric motor.

Water from well number 3 had a total residue of 390, a total hardness of 369.5, and a content of iron of 1.3 parts per million as shown by the analysis of sample number 86287, collected September 7, 1939.

Analysis of Sample Number 86287 from Well Number 3.

Determinations Made.		Pts. per million.
Iron	Fe	
(filtered)		0.0
(unfiltered)		1.3
Manganese	Mn	0.0
Silica	SiO_2	20.5
Turbidity		8.0
Color		0.0
Odor		0.0
Calcium	Ca	73.3
Magnesium	Mg	45.3
Ammonium	NH_4	1.4
Sodium	Na	10.8
Sulfate	SO_4	16.6
Nitrate	NO_3	0.9
Chloride	Cl	2.0
Alkalinity as $CaCO_3$		
Phenolphthalein		0.0
Methyl Orange		376.0
Residue		390.0
Total Hardness		369.5

Hypothetical Combinations.		Pts. per million.	Grs. per gallon.
Sodium Nitrate	$NaNO_3$	0.9	0.05
Sodium Chloride	NaCl	3.5	0.20
Sodium Sulfate	Na_2SO_4	24.7	1.44
Sodium Carbonate	Na_2CO_3	2.7	0.16
Ammonium Carbonate	$(NH_4)_2CO_3$	3.8	0.22
Magnesium Carbonate	$MgCO_3$	157.2	9.16
Calcium Carbonate	$CaCO_3$	183.1	10.67
Silica	SiO_2	20.5	1.20
Total		396.4	23.10

WILLIAMSFIELD (445). Williamsfield is located in the east central part of Knox County on the drainage area of Spoon River, a tributary of Illinois River.

In 1939 the village began to develop a water supply from wells penetrating the sand and gravel deposits in the flood plain of Spoon River.

On July *7*, 1939 the State Water Survey conducted a production test on the first well completed, which is located about $1\frac{1}{2}$ miles north of the village. The well was constructed by excavating a pit 10 feet square and within which was built an 8-inch cylindrical brick wall 6 feet

Analysis of Sample Number 85972 from Proposed Village Well.

Determinations Made.		Pts. per million.
Iron	Fe	
(unfiltered)		0.0
Manganese	Mn	0.0
Silica	SiO_2	18.0
Turbidity		0.0
Color		0.0
Odor		Ccl
Calcium	Ca	80.2
Magnesium	Mg	31.3
Ammonium	NH_4	trace
Sodium	Na	2.8
Sulfate	SO_4	42.8
Nitrate	NO_3	6.1
Chloride	Cl	8.0
Alkalinity as $CaCO_3$		
Phenolphthalein		0.0
Methyl Orange		274.0
Residue		355.0
Total Hardness		329.0
Free CO_2		16.0
pH = 6.8		

Hypothetical Combinations.		Pts. per million.	Grs. per gallon.
Sodium Nitrate	$NaNO_3$	8.5	0.49
Sodium Chloride	NaCl	1.2	0.07
Magnesium Chloride	$MgCl_2$	10.0	0.58
Magnesium Sulfate	$MgSO_4$	53.5	3.12
Magnesium Carbonate	$MgCO_3$	62.0	3.61
Calcium Carbonate	$CaCO_3$	200.5	11.69
Silica	SiO_2	18.0	1.05
Total		353.7	20.61

inside diameter and 10.8 feet high supported by a concrete slab footing. The lower 8.1 feet of brick work was laid up dry while the upper 2.7 feet was well bonded in cement mortar. The space outside the brick wall was filled with washed gravel. The sea level elevation of the top of the wall is 587.0 feet.

The production test conducted by the State Water Survey indicated a specific capacity of approximately 1.8 gallons per minute per foot of drawdown. At the time the test was conducted the maximum pumping rate for continuous pumping was about 19 gallons per minute. The temperature of the water was 53° F.

The water had a total residue of 355 and a total hardness of 329 parts per million without iron as shown by the analysis of sample number 85972, collected at the end of the production test on July *7*. 1939.