

BULLETIN NO. 33

1940

STATE OF ILLINOIS

JOHN STELLE, Governor



WATER RESOURCES

IN

PEORIA-PEKIN DISTRICT

DEPARTMENT OF REGISTRATION AND EDUCATION

J. J. HALLIHAN, Director

STATE WATER SURVEY DIVISION

A. M. BUSWELL, Chief

URBANA, ILLINOIS

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WATER RESOURCES
IN
PEORIA-PEKIN DISTRICT

ISSUED BY

STATE WATER SURVEY DIVISION

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URBANA, ILLINOIS

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INTRODUCTION.

This report on the water resources of the Peoria-Pekin area is a compilation of the data accumulated in our files together with information collected largely by correspondence to fill in some of the gaps in our statistics. It contains information concerning 97 water supplies, 73 in Peoria County and 24 in Tazewell County, which is essential to the further development of water resources in this area. Detailed information and chemical analyses are given concerning 73 water supplies, 54 in Peoria County and 19 in Tazewell County. It has not been possible to make a complete systematic field study. Such a study would cost many thousands of dollars and it is doubtful whether the additional data obtained would justify the expense.

The Peoria-Pekin metropolitan district embraces the communities of Peoria Heights, Peoria and Bartonville on the west side of the river, an area of approximately 19 square miles, and East Peoria, Creve Coeur and Pekin on the east side of the river, an area of approximately 13 square miles.

The industrial development is largely within the corporate limits of Peoria and Bartonville on the west side of the river and East Peoria and Pekin on the east side.

For the 73 plants described in the Peoria district the daily extraction is probably in the neighborhood of 54,000,000 gallons or more, of which the municipal demands of Peoria Heights, Peoria and Bartonville represent about 22 per cent.

For the 24 plants described in the East Peoria-Pekin district the daily extraction is probably in the neighborhood of 20,000,000 gallons or more, of which the municipal demands of East Peoria, Creve Coeur and Pekin represent about 8.5 per cent.

The figures given here are not assumed to be exact, but they are based on the best information available and may be considered as representative of the order of magnitude of the daily extraction for the wells described in this bulletin.

Water may be obtained from three sources in this area:

- a. Surface streams.
- b. Sand and gravels of the drift, terraces and river flood plain.
- c. Limestones and sandstones beneath the drift.

Surface streams.

Of the surface streams, Ten-Mile Creek, Farm Creek, Lick Creek and Lost Creek, all on the east side of the river, have little or no water in them at times so that they have no values as a possible source of surface water, although a fair-sized artificial reservoir could conveniently

be developed on Lick Creek. A dam constructed across the valley of this stream in the northeast quarter of Section 25, T. 25 N., E. 5 W., with spillway at elevation 520 feet would create a reservoir having a depth at the dam of 50 feet, a pool area of 260 acres, a storage of approximately 4350 acre feet (1,450,000,000 gallons) and a watershed of about 15.6 square miles.

Kickapoo and LaMarsh Creeks on the west side of the river have some water most of the time, though at times of drought the flow is practically zero. Under these circumstances they would have no value as a steady source of surface water.

The low dry weather flow in LaMarsh Creek could be overcome by creating on this stream an artificial reservoir. The drainage system of this stream consists of two principal branches, West Branch and East Branch. A dam across the valley below the junction of these two branches in the southeast quarter of Section 16, T. 7 N., E. 7 E., with spillway at elevation 500 feet would create a reservoir having a depth at the dam of 50 feet, a pool area of 970 acres, a storage of approximately 16,200 acre feet (5,400,000,000 gallons) and a watershed of about 40 square miles.

Kickapoo Creek is occupied by the Chicago, Burlington and Quincy Railroad and hence would not be available for a reservoir development.

The Illinois Eiver may be used as a source of raw water supply the year around, but owing to its character the water would require treatment for most uses. The summer temperature is a drawback for many uses.

Rock wells.

Bock well waters may be obtained almost anywhere, but as the water is highly mineralized and frequently has a strong sulfur taste and odor, their use is not general.

There are two water-bearing zones. The first is found between elevations 0 and 150 feet above sea level, and has a hydrostatic pressure sufficient to cause a free flow at elevations 460 feet or less above sea level. The second zone is found between elevations 250 feet and 575 feet below sea level. The hydrostatic pressure in this aquifer is sufficient to cause a free flow at elevation 520 feet or less above sea level.

Waters from these deep aquifers have been developed for bathing pool purposes, but that is about all, though some people enjoy the flavor of sulfur water. The water is warmer than that from the sand and gravel deposits.

Drift wells.

Except for the small amount of water taken from the river and from the deep rock wells, all of the municipal and industrial demands are supplied from wells penetrating sand and gravel deposits in terraces or in the flood plain of the river. As might be expected these wells vary in depth, diameter and yield. The deeper wells are of course in the bluff areas, as in Peoria Heights, where wells 330 feet or more in depth have been constructed, while on the river flood plain and terraces wells as shallow as 35 feet are found. Production rates vary from 10 to nearly 3000 g.p.m.

The drift wells form a very great problem from the hydrological standpoint. At present from 50 to 60 million gallons per day are extracted in the Peoria district from the drift forming the different terraces. We are as yet far from knowing the source or sources of this great amount of water.

Measurements of water levels in several wells show a steady recession of the water level, which amounts to about 10 feet in the last six years. This is a clear indication that more water is pumped out of the drift than that which is its natural inflow. Assuming an effected area of about 8 square miles and a porosity of the soil of about 25 per cent, then we get a depletion of the water storage of about 2 million gallons per day. This figure (as well as all those in the following hydrologic calculation) may, however, be used only as a rough approximation, as it is based on rather crude assumptions. It does not indicate that a reduction in pumpage of 2 million gallons per day will stop recession since many factors enter tending to produce a natural equilibrium. For example, the lower water table may tend to cause greater inflow by increasing the slope of the ground water stream. Furthermore, the ground water level is somewhat dependent on the river stages. This causes some uncertainties in determining the recession caused through over-pumping. Since the dam below Peoria has been put in operation (December 18, 1938) less fluctuations occur in the ground water level, but the time is too short for a better definition of the recession.

What causes the fluctuation in the ground water is not yet clear, an explanation depends on determining the sources.

As possible sources of the ground water available for extraction can be considered:

Infiltration from the precipitation.

Inflow from infiltration on the hills.

The ground water stream in the Illinois Eiver Valley.

Infiltration through the bottom of the Illinois Eiver.

Inflow from seepage in the side valleys.

It will be shown with a few calculations and observations that none of these sources really gives a satisfactory explanation for the origin of the large amount of water that is actually extracted. All sources play a role, but their relative importance is obscure. Such knowledge is needed to plan effective remedial measures.

Infiltration from the precipitation amounts to very little water. An inch of rainfall per month would furnish a total amount of water of seventeen and one-half million gallons per square mile, or an average of 580,000 gallons per day. Considering that in the Peoria district only from 10 to 25 per cent of the surface is permeable and that only about 25 per cent of the water falling on this permeable ground penetrates into the ground, an average monthly rainfall at Peoria of 2.91 inches would furnish to the ground water about 105,000 gallons per day per square mile. The different geological formations at Peoria produce, then

Alluvial terrace	1.6 sq. miles	169,000 g. p. d.
Late Wisconsin terrace.....	0.8 sq. mile	84,500 g. p. d.
Early Wisconsin terrace.....	5.2 sq. miles	549,000 g. p. d.
	<hr/>	<hr/>
	7.6 sq. miles	802,500 g. p. d.

Precipitation adds, therefore, less than 1 million gallons per day to the ground water supply.

The neighboring nonimproved bottom land may produce an inflow of up to four times as much per square mile as city land, or about 400,000 gallons per day per square mile. To get 50 million gallons per day would require an area of about 125 square miles or involve a stretch up the river valley about 50 miles long having an average width of $2\frac{1}{2}$ miles.

The penetration on the hills is also not very considerable as the contributing area is only about 5 square miles, partly densely built up and may not furnish more than 1.5 million gallons per day.

The actual velocity in the ground water stream in the Illinois valley is unknown. Assuming an average width of the valley of 2.5 miles, a depth of 75 feet in the deepest point and a porosity of 25 per cent, we get an area of 165,000 square feet open for the flow of water. To get a flow of 50 million gallons per day through such an area we need a velocity of 40 feet per day. This would be a very high velocity for the conditions prevailing at Peoria. Calculations and observations in other places show that the velocity of flow through coarse sand and sandy gravel is about 6.33 feet per day with a gradient of 1 per cent. The gradient of the Illinois River above Peoria is only about 2 inches per mile. The gradient of the ground water near the well district may be somewhat steeper, but hardly over 1 foot per mile for the valley (not the individual drawdown cone). This would be a gradient of about $\frac{1}{50}$ of 1 per cent and allow a velocity of only 0.13 ft. per day. This apparent discrepancy between the calculated and required velocities might exclude the ground water stream as one of the important sources of the 50 million gallons per day that are now being extracted.

Infiltration through the bottom of the Illinois River shows some similar problems. The possibility of such an infiltration is doubted by many hydrologists on the assumption that the silting of the river bottom would tend to make it impervious to the passage of water. Yet assuming that some may go through, we can calculate the velocity of passage that is necessary to produce a certain inflow to the ground water stream. In flat rivers, the wetted area is practically the same as the water surface. Above Peoria the river has an average width of about 5,000 feet for a distance of 10 to 15 miles. Calculating then with an effective area of 12 square miles and a porosity of the silt of from 5 to 10 per cent we get an active infiltration area of about 28 million square feet. To pass 50 million gallons per day through such an area we need a velocity of about 3 inches per day. This velocity is fairly reasonable as the velocity through silt and fine sand at a 1 per cent gradient is about $\frac{3}{4}$ inches per day, and we may have a gradient of 4 per cent between river and ground water under the existing conditions. One must consider that the assumptions of the calculations are very rough and that the flow would have to be carried as a ground water stream, which was shown to be a doubtful possibility.

The inflow from seepage in the side valley cannot yet be calculated even approximately. There is little silting in the side creeks and loss through seepage into the ground is more probable than in the Illinois River itself. However, the gravel deposits in the side valleys are small and any considerable flow has not been detected.

Another interesting fact about the ground water conditions can be studied from the temperature readings at the Hiram Walker & Sons plant. These indicate that the highest temperatures of the well water occur in November and the lowest in May-June. If the water should come from the river it would mean a period of travel underground of from 3 to 4 months. With the calculated velocity of 40 feet per day the water would have traveled in that time about 4000 feet, but if we should have a velocity of only 0.13 feet per day, the water could travel only 130 feet or less than the distance from the river to the wells. This shows again the uncertainties we have with our present knowledge about the underground flow in the Peoria district.

All these calculations indicate clearly that more studies are required to clear up the ground water resources at Peoria, where the large pumpage from the gravel tends to cause a critical condition in the safety of a continued supply.

MINERAL QUALITY OF PEORTA-PEKIN WELL WATERS.

The wide variations found in the sand and gravel waters in this vicinity have long been cause for speculation but without any consistent explanation.

Well waters are usually considered to be fairly constant in mineral character over a considerable period of time for wide local areas when obtained from the same aquifer. This would be expected where there is little movement of ground water. However rough calculations based on storage volume and total pumpage records indicate that there must be a continual infiltration of water from outside sources at a rate equal to complete replacement biennially in this particular area. Although such over-all calculation may admittedly be two or three hundred per cent in error, and much more so in localized areas, it is to be expected that some general tendencies in change or consistency of quality should be noticeable.

Some 150 analyses are on record in this area. The variations in mineral content of waters from sand and gravel are tabulated below. Variations of 10 to 20 per cent in the figures given for general concentrations are not uncommon. Hypothetical combinations are purposely avoided because of their anomalous nature.

	Parts per million.		
	Minimum.	Maximum.	General.
Iron.....	0	28	0
Chlorides.....	3	478	30
Nitrates.....	0	62	15
Sulfates.....	40	1018	200
Calcium.....	35	271	100
Magnesium.....	23	197	40
Alkalinity as CaCO ₃	204	430	325
Hardness as CaCO ₃	134	1487	450
Residue.....	334	2037	650

By studying analyses of waters from various local areas using "tracer" ions to note variations in quality, a surprising degree of reasonableness is obtained. Several noticeable peculiarities also are to be noted. At Peoria Heights the mineral quality of the waters appears to be changing with time, as may be noted in the following table:

	Well No. 1.		Well No. 2.		Well No. 3.
	1935	1940	1935	1940	1940
Chlorides.....	22	6	10	16	12
Sulfates.....	50	2	80	47	105
Hardness.....	441	237	468	360	483
Residue.....	510	453	497	479	525

A similar condition is recorded for the Hiram Walker No. 2 well, where the change was noticeable during the production test and confirmed several months later.

	January, 1934.				December 1934.
	15 min.	2 hrs.	3½ hrs.	7 hrs.	
Chlorides.....	20	18	18	17	19
Sulfates.....	248	243	232	229	55
Hardness.....	498	491	482	441	311
Residue.....	654	653	637	634	375

Perhaps the most interesting data concern the effect of the various old sulfur wells on the mineral quality of the sand and gravel waters. These wells penetrate the Mississippian and Silurian formations and yield waters high in chloride and hydrogen sulfide content and relatively low in hardness. Since the static level of these sulfur wells is always much higher than that of the more shallow wells, it is to be expected that there should be some penetration of this water into the sand and gravel strata. Casings, if there had been any, would in all probability be eaten away by such highly corrosive water and would no longer serve to prevent the infiltration. The extent of penetration is surprising.

The chloride content of these waters is about 1400 to 1500 parts per million and serves as an excellent "tracer" ion since most of the sand and gravel waters are of less than 25 parts per million chloride content.

The greatest offender appears to be the old Sulfur Water Bath House well located near the heart of the Peoria business district or possibly a similar unknown well located near Adams and Fulton Streets. Analyses of waters from nine relatively new wells directly south and southwest of this well indicate chloride contents of 127 to 575 parts per

million. Since the water from this flowing well discharges to waste, it is not entirely certain that the chloride is from infiltration directly from the well or from the sewer.

In all cases but one, only a single analysis is on record. The water from the Block & Kuhl well in 1937 was of 478 parts per million chloride, 246 parts per million hardness and 1440 parts per million residue. In 1940 an analysis showed but 41 parts per million chloride, 601 parts per million hardness and 702 parts per million residue. It appears that water is being drawn from a fresher source.

Another old sulfur well is located on the property of the Peoria Union Stock Yards. A 68-foot well 200 feet distant was found to be of 1190 parts per million chloride content causing considerable pump corrosion. Further investigation indicated the waters from the Godel well and the Shufeldt well 400 feet and 700 feet south and southwest to contain 250 parts per million chloride. One analysis of a 70-foot Wilson Provision Company well 300 feet east indicated 936 parts per million chloride. Other wells in 1933 indicated chloride contents less than 35 parts per million. However, a later sample from the number 3 well indicated 186 parts per million chloride after a new turbine pump had been installed in 1935. Water from the National Cooperage and Woodenware Co. well 800 feet west had 82 parts per million chlorides in 1933 and 27 parts per million chlorides in 1934.

These cases cited indicate some of the peculiarities noted and some possible explanations of the wide variations found.

WATER SUPPLIES OF PEORIA-PEKIN DISTRICT LYING IN PEORIA COUNTY.

ALLAIRE-WOODWAED COMPANY. The plant of the Allaire-Woodward Company is situated on the east side of North Adams Street and the north side of Alexander Avenue and extends back to the Chicago, Eock Island and Pacific Railroad. The well was constructed in July 1930 by the Kelly Well Company of Grand Island, Nebraska, at a location approximately 1120 feet south and 1400 feet west of the center of Section 35, T. 9 N., E. 8 E. of the 4th P. M.

The ground surface at the well is about 11.5 feet lower than the sidewalk grade at the Adams Street corner or approximately 483.4 feet above sea level. The depth is 56 feet 2 inches. During construction the following materials were encountered:

0'— 9'	.....	Hardpan
9'—21'	.....	Hardpan, boulders and clay
21'—42'	.....	Clay, gravel and boulders
42'—56' 2"	.....	Coarse gravel

The well is cased with a Kelly concrete well casing and screen having an internal diameter of 18 inches and an external diameter of 24 inches. It consists of a concrete plug 8 inches thick in the bottom, 11 feet 10 inches of screen and 43 feet 8 inches of solid casing. A gravel filter of selected material placed around the screen and casing had a thickness of 7 inches and a height of 17 feet above the well bottom.

A production test made by the Kelly Well Company upon completion of the well indicated a yield of 280 gallons per minute with a draw-down of only 2 inches from a static water level of 42 feet below the surface.

The well was equipped with a Sterling deep-well turbine pump, the assembly of which consisted of 50 feet of 5-inch column pipe, three stages of 10-inch bowls having an over-all length of 2 feet 11% inches. There was no suction pipe on the bottom of the bowls. This unit was rated at 300 gallons per minute against a head of 105 feet when operated at a speed of 1750 revolutions per minute.

The pump is direct connected to a Westinghouse electric motor rated at 15 horsepower.

When visited in January 1940 the capacity of the well was only sufficient to provide a portion of the plant requirements, the balance being obtained from the municipal supply.

The water had a residue of 695, a total hardness of 509.5, and a manganese content of 0.2 parts per million as shown by analysis of sample number 73485, collected September 1933.

Analysis of Water Sample Number 73485 from a 56.2 Foot Well at the Plant of the Allaire-Woodward Company.

Determinations Made.		Hypothetical Combinations.		
	Pts. per million.		Pts. per million.	Grs. per gallon.
Iron.....Fe	0.0	Sodium Nitrate.....NaNO ₃	21.2	1.24
Manganese..Mn	0.2	Sodium Chloride.....NaCl	54.3	3.17
Silica.....SiO ₂	8.0	Sodium Sulfate.....Na ₂ SO ₄	17.1	1.00
Turbidity.....	0.0	Magnesium Sulfate.....MgSO ₄	189.0	11.03
Calcium....Ca	141.0	Calcium Sulfate.....CaSO ₄	107.5	6.27
Magnesium..Mg	38.2	Calcium Carbonate.....CaCO ₃	260.0	15.18
Ammonium..NH ₄	0.01	Calcium Silicate.....CaSiO ₃	15.7	0.92
Sodium....Na	32.7	Manganese Oxide.....MnO	0.3	0.02
Sulfate.....SO ₄	238.0			
Nitrate.....NO ₃	15.5	Total.....	665.1	38.83
Chloride....Cl	33.0			
Alkalinity as CaCO ₃				
Phenolphthalein..	0.0			
Methyl Orange...	260.0			
Residue.....	695.0			
Total Hardness....	509.5			

ARMOUR PACKING COMPANY. The plant of the Armour Packing Company is located on the northwesterly corner of Harrison and Water Streets.

The well located in the basement of the building at an elevation about 4 feet below street grade of Water Street and approximately 830 feet east and 200 feet south of the center of Section 9, T. 8 N., E. 8 E. of the 4th P. M., is reported to be 10 inches in diameter and 62 feet deep.

The water level on June 17, 1940, was 39.5 feet below the pump base. The daily extraction is reported to be 288,000 gallons.

THE B. & M. STOE. The B. & M. Store, situated at 201-207 South Adams, has a well, the water from which is used for air cooling in the summertime.

The well is 8 inches in diameter and has a depth of 75 feet below the level of the basement floor. It is equipped with a Pomona deep well turbine pump direct connected to a Westinghouse Electric motor. A delivery of approximately 125 gallons per minute is obtained for 10 hours per day during the hot summer weather.

BAEETT COMPANY. The Barrett Company plant is located in the north half of the northwest quarter of the southeast quarter of Section 19, T. 8 N., E. 8 E., 4th P. M.

In 1933 the Barrett Company had fifteen wells on their property of which only seven were producers. Of these seven wells, one was 92 feet deep and cased with a concrete casing and screen having an outside diameter of 36 inches. It is located about 230 feet south and 1110 feet east of the center of Section 19. Another was 80 feet deep and cased with a concrete casing and screen having an outside diameter of 16 inches. The remaining wells are all 8 inches in diameter and vary in depth from 47 feet 7 inches to 110 feet.

All wells are connected into a single suction header. The pump is a direct suction steam pump and draws water at a rate of 1500 gallons per minute for 24 hours per day, most of which is apparently obtained from the 36-inch well. The drawdown when pumping at the 1500 gallon per minute rate is about 9 feet.

The water had a residue of 748, a total hardness of 600, iron of 0.4 and manganese of 0.4 parts per million as shown by the analysis of sample number 73459, collected August 30, 1933, from the pump header, and which sample represented water from all the wells being pumped.

Analysis of Sample Number 73459 from the Barrett Company 92-Foot Well.

Determinations Made.		Hypothetical Combinations.	
	Pts. per million.		Pts. per million. Grs. per gallon.
Iron.....Fe	0.4	Sodium Chloride.....NaCl	49.1 2.86
Manganese..Mn	0.4	Sodium Sulfate.....Na ₂ SO ₄	28.4 1.66
Silica.....SiO ₂	15.0	Magnesium Sulfate....MgSO ₄	254.0 14.82
Turbidity.....	0.0	Magnesium Carbonate..MgCO ₃	9.3 0.54
Calcium.....Ca	151.2	Calcium Carbonate.....CaCO ₃	353.0 20.65
Magnesium..Mg	54.0	Calcium Silicate.....CaSiO ₃	29.0 1.69
Ammonium..NH ₄	trace	Iron Oxide.....Fe ₂ O ₃	0.6 0.04
Sodium.....Na	23.5	Manganese Oxide.....MnO	0.5 0.03
Sulfate.....SO ₄	221.8		
Nitrate.....NO ₃	0.3	Total.....	723.9 42.29
Chloride....Cl	30.0		
Alkalinity as CaCO ₃			
Phenolphthalein..	0.0		
Methyl Orange...	364.0		
Residue.....	748.0		
Total Hardness....	600.0		

BEMIS BAG COMPANY. The plant of the Bemis Bag Company is located adjacent to the east right-of-way line of the Chicago, Rock Island and Pacific Railroad and about in line with the easterly extension of Sloan Street.

Well number 1 is located about 25 feet easterly of the railroad right-of-way and 200 feet northerly of the south line of Sloan Street extended or approximately 50 feet north and 700 feet west of the center of Section 35, T. 9 N., E. 8 E. of the 4th P. M., and was constructed in 1930 by the Kelly Well Company of Grand Island, Nebraska. In its construction the following materials were encountered:

Materials.	Thickness in feet.	Depth in feet.
Gravel and clay.....	.19	19
Gravel and small boulders.....	.18	37
Sand, gravel, clay and boulders.....	.16	53
Gray sand.....	.3	56
Gravel, clay boulders.....	.9	65
Blue clay and boulders below.....		65

The well is screened and cased with concrete units having an internal diameter of 25 inches and an external diameter of 32 inches. On the bottom of the well is an 8-inch thick plug on which rests 23 feet 10 inches of Kelly concrete screen and above which is 34 feet 6 inches of concrete casing. The top of the casing terminates at the floor level of the pump pit or about 6 feet below ground level.

According to the Kelly Well Company, static water level was 33 feet 8 inches below the top of the concrete casing or 39 feet 8 inches below ground level. Upon completion of the well it was reported that the well produced 840 gallons per minute with a drawdown of 5 feet 2 inches.

The well was originally equipped with a Pomona deep-well turbine pump, the assembly of which consisted of 49 feet 2¾ inches of column pipe, four stages of 18-inch turbine having an over-all length of 4 feet 9 5/16 inches and a metal basket strainer 3 feet long. The pump was direct connected to a Westinghouse induction motor of 125 horsepower which operated at full load speed of 1160 revolutions per minute.

Upon the completion of well number 2 this pumping unit was removed and installed in the new well and sometime later a new Pomona pump was installed. The assembly of this new unit in well number 1 consists of 50 feet of 12-inch column pipe, four stages of 18-inch bowls having an over-all length of 5 feet and but 6 inches of 12-inch suction pipe. It is rated at 2000 gallons per minute against a 170-foot head and is direct connected to a Westinghouse Electric Company 125 horsepower electric motor which operates at a speed of 1760 revolutions per minute.

The water had a residue of 720 and a total hardness of 506 parts per million with no iron or manganese, as shown by analysis of sample number 73419, collected August 31, 1933.

Analysis of Sample Number 73419 from the G5-Foot Well at the Bemis Bag Company.
Determinations Made. Hypothetical Combinations.

		Pts. per million.			Pts. per million.	Grs. per gallon.
Iron.....Fe	0.0	Sodium Nitrate.....NaNO ₃	37.4	2.18		
Manganese..Mn	0.0	Sodium Chloride.....NaCl	62.6	3.65		
Silica.....SiO ₂	9.0	Sodium Sulfate.....Na ₂ SO ₄	57.5	3.36		
Turbidity.....	0.0	Ammonium Sulfate.....(NH ₄) ₂ SO ₄	0.7	0.04		
Calcium.....Ca	136.0	Magnesium Sulfate.....MgSO ₄	199.8	11.66		
Magnesium..Mg	40.4	Calcium Sulfate.....CaSO ₄	1.4	0.08		
Ammonium..NH ₄	0.3	Calcium Carbonate.....CaCO ₃	324.0	18.91		
Sodium.....Na	53.3	Calcium Silicate.....CaSiO ₃	17.4	1.02		
Sulfate.....SO ₄	200.0					
Nitrate.....NO ₃	27.5	Total.....	700.8	40.90		
Chloride....Cl	38.0					
Alkalinity as CaCO ₃						
Phenolphthalein..	0.0					
Methyl Orange...	324.0					
Residue.....	720.0					
Total Hardness....	506.0					

Well number 2, located about 55 feet northerly of number 1 or 100 feet north and 660 feet west of the center of Section 35, was completed in June, 1934, by the Layne North Central Company to a depth of 57 feet below bottom of pump pit or 62 feet below ground level. The well is of the double casing type, there being 47 feet of 38-inch outer casing and 47 feet of 26-inch inner casing, below which is 10 feet of Layne 26-inch shutter screen. The annular space between the two casings and around the screen was filled with selected gravel.

Well number 2 is operated the first five days of the week while well number 1 is operated on Saturdays and Sundays, as its production has fallen to between 700 and 800 gallons per minute.

The water has a residue of 540, and a total hardness of 437.5 parts per million without iron or manganese, as shown by the analysis of sample number 87059, collected January 10, 1940.

Analysis of Sample Number 87059 from Well Number 2.

Determinations Made.		Hypothetical Combinations.		
	Pts. per million.		Pts. per million.	Grs. per gallon.
Iron..... Fe		Sodium Nitrate..... NaNO ₃	2.6	0.15
(filtered).....	0.0	Sodium Chloride..... NaCl	39.7	2.31
(unfiltered).....	0.0	Sodium Sulfate..... Na ₂ SO ₄	4.3	0.25
Manganese.. Mn	0.0	Ammonium Sulfate..... (NH ₄) ₂ SO ₄	1.9	0.11
Silica..... SiO ₂	23.0	Magnesium Carbonate.. MgCO ₃	45.9	2.68
Turbidity.....	trace	Magnesium Sulfate..... MgSO ₄	124.6	7.26
Color.....	0.0	Calcium Carbonate..... CaCO ₃	279.7	18.31
Odor.....	0.0	Silica..... SiO ₂	23.0	1.34
Calcium..... Ca	111.8			
Magnesium.. Mg	38.4	Total.....	521.7	30.41
Ammonium.. NH ₄	0.5			
Sodium.... Na	17.7			
Sulfate.... SO ₄	103.6			
Nitrate.... NO ₃	1.7			
Chloride... Cl	24.0			
Alkalinity as CaCO ₃				
Phenolphthalein..	0.0			
Methyl Orange...	334.0			
Residue.....	540.0			
Total Hardness....	437.5			

CENTEAL PAEK. The area formerly known as Central Park but now owned by the Illinois Power and Light Company for street car storage and repair yard is located westerly of Jefferson Street between Abington and Van Buren Streets in the northeast quarter of the northeast quarter of Section 3, T. 8 N., E. 8 E., 4th P. M.

When the area was operated as a park a well 915 feet deep below a ground elevation of 476 feet above mean sea level furnished water for a swimming pool. The water had a rather strong odor and taste of sulfur and flowed from the well top in a sufficient volume to maintain a fresh condition in the pool. The well was capped in about 1924 and the top is now covered with a concrete block.

The well is located on the center line of Madison Street extended across the park and some 390 feet south of the south line of Van Buren Street or approximately 550 feet south and 725 feet west of the northeast corner of Section 3. This well entered the same sulfur water-bearing formation as the Glen Oak Park, Logan Field, Peoria Mineral Company, and other deep wells in the vicinity. The log of this well, as reported in U.S.G.S. Bulletin 506, is as follows:

Materials.	Thickness in feet.	Depth in feet.
Pleistocene—		
Loam and clay.	9	9
Gravel.	12	21
Quicksand.	8	29
Pennsylvanian—		
Coal.	4	33
Shale (blue).	26	59
Rock (coral rock) sandstone?.	30	89
Soapstone, soft. . . . .	.6	95
Rock (coral rock) sandstone?.	45	140
Soapstone, soft, gray.	19	159
Shale, blue. . . . .	.17	176
Soapstone.	194	370
Mississippian—		
Slate.	5	375
Limestone, blue.	18	393
Sandstone, brown. . . . .	.6	399
Limestone, hard, blue. . . . .	.65	464
Devonian and lower carboniferous—		
Hard (?) possibly Burlington Limestone.	45	509
Slate, blue. . . . .	.14	523
Shale, soft.	200	723
Slate. . . . .	.6	729
Limestone.	22	751
Silurian (Niagaran)—		
Limestone, blue.	52	803
Sandstone, brown. . . . .	.76	879
Limestone, porous.	36	915

The water had a mineral content of 3085, a total hardness of 227 and an iron content of 2.0 parts per million, as shown by the analysis of sample number 15250, collected October 29, 1906.

Analysis of Sample Number 15250 from a Flowing Well in Central Park.

Determinations Made.		Hypothetical Combinations.	
	Pts. per million.		
Iron. Fe	2.0	Sodium Nitrate. NaNO ₃	0.7
Silica. SiO ₂	11.2	Sodium Chloride. NaCl	2361.5
Alumina. Al ₂ O ₃	4.0	Sodium Sulfate. Na ₂ SO ₄	401.6
Calcium. Ca	49.2	Sodium Carbonate. Na ₂ CO ₃	83.1
Magnesium. Mg	25.4	Ammonium Carbonate. (NH ₄) ₂ CO ₃	6.1
Ammonium. NH ₄	2.3	Magnesium Carbonate. MgCO ₃	88.0
Sodium. Na	1103.0	Calcium Carbonate. CaCO ₃	122.8
Sulfate. SO ₄	271.4	Iron Carbonate. FeCO ₃	4.1
Nitrate. NO ₃	0.5	Alumina. Al ₂ O ₃	4.0
Chloride. Cl	1425.0	Silica. SiO ₂	11.2
Alkalinity as CaCO ₃	379.0	Bases.	2.0
Total Hardness.	227.0		
		Total.	3085.1
			179.92

CENTURY DISTILLERY. The plant of the Century Distillery Company is located in the northeast quarter of the northeast quarter of Section 19, T. 8 N., E. 8 E., 4th P. M. Three wells, drilled by Mr. Schilling in 1933, are all near together at about 200 feet west and 700 feet south of the northeast corner of Section 19.

Each well is reported to be 60 feet deep and to be eased with 40 feet of 14-inch casing and 20 feet of screen.

When completed static water level was reported to be 15 feet below ground surface. When the wells were pumped at a rate of 50 to 100 gallons per minute for a few hours no change in water level was observed.

The water had a residue of 620 and a total hardness of 538 parts per million with no iron or manganese, as shown by the analysis of sample number 80708, collected February 20, 1934. The temperature of the water was 54° F.

Analysis of Sample Number 80708 from the Combined Discharge
from Three 60-Foot Wells.

Determinations Made.		Hypothetical Combinations.		
	Pts. per million.		Pts. per million.	Grs. per gallon.
Iron.....Fe	0.0	Sodium Nitrate.....NaNO ₃	40.8	2.38
Manganese..Mn	0.0	Magnesium Nitrate....Mg(NO ₃) ₂	11.2	0.65
Silica.....SiO ₂	8.0	Magnesium Chloride...MgCl ₂	39.1	2.28
Turbidity.....	0.0	Magnesium Sulfate....MgSO ₄	185.4	10.82
Calcium.....Ca	134.2	Calcium Sulfate.....CaSO ₄	32.0	1.87
Magnesium..Mg	49.3	Calcium Carbonate....CaCO ₃	312.3	18.22
Ammonium..NH ₄	.....	Silica.....SiO ₂	8.0	0.47
Sodium.....Na	11.1			
Sulfate.....SO ₄	170.3	Total.....	628.8	36.69
Nitrate.....NO ₃	39.0			
Chloride....Cl	29.0			
Alkalinity as CaCO ₃				
Phenolphthalein..	0.0			
Methyl Orange...	312.0			
Residue.....	620.0			
Total Hardness....	538.0			

A fourth well has more recently been constructed of the same size and the same depth.

All four wells are reported to be equipped with electric motor driven deep well turbine pumps, each rated at 1350 g.p.m. The average daily production is about 3,750,000 gallons.

CEREAL FOODS COMPANY. The plant of the Cereal Foods Company is located on the southerly side of Cedar Street near the river. A well constructed in about 1923 is located approximately 950 feet south and 500 feet east of the northwest corner of Section 16, T. 8 N., R. 8 E., 4th P. M. It is reported to be 46 feet deep and cased with 41 feet of 4-inch pipe and 5 feet of strainer.

Water is drawn from the well by direct suction with a double stroke steam pump 7 inches by 4½ inches by 6 inches at a rate of 90 to 120 gallons per minute. Static water level ranges between 11 and 24 feet, depending on the stage of water in the river.

The water had a residue of 508, a total hardness of 396 and a manganese content of 0.4 parts per million with no iron, as shown by analysis of sample number 73455, collected August 31, 1933. The water temperature was 53° F.

Analysis of Sample Number 73455 from a 46-Foot Well.

Determinations Made.		Hypothetical Combinations.	
	Pts. per million.		Pts. per million. Grs. per gallon.
Iron.....Fe	0.0	Sodium Nitrate.....NaNO ₃	9.4 0.55
Manganese..Mn	0.4	Sodium Chloride.....NaCl	32.8 1.91
Silica.....SiO ₂	12.0	Sodium Sulfate.....Na ₂ SO ₄	1.4 0.08
Turbidity.....	0	Ammonium Sulfate.....(NH ₄) ₂ SO ₄	1.3 0.08
Calcium.....Ca	107.0	Magnesium Sulfate.....MgSO ₄	154.8 9.03
Magnesium..Mg	31.2	Calcium Sulfate.....CaSO ₄	51.1 2.98
Ammonium..NH ₄	0.3	Calcium Carbonate....CaCO ₃	210.0 12.25
Sodium.....Na	15.9	Calcium Silicate.....CaSiO ₃	23.2 1.35
Sulfate.....SO ₄	161.6		
Nitrate.....NO ₃	7.1	Total.....	484.0 28.23
Chloride....Cl	20.0		
Alkalinity as CaCO ₃			
Phenolphthalein..	0.0		
Methyl Orange...	210.0		
Residue.....	508.0		
Total Hardness....	396.0		

CHUECHILL DRUG COMPANY. The Churchill Drug Company is located on the easterly side of Washington Street near Maple Street. The well, located about 860 feet north and 1190 feet west of the southeast corner of the southwest quarter of Section 9, T. 8 N., E. 8 E., 4th P. 11., is reported to be 46 feet deep below the basement floor or 66 feet deep below the grade of Washington Street and to be cased with 6-inch pipe. Static water level was reported in 1933 as 20 feet below the basement floor.

The water had a residue of 794, a total hardness of 597.5 and an iron content of 0.6 parts per million, as shown by analysis of sample number 73494, collected September 11, 1933.

Analysis of Sample Number 73494 from the Churchill Drug Company Well.

Determinations Made.		Hypothetical Combinations.	
	Pts. per million.		Pts. per million. Grs. per gallon.
Iron.....Fe	0.6	Sodium Nitrate.....NaNO ₃	4.3 0.25
Manganese..Mn	0.0	Sodium Chloride.....NaCl	141.5 8.25
Silica.....SiO ₂	16.0	Magnesium Chloride...MgCl ₂	27.1 1.58
Turbidity.....	0	Magnesium Sulfate....MgSO ₄	236.5 13.80
Calcium.....Ca	143.0	Magnesium Carbonate..MgCO ₃	12.6 0.74
Magnesium..Mg	58.5	Calcium Carbonate....CaCO ₃	331.3 19.31
Ammonium..NH ₄	trace	Calcium Silicate.....CaSiO ₃	30.8 1.80
Sodium.....Na	55.7	Iron Oxide.....Fe ₂ O ₃	0.9 0.05
Sulfate.....SO ₄	188.7		
Nitrate.....NO ₃	3.1	Total.....	785.0 45.78
Chloride....Cl	106.0		
Alkalinity as CaCO ₃			
Phenolphthalein..	0.0		
Methyl Orange...	346.0		
Residue.....	794.0		
Total Hardness....	597.5		

CHURCHS CEEAMEEY. The plant of the Churchs Creamery is situated at 1604 South Adams Street.

A private water supply is obtained from an 8-inch well 100 feet deep. The well is equipped with a Pomona deep-well turbine rated at

30 gallons per minute. It operates about 4 hours per day. The water temperature is 56° F.

COCA-COLA BOTTLING COMPANY. The plant of the Coca-Cola Bottling Company is located at 2421 South Adams Street.

The plant is supplied with water from a well 8 inches in diameter and 105 feet deep equipped with a Pomona deep-well turbine pump having a capacity of 100 gallons per minute or about 48,000 gallons per day.

COMMERCIAL SOLVENTS COMPANY. The plant of the Commercial Solvents Company is situated in the southeast quarter of the northeast quarter of Section 19, T. 8 N., E. 8 E. of the 4th P. M. Water for this industry originally was obtained from a battery of 21 wells ranging in size from 6 inches to 10 inches in diameter and producing a total of about 2000 gallons per minute. These wells occupy an oval shaped area a little east of the center of the company property. The extreme distance between any two wells and representing the long axis of the oval is about 380 feet.

In about 1930 six test borings were made and on the basis of the data obtained three gravel walled wells were constructed.

In the construction of well number 1 the following materials were encountered:

Materials.	Thickness in feet.	Depth in feet.
Clay fill	6	6
Clay and gravel	24	30
Gravel	38	68
Shale and boulders	2	70

The well has a diameter of 24 inches and is cased with 40 feet of screen and 28 feet of casing. Surrounding the screen and lower part of the casing is a 7-inch thick envelope of selected gravel.

The water from this well had a residue of 795 and a total hardness of 557 parts per million with no iron or manganese, as shown by analysis of sample number 72349, collected January 20, 1933.

Analysis of Sample Number 72349 from Well Number 1.

Determinations Made.	Pts. per million.	Hypothetical Combinations.	Pts. per million.	Grs. per gallon.
Iron Fe	0.0	Sodium Nitrate NaNO ₃	1.7	0.10
Manganese Mn	0.0	Sodium Chloride NaCl	97.1	5.67
Silica SiO ₂	18.0	Sodium Sulfate Na ₂ SO ₄	54.7	3.19
Turbidity	0.0	Magnesium Sulfate MgSO ₄	249.5	14.58
Calcium Ca	139.0	Magnesium Carbonate MgCO ₃	2.1	0.12
Magnesium Mg	50.9	Calcium Carbonate CaCO ₃	347.5	20.28
Ammonium NH ₄	0.02	Silica SiO ₂	18.0	1.05
Sodium Na	56.4			
Sulfate SO ₄	235.5	Total	770.6	44.99
Nitrate NO ₃	1.2			
Chloride Cl	59.0			
Alkalinity as CaCO ₃				
Phenolphthalein	0.0			
Methyl Orange	350.0			
Residue	795.0			
Total Hardness	557.0			

Well number 2 is westerly and a little south of well number 1 a distance of 327 feet. In the construction of this well the following materials were penetrated:

Materials.	Thickness in feet.	Depth in feet.
Soil and clay . . . . .	.6	6
Sand, clay and gravel . . . . .	.25	31
Gravel and sand . . . . .	.34	65
Shale . . . . .	.3	68

As in well number 1, the screen is 24 inches in diameter by 40 feet long and is surrounded with a 7-inch thick wall of selected gravel. A 24-inch casing extends from the top of the screen to the ground surface.

The water from well number 2 had a residue of 628, a total hardness of 519.5 and a manganese content of 0.2 parts per million, but no iron, as shown by analysis of sample number 72350, collected January 20, 1933.

Analysis of Sample Number 72350 from Well Number 2.

Determinations Made.		Hypothetical Combinations.		
	Pts. per million.		Pts. per million.	Grs. per gallon.
Iron Fe	0.0	Sodium Nitrate NaNO ₃	28.9	1.69
Manganese Mn	0.2	Sodium Chloride NaCl	15.2	0.89
Silica SiO ₂	13.0	Magnesium Chloride MgCl ₂	11.9	0.69
Turbidity	0.0	Magnesium Sulfate MgSO ₄	225.0	13.12
Calcium Ca	119.8	Magnesium Carbonate MgCO ₃	17.3	1.01
Magnesium Mg	53.5	Calcium Carbonate CaCO ₃	299.5	17.48
Ammonium NH ₄	0.04	Manganese Oxide MnO	0.3	0.02
Sodium Na	13.8	Silica SiO ₂	13.0	0.76
Sulfate SO ₄	179.7			
Nitrate NO ₃	21.3	Total	611.1	35.66
Chloride Cl	18.0			
Alkalinity as CaCO ₃				
Phenolphthalein	0.0			
Methyl Orange	320.0			
Residue	628.0			
Total Hardness	519.5			

Well number 3 is located southwesterly of well number 2 a distance of 350 feet. In the construction of this well the following materials were penetrated:

Materials.	Thickness in feet.	Depth in feet.
Soil and clay . . . . .	.5	5
Clay and sand . . . . .	.5	10
Coarse gravel . . . . .	.5	15
Clay, sand and gravel . . . . .	.14	29
Sand and gravel . . . . .	.6	35
Gravel with large hard particles . . . . .	.20	55
Gravel . . . . .	.8	63
Shale and boulders . . . . .	.2	65

As in the two previous wells the 40 feet of 24-inch screen was surrounded with 7-inch thick wall of selected gravel. A length of blank casing extended from the top of the screen to the ground surface.

The water from well number 3 had a residue of 902, a total hardness of 702, an iron content of 0.7 parts per million and a trace of manganese as shown by analysis of sample number 72351, collected January 20, 1933.

Analysis of Sample Number 72351 from Well Number 3.

Determinations Made.		Hypothetical Combinations.		
	Pts. per million.		Pts. per million.	Grs. per gallon.
Iron.....Fe	0.7	Sodium Nitrate..... NaNO_3	15.8	0.89
Manganese..Mn	trace	Sodium Chloride..... NaCl	28.1	1.64
Silica..... SiO_2	17.0	Sodium Sulfate..... Na_2SO_4	54.7	3.19
Turbidity.....	0.0	Magnesium Sulfate..... MgSO_4	343.0	20.00
Calcium.....Ca	166.8	Calcium Sulfate..... CaSO_4	53.1	3.10
Magnesium..Mg	69.2	Calcium Carbonate..... CaCO_3	378.0	22.06
Ammonium.. NH_4	0.02	Iron Oxide..... Fe_2O_3	1.0	0.06
Sodium.....Na	32.9	Silica..... SiO_2	17.0	0.99
Sulfate..... SO_4	348.0			
Nitrate..... NO_3	11.1	Total.....	890.2	51.93
Chloride....Cl	17.0			
Alkalinity as CaCO_3				
Phenolphthalein..	0.0			
Methyl Orange...	378.0			
Residue.....	902.0			
Total Hardness....	702.0			

When tested, with all three wells discharging simultaneously, the drawdown in the end wells, numbers 1 and 3, was less than 7 feet and in well number 2, the middle well, less than 10 feet.

Within several months after the completion of the first three wells a fourth was constructed in a similar manner at a site about 400 feet north and a little east of well number 3. The materials encountered were reported as follows:

Materials.	Thickness in feet.	Depth in feet.
Cinders and clay.....	.6	6
Clay and sand.....	.6	12
Clay and gravel.....	.9	21
Gravel.....	.9	30
Coarse gravel.....	.5	35
Gravel.....	.13	48
Coarse gravel.....	.3	51
Shale.....	.2	53

The water from well number 4 had a residue of 562, a total hardness of 486.5, and an iron content of 1.2 parts per million with no

Analysis of Sample Number 72352 from Well Number 4.

Determinations Made.		Hypothetical Combinations.		
	Pts. per million.		Pts. per million.	Grs. per gallon.
Iron.....Fe	1.2	Sodium Nitrate..... NaNO_3	1.7	0.10
Manganese..Mn	0.0	Magnesium Nitrate.... $\text{Mg}(\text{NO}_3)_2$	46.0	2.68
Silica..... SiO_2	18.0	Magnesium Chloride... MgCl_2	20.0	1.17
Turbidity.....	0.0	Magnesium Sulfate..... MgSO_4	175.2	10.22
Calcium.....Ca	115.6	Calcium Sulfate..... CaSO_4	6.8	0.40
Magnesium..Mg	47.9	Calcium Carbonate.... CaCO_3	284.0	16.57
Ammonium.. NH_4	0.03	Iron Oxide..... Fe_2O_3	1.7	0.10
Sodium.....Na	0.5	Silica..... SiO_2	18.0	1.05
Sulfate..... SO_4	144.3			
Nitrate..... NO_3	39.8	Total.....	553.4	32.29
Chloride....Cl	15.0			
Alkalinity as CaCO_3				
Phenolphthalein..	0.0			
Methyl Orange...	284.0			
Residue.....	562.0			
Total Hardness....	486.5			

manganese as shown by analysis of sample number 72352, collected January 20, 1933.

Prior to the construction of well number 5, which was completed in 1931, seven test wells were drilled for the purpose of determining the best location for the well and also to give information on the materials to be penetrated. This well is located about 250 feet distant from well number 1 and a little west of due north. The construction was similar to that followed in the four previous wells. The materials penetrated were as follows:

Materials.	Thickness in feet.	Depth in feet.
Till and top soil	10	10
Sand and gravel with boulders	73	83

The water from well number 5 had a residue of 581, a total hardness of 491.5 parts per million, with no iron or manganese as shown by analysis of sample 72353, collected January 20, 1933.

Analysis of Sample Number 72353 from Well Number 5.

Determinations Made.		Hypothetical Combinations.	
	Pts. per million.		Pts. per million.
Iron Fe	0.0	Sodium Nitrate NaNO ₃	25.5
Manganese Mn	0.0	Magnesium Nitrate Mg(NO ₃) ₂	25.2
Silica SiO ₂	17.0	Magnesium Chloride MgCl ₂	26.7
Turbidity	0.0	Magnesium Sulfate MgSO ₄	176.3
Calcium Ca	116.6	Magnesium Carbonate MgCO ₃	7.2
Magnesium Mg	48.7	Calcium Carbonate CaCO ₃	291.5
Ammonium NH ₄	0.02	Silica SiO ₂	17.0
Sodium Na	6.9		
Sulfate SO ₄	140.8	Total	569.4
Nitrate NO ₃	39.8		
Chloride Cl	20.0		
Alkalinity as CaCO ₃			
Phenolphthalein	0.0		
Methyl Orange	300.0		
Residue	581.0		
Total Hardness	491.5		

During 1934 the Layne Western Company put down ten additional test holes as a basis for determining the best location for another well. This well, well number C, was constructed by the Layne Western Company during the early part of 1935 at a site about 250 feet distant and a little east of south, from well number 2.

The well was constructed by first removing all the material inside a 38-inch diameter outside casing to a depth of 55 feet. Inside this casing was then installed 20.5 feet of Layne shutter screen, the slot widths of which were 0.205 inches (No. 3½), made up of a lower section 5 feet 2 inches long shaped as a truncated cone with a bottom outside diameter of 36 inches and a top outside diameter of 26 inches and an upper section, cylindrical in shape, 15 feet 4 inches long, with an outside diameter of 26 inches. Above the screen section was 60 feet 2 inches of blank casing which, when the well was completed to its final depth of 78 feet 8 inches, extended above the ground surface one foot. After the screen had been installed together with sufficient inner casing to bring

it above the ground surface, selected gravel was placed in the annular space between the screen and outer casing and the natural material below the bottom of the screen was removed through the screen and inner casing. As this material was removed and the screen and casing settled more gravel was placed in the annular space thus creating a gravel filter wall around the screen. Some 12.5 cubic yards of selected gravel was used.

During the construction of the well the following materials were penetrated:

Materials.	Thickness in feet.	Depth in feet.
Cinder fill.....	5	5
Clay, sand and gravel.....	5	10
Clay, gravel and boulders.....	16	26
Medium gravel and boulders.....	24	50
Sand, gravel and boulders.....	28' 8"	78' 8"
Shale at 78' 8".		

Water-bearing material was found at a depth of 26 feet and upon completion of the well static water level stood 22 feet below the ground surface.

The well is equipped with a Layne single-stage 24-inch deep-well turbine rated at 2000 gallons per minute at 1160 revolutions per minute. The pump is direct connected to a General Electric motor rated at 50-horsepower at 1160 revolutions per minute.

The water from well number 6 had a residue of 890, a total hardness of 624.5 and an iron content of 0.8 parts per million with a trace of manganese as shown by analysis of sample number 76409, collected August 14, 1935.

Analysis of Sample Number 76409 from Well Number 6.				
Determinations Made.		Hypothetical Combinations.		
	Pts. per million.		Pts. per million.	Grs. per gallon.
Iron..... Fe				
(filtered).....	0.0	Sodium Nitrate..... NaNO ₃	2.6	0.15
(unfiltered).....	0.8	Sodium Chloride..... NaCl	26.3	1.53
Manganese.. Mn	trace	Sodium Sulfate..... Na ₂ SO ₄	166.4	9.70
Silica..... SiO₂	10.0	Ammonium Sulfate..... (NH ₄) ₂ SO ₄	0.7	0.04
Turbidity.....	0.0	Magnesium Sulfate..... MgSO ₄	307.4	17.93
Color.....	0.0	Calcium Sulfate..... CaSO ₄	1.4	0.08
Odor.....	0.0	Calcium Carbonate..... CaCO ₃	368.2	21.48
Calcium.... Ca	147.5	Silica..... SiO ₂	10.0	0.58
Magnesium.. Mg	62.2	Total.....	883.0	51.49
Ammonium.. NH₄	0.2			
Sodium.... Na	64.6			
Sulfate.... SO₄	358.8			
Nitrate.... NO₃	1.9			
Chloride... Cl	16.0			
Alkalinity as CaCO₃				
Phenolphthalein..	0.0			
Methyl Orange...	368.0			
Residue.....	890.0			
Total Hardness....	624.5			

EASTERN BEEF AND PROVISION COMPANY. The plant of the Eastern Beef and Provision Company is located on the west side of South Adams Street at No. 521. This is just south of Bridge Street.

Water is supplied by a well drilled, by M. Ebert and Son of Washington, Illinois, in 1928. It is located about 260 feet west and 30 feet south of the center of Section 9, T. 8 N., R. 8 E., 4th P. M. and has a depth of 76 feet below the basement floor or about 85 feet below the street grade of Adams Street. The well is cased with 10 feet of 4-inch screen and 66 feet of 4-inch casing. In September 1933 static water level was reported to be 41 feet below the basement floor.

The well is equipped with a Myers deep-well cylinder pump, the working barrel of which has an internal diameter of 3 inches and a setting of 68 feet below floor level. The rate of discharge is 16 gallons per minute. The pump is belt connected to a 2-horsepower electric motor which operates at a speed of 1800 revolutions per minute.

The water from this well had a residue of 1133, a total hardness of 570 and an iron content of 0.1 parts per million with no manganese as shown by the analysis of sample number 80074, collected September 12, 1933.

Analysis of Sample Number 80074 from the 76-Foot Well.				
Determinations Made.		Hypothetical Combinations.		
	Pts. per million.		Pts. per million.	
			Grs. per gallon.	
Iron..... Fe	0.1	Sodium Nitrate..... NaNO ₃	39.1	2.28
Manganese.. Mn	0.0	Sodium Chloride..... NaCl	473.3	27.60
Silica..... SiO ₂	11.0	Sodium Sulfate..... Na ₂ SO ₄	5.0	0.29
Turbidity.....	0.0	Magnesium Sulfate.... MgSO ₄	228.2	13.32
Calcium.... Ca	135.0	Magnesium Carbonate.. MgCO ₃	36.3	2.12
Magnesium.. Mg	56.6	Calcium Carbonate.... CaCO ₃	319.0	18.60
Ammonium.. NH ₄	0.02	Calcium Silicate..... CaSiO ₃	21.5	1.25
Sodium.... Na	198.2	Iron Oxide..... Fe ₂ O ₃	0.1	0.01
Sulfate.... SO ₄	185.5			
Nitrate.... NO ₃	28.3	Total.....	1122.5	65.47
Chloride.... Cl	287.0			
Alkalinity as CaCO ₃				
Phenolphthalein..	0.0			
Methyl Orange...	362.0			
Residue.....	1133.0			
Total Hardness.....	570.0			

GIPPS BEEWING COMPANY. The Gipps Brewing Company plant is situated on the southeasterly corner of the intersection of Water and Franklin Streets.

Water is obtained from two wells in the engine room about 42 feet deep. Well number 1, the westerly well, is located about 60 feet south of the southerly line of Franklin Street and 35 feet east of the easterly line of Water Street, or approximately 465 feet east and 800 feet south of the center of Section 9, T. 8 N., R. 8 E. 4th P. M. It was constructed late in 1933 and is cased with 10-inch pipe below which is 12 feet of 10-inch Cook screen with number 80 slot. When first completed static water level was 22 feet 3 inches below the floor level but on January 11, 1940 static water level was 36 feet 4 inches below floor level. The well was equipped with a 10-inch Sterling deep-well turbine pump. The assembly as originally installed consisted of 24 feet of column pipe, four stages of impellers having an over-all length of 3 feet 6¾ inches and

12 feet of suction pipe. It was rated at 300 gallons per minute. The pump was direct connected to a U. S. electric motor of 20-horsepower which operated at a speed of 1750 revolutions per minute.

Well number 2 is 35 feet easterly of number 1. It is cased with 10-inch pipe and 10 feet of 10-inch Cook screen with number 80 slot. It is equipped with a Pomona deep-well turbine pump rated at 150 gallons per minute but which in January 1940 was only delivering about 55 gallons per minute. The assembly of the pump consists of 35 feet of 5-inch column, 13 stages of 6-inch pump having an over-all length of 4 feet. There was no suction below the bowls. It was direct connected to a 15-horsepower Westinghouse electric motor which operated at a speed of 1755 revolutions per minute. It was reported that the operation of the pump in Well number 2 at a rate of 50 to 55 gallons per minute created but a small lowering of water level in Well number 1 but when the number 1 well was operating at a rate of 300 gallons per minute considerable lowering of water level in well number 2 took place.

The water had a residue of 740 and a total hardness of 506.5 parts per million with no iron or manganese as shown by the analysis of sample number 73498, collected September 12, 1933.

Analysis of Sample Number 73498 from Well No. 2.

Determinations Made.		Hypothetical Combinations.		
	Pts. per million.			
Iron..... Fe	0.0	Sodium Nitrate..... NaNO ₃	21.3	1.24
Manganese.. Mn	0.0	Sodium Chloride..... NaCl	142.0	8.28
Silica..... SiO ₂	15.0	Sodium Sulfate..... Na ₂ SO ₄	4.3	0.25
Turbidity.....	0.0	Magnesium Sulfate..... MgSO ₄	188.6	11.00
Calcium..... Ca	140.0	Calcium Sulfate..... CaSO ₄	66.7	3.89
Magnesium.. Mg	38.1	Calcium Carbonate..... CaCO ₃	276.0	16.10
Ammonium.. NH ₄	trace	Calcium Silicate..... CaSiO ₃	29.0	1.69
Sodium..... Na	63.0			
Sulfate..... SO ₄	201.0	Total.....	727.9	42.45
Nitrate..... NO ₃	15.5			
Chloride.... Cl	86.0			
Alkalinity as CaCO ₃				
Phenolphthalein..	0.0			
Methyl Orange...	276.0			
Residue.....	740.0			
Total Hardness....	506.5			

GLEN OAK PAEK. Glen Oak Park is situated on the uplands of the bluff in the north part of the city of Peoria. It extends from Springdale Eoad on the east to Pacific Street on the west and from Abington Street on the south to Springdale Cemetery and E. Gift Avenue on the north. Glen Oak Park swimming pool is situated south of Abington Street between Glendale and Perry Avenues.

The original sulfur well is located in the northeasterly part of the park about 1685 feet east and 1650 feet north of the center of the intersection of Abington Street and Prospect Eoad or approximately 900 feet east and 200 feet south of the center of Section 34, T. 9 N., R. 8 E. of the 4th P. M.

When first completed the well had a depth of 1040 feet below the surface, which is at elevation 534 feet above mean sea level. Water

flowed from the top of the well until the new well at the swimming pool, some 3000 feet away, was drilled in 1923.

In 1934 water level was reported as 6 feet below the top of the well casing and a small horizontal centrifugal pump drew water from the well by direct suction at a rate of 5 gallons per minute for a public drinking fountain and also to augment the flow in a small stream nearby. In January 1940 however, the water level had receded to below the suction left by the pump. The log of this well as reported in the United States Geological Survey Bulletin 506 is as follows:

Materials.	Thickness in feet.	Depth in feet.
Drift, gravel and clay.....	.150	150
Pennsylvanian—		
Shale mostly.....	.130	280
Sandstone.....	.20	300
Shale.....	.80	380
Shale with coal.....	.10	390
Shale, black micaceous.....	.10	400
Mississippian—		
Limestone, with chert and green shale.....	.30	430
Limestone, some chert.....	.50	480
Limestone, crystalline.....	.45	525
Devonian and Lower Carboniferous—		
Shale, greenish.....	.65	590
Shale, gray.....	.130	720
Limestone.....	.85	805
Silurian (Niagaran)—		
Limestone, dolomitic.....	.100	905
Limestone, dolomitic porous in lower part.....	.135	1040

Salty water was encountered between depths of 404 feet and 534 feet, while sulfur water was found between depths of 755 feet and 1040 feet.

The well which supplied water for the swimming pool is located about 45 feet easterly and 150 feet northerly of the intersection of Hayward Street and Glendale Avenue or approximately 200 feet east and 300 feet south of the northwest corner of the northeast quarter of Section 3, T. 8 N., R. 8 E.

The well was constructed in 1923, by the Gray, Milaeger Company of Milwaukee, Wisconsin, to a depth of 1023 feet below the surface which is at elevation of 515 feet above mean sea level. The following is a log of the well:

Materials.	Thickness in feet.	Depth in feet.
Clay.....	.10	10
Sand and Gravel.....	.60	70
Slate, gray.....	.59	129
Coal.....	.5	134
Slate, gray.....	.13	147
Coal.....	.6	153
Sand and shale with salt water.....	.47	200
Shale, gray.....	.85	285
Sand and shale.....	.5	290
Coal.....	.5	295
Shale, black.....	.25	320
Shale, gray.....	.5	325

Materials.	Thickness in feet.	Depth in feet.
Limestone . . . . .	.18	343
Shale, gray. . . . .	.21	364
Sandstone, flow of water. . . . .	.130	494
Slate, gray. . . . .	.111	605
Limestone. . . . .	.15	620
Slate, gray. . . . .	.70	690
Limestone, brown. . . . .	.51	741
Sandstone, white flow of sulfur water. . . . .	.24	765
Sandstone, white and limestone. . . . .	.258	1023

A 12-inch casing was set with its bottom at a depth of 93 feet, below which the hole is 12 inches in diameter to a depth of 365 feet. Between depths of 365 feet and 694 feet the hole has a diameter of 10 inches. An 8-inch diameter casing was installed from the surface to a depth of 694 feet below which the well was finished as an 8-inch open hole.

In 1932 Mr. Schilling of Peoria made repairs on the well and installed 400 feet of 6¼-inch pipe with a packer at a 350-foot depth.

In 1934 the well flowed at 2½ feet below the ground surface at a rate of 5 gallons per minute, the static water pressure being equivalent to 12 feet above ground. The temperature of the natural flowing water in January 1934 was 64° F.

During the winter the well flow is wasted to the sewer but during the summer season a horizontal centrifugal pump having a 4-inch discharge was used to maintain fresh water in the swimming pool. It is estimated the pump delivered about 400 gallons per minute. The water has a strong sulfur odor especially in the summertime when the well is pumped. It also has a strong salty flavor.

Some time prior to January 1940 the use of the swimming pool was discontinued and the well water is now allowed to flow to waste. At that time the natural flow from two ¾-inch pipe outlets was about 2 gallons per minute.

The water had a residue of 3088, a total hardness of 166.5 and an iron content of 0.7 parts per million with no manganese as shown by the analysis of sample number 80059, collected January 4, 1934 when the water was flowing to waste.

Analysis of Sample Number 80059 from the 1023-Foot Well at the Glen Oak Park Swimming Pool.

Determinations Made.		Hypothetical Combinations.		
	Pts. per million.		Pts. per million.	Grs. per gallon.
Iron Fe	0.7	Sodium Nitrate. NaNO ₃	0.8	0.05
Manganese . . Mn	0.0	Sodium Chloride. NaCl	2323.8	135.48
Silica SiO ₂	8.0	Sodium Sulfate. Na ₂ SO ₄	354.0	20.64
Turbidity	3.0	Sodium Carbonate. Na ₂ CO ₃	231.0	13.47
Calcium. Ca	39.5	Ammonium Carbonate. . (NH ₄) ₂ CO ₃	4.8	0.28
Magnesium. . Mg	16.6	Magnesium Carbonate. MgCO ₃	57.4	3.35
Ammonium. . . NH ₄	1.8	Calcium Carbonate. . . . CaCO ₃	85.0	4.95
Sodium. Na	1129.5	Calcium Silicate. CaSiO ₃	15.7	0.91
Sulfate. SO ₄	240.0	Iron Oxide. Fe ₂ O ₃	1.0	0.06
Nitrate. NO ₃	0.9			
Chloride. Cl	1410.0	Total.	3073.5	179.19
Alkalinity as CaCO ₃				
Phenolphthalein. .	0.0			
Methyl Orange. . .	376.0			
Residue.	3088.0			
Total Hardness. . . .	166.5			

GODEL AND SONS. The packing plant of Godel and Sons is situated near the river on the southerly side of South Street. The company obtains water for industrial purposes from two wells each 38 feet deep. One well is cased with 28 feet of 8-inch casing and 10 feet of screen and the other with 28 feet of 6-inch casing and 10 feet of screen. The 8-inch well is located approximately 450 feet south and 710 feet east of the center of Section 17, T. 8 N., R. 8 E., 4th P. M. The 6-inch well is 12 feet east of the 8-inch well.

It is reported that in the construction of these two wells 18 feet of clay and top soil was first encountered followed by 20 feet of pea gravel to the bottom of the hole. Static water level is 18 feet below the ground surface or at the top of the gravel.

Water is drawn from the 8-inch well with a single stroke direct suction steam pump while a double stroke Dean Brothers steam pump takes direct suction from the 6-inch well. These pumps are in regular operation.

In addition to these two wells, the company has four 10-inch wells located some 250 feet to the southeast which are connected by a suction header to a steam fire pump. The water from these wells is used for fire protection only.

The water from the 8-inch well had a residue of 1085 and a total hardness of 327.5 parts per million with no iron or manganese as shown by the analysis of sample number 73454, collected August 31, 1933.

		Analysis of Sample Number 73454 from a 38-Foot Well.				
		Determinations Made.		Hypothetical Combinations.		
		Pts. per million.		Pts. per million.	Grs. per gallon.	
Iron.....	Fe	0.0	Sodium Nitrate.....	NaNO ₃	3.65	2.13
Manganese.....	Mn	0.0	Sodium Chloride.....	NaCl	412.1	24.02
Silica.....	SiO ₂	15.0	Sodium Sulfate.....	Na ₂ SO ₄	281.3	16.41
Turbidity.....		0.0	Sodium Carbonate.....	Na ₂ CO ₃	46.1	2.69
Calcium.....	Ca	89.4	Magnesium Carbonate.....	MgCO ₃	87.8	5.18
Magnesium.....	Mg	25.4	Calcium Carbonate.....	CaCO ₃	198.5	11.57
Ammonium.....	NH ₄	trace	Calcium Silicate.....	CaSiO ₃	29.0	1.69
Sodium.....	Na	183.0				
Sulfate.....	SO ₄	190.3	Total.....		1091.3	63.69
Nitrate.....	NO ₃	26.6				
Chloride.....	Cl	250.0				
Alkalinity as CaCO ₃						
Phenolphthalein..		0.0				
Methyl Orange...		346.0				
Residue.....		1085.0				
Total Hardness....		327.5				

W. T. GRANT COMPANY. The department store of W. T. Grant Company is located at 107 South Adams Street.

A well to supply water for air cooling was constructed in 1938 by M. Ebert and Son of Washington, Illinois, at a site beneath the sidewalk on South Adams Street. The site is approximately 1540 feet south and 1520 feet west of the northeast corner of Section 9, T. 8 N., R. 8 E., of the 4th P. M.

The well is 8 inches in diameter and 84 feet deep. It is cased with 76 feet of 8-inch pipe and 8 feet of 8-inch Johnson Everdur screen having number 80 slots. Static water level was 61 feet. The well is

equipped with a Pomona deep-well turbine pump rated at 75 gallons per minute.

The water has a total mineral content of 1332 and a total hardness of 572.1 parts per million as shown by the analysis of sample number 88354, collected July 16, 1940.

Analysis of Sample Number 88354.
Determinations Made.

	Pts. per million.
Turbidity.	0.0
Color.	0.0
Odor.	0.0
Iron. Fe	
(filtered).	0.0
(unfiltered).	0.0
Nitrate. NO ₃	174.0
Chloride. Cl	250.0
Sulfate. SO ₄	218.7
Alkalinity as CaCO ₃	
Phenolphthalein.	0.0
Methyl Orange.	352.0
Calcium. Ca	142.5
Magnesium. Mg	52.6
Total hardness as CaCO ₃	572.1
Total mineral content.	1332.0
pH=7.1	

GEANT STEEET WELL. Sometime between 1868 and 1888 a deep well was drilled on property located adjacent to the south side of Grant Street, and which, during that period, was occupied by the Peoria City Water Works pumping station. The well is located about 35 feet southerly of the southerly line of Grant Street and 1200 feet easterly of the center line of Adams Street, or 500 feet east and 2180 feet south of the northwest corner of Section 2, T. 8 N., E. 8 E., 4th P. M.

The records of the well have been lost but it is thought to have been drilled in the hope of finding oil and to have been drilled to a depth of 1100 to 1200 feet though there are some who say the original depth was between 1600 and 1700 feet. Whatever the actual depth it was deep enough to penetrate the formations from which sulfur water was obtained. The well has continued to flow from the time it was completed to the present, although there apparently has been some decrease in volume.

After the abandonment of the well as an oil well and during the time the city operated the water works plant at this site the water was used for boiler purposes. The records do not indicate that it was ever used as part of the public supply for the city.

For years after the removal of the water works from this site the well top was arranged so that persons in the neighborhood could avail themselves of the water, but since 1935 the water has been used for condensing purposes by the La Tourneau Company who acquired the property at that time. It is reported that the well flows at a rate of about 8000 gallons per day under a pressure of 20 pounds.

The water had a residue of 1461, a total hardness of 204, and an iron content of 0.5 parts per million without manganese as shown by the

analysis of sample number 80072, collected January 4, 1934. The temperature of the water was 65° F.

Analysis of Sample Number 80072 From a Flowing Well at the Foot of Grant Street.
Determinations Made. Hypothetical Combinations.

	Pts. per million.		Pts. per million.	Grs. per gallon.
Iron.....Fe	0.5	Sodium Nitrate.....NaNO ₃	0.8	0.05
Manganese..Mn	0.0	Sodium Chloride.....NaCl	379.0	22.10
Silica.....SiO ₂	8.0	Sodium Sulfate.....Na ₂ SO ₄	833.0	48.58
Turbidity.....	0.0	Sodium Carbonate.....Na ₂ CO ₃	44.0	2.56
Calcium.....Ca	52.9	Ammonium Carbonate..(NH ₄) ₂ CO ₃	3.8	0.22
Magnesium..Mg.	17.4	Magnesium Carbonate..MgCO ₃	60.3	3.52
Ammonium..NH ₄	1.5	Calcium Carbonate....CaCO ₃	119.0	6.94
Sodium.....Na	438.0	Calcium Silicate.....CaSiO ₃	15.7	0.91
Sulfate.....SO ₄	564.0	Iron Oxide.....Fe ₂ O ₃	0.7	0.04
Nitrate.....NO ₃	0.9			
Chloride....Cl	230.0	Total.....	1456.3	84.92
Alkalinity as CaCO ₃				
Phenolphthalein..	0.0			
Methyl Orange...	236.0			
Residue.....	1461.0			
Total Hardness....	204.0			

HART GRAIN WEIGHER COMPANY. The plant of the Hart Grain Weigher Company is situated on the west side of Water Street between Eaton and Hancock Streets.

A well located approximately 1220 feet south and 150 feet east of the northwest corner of Section 10, T. 8 N., R. 8 E., 4th P. M., was drilled in 1915 to a depth of 27 feet below the basement floor or 35 feet below ground level. In 1924 Mr. Schilling of Peoria deepened the well 12 feet, but could go no farther because of large boulders. Below the basement floor the well passed through 22 feet of sand and gravel and 17 feet of small boulders. It is cased with 5-inch casing to a depth of 30 feet. The well is equipped with a Fairbanks-Morse direct suction pump.

Analysis of Sample Number 73490 from a 47-Foot Well at the Hart Grain Weigher Company.

	Pts. per million.		Pts. per million.	Grs. per gallon.
Iron.....Fe	0.0	Sodium Nitrate.....NaNO ₃	24.7	1.44
Manganese..Mn	0.0	Sodium Chloride.....NaCl	94.7	5.52
Silica.....SiO ₂	15.0	Ammonium Chloride....NH ₄ Cl	0.5	0.03
Turbidity.....	0.0	Magnesium Chloride...MgCl ₂	7.1	0.41
Calcium.....Ca	181.6	Magnesium Sulfate....MgSO ₄	232.3	13.56
Magnesium..Mg	48.9	Calcium Sulfate.....CaSO ₄	63.9	3.72
Ammonium..NH ₄	0.1	Calcium Carbonate....CaCO ₃	382.0	22.22
Sodium.....Na	43.9	Calcium Silicate.....CaSiO ₃	29.0	1.69
Sulfate.....SO ₄	230.8			
Nitrate.....NO ₃	17.7	Total.....	834.2	48.59
Chloride....Cl	63.0			
Alkalinity as CaCO ₃				
Phenolphthalein..	0.0			
Methyl Orange...	382.0			
Residue.....	877.0			
Total Hardness....	654.5			

The water had a residue of 877 and a total hardness of 654.5 parts per million with no iron or manganese, as shown by the analysis of sample number 73490, collected September 13, 1933. The water temperature was 58° F.

IDEAL TEQY DYEES, CLEANERS AND LAUNDEBEBES.
The establishment of the Ideal Trov Dyers, Cleaners and Launderers is located at 917-923 Main Street.

Two wells constructed by M. Ebert and Son of Washington, Illinois, supply a daily average of 150,000 gallons. Both wells are equipped with electric motor driven Pomona deep-well turbine pumps. The pump in the 10-inch well is rated at 300 gallons per minute, while the pump in the 8-inch well is rated at 200 gallons per minute.

INTEBIOE MALT AND GEAIN COMPANY. The plant of the Interior Malt and Grain Company is situated about 400 feet southwesterly from the foot of Cedar Street.

There are three wells at this plant. Two are for emergency use and are located near together at a site approximately 1320 feet south and 400 feet east of the northwest corner of Section 16, T. 8 N., E. 8 E., 4th P. M. They were drilled in 1913 by Mr. Schilling of Peoria to a depth of 47 feet. One well is cased with 39 feet of 8-inch casing and 8 feet of screen, while the other is cased with 39 feet of 10-inch casing and 8 feet of screen. The wells are reported to have penetrated gravel for the entire depth. Each well is equipped with a direct suction, horizontal centrifugal pump capable of delivering 350 gallons per minute. Static water level was reported as 14 feet below pump base on August 31, 1933.

The third well is located in the northwesterly corner of the malt house and approximately 1230 feet south and 310 feet east of the northwest corner of Section 16. The well was drilled in 1930 by Mr. Schilling to a depth of 50 feet. It penetrated gravel all the way and is cased with 38 feet of 12-inch casing and 12 feet of screen.

Analysis of Sample Number 73449 from the 12-Inch Well in the Malt House.
Determinations Made. Hypothetical Combinations.

	Pts. per million.		Pts. per million.	Gr. per gallon.
Iron.....Fe	0.0	Sodium Nitrate.....NaNO ₃	8.5	0.50
Manganese..Mn	0.0	Sodium Chloride.....NaCl	46.2	2.69
Silica.....SiO ₂	13.0	Sodium Sulfate.....Na ₂ SO ₄	24.9	1.45
Turbidity.....	0.0	Magnesium Sulfate....MgSO ₄	173.4	10.11
Calcium.....Ca	126.0	Calcium Sulfate.....CaSO ₄	64.7	3.77
Magnesium..Mg	35.0	Calcium Carbonate....CaCO ₃	246.0	14.34
Ammonium..NH ₄	trace	Calcium Silicate.....CaSiO ₃	25.0	1.46
Sodium.....Na	28.5			
Sulfate.....SO ₄	201.2	Total.....	588.7	34.32
Nitrate.....NO ₃	6.2			
Chloride....Cl	28.0			
Alkalinity as CaCO ₃				
Phenolphthalein..	0.0			
Methyl Orange...	246.0			
Residue.....	613.0			
Total Hardness....	459.0			

The well is equipped with a deep-well turbine pump direct connected to a 30-horsepower electric motor which operates at a full load speed of 1750 revolutions per minute. The pump delivers at a rate of 750 gallons per minute for 12 hours per day. On December 13, 1934, it was reported that static water level was 28 feet below the pump base and that the drawdown was 2 feet 6 inches when the pump was operating. Also the temperature of the water was between 61° and 62° F. for 60 days prior.

The water had a residue of 613 and a total hardness of 459 parts per million without iron or manganese, as shown by the analysis of sample number 73449, collected August 31, 1933.

JEFFERSON BUILDING. The Jefferson Building is situated on the southerly corner of the intersection of Jefferson and Fulton Streets.

The well, which was drilled in 1930, is located about 1110 feet north and 620 feet east of the center of Section 9, T. 8 N., R. 8 E. It has a depth of 76 feet below the level of the basement floor or 90 feet below the level of Jefferson Street. It is cased with 66 feet of 6-inch pipe and 10 feet 6f screen. The static water level, as reported in September, 1933, was 50 feet below the basement floor, and when pumping at a 100 gallon per minute rate only a slight drawdown took place.

The well is equipped with a Pomona deep-well turbine pump, the assembly of which consists of 50 feet of 4½-inch column, 26 stages of six bowls having an over-all length of 8 feet and 10 feet of 4½-inch suction pipe. The pump is connected to a Westinghouse Electric Company induction motor rated at 15 horsepower when operating at a full load speed of 1760 revolutions per minute.

The water, which is used for all purposes throughout the building, had a residue of 706.7 and a total hardness of 528 parts per million with no iron or manganese, as shown by the analysis of sample number 73502, collected September 12, 1933. The temperature of the water was 60° F.

Analysis of Sample Number 73502 from the Jefferson Building Well.
Determinations Made. Hypothetical Combinations.

	Pts. per million.		Pts. per million.	Grs. per gallon.
Iron.....Fe	0.0	Sodium Nitrate.....NaNO ₃	36.6	2.14
Manganese...Mn	0.0	Sodium Chloride.....NaCl	102.9	6.00
Silica.....SiO ₂	15.0	Magnesium Chloride...MgCl ₂	18.1	1.06
Turbidity.....	0.0	Magnesium Sulfate....MgSO ₄	222.1	12.95
Calcium.....Ca	124.4	Magnesium Carbonate..MgCO ₃	11.8	0.64
Magnesium...Mg	52.9	Calcium Carbonate....CaCO ₃	286.2	16.70
Ammonium...NH ₄	0.01	Calcium Silicate.....CaSiO ₃	29.0	1.69
Sodium.....Na	50.4			
Sulfate.....SO ₄	182.0	Total.....	706.7	41.18
Nitrate.....NO ₃	26.5			
Chloride....Cl	76.0			
Alkalinity as CaCO ₃				
Phenolphthalein..	0.0			
Methyl Orange...	300.0			
Residue.....	706.7			
Total Hardness....	528.0			

JEFFERSON HOTEL. The Jefferson Hotel is situated on the northerly corner of the intersection of Jefferson and Liberty Streets. The well, which was drilled in 1933 by M. Ebert of Washington, Illinois, is located within the building about 1130 feet north and 290 feet east of the center of Section 9, T. 8 N., E. 8 E., 4th P. M.

The well is 87 feet deep below the level of the basement floor, which in turn is 11 feet below street grade. During construction miscellaneous materials were encountered to 49 feet. Between 49 feet and 85 feet fine sand was penetrated, and from 85 feet to 87 feet gravel was encountered. The well is cased with 10-inch pipe.

The well is equipped with a Pomona deep-well turbine pump, the assembly of which consists of 75 feet of 6-inch column pipe, 13 stages of 8-inch bowls having an over-all length of 8 feet and no suction pipe. The pump is direct connected to a Westinghouse Electric Company induction motor rated at 25 horsepower at full load speed of 1760 revolutions per minute. The pump is rated at 200 gallons per minute against 294 foot head.

The water, which is used for all purposes about the hotel, has a residue of 585 and a total hardness of 484 parts per million, with a trace of iron but no manganese, as shown by the analysis of sample number 73489, collected September 12, 1933. The water temperature was 60° E.

Analysis of Sample Number 73489 from the Jefferson Hotel Well.			
Determinations Made.		Hypothetical Combinations.	
	Pts. per million.		Pts. per million.
Iron.....Fe	trace	Sodium Nitrate.....NaNO ₃	42.5
Manganese..Mn	0.0	Sodium Chloride.....NaCl	12.3
Silica.....SiO ₂	10.0	Magnesium Chloride....MgCl ₂	24.8
Turbidity.....	0.0	Magnesium Sulfate....MgSO ₄	168.0
Calcium.....Ca	114.0	Magnesium Carbonate..MgCO ₃	28.3
Magnesium..Mg	48.4	Calcium Carbonate.....CaCO ₃	268.5
Ammonium..NH ₄	0.01	Calcium Silicate.....CaSiO ₃	19.2
Sodium.....Na	16.3		
Sulfate.....SO ₄	134.2	Total.....	563.6
Nitrate.....NO ₃	31.0		
Chloride....Cl	26.0		
Alkalinity as CaCO ₃			
Phenolphthalein..	0.0		
Methyl Orange...	302.0		
Residue.....	585.0		
Total Hardness....	484.0		

K. E. W. LAUNDRY. The plant of the K. E. W. Laundry Company is located at 207 Livingston Street.

Water is supplied by a well 97 feet deep. It is reported that the well is equipped with a Sterling deep-well turbine pump rated at 120 gallons per minute and that the maximum demand is 40,000 gallons per day.

KEYSTONE STEEL AND WIRE COMPANY. The present Keystone Steel and Wire Company plant occupies the old plant of the Acme Harvester Company.

When the Acme Harvester Company was in operation a well 390 feet deep was drilled as a coal prospect. The materials penetrated, as reported in U. S. Geological Survey Bulletin 506, were:

Materials.	Thickness		Depth	
	Feet.	Inches.	Feet.	Inches.
Pleistocene—				
Drift . . . . .	.30		30	
Sand . . . . .	.6		36	
Pennsylvanian—				
Sandstone . . . . .	.3		39	
Sandstone, argillaceous . . . . .	.20		59	
Soapstone . . . . .	.20		79	
Iron band . . . . .		.5	79	5
Shale, dark . . . . .		.11	80	4
Iron band . . . . .		.11	81	3
Shale, dark . . . . .	.10		91	3
Slate . . . . .	.3		94	3
Soapstone . . . . .	.12		106	3
Coal . . . . .	.2	8	108	11
Fire clay . . . . .	.14	9	123	8
Soapstone . . . . .	.14		137	8
Sandstone, hard . . . . .	.10	4	148	
Coal ?				
Fire clay . . . . .	.1	8	149	8
Sandstone, hard . . . . .	.8		157	8
Soapstone, dirty . . . . .	.12		169	8
Sandstone . . . . .	.7		176	8
Shale, almost black . . . . .	.11		187	8
Fire clay . . . . .		.4	188	
Shale, dark . . . . .	.15		203	
Sandstone . . . . .	.8		211	
Coal ?				
Fire clay . . . . .	.1	4	212	4
Argillaceous rock . . . . .	.14		226	4
Sandstone . . . . .	.21		247	4
Coal ?				
Argillaceous rock . . . . .	.69		316	4
Clay . . . . .	.1		317	4
Limestone . . . . .	.47		364	4
Chert . . . . .	.2		366	4
Limestone . . . . .	.4		370	4
Chert . . . . .	.5		375	4
Limestone . . . . .	.2		377	4
Chert . . . . .	.7		384	4
Porous yellowish rock . . . . .	.6		390	4

The total depth as here given of 390 feet 4 inches is not quite correct, as there were three veins of coal for which no thickness was given. The original and final depth, however, may not exceed 400 feet.

The water had a residue of 8090, a total hardness of 270.5 and an iron content of 0.6 parts per million without manganese, as shown by the analysis of sample number 72348, collected January 21, 1933.

Analysis of Sample Number 72348 of Acme Harvester Well 390 Feet 4 Inches Deep.

Determinations Made.		Hypothetical Combinations.	
	Pts. per million.		Pts. per million. Grs. per gallon.
Iron.....Fe	0.6	Sodium Nitrate.....NaNO ₃	33.2 1.94
Manganese..Mn	0.0	Sodium Chloride.....NaCl	7448.4 433.50
Silica.....SiO ₂	9.0	Sodium Carbonate.....Na ₂ CO ₃	321.7 18.76
Turbidity.....	5.0	Magnesium Carbonate..MgCO ₃	119.7 6.08
Calcium.....Ca	51.4	Calcium Carbonate.....CaCO ₃	128.5 7.50
Magnesium..Mg	34.5	Silica.....SiO ₂	9.0 0.52
Ammonium..NH ₄	0.03		
Sodium.....Na	3080.0	Total.....	8060.5 469.20
Sulfate.....SO ₄	0.0		
Nitrate.....NO ₃	24.3		
Chloride....Cl	4518.0		
Alkalinity as CaCO ₃			
Phenolphthalein..	0.0		
Methyl Orange...	574.0		
Residue.....	8090.0		
Total Hardness....	270.5		

The Keystone Steel and Iron Company has another well reported to be 97 feet deep located! in the northeast quarter of the southwest quarter of the northwest quarter of Section 30, T. 8 N., E. 8 E., 4th P. M., equipped with a direct suction triplex pump.

The water had a residue of 429, a total hardness of 375 and a content of iron of 1.2 parts per million, with only a trace of manganese, as shown by the analysis of sample number 72419, collected February 3, 1933.

Analysis of Sample Number 72419 from a 97-Foot Well.

Determinations Made.		Hypothetical Combinations.	
	Pts. per million.		Pts. per million. Grs. per gallon.
Iron.....Fe	1.2	Sodium Nitrate.....NaNO ₃	0.9 0.05
Manganese..Mn	trace	Sodium Chloride.....NaCl	56.1 3.27
Silica.....SiO ₂	14.0	Magnesium Chloride....MgCl ₂	5.2 0.30
Turbidity.....	0.0	Magnesium Sulfate....MgSO ₄	47.5 2.77
Calcium.....Ca	87.8	Magnesium Carbonate..MgCO ₃	93.2 5.44
Magnesium..Mg	37.8	Calcium Carbonate.....CaCO ₃	219.5 12.82
Ammonium..NH ₄	trace	Iron Oxide.....Fe ₂ O ₃	1.7 0.10
Sodium.....Na	22.3	Silica.....SiO ₂	14.0 0.82
Sulfate.....SO ₄	38.1		
Nitrate.....NO ₃	0.3	Total.....	438.1 25.57
Chloride....Cl	38.0		
Alkalinity as CaCO ₃			
Phenolphthalein..	0.0		
Methyl Orange...	330.0		
Residue.....	429.0		
Total Hardness....	375.0		

KLEIN'S EADY-TO-WEAE STOE. The store of the D. W. Klein Company is located at 222 South Adams Street.

A well 67 feet deep equipped with an electric motor driven Pomona deep-well turbine pump rated at 140 gallons per minute against a head of 90 feet supplies water for an air cooling unit only. This unit is operated only during the warmer summer months and requires about 100 gallons per minute when operating at full capacity.

S. S. KEESGE COMPANY. The S. S. Kresge Company 5, 10 & 25 Cent Store is located at 108 South Adams Street.

A well drilled in February, 1937, by M. Ebert and Son of Washington, Illinois, is 8! inches in diameter and 81 feet deep below the sidewalk or 73 feet below the level of the basement floor. The well is cased below the basement floor with 63 feet of 8-inch pipe and 10 feet of Johnson No. 125 Everdur screen. The water temperature was 57° F. The 7-stage deep-well turbine pump has a setting of 61 feet 10 inches and is rated at 250 gallons per minute. It is estimated that the cooling apparatus requires about 150 gallons per minute or 81,000 gallons per day for a nine-hour day in midsummer. When the well was completed static water level was reported as 21 feet below the basement floor level.

The S. S. Kresge Company 25 Cent to \$1.00 Store is located at 119 South Adams Street.

A well drilled in May, 1938, by Andriot Davidson Company of Louisville, Kentucky, is 8 inches in diameter and 87 feet deep below street grade. The material penetrated between 0 and 68 feet was sand and gravel; 68 to 87 feet, coarse gravel; 87 to 88 feet, mud; 88 feet, rock. The well is cased with 53 feet of 8-inch pipe and 10 feet of Johnson No. 20 Everdur screen. The water temperature was 62° F. The 4-stage deep-well turbine pump is rated at 200 gallons per minute. After completion a production of 300 gallons per minute was obtained at the end of six hours of pumping, with a drawdown of 10 feet below a static level of 68 feet below grade.

The cooling system requires about 81,000 gallons per day for a nine-hour day in midsummer.

LAKE ERIE MINING COMPANY. The plant of the Lake Erie Mining Company is situated on Water Street in the vicinity of Persimmon Street.

A well was constructed in 1933 by M. Ebert and Son of Washington, Illinois, at a location approximately 450 feet north and 1370 feet east of the southwest corner of Section 9, T. 8 N., E. 8 E., 4th P. M. The well, constructed on ground having an elevation of 463 feet above mean sea level, is 61 feet deep and is cased with 10-inch pipe. Upon test the well delivered 500 gallons per minute, with 4 feet of drawdown from a static water level of 24 feet.

The well is equipped with a Pomona deep-well turbine pump, the assembly of which consisted of 30 feet of 6-inch column pipe, four stages of 10-inch bowls having an over-all length of 5 feet and 10 feet of 6-inch suction pipe. The pump is rated at 200 gallons per minute and is direct connected to a 20-horsepower Westinghouse Electric Company induction motor having a full load speed of 1750 revolutions per minute.

The water had a residue of 694, a total hardness of 526.5 and an iron content of 0.1 parts per million with no manganese, as shown by the analysis of sample number 73450, collected August 31, 1933. The water had a temperature of 61° F.

Analysis of Sample Number 73450 from the Lake Erie Mining Company Well.
 Determinations Made. Hypothetical Combinations.

	Pts. per million.		Pts. per million.	Grs. per gallon.
Iron Fe	0.1	Sodium Nitrate NaNO ₃	7.7	0.45
Manganese . . Mn	0.0	Sodium Chloride NaCl	59.6	3.48
Silica SiO ₂	13.0	Sodium Sulfate Na ₂ SO ₄	31.3	1.83
Turbidity	0.0	Ammonium Sulfate (NH ₄) ₂ SO ₄	1.3	0.08
Calcium Ca	135.0	Magnesium Sulfate MgSO ₄	227.5	13.27
Magnesium . . Mg	46.0	Calcium Carbonate CaCO ₃	316.0	18.43
Ammonium . . NH ₃	0.3	Calcium Silicate CaSiO ₃	25.0	1.46
Sodium Na	35.6	Iron Oxide Fe ₂ O ₃	0.1	0.01
Sulfate SO ₄	203.7			
Nitrate NO ₃	5.3	Total	668.5	39.01
Chloride Cl	36.0			
Alkalinity as CaCO ₃				
Phenolphthalein . .	0.0			
Methyl Orange . . .	316.0			
Residue	604.0			
Total Hardness	526.5			

LARKIN COMPANY. The plant of the Larkin Company is situated on the westerly corner of the intersection of Water Street and Harrison Street.

The water supply was originally supplied from two wells about 5 feet apart, but only one is used at present. The wells are located about 25 feet from Water Street and 30 feet from Harrison Street, or approximately 400 feet south and 650 feet east of the center of Section 9, T. 8 N., R. 8 E., 4th P. M.

These wells were probably constructed in about 1907 and are supposed to be about 39 or 40 feet deep. One which is not used is cased with 6-inch pipe and is equipped with a direct suction rotary pump. The other well is cased with 6-inch pipe to a depth of at least 33 feet below the top, which is 20 inches above the level of the basement floor. The basement floor is about 8 feet below the grade of Water Street. Below the casing is a well screen of unknown size and length.

The well is pumped by direct suction by either of two small Goulds triplex pumps using a common suction pipe down the well. On January 13, 1940, static water level was 25 feet 11 inches below the top of the casing. The larger triplex pump has 3-inch diameter cylinders and 4-inch stroke. It is belt connected to a 3-horsepower electric motor and operates at 50 revolutions per minute. The small pump has 2½-inch cylinder and 4-inch stroke. It is belt connected to a 2½-horsepower electric motor and operates at 48 revolutions per minute. The 2-inch suction pipe in the well has a foot valve at a depth of 33 feet below which is some 4 or 5 feet of 1½-inch suction pipe.

Both pumps cannot be operated at the same time because of the small size of the suction pipe. In summer the well is pumped almost continuously as the water is used for air conditioning as well as for flushing.

The water has a residue of 603 and a total hardness of 447 parts per million without iron or manganese as shown by the analysis of sample number 87060, collected January 13, 1940.

Analysis of Sample Number 87060 from the Larkin Company Well.
 Determinations Made. Hypothetical Combinations.

	Pts. per million.		Pts. per million.	Grs. per gallon.
Iron Fe		Sodium Sulfate NaNO ₃	12.8	0.75
(filtered)	0.0	Sodium Chloride NaCl	69.5	4.05
(unfiltered)	0.0	Magnesium Chloride MgCl ₂	9.1	0.53
Manganese Mn	0.0	Magnesium Sulfate MgSO ₄	149.9	8.73
Silica SiO ₂	19.0	Calcium Sulfate CaSO ₄	4.1	0.24
Turbidity	trace	Calcium Carbonate CaCO ₃	310.2	18.08
Color	0.0	Silica SiO ₂	19.0	1.11
Odor	0.0			
Calcium Ca	125.3	Total	574.6	33.49
Magnesium Mg	32.7			
Ammonium NH ₄	0.0			
Sodium Na	30.8			
Sulfate SO ₄	122.3			
Nitrate NO ₃	9.3			
Chloride Cl	49.0			
Alkalinity as CaCO ₃				
Phenolphthalein	0.0			
Methyl Orange	310.0			
Residue	603.0			
Total Hardness	447.0			

LOGAN FIELD. Logan Field is situated in the southwesterly part of the city. It is bounded on the north by Starr Street, on the east by Lydia Street, on the south by Humbolt Street and on the west by Livingston Street. The swimming pool and well are in the southwesterly part near Humbolt Street and Livingston Street.

A well to supply water for the pool was drilled in 1922 by Gray Milaeager Drilling Company to a depth of 1297 feet at a location about 1400 feet east and 500 feet south of the center of Section 18, T. 8 IST, E. 8 E., 4th P. M. The well originally was cased with 8-inch pipe to a depth of 788 feet.

Repairs were made in 1930 by the Gray-Milaeager Drilling Co., at which time the hole was reamed from the surface to a depth of 410 feet and new casing installed, consisting of 213 feet of 10-inch pipe, a 10 x 6½ swedge nipple, and 1086 feet of 61.4-inch pipe. The old 8-inch casing between depths of 410 feet and 7788 feet was left in place. Wall packers were placed at depths of 825 feet and 1272 feet. The 6¼-inch casing was slotted between depths of 1272 feet and 1299 feet. The well was extended as a 6-inch hole to a depth of 1499 feet.

The log of the well as recorded by the driller and furnished by the State Geological Survey is as follows:

Materials.	Thickness in feet.	Depth in feet.
Sandy loam . . . . .	.5	5
Sand . . . . .	.55	60
Sand and fine gravel . . . . .	.146	206
Light colored shale . . . . .	.31	237
Coal . . . . .	.3	240
Black slate . . . . .	.160	400
Hard gray limestone . . . . .	.20	420
Hard white limestone . . . . .	.100	520
Slate and soapstone . . . . .	.60	580

Materials.	Thickness in feet.	Depth in feet.
Brown slate and soapstone	170	750
Light slate and soapstone	25	775
Hard brown limestone	30	805
Hard white limestone	200	1005
Hard gray limestone	70	1075
Blue slatestone	5	1080
Slatestone, streaked with lime and soapstone	120	1200
Light shale	30	1230
Light hard shale	20	1250
Limestone	10	1260
Limestone and sandstone	37	1297
Limestone	202	1499

When the repairs were completed the well flowed at a rate of about 312 gallons per minute. It was reported that sulfur water was found at a depth of about 1050 feet also that the largest flow appeared to come from about the 1292-foot depth. Water temperature on July 23, 1930 was 62° F.

The well was again visited on January 4, 1934 at which time it was estimated that it was flowing at a rate of 100 g. p. m. at a depth of 2 feet below the top of the casing. The water had a residue of 1557, a total hardness of 249.5, iron content of 0.7 and a manganese content of 0.1 parts per million as shown by analysis of sample number 80060, collected January 4, 1934.

Analysis of Sample Number 80060 from the Logan Field Well.

Determinations Made.		Hypothetical Combinations.		
	Pts. per million.		Pts. per million.	Grs. per gallon.
Iron Fe	0.7	Sodium Nitrate NaNO ₃	0.8	0.05
Manganese Mn	0.1	Sodium Chloride NaCl	415.0	24.20
Silica SiO ₂	9.0	Sodium Sulfate Na ₂ SO ₄	925.0	53.90
Turbidity	0.0	Ammonium Sulfate (NH ₄) ₂ SO ₄	5.3	0.31
Calcium Ca	60.9	Magnesium Sulfate MgSO ₄	3.0	0.17
Magnesium Mg	23.6	Magnesium Carbonate MgCO ₃	79.8	4.65
Ammonium NH ₄	1.4	Calcium Carbonate CaCO ₃	137.5	8.02
Sodium Na	463.5	Calcium Silicate CaSiO ₃	17.4	1.02
Sulfate SO ₄	633.5	Iron Oxide Fe ₂ O ₃	1.0	0.06
Nitrate NO ₃	0.8	Manganese Oxide MnO	0.1	0.01
Chloride Cl	252.0			
Alkalinity as CaCO ₃		Total	1584.9	92.39
Phenolphthaleim	0.0			
Methyl Orange	232.0			
Residue	1557.0			
Total Hardness	249.5			

McELWEE PACKING HOUSE. The McElwee Packing House is located at the foot of Sanger Street on the northerly side of the street. The company has a 4-inch well 56 feet deep located about 800 feet north and 2470 feet east of the southwest corner of Section 17, T. 8 N., R. 8 E., 4th P. M. The well is equipped with a horizontal double stroke steam pump. The water cylinders are 4½ inches in diameter, the steam cylinder 7 inches and the stroke is 10 inches. It operates 24 hours per day at a speed of 45 strokes per minute which represents a theoretical discharge of 62 gallons per minute. Water is drawn from the well by direct suction.

The water had a residue of 855, a total hardness of 594 and a manganese content of 0.2 parts per million with no iron as shown by the analysis of sample number 73456, collected on August 30, 1933. The water temperature was 58° F.

Analysis of Sample Number 73456 from 50-Foot Driven Well.

Determinations Made.		Hypothetical Combinations.	
	Pts. per million.		Pts. per million. Grs. per gallon.
Iron.....Fe	0.0	Sodium Nitrate.....NaNO ₃	9.4 0.55
Manganese..Mn	0.2	Sodium Chloride.....NaCl	128.7 7.50
Silica.....SiO ₂	13.0	Sodium Sulfate.....Na ₂ SO ₄	36.4 2.12
Turbidity.....	0.0	Ammonium Sulfate.....(NH ₄) ₂ SO ₄	4.6 0.27
Calcium.....Ca	156.8	Magnesium Sulfate.....MgSO ₄	243.0 14.18
Magnesium..Mg	49.1	Calcium Sulfate.....CaSO ₄	38.8 2.26
Ammonium..NH ₄	1.3	Calcium Carbonate.....CaCO ₃	342.1 19.96
Sodium....Na	64.8	Calcium Silicate.....CaSiO ₃	25.0 1.46
Sulfate.....SO ₄	249.5	Manganese Oxide.....MnO	0.3 0.02
Nitrate.....NO ₃	7.1		
Chloride....Cl	78.0	Total.....	828.3 48.32
Alkalinity as CaCO ₃			
Phenolphthalein..	0.0		
Methyl Orange...	342.0		
Residue.....	855.0		
Total Hardness....	594.0		

MAYEE HOTEL. The Mayer Hotel is situated at 200 North Adams Street.

A well 75 feet deep supplies water for all the hotel needs which averages about 2,400,000 gallons per year or approximately 6,575 gallons per day.

METHODIST HOSPITAL. The Methodist Hospital is situated on the easterly side of Crescent Avenue about a block northerly of Hamilton Street.

The well, located approximately 900 feet south and 300 feet west of the center of Section 4, T. 8 N., R. 8 E., 4th P. M., is 169 feet deep below the ground surface or about 157 feet below the level of the basement floor. It was reported that the first 80 feet was clay and the balance sand and gravel. The 8-inch casing extends from the basement floor to a depth of 146 feet, below which is 11 feet of screen. Static water level was reported to be 126 feet below floor level in September 1933.

The well is equipped with a Pomona deep-well turbine pump the assembly of which consists of 130 feet of 5-inch column pipe, 27 stages of 8-inch bowls having an over-all length of 16 feet and 10 feet of 5-inch suction pipe. The pump discharges at the rate of 120 gallons per minute. The water is used for all purposes and the daily production from the well is about 40,000 gallons. The pump is direct connected to a Westinghouse Electric Company electric motor rated at 15 horsepower at a full load speed of 1160 revolutions per minute.

The water had a residue of 357, a total hardness of 344, an iron content of 0.8 and a manganese content of 0.3 parts per million as shown by the analysis of sample number 73500, collected September 13, 1933.

The analysis of sample number 69960, collected November 23, 1931 was practically the same except the iron was 1.4 and the manganese was 0.1 parts per million.

Analysis of Sample Number 73500 from the 169-Foot Well at the Methodist Hospital.

Determinations Made.		Hypothetical Combinations.	
	Pts. per million.		Pts. per million. Grs. per gallon.
Iron.....Fe	0.8	Sodium Nitrate.....NaNO ₃	3.4 0.20
Manganese..Mn	0.3	Sodium Chloride.....NaCl	8.2 0.48
Silica.....SiO ₂	18.0	Sodium Sulfate.....Na ₂ SO ₄	0.3 0.02
Turbidity.....	0.0	Sodium Carbonate.....Na ₂ CO ₃	31.8 1.86
Calcium.....Ca	77.8	Magnesium Carbonate..MgCO ₃	126.1 7.36
Magnesium..Mg	36.4	Calcium Carbonate.....CaCO ₃	164.6 9.60
Ammonium...NH ₄	trace	Calcium Silicate.....CaSiO ₃	34.8 2.03
Sodium.....Na	18.0	Iron Oxide.....Fe ₂ O ₃	1.1 0.06
Sulfate.....SO ₄	0.2	Manganese Oxide.....MnO	0.4 0.02
Nitrate.....NO ₃	2.7		
Chloride....Cl	5.0	Total.....	370.7 21.63
Alkalinity as CaCO ₃			
Phenolphthalein..	0.0		
Methyl Orange...	344.0		
Residue.....	357.0		
Total Hardness....	344.0		

MIDLAND BAKERY. The Midland Bakery is situated on Jefferson Street just westerly of Walnut Street.

The well, located 70 feet south and 760 feet west of the center of Section 9, T. 8 N., R. 8 E., 4th P. M. was finished at the base of the sand at a depth of 76 feet below the ground surface. Static water level was reported in 1933 to be 25 or 30 feet below the surface. The well is cased with 6-inch pipe.

The well is equipped with an A. D. Cook deep-well cylinder pump having a stroke of 24 inches. The working barrel is 5½ inches in diameter and is set near the bottom of the well.

Analysis of Sample Number 73488 from the Midland Baking Company 76-Foot Well.

Determinations Made.		Hypothetical Combinations.	
	Pts. per million.		Pts. per million. Grs. per gallon.
Iron.....Fe	trace	Sodium Nitrate.....NaNO ₃	64.6 3.77
Manganese..Mn	0.0	Magnesium Nitrate....Mg(NO ₃) ₂	17.8 1.04
Silica.....SiO ₂	9.0	Magnesium Chloride...MgCl ₂	47.2 2.75
Turbidity.....	0.0	Magnesium Sulfate....MgSO ₄	225.0 13.13
Calcium.....Ca	142.0	Calcium Sulfate.....CaSO ₄	70.7 4.12
Magnesium..Mg	60.5	Calcium Carbonate.....CaCO ₃	288.0 16.80
Ammonium...NH ₄	trace	Calcium Silicate.....CaSiO ₃	17.4 1.02
Sodium.....Na	17.5		
Sulfate.....SO ₄	230.0	Total.....	730.7 42.63
Nitrate.....NO ₃	62.0		
Chloride....Cl	35.0		
Alkalinity as CaCO ₃			
Phenolphthalein..	0.0		
Methyl Orange...	288.0		
Residue.....	756.0		
Total Hardness....	603.5		

The pump discharges into a pressure supply tank arranged with automatic pressure controls which maintains the tank pressure between 40 and 50 pounds. The pump is powered by an electric motor and delivers water at a rate of about 60 gallons per minute.

The water had a residue of 756, and a total hardness of 603.5 parts per million with a trace of iron as shown by the analysis of sample number 73488, collected September 13, 1933.

MT. HAWLEY COUNTRY CLUB. The Mt. Hawley Country Club occupies all of the north one-half of the northwest quarter of Section 9 and an additional tract of about 40 acres in the southwest quarter of the southwest quarter of Section 4, T. 9 N., R. 8 E., of the 4th P. M. The water supply is obtained from two wells located 12 feet apart at a site about 600 feet west and 300 feet north of the southwest corner of the northeast quarter of the northwest quarter of Section 9.

Well number 1 was drilled in 1912, by M. Ebert and Son of Washington, Illinois, to a depth of 365 feet where it terminates in gravel. It was originally cased with 353 feet of 4-inch pipe and 12 feet of Johnson number 14 screen. An Eureka cylinder was placed in the bottom of the casing. In 1937 repairs were made by inserting a 3-inch casing inside the 4-inch casing without removing the Eureka cylinder. The 3-inch casing now serves as the drop pipe for an A. D. Cook 3-inch deep-well cylinder pump. This unit is single acting and operates with an 18-inch stroke. It discharges at a rate of 17 gallons per minute into a storage pressure tank against a pressure of 40 to 47 pounds per square inch. The operation of the pump is controlled by an automatic pressure regulator on the tank. The pump is powered by a 7½-horsepower General Electric Company electric motor to which it is belt-connected.

Static water level was reported as 328 feet below the ground level when the well was new but in 1929 it was reported as being 335 feet below the surface. Ground level or the floor of the pump house is approximately 785 feet above sea level.

Well number 2 was drilled in 1929, by John Bolliger and Sons of Fairbury, Illinois, to a depth of 364 feet. The following log was submitted by the driller.

Materials.	Thickness ' in feet.	Depth in feet.
Soil and yellow clay. . . . .	.15	15
Case at 12 feet.		
Gray hardpan. . . . .	.25	40
At 40 feet some coarse gravel, very little water.		
Light chocolate brown hardpan one foot loose sand at 175 feet . . . . .	.135	175
Light chocolate brown hardpan. . . . .	.75	250
Light gray hardpan with gravel . . . . .	.44	294
Fine gray sand, muddy, dry. . . . .	.6	300
Fine dry sand. . . . .	.50	350
Sand, water-bearing. . . . .	.14	364
Water-bearing sand not fully penetrated.		

The well is cased with 352 feet of 6-inch pipe and 12 feet of Johnson number 50-slot screen. The well is equipped with an E. E. Meyers deep-well cylinder pump which operates with a 24-inch stroke at a speed

of 30 strokes per minute. The double acting working barrel is 3¾ inches in diameter and is installed close to the bottom of the well. The pump is belt-connected to a 7½-horsepower electric motor and discharges at a rate of 40 gallons per minute into a small surface reservoir, about an acre in area, adjacent to the rear of the pumping station. Water is drawn from this reservoir for sprinkling the greens by either of two motor-driven centrifugal pumps. In dry weather the Meyer unit operates 24 hours per day.

The water from well number 1 had a residue of 334, a total hardness of 348, an iron content of 6.0 and a manganese content of 0.2 parts per million as shown by the analysis of sample number 74108, collected January 17, 1934.

Determinations Made.		Hypothetical Combinations.		
	Pts. per million.		Pts. per million.	Grs. per gallon.
Iron..... Fe		Sodium Nitrate..... NaNO ₃	0.9	.05
(filtered).....	trace	Sodium Chloride..... NaCl	2.3	0.13
(unfiltered).....	6.0	Magnesium Chloride.... MgCl ₂	1.9	0.11
Manganese.. Mn	0.2	Magnesium Sulfate.... MgSO ₄	21.7	1.27
Silica..... SiO ₂	10.0	Magnesium Carbonate.. MgCO ₃	107.6	6.28
Turbidity.....	7.0	Calcium Carbonate.... CaCO ₃	200.7	11.70
Calcium.... Ca	80.1	Iron Oxide..... Fe ₂ O ₃	trace	.....
Magnesium.. Mg	36.5	Manganese Oxide..... MnO	0.3	0.02
Ammonium.. NH ₄	0.1	Silica..... SiO ₂	10.0	0.58
Sodium..... Na	1.1			
Sulfate..... SO ₄	17.3	Total.....	345.4	20.14
Nitrate..... NO ₃	0.6			
Chloride.... Cl	3.0			
Alkalinity as CaCO ₃				
Phenolphthalein..	0.0			
Methyl Orange....	328.0			
Residue.....	334.0			
Total Hardness....	348.0			

MURISON LABEL COMPANY. The plant of the Murison Label Company is situated in the northeast quarter of the southeast quarter of Section 15, T. 9 N., E. 8 E., 4th P. M. It is adjacent to and west of Highway 29.

There are two wells on the property. Well number 1 was constructed by E. W. Johnson of Bloomington, Illinois in 1931 to a final depth of 110 feet at a site approximately 1930 feet east and 320 feet south of the center of Section 15. The well penetrated 60 feet of clay, 10 feet of blue clay, 5 feet of sand, 5 feet of clay, and 30 feet of coarse sand. It is cased with 10-inch casing to a depth of 96 feet and with 15 feet of Johnson screen. The well is equipped with a Sterling turbine deep-well pump consisting of 60 feet of 6-inch column, three stages of pump having an over-all length of 4 feet and 30 feet of 6-inch suction pipe. It is rated at 400 gallons per minute. The pump is direct connected to a U. S. electric motor of 20-horsepower which operates at a full load speed of 1750 revolutions per minute.

The water from this well is used for drinking and all other factory purposes as well as for air conditioning. It had a residue of 483, a total

hardness of 343, and an iron content of 1.3 parts per million with no manganese as shown by the analysis of sample number 80161, collected January 16, 1934.

Analysis of Sample Number 80161 from 110-Foot Well.

Determinations Made.		Hypothetical Combinations.	
	Pts. per million.		Pts. per million. Grs. per gallon.
Iron.....Fe	1.3	Sodium Nitrate.....NaNO ₃	1.7 0.10
Manganese..Mn	0.0	Sodium Chloride.....NaCl	31.0 1.81
Silica.....SiO ₂	10.0	Sodium Sulfate.....Na ₂ SO ₄	49.0 2.86
Turbidity.....	0.0	Sodium Carbonate.....Na ₂ CO ₃	88.0 5.13
Calcium.....Ca	78.5	Ammonium Carbonate..(NH ₄) ₂ CO ₃	0.5 0.03
Magnesium..Mg	35.8	Magnesium Carbonate..MgCO ₃	124.1 7.23
Ammonium..NH ₄	0.1	Calcium Carbonate....CaCO ₃	179.5 10.47
Sodium.....Na	66.7	Calcium Silicate.....CaSiO ₃	19.2 1.12
Sulfate.....SO ₄	33.1	Iron Oxide.....Fe ₂ O ₃	1.8 0.10
Nitrate.....NO ₃	1.5		
Chloride....Cl	19.0	Total.....	494.8 28.85
Alkalinity as CaCO ₃			
Phenolphthalein..	0.0		
Methyl Orange...	410.0		
Residue.....	483.0		
Total Hardness....	343.0		

NATIONAL COOPERAGE AND WOODENWARE COMPANY.

The plant of the National Cooperage and Woodenware Company is situated on the easterly side of Washington Street between Warren and Newland Streets. The well is approximately 300 feet south and 240 feet west of the center of Section 17, T. 8 N., E. 8 E. of the 4th P. M. It is reported to be in gravel for practically its entire depth of 55 feet and to be cased with 6-inch pipe.

The well is equipped with an A. D. Cook steam head deep-well cylinder pump which operates with a 30-inch stroke. The 5-inch working barrel is attached to the bottom of 50 feet of drop pipe. The average daily pumpage is about 13,200 gallons.

Analysis of Sample Number 74460 from the 55-Foot Well.

Determinations Made.		Hypothetical Combinations.	
	Pts. per million.		Pts. per million. Grs. per gallon.
Iron.....Fe	0.0	Sodium Nitrate.....NaNO ₃	54.4 3.17
Manganese..Mn	0.0	Sodium Chloride.....NaCl	31.0 1.81
Silica.....SiO ₂	12.0	Magnesium Chloride...MgCl ₂	11.0 0.64
Turbidity.....	0.0	Magnesium Sulfate....MgSO ₄	236.0 13.76
Calcium.....Ca	124.0	Calcium Sulfate.....CaSO ₄	2.7 0.16
Magnesium..Mg	50.5	Calcium Carbonate....CaCO ₃	288.0 16.80
Ammonium..NH ₄	trace	Calcium Silicate.....CaSiO ₃	23.2 1.35
Sodium.....Na	26.9		
Sulfate.....SO ₄	190.4	Total.....	646.3 37.69
Nitrate.....NO ₃	39.8		
Chloride....Cl	27.0		
Alkalinity as CaCO ₃			
Phenolphthalein..	0.0		
Methyl Orange...	288.0		
Residue.....	669.0		
Total Hardness....	517.5		

The water had a residue of 669 and a total hardness of 517.5 without iron or manganese as shown by the analysis of sample number 74460., collected April 26, 1934. The water temperature in August 1933 was 60° F.

L. E. NELSON MANUFACTURING COMPANY. The L. E. Nelson Manufacturing Company Inc., is located at 1715-1725 South Washington Street.

Water is supplied the plant from a well 60 feet deep at a rate between 15,000 and 25,000 gallons per day.

OAKFOED AND FAHNSTOCK COMPANY. The Oakford and Fahnstock Company plant is situated on the easterly side of Washington Street south of Liberty Street.

The well, located in the basement and approximately 50 feet westerly of Commercial Street and 115 feet south of Liberty Street or 75 feet north and 800 feet east of the center of section 9, T. 8 N., E. 8 E., 4th P. M. is 39 feet deep below the basement floor. The basement floor is about 6 feet below the street grade of Commercial Street. The well, which passed through gravel practically all the way, is cased with 30 feet of 8-inch pipe and 9 feet of screen. The water was used for cooling and flushing purposes only but in January 1940 its use had been discontinued.

The well is equipped with a Meyers horizontal double-acting direct-suction pump with 5-inch diameter cylinders and 4-inch stroke. The 2-inch suction line extends 30 feet into the well. The pump is belt connected to a 3-horsepower electric motor and operates at a rate of 58 strokes per minute, the delivery rate being approximately 40 gallons per minute. Water temperature on September 12, 1933 was 60° F. and static water level was 15 feet below the basement floor.

The water had a residue of 1431, and a total hardness of 429.5 parts per million with no iron or manganese as shown by the analysis of sample number 74463, collected April 26, 1934.

Analysis of Sample Number 74463.

Determinations Made.		Hypothetical Combinations.		
	Pts. per million.		Pts. per million.	Grs. per gallon.
Iron.....Fe	0.0	Sodium Nitrate.....NaNO ₃	30.6	1.79
Manganesec...Mn	0.0	Sodium Chloride.....NaCl	794.5	46.33
Silica.....SiO ₂	12.0	Sodium Sulfate.....Na ₂ SO ₄	175.3	10.23
Turbidity.....	0.0	Magnesium Sulfate....MgSO ₄	30.7	1.79
Calcium.....Ca	99.0	Magnesium Carbonate..MgCO ₃	132.0	7.70
Magnesium...Mg	44.3	Calcium Carbonate....CaCO ₃	227.5	13.28
Ammonium...NH ₄	trace	Calcium Silicate.....CaSiO ₂	23.2	1.35
Sodium.....Na	377.5			
Sulfate.....SO ₄	143.2	Total.....	1413.8	82.47
Nitrate.....NO ₃	22.1			
Chloride....Cl	482.0			
Alkalinity as CaCO ₃				
Phenolphthalein..	0.0			
Methyl Orange...	384.0			
Residue.....	1431.0			
Total Hardness....	429.5			

PALACE CAFETEEIA. The Palace Cafeteria is situated on the easterly side of Madison Street south of Main Street.

The well, located approximately 920 feet south and 630 feet east of the northwest corner of the northeast quarter of Section 9, T. 8 N., R. 8 E., 4th P. M., was drilled by M. Ebert of Washington, Illinois to a depth of 92 feet below the street level or 84 feet below the basement floor level. It terminates in sand and gravel and is cased with 4-inch pipe. Static water level was reported as 46 feet below basement floor.

The well is equipped with a Meyers single stroke deep-well pump which operates with a 12-inch stroke at a speed of 34 strokes per minute. The pump discharges into a pressure storage tank arranged with pressure controls for starting and stopping the pump.

The water had a residue of 683, and a total hardness of 565.5 parts per million with but a trace of iron and no manganese as shown by the analysis of sample number 73497, collected September 12, 1933. The water is used for all purposes.

Determinations Made.		Analysis of Sample Number 73497.		Hypothetical Combinations.	
	Pts. per million.			Pts. per million.	Grs. per gallon.
Iron.....Fe	trace	Sodium Nitrate.....	NaNO ₃	30.6	1.78
Manganese..Mn	0.0	Sodium Chloride.....	NaCl	36.8	2.15
Silica.....SiO ₂	14.0	Magnesium Chloride...	MgCl ₂	9.1	0.53
Turbidity.....	0.0	Magnesium Carbonate..	MgCO ₃	18.6	1.08
Calcium.....Ca	131.0	Calcium Carbonate....	CaCO ₃	304.0	17.74
Magnesium..Mg	57.8	Calcium Silicate.....	CaSiO ₃	27.3	1.59
Ammonium..NH ₄	trace				
Sodium.....Na	22.8	Total.....		675.1	39.38
Sulfate.....SO ₄	198.8				
Nitrate.....NO ₃	22.1				
Chloride....Cl	29.0				
Alkalinity as CaCO ₃					
Phenolphthalein..	0.0				
Methyl Orange...	326.0				
Residue.....	683.0				
Total Hardness....	565.5				

PENNSYLVANIA-MARYLAND AND INDUSTRIAL ALCOHOL COMPANY. The plant of the Pennsylvania-Maryland and Industrial Alcohol Company is situated in the northwest quarter of the southeast quarter of Section 19, T. 8 N., R. 8 E., 4th P. M. The plant is supplied with water from eleven wells. These are divided into a group of four, a group of five and two independent wells.

The four-well group is the most southerly of all. The spacing and position between them is irregular but they can be enclosed within a circle having a diameter of about 30 feet. The center of the group is located about 650 feet south and 50 feet east of the center of Section 19. Well number 1 is 8 inches in diameter and 62 feet 4 inches deep. Well number 2 is 10 inches in diameter and 56 feet 11 inches deep. Well number 3 is 8 inches in diameter and 52 feet 9 inches deep, and well number 4 is 10 inches in diameter and 56 feet 5 inches deep below ground surface which has an average elevation of about 451 feet above sea level. All terminate in a gravel formation. The wells are connected into one

suction header and are pumped as a unit by a steam pump at a rate of 350 gallons per minute for 24 hours per day.

The water from this group of four wells had a residue of 592, a total hardness of 512.5, an iron content of 0.4 and a manganese content of 0.2 parts per million as shown by the analysis of sample number 73457, collected August 29, 1933.

Analysis of Sample Number 73457 from the Group of Four Wells.				
Determinations Made.		Hypothetical Combinations.		
	Pts. per million.			
		Pts. per million.	Grs. per gallon.	
Iron.....Fe	0.4	Sodium Nitrate.....NaNO ₃	3.4	0.20
Manganese..Mn	0.2	Sodium Chloride.....NaCl	16.4	0.96
Silica.....SiO ₂	9.0	Sodium Sulfate.....Na ₂ SO ₄	9.9	0.58
Turbidity.....	0.0	Magnesium Sulfate....MgSO ₄	225.7	13.17
Calcium.....Ca	129.2	Magnesium Carbonate..MgCO ₃	1.7	0.10
Magnesium..Mg	46.1	Calcium Carbonate....CaCO ₃	316.1	18.45
Ammonium..NH ₄	trace	Calcium Silicate.....CaSiO ₃	17.4	1.02
Sodium.....Na	10.6	Iron Oxide.....Fe ₂ O ₃	0.6	0.04
Sulfate.....SO ₄	187.0	Manganese Oxide.....MnO	0.3	0.02
Nitrate.....NO ₃	2.7			
Chloride....Cl	10.0	Total.....	591.5	34.54
Alkalinity as CaCO ₃				
Phenolphthalein..	0.0			
Methyl Orange...	310.0			
Residue.....	592.0			
Total Hardness....	512.5			

The group of five wells is located in a north and south line spaced 10 feet on centers. They are east and north of the four-well cluster. The north well is 550 feet south and 130 feet east of the center of Section 19. The wells in this group are all 10 inches in diameter and in order from north to south have depths of 59 feet, 64.3 feet, 62.5 feet, 61.0 feet and 63.7 feet respectively below the ground surface which has an elevation of 447 feet above sea level. All terminate in gravel. These five wells are all connected into a single suction header and are pumped as a unit by a Gardner steam pump at a rate of 600 gallons per minute for 24 hours per day.

Analysis of Sample Number 73458 from the Group of Five Wells.				
Determinations Made.		Hypothetical Combinations.		
	Pts. per million.			
		Pts. per million.	Grs. per gallon.	
Iron.....Fe	2.4	Sodium Chloride.....NaCl	16.4	0.96
Manganese..Mn	0.9	Sodium Sulfate.....Na ₂ SO ₄	51.2	2.99
Silica.....SiO ₂	14.0	Ammonium Sulfate....(NH ₄) ₂ SO ₄	0.7	0.04
Turbidity.....	0.0	Magnesium Sulfate....MgSO ₄	229.2	13.38
Calcium.....Ca	155.4	Calcium Sulfate.....CaSO ₄	39.5	2.31
Magnesium..Mg	46.3	Calcium Carbonate....CaCO ₃	336.2	19.63
Ammonium..NH ₄	0.3	Calcium Silicate.....CaSiO ₃	27.3	1.59
Sodium.....Na	23.0	Iron Oxide.....Fe ₂ O ₃	3.4	0.20
Sulfate.....SO ₄	246.3	Manganese Oxide.....MnO	1.2	0.07
Nitrate.....NO ₃	0.3			
Chloride....Cl	10.0	Total.....	705.1	41.17
Alkalinity as CaCO ₃				
Phenolphthalein..	0.0			
Methyl Orange...	336.0			
Residue.....	730.0			
Total Hardness....	579.0			

The water had a residue of 730, a total hardness of 579, an iron content of 2.4 and manganese content of 0.9 parts per million as shown by the analysis of sample number 73458, collected August 29, 1933.

The "new west well" completed in 1933 is located about 170 feet north of the four-well cluster. It is 90 feet deep and of the gravel packed type. The outer casing is 30 inches in diameter and extends to a depth of 60 feet. The inner casing has an outside diameter of 13 inches and a length of 72 feet, below which is 18 feet of screen with 14-inch slots. The annular space between the two casings and outside the screen was filled with selected gravel. Static water level was 18 feet below ground surface on August 29, 1933, before the permanent pump had been placed. A preliminary test gave a production of 900 gallons per minute. Ground surface was about 4583 feet above sea level.

The "new east well" completed in 1933 is 196 feet east and 59 feet north of the "new west well" and of a similar type of construction. It has a total depth of 87 feet and is cased with 66 feet of 13-inch inner casing and 21 feet of screen, while the outer casing, which is 30 inches in diameter, extends to a depth of 66 feet below ground surface, which is 454.4 feet above sea level.

PEOEIA APRON AND TOWEL SUPPLY. The Peoria Apron and Towel Supply is located at 401 Hurlburt Street.

A water supply of about 35,000 gallons per day is obtained from a well 8 inches in diameter and 118 feet deep.

PEOEIA BEEWING COMPANY. The plant of the Peoria Brewing Company is situated on the easterly side of Washington Street near Edmond Street.

The well, located approximately 1030 feet south and 820 feet west of the northeast corner of Section 17, T. 8 N., E. 8 E, 4th P. M., was reamed and cleaned out in 1933 by C. Ebert of Washington, Illinois. It is 50 feet deep below the floor of the pump pit or 60 feet deep below ground surface, and is cased with 40 feet of 12-inch pipe and 10 feet

Analysis of Sample Number 80837 from 60-Foot Well.

Determinations Made.		Hypothetical Combinations.		
	Pts. per million.		Pts. per million.	Grs. per gallon.
Iron Fe	0.0	Sodium Nitrate NaNO ₃	26.4	1.54
Manganese Mn	0.0	Sodium Chloride NaCl	52.6	3.07
Silica SiO ₂	9.0	Sodium Sulfate Na ₂ SO ₄	19.9	1.16
Turbidity	0.0	Magnesium Sulfate MgSO ₄	189.0	11.03
Calcium Ca	126.0	Magnesium Carbonate MgCO ₃	12.7	0.74
Magnesium Mg	41.8	Calcium Carbonate CaCO ₃	315.2	18.39
Ammonium NH ₄	0.1	Silica SiO ₂	9.0	0.52
Sodium Na	34.3			
Sulfate SO ₄	165.0	Total	624.8	36.45
Nitrate NO ₃	19.0			
Chloride Cl	32.0			
Alkalinity as CaCO ₃				
Phenolphthalein	0.0			
Methyl Orange	330.0			
Residue	618.0			
Total Hardness	487.0			

of screen. The lower part is in gravel and static water level was reported as 35 feet below ground surface.

The well is equipped with a Sterling deep-well turbine pump rated at 300 gallons per minute. The pump operation is automatically controlled by a pressure regulating device in the pressure storage tank.

The water, which is used for all purposes about the plant, had a residue of 618 and a total hardness of 487 parts per million, without iron or manganese, as shown by the analysis of sample number 80837, collected March 5, 1934.

PEOEIA COEDAGE COMPANY. The Peoria Cordage Company plant is situated on the westerly side of Water Street about a block northerly of Edmund Street.

The well, located approximately 940 feet south and 520 feet west of the northeast corner of Section 17, T. 8 N., R. 8 E., 4th P. M., is 60 feet deep and terminates in gravel. It is cased with 58 feet of 6-inch pipe and 2 feet of screen.

The well is equipped with an A. D. Cook steam head deep-well cylinder pump which operates 8 hours per day and delivers at the rate of 35 gallons per minute.

The water, which is used for boiler purposes only, had a residue of 678 and a total hardness of 509.5 parts per million, without iron or manganese, as shown by the analysis of sample number 73445, collected August 31, 1933.

Analysis of Sample Number 73445 from 60-Foot Well.

Determinations Made.		Hypothetical Combinations.	
	Pts. per million.		Pts. per million. Grs. per gallon.
Iron.....Fe	0.0	Sodium Nitrate.....NaNO ₃	27.2 1.59
Manganesec..Mn	0.0	Sodium Chloride.....NaCl	62.6 3.68
Silica.....SiO ₂	15.0	Sodium Sulfate.....Na ₂ SO ₄	14.2 0.82
Turbidity.....	0.0	Magnesium Sulfate.....MgSO ₄	207.1 12.09
Calcium.....Ca	135.0	Calcium Sulfate.....CaSO ₄	44.2 2.58
Magnesium..Mg	41.8	Calcium Carbonate.....CaCO ₃	280.0 16.31
Ammonium..NH ₄	trace	Calcium Silicate.....CaSiO ₃	29.0 1.69
Sodium.....Na	36.6		
Sulfate.....SO ₄	206.0	Total.....	664.3 38.76
Nitrate.....NO ₃	19.9		
Chloride....Cl	38.0		
Alkalinity as CaCO ₃			
Phenolphthalein..	0.0		
Methyl Orange...	280.0		
Residue.....	678.0		
Total Hardness....	509.5		

PEOEIA COUNTY JAIL. The Peoria County Jail occupies a site directly across Hamilton Street from the county courthouse. The well is located approximately 880 feet south and 1030 feet west of the northeast corner of Section 9, T. 8 N., R. 8 E., 4th P. M. It was constructed by the Thorpe Concrete Well Company of Alton, Illinois, in December, 1930, to a depth of 87 feet and is cased with concrete pipe and porous concrete screen having an external diameter of 26 inches.

The well passes through gravel nearly all the way, the bottom being at the top of the shale.

The well is equipped with an A. D. Cook deep-well cylinder pump powered by an electric motor. The pump assembly consists of 75 feet of 10-inch drop pipe and an 8-inch working barrel 8 feet long. The pump is of the double acting type and operates with a 24-inch stroke at a speed of 16 strokes per minute.

Water is supplied to the courthouse as well as to the jail.

Static water level was reported as 60 feet below ground surface on April 26, 1934.

The water had a residue of 818 and a total hardness of 491 parts per million, with but a trace of iron and no manganese, as shown by the analysis of sample number 74462, collected April 26, 1934.

Analysis of Sample Number 74462 from the 00-Foot Well.

Determinations Made.		Hypothetical Combinations.	
	Pts. per million.		Pts. per million. Grs. per gallon.
Iron..... Fe	trace	Sodium Nitrate..... NaNO ₃	20.4 1.19
Manganese.. Mn	0.0	Sodium Chloride..... NaCl	233.8 13.64
Silica..... SiO ₂	12.0	Sodium Sulfate..... Na ₂ SO ₄	64.6 3.77
Turbidity.....	0.0	Magnesium Sulfate..... MgSO ₄	114.3 6.67
Calcium..... Ca	113.0	Magnesium Carbonate.. MgCO ₃	95.7 5.58
Magnesium.. Mg	50.8	Calcium Carbonate.... CaCO ₃	262.5 15.32
Ammonium.. NH ₄	trace	Calcium Silicate..... CaSiO ₃	23.2 1.35
Sodium..... Na	118.5		
Sulfate..... SO ₄	135.0	Total	814.5 47.52
Nitrate..... NO ₃	15.1		
Chloride.... Cl	142.0		
Alkalinity as CaCO ₃			
Phenolphthalein..	0.0		
Methyl Orange...	376.0		
Residue.....	818.0		
Total Hardness....	491.0		

PEOEIA CREAMERY COMPANY. The plant of the Peoria Creamery Company is situated on the northerly corner of the intersection of Washington and Walnut Streets. The company has two wells, a 6-inch and a 10-inch, located about 8 feet apart and approximately 490 feet south and 120 feet west of the center of Section 9, T. 8 N., R. 8 E., 4th P. M.

The 6-inch well is 58 feet deep below the basement floor or about 72 feet below the grade of Washington Street. It passes through gravel all the way, the bottom being on clay. There is 48 feet of 6-inch casing and 10 feet of screen. On September 2, 1933, static water level was reported as 22 feet below the basement flow level. The well is equipped with an electric motor powered deep-well turbine pump rated at 125 gallons per minute when operating at a speed of 3600 revolutions per minute. The top of the bowl assembly is set at 48 feet below the floor level. It operates 10 hours per day.

The 10-inch well is 48 feet deep below the bottom of a concrete pump pit that is 18 feet deep. It is cased with 38 feet of 10-inch pipe and 10 feet of screen. The well is equipped with a motor driven horizontal centrifugal pump set on the bottom of the pit. Water is drawn

by direct suction from the well at a rate of 450 gallons per minute for 10 hours per day. A drawdown of 14 feet is created when both pumps are in operation.

Water from these two wells is used for industrial purposes.

The water had a residue of 1008, a total hardness of 546.5 and an iron content of 0.8 parts per million, but without manganese, as shown by the analysis of sample number 73444, collected September 22, 1933, from the 6-inch well. The water had a temperature of 61° P.

Analysis of Sample Number 73444 from the 6-Inch Well.

Determinations Made.		Hypothetical Combinations.		
	Pts. per million.		Pts. per million.	Grs. per gallon.
Turbidity.....	0	Sodium Nitrate.....NaNO ₃	48.4	2.82
Color.....	0	Sodium Chloride.....NaCl	352.0	20.54
Odor.....	0	Magnesium Chloride...MgCl ₂	54.8	3.20
Iron.....Fe		Magnesium Sulfate....MgSO ₄	196.2	11.45
(unfiltered).....	0.8	Calcium Sulfate.....CaSO ₄	36.5	2.13
Manganese..Mn	0.0	Calcium Carbonate....CaCO ₃	302.0	17.62
Silica.....SiO ₂	13.0	Silica.....SiO ₂	0.13	0.76
Calcium....Ca	130.0			
Magnesium..Mg	54.0	Total.....	1012.9	58.52
Ammonium..NH ₄	.....		
Sodium.....Na	152.3			
Sulfate.....SO ₄	179.6			
Nitrate.....NO ₃	35.4			
Chloride....Cl	255.0			
Alkalinity as CaCO ₃				
Phenolphthalein..	0.0			
Methyl Orange...	302.0			
Total hardness.....	546.5			
Residue.....	1008.0			

PEORIA HEIGHTS. During the winter of 1934 and 1935 M. Ebert and Son of Washington, Illinois, completed two municipal water supply wells for the village.

Well number 1, located approximately 10 feet east and 900 feet south of the northwest corner of Section 23, T. 9 N., E. 8 E., 4th P. M., was completed in sand and gravel at a depth of 127 feet below the top of the pump base, which is at elevation 536.8 feet above sea level. It is cased with 16-inch pipe, below which is 25 feet of 15-inch Cook screen, the top 5 feet of which has number 60 slots, the next 5 feet number 80 slots, the next 10 feet number 100 slots and the lower 5 feet number 187 slots. The well is equipped with a 12-inch American deep-well turbine pump rated at 500 gallons per minute against a head of 392 feet when operating at a speed of 1150 revolutions per minute. The pump has a setting of 100 feet, with 10 feet of 10-inch suction pipe on the bottom. It is direct connected to a 75-horsepower electric motor. Mr. Walter C. Baches, engineer for the village, reported a production of 510 gallons per minute, with a drawdown of 6 feet below a static water level of 91 feet.

Well number 2, located approximately 100 feet east and 690 feet south of the northwest corner of Section 23, was completed to a depth of 99 feet below the top of the pump base, which is at elevation 507.8 feet above sea level. It is cased with 16-inch pipe, below which is 25 feet

of 15-inch Cook screen, the top 5 feet of which has number 20 slots, the next 5 feet number 40 slots, the next 5 feet number 60 slots, the next 2.5 feet number 80 slots and the bottom 7.5 feet number 120 slots. The well is equipped with a 12-inch American deep-well turbine pump rated at 500 gallons per minute against a head of 392 feet when operating at a speed of 1150 revolutions per minute. The pump has a setting of 70 feet, with 10 feet of 10-inch suction pipe on the bottom.

Well number 3, located approximately 165 feet east and 795 feet south of the northwest corner of Section 23, was completed in 1939 by M. Ebert and Son to a depth of 95 feet below the top of the pump base, which is at elevation 505.0 feet above sea level.

The water from well number 1 has a residue of 497.0 and a total hardness of 468.5 parts per million, without iron or manganese, as is shown by the analysis of sample number 76278, collected June 26, 1935.

Analysis of Sample Number 76278 from Well Number 1.

Determinations Made.		Hypothetical Combinations.	
	Pts. per million.		Pts. per million. Grs. per gallon.
Iron.....Fe	0.0	Sodium Nitrate.....NaNO ₃	6.0 0.35
Manganese...Mn	0.0	Magnesium Nitrate....Mg(NO ₃) ₂	0.7 0.04
Silica.....SiO ₂	10.0	Magnesium Chloride....MgCl ₂	13.3 0.78
Turbidity.....	0.0	Magnesium Sulfate....MgSO ₄	100.5 5.86
Calcium.....Ca	108.3	Magnesium Carbonate..MgCO ₃	84.3 4.92
Magnesium..Mg	47.7	Calcium Carbonate....CaCO ₃	254.8 14.85
Ammonium..NH ₄	0.0	Calcium Silicate.....CaSiO ₃	19.2 1.12
Sodium.....Na	1.6		
Sulfate.....SO ₄	80.2	Total.....	478.8 27.92
Nitrate.....NO ₃	4.9		
Chloride....Cl	10.0		
Alkalinity as CaCO ₃			
Phenolphthalein..	0.0		
Methyl Orange...	354.0		
Residue.....	497.0		
Total Hardness...	468.5		

PEORIA MUNICIPAL TUBERCULOSIS SANITORIUM.

The grounds of the Peoria Municipal Tuberculosis Sanitorium are situated in the westerly part of the northwest quarter of the southeast quarter and the easterly part of the northeast quarter of the southwest quarter of Section 15, T. 9 N., R. 8 E., 4th P. M.

Since the establishment of the sanitorium four wells have been constructed, but the records are only available for the last three.

Well number 1 was constructed in 1926 to a reported depth of 120 feet, where a good water-bearing bed of sand and gravel was found. It originally was cased with 6-inch casing to a depth of 105 feet, below which was 15 feet of number 10-slot screen.

The original pump installation, consisting of a deep-well cylinder type pump, was removed and a G-inch Sterling deep-well turbine pump installed in 1930. The assembly of the Sterling turbine consisted of 100 feet of 3-inch column pipe, 16 bowls having an over-all length of 12 feet and a basket strainer on the bottom. It was direct connected to a 5-horsepower electric motor and was rated at 50 gallons per minute. This unit remained in service in well number 1 until 1932, when it was

removed for installation in well number 2, which was constructed during 1931.

In 193C it was found by direct measurement that the depth of well number 1 was 115.6 feet and the distance to static water level 85.2 feet. It was also observed that after 5.5 hours of pumping of well number 2 there was only a slight lowering of the water level in well number 1.

In 1931 E. W. Johnson of Bloomington constructed well number 2 to a depth of 120 feet at a site 7 feet west of well number 1. It was cased with 6-inch pipe. In 1932 the 6-inch Sterling pump in well number 1 was removed and reinstalled in this new well, and in 1937 the unit was changed over from oil lubrication to water lubrication.

The water had a residue of 462, a total hardness of 322.5, an iron content of 1.5, and a manganese content of 0.2 parts per million, as shown by the analysis of sample number 80158, collected January 16, 1934. The water had a temperature of 55° F.

Analysis of Sample Number 80158 from Well Number 2.

Determinations Made.		Hypothetical Combinations.	
	Pts. per million.		Pts. per million. Grs. per gallon.
Iron.....Fe	1.5	Sodium Nitrate.....NaNO ₃	6.8 .40
Manganese...Mn	0.2	Sodium Chloride.....NaCl	16.4 .96
Silica.....SiO ₂	10.0	Sodium Sulfate.....Na ₂ SO ₄	19.9 1.16
Turbidity.....	3	Sodium Carbonate.....Na ₂ CO ₃	118.2 6.89
Calcium.....Ca	73.4	Ammonium Carbonate..(NH ₄) ₂ CO ₃	8.2 .48
Magnesium...Mg	33.8	Magnesium Carbonate..MgCO ₃	117.3 6.84
Ammonium...NH ₄	3.0	Calcium Carbonate....CaCO ₃	167.0 9.74
Sodium.....Na	66.0	Calcium Silicate.....CaSiO ₃	19.2 1.12
Sulfate.....SO ₄	13.4	Iron Oxide.....Fe ₂ O ₃	2.1 .12
Nitrate.....NO ₃	5.3	Manganese Oxide.....MnO	.3 .02
Chloride....Cl	10.0		
Alkalinity as CaCO ₃		Total.....	475.4 27.73
Phenolphthalein..	0.0		
Methyl Orange...	426.0		
Residue.....	462.0		
Total Hardness....	322.5		

Well number 3 was constructed in 1936 by M. Ebert and Son of Washington, Illinois, to a depth of 162 feet at a site 8 feet east of well number 1 or 80 feet east and 500 feet south of the center of Section 15. The materials penetrated were reported as follows:

Materials.	Thickness in feet.	Depth in feet.
Yellow clay.....	25	25
Sand.....	100	125
Fairly coarse sand.....	25	150
Very fine sand.....	3	153
Coarse sand.....	7	160
Extremely fine sand.....	2	162

The well was cased with 152 feet of 8-inch pipe and 10 feet of Johnson screen. The screen had number 10 slots for the top one foot, number 20 slots for the next foot, number 40 slots for the next foot and number 80 slots for the bottom seven feet.

Upon tests the well produced 637 gallons per minute with a drawdown of 31.3 feet below a static level of 76 feet.

The fine sand in the well gave some trouble and in 1937 the original screen was removed and 15 feet of number 12-slot screen installed.

The well is equipped with an American deep-well turbine pump. The pump is direct connected to a U. S. electric motor of 15 horsepower which operates at 1800 revolutions per minute. The pump is rated to deliver 100 gallons per minute against a 270 foot head.

The water had a residue of 424, a total hardness of 268, an iron content of 0.5, and a manganese content of 0.4 parts per million, as shown by the analysis of sample number 83368, collected April 22, 1938.

Analysis of Sample Number 83368 from Well Number 3 162 Feet Deep.

Determinations Made.		Hypothetical Combinations.		
	Pts. per million		Pts. per millica	Grs. per gallon
Iron.....Fe		Sodium Nitrate.....NaNO ₃	16.2	0.95
(filtered).....	0.1	Sodium Chloride.....NaCl	16.4	0.95
(unfiltered).....	0.5	Sodium Sulfate.....Na ₂ SO ₄	1.4	0.08
Manganese...Mn	0.4	Sodium Carbonate.....Na ₂ CO ₃	132.0	7.70
Silica.....SiO ₂	6.0	Ammonium Carbonate...(NH ₄) ₂ CO ₃	7.3	0.43
Turbidity.....	5.0	Magnesium Carbonate...MgCO ₃	112.9	6.58
Color.....	1.0	Calcium Carbonate....CaCO ₃	134.1	7.82
Odor.....	0.0	Manganese Oxide.....MnO	.5	.03
Calcium.....Ca	53.7	Silica.....SiO ₂	6.0	.35
Magnesium...Mg	32.6			
Ammonium...NH ₄	2.8	Total.....	426.8	24.89
Sodium.....Na	68.5			
Sulfate.....SO ₄	1.0			
Nitrate.....NO ₃	11.5			
Chloride....Cl	10.0			
Alkalinity as CaCO ₃				
Phenolphthalein..	10.0			
Methyl Orange...	400.0			
Residue.....	424.0			
Total Hardness....	268.0			

PEORIA PACKING COMPANY. The plant of the Peoria Packing Company is situated on the easterly side of Water Street between South and Cass Streets.

The plant is supplied with water from two wells, a 6-inch and an 8-inch located about 5 feet apart and approximately 210 feet north and 750 feet east of the center of Section 17, T. 8 N., R. 8 E. of the 4th P. M. Both wells are reported to be 52 feet deep below the ground level water being obtained from the gravel. Static water level was reported on August 31, 1933 as 22 feet below ground surface, and in 1940 as 24 to 25 feet below the ground surface. These wells are pumped 24 hours per day at an estimated rate of 500 gallons per minute.

The 8-inch well was originally equipped with a Pomona deep-well turbine pump rated at 110 gallons per minute. It was direct connected to a 5-horsepower induction motor which operated at a full load speed of 3400 revolutions per minute.

The water had a residue of 773, and a total hardness of 555.5 parts per million without iron or manganese as shown by the analysis of sample number 73447, collected August 31, 1933. Water temperature was 58° F.

Analysis of Sample Number 73447 from the 8-Inch Well.

Determinations Made.		Hypothetical Combinations.	
	Pts. per million.		Pts. per million. Grs. per gallon.
Turbidity.....	0	Sodium Nitrate..... NaNO ₃	73.1 4.26
Color.....	0	Sodium Chloride..... NaCl	52.5 3.61
Odor.....	0	Magnesium Chloride.... MgCl ₂	32.4 1.89
Iron..... Fe		Magnesium Sulfate.... MgSO ₄	188.3 10.97
(unfiltered).....	trace	Calcium Sulfate..... CaSO ₄	88.6 5.16
Manganese... Mn	0.0	Calcium Carbonate..... CaCO ₃	300.2 17.50
Silica..... SiO ₂	15.0	Silica..... SiO ₂	15.0 0.88
Chloride.... Cl	56.0		
Calcium..... Ca	146.0	Total.....	750.2 44.27
Magnesium... Mg	46.3		
Ammonium... NH ₄	.....	
Sodium..... Na	40.5		
Sulfate..... SO ₄	213.0		
Nitrate..... NO ₃	53.2		
Alkalinity as CaCO ₃			
Phenolphthalein..	0.0		
Methyl Orange...	300.0		
Total Hardness....	555.5		
Residue.....	773.0		

PEORIA AND PEKIN UNION RAILWAY COMPANY. The Peoria and Pekin Union Railway Company constructed in 1939 near the roundhouse a well 81 feet deep that is cased with 64 feet 10 inches of 12-inch pipe and 15 feet of Johnson Everdur No. 125 slot screen. The well penetrates coarse sand and gravel all the way. Shale was found at the bottom.

The well is equipped with a Worthington 5-stage deep-well turbine pump. On test upon completion of the well a production of 1158 gallons per minute was obtained with a drawdown of but 2 feet below a static level of 38 feet. The normal rate of pumpage is about 620 gallons per minute. The well has furnished 500,000 gallons per day for 24 hours.

PEORIA SANITARY DISTRICT. The sewage treatment plant of the Peoria Sanitary District is located at the river just northerly of the mouth of Kickapoo Creek in the southwest quarter of the northwest quarter and the northwest quarter of the southwest quarter of Section 20, T. 8 N., R. 8 E. of the 4th P. M. The well is located 950 feet north and 750 feet east of the southwest corner of the northwest quarter of Section 20.

A test well drilled within a few feet of the location of the permanent well penetrated 31 feet of surface clay, 72 feet of sand and gravel and 98 feet 5 inches of shale.

The permanent well was drilled to a depth of 102 feet below the surface of the ground which had an elevation of 454.7 feet above sea level. It was cased with 95 feet of 12-inch pipe and 5 feet of screen. When tested the well produced 500 gallons per minute with a drawdown of 15 inches from a static level of 32 feet at the end of a 24-hour pumping period. The well is equipped with a deep-well turbine pump, rated at 250 gallons per minute, direct connected to a 25-horsepower electric motor operating at 1750 revolutions per minute. At a production rate of 250 gallons per minute the drawdown is reported to be but 6 inches.

The water had a residue of 984.0, a total hardness of 685.5, an iron content of 0.7 and manganese content of 0.2 parts per million as shown by the analysis of sample number 73453, collected August 30, 1933.

Analysis of Sample Number 73453 from 102-Foot Well.

Determinations Made.		Hypothetical Combinations.		
	Pts. per million.		Pts. per million.	Grs. per gallon.
Iron.....Fe	0.7	Sodium Nitrate.....NaNO ₃	0.9	0.05
Manganese...Mn	0.2	Sodium Chloride.....NaCl	120.4	7.02
Silica.....SiO ₂	16.0	Sodium Sulfate.....Na ₂ SO ₄	73.2	4.56
Turbidity.....	0.0	Magnesium Sulfate....MgSO ₄	300.0	17.49
Calcium.....Ca	173.0	Magnesium Carbonate..MgCO ₃	3.4	0.20
Magnesium...Mg	61.5	Calcium Carbonate....CaCO ₃	406.0	23.67
Ammonium...NH ₄	trace	Calcium Silicate.....CaSiO ₃	30.8	1.80
Sodium.....Na	72.9	Iron Oxide.....Fe ₂ O ₃	1.0	0.06
Sulfate.....SO ₄	292.0	Manganese Oxide.....MnO	0.3	0.01
Nitrate.....NO ₃	0.9			
Chloride....Cl	73.0	Total.....	941.0	54.86
Alkalinity as CaCO ₃				
Phenolphthalein..	0.0			
Methyl Orange...	410.0			
Residue.....	984.0			
Total Hardness....	685.5			

PEORIA SERVICE COMPANY. The Peoria Service Company has two plants, one being situated on Adams Street at Locust Street where there is one well, and the other on the westerly side of Washington Street at Apple Street where there are two wells.

The well at Adams and Locust Street is located approximately 620 feet north and 390 feet east of the southwest corner of Section 9, T. 8 N., E. 8 E., 4th P. M. It was completed in May 1930 by the Kelly Well Company of Grand Island, Nebraska to a depth of 94 feet, and was cased with 35 feet 9 inches of concrete screen and 48 feet 3 inches of concrete casing, the top of which is at the bottom of a concrete pump pit 10 feet deep below the ground surface. The blank casing and screen have an outside diameter of 32 inches and an inside diameter of 25 inches. The screen section was provided with an envelope of selected gravel 3 inches thick. The bottom of the screen rests on an 8-inch thick concrete plug placed on bedrock. Sand and gravel with some clay was encountered from the surface to 37 feet and sand and gravel below that. The coarsest material was found at the bottom on top of bedrock at a depth of 94 feet 8 inches.

The well is equipped with a Pomona deep-well turbine pump consisting of 50 feet of 10-inch column pipe, two stages of 14-inch bowls having an over-all length of 3 feet and 10 feet of 9-inch suction pipe. The pump is direct connected to a Westirhouse Electric Company electric motor of 60 horsepower which operates at a full load speed of 1750 revolutions per minute.

When the well was completed static water level was reported as 58 feet below the ground surface, but in August 1932 it was found to be 62 feet.

The pump operates 24 hours per day at a delivery rate of 1400 gallons per minute. It was reported that at this rate a drawdown of 2 feet takes place.

The water had a residue of 701, and a total hardness of 525.5 parts per million without iron or manganese as shown by the analysis of sample number 73442, collected August 30, 1933. The temperature of the water on that date was reported as 57° F.

Analysis of Sample Number 73442 from a 94-Foot Well at Adams and Locust Streets.
Determinations Made. Hypothetical Combinations.

	Pts. per million.		Pts. per million.	Grs. per gallon.
Iron.....Fe	0.0	Sodium Nitrate.....NaNO ₃	73.1	4.26
Manganese...Mn	0.0	Sodium Chloride.....NaCl	44.4	2.59
Silica.....SiO ₂	15.0	Magnesium Chloride...MgCl ₂	13.3	0.78
Turbidity.....	0.0	Magnesium Sulfate....MgSO ₄	215.5	12.57
Calcium.....Ca	133.0	Calcium Sulfate.....CaSO ₄	51.0	2.98
Magnesium...Mg	47.0	Calcium Carbonate....CaCO ₃	270.0	15.72
Ammonium...NH ₄	trace	Calcium Silicate.....CaSiO ₃	29.0	1.69
Sodium.....Na	37.2			
Sulfate.....SO ₄	208.0	Total.....	696.3	40.59
Nitrate.....NO ₃	53.2			
Chloride....Cl	37.0			
Alkalinity as CaCO ₃				
Phenolphthalein..	0.0			
Methyl Orange...	270.0			
Residue.....	701.0			
Total Hardness....	525.5			

At the Washington, Apple Streets plant are two wells about 20 feet apart. The approximate location of these is 75 feet south and 425 feet west of the center of Section 17, T. 8 N., R. 8 E., 4th P. M. They are reported to have been constructed in 1918 to a depth of 90 feet and cased with 10-inch pipe.

The wells are each equipped with A. D. Cook deep-well cylinder pumps consisting of 70 feet of drop pipe and a 5-inch diameter working barrel. The pumps operate at 31 strokes per minute with a 30-inch stroke. Each delivers at a rate of 200 gallons per minute for 24 hours per day. Static water varies with the river stage between 30 and 35 feet below ground surface.

Analysis of Sample Number S00G1 from the 90-Foot Well at the Washington and Apple Street Plant.

	Pts. per million.		Pts. per million.	Grs. per gallon.
Iron.....Fe	0.15	Sodium Nitrate.....NaNO ₃	51.0	2.98
Manganese...Mn	0.0	Sodium Chloride.....NaCl	31.0	1.81
Silica.....SiO ₂	12.0	Magnesium Chloride...MgCl ₂	5.7	0.33
Turbidity.....	0.0	Magnesium Sulfate....MgSO ₄	171.6	10.00
Calcium.....Ca	113.0	Magnesium Carbonate..MgCO ₃	15.2	0.89
Magnesium...Mg	40.5	Calcium Carbonate....CaCO ₃	264.0	15.40
Ammonium...NH ₄	0.01	Calcium Silicate.....CaSiO ₃	23.2	1.35
Sodium.....Na	26.0	Iron Oxide.....Fe ₂ O ₃	0.2	0.01
Sulfate.....SO ₄	137.0			
Nitrate.....NO ₃	37.2	Total.....	561.9	32.77
Chloride....Cl	23.0			
Alkalinity as CaCO ₃				
Phenolphthalein..	1.4			
Methyl Orange...	282.0			
Residue.....	552.0			
Total Hardness....	450.5			

The water had a residue of 659, a total hardness of 487.5 and an iron content of 0.15 parts per million with no manganese as shown by the analysis of sample number 73443, collected August 30, 1933. The temperature of the water on this date was 55° F.

The analysis of sample number 800G1, collected January 5, 1934 showed a residue of 552, a total hardness of 450.5 and an iron content of 0.15 parts per million, but without manganese.

PEOEIA STATE HOSPITAL. The Peoria State Hospital occupies part of the south half of the southwest quarter of Section 25, the southeast quarter of the southeast quarter of Section 26, and a part of the north half of the northwest quarter of Section 36, T. 8 N., R. 8 E. of the 4th P. M.

Sometime about 1909 the institution attempted to develop its own water supply and made some GO pioneer wells in the river bottoms in Sections 29, 30 and 31. The deepest holes were about 80 feet, while some extended to 65 feet below low water in the river. No rock was noted in any of these holes and no water was found. Most of the material noted was "slushy clay."¹

A well located about 100 feet south of Kickapoo Creek and 100 feet east of the Toledo, Peoria and Western Railway penetrated 100 feet of sand and gravel before encountering bedrock. A second well located about 500 feet south of the first found bedrock 60 feet below the surface while a third well located 400 feet still further south found bedrock at 40 feet.¹

In 1903 the J. P. Miller Artesian Well Company of Chicago constructed a well to a depth of 1864 feet at a site about 500 feet north of the southeast corner of Section 26. The log of materials penetrated below the ground surface, which is at elevation about 605 feet above sea level, is as follows²:

Materials.	Thickness in feet.	Depth in feet.
Pleistocene—		
Loam, drift	40	40
Pennsylvanian—		
Coal	3' 7"	43' 7"
Shale	17' 3"	60' 10"
Rock	3' 7"	64' 5"
Shale	90' 11"	155' 4"
Coal	4' 7"	159' 11"
Shale	262'	421' 11"
Mississippian—		
Lime rock	228' 7"	650' 6"
Devonian—		
Shale	235'	885' 6"
Silurian (Niagaran)—		
Lime rock	265'	1150' 6"
Ordovician—		
Shale	200'	1350' 6"
Galena Trenton	315'	1665' 6"
St. Peter sandstone	199' 1"	1864' 7"

The well is cased with 60 feet 9 inches of 12-inch pipe, 421 feet 6 inches of 10 5/8-inch pipe and 1350.5 feet of 6-inch pipe extending from the surface to a seat in the Galena, Trenton limestone.

(1) U. S. G. S. Bulletin 506, page 66.

(2) U. S. G. S. Bulletin, 506, page 12.

It was reported that a strong flow of water was encountered in the top of the Galena limestone, but little from the bottom. The St. Peter sandstone also furnished some water. Sulfur water was found at about 920 feet. When first completed, water rose to within 13 feet of the top of the well. In 1934 this well furnished about 240,000 gallons per day, which was about 80 per cent of the institution needs, the balance being obtained from the Peoria Water Works Company.

The well is pumped by air lift, and the 2-inch air pipe extends 236 feet into the 6-inch casing which serves as the eductor pipe. The water is discharged directly into a receiving basin 12 feet wide by 16 feet long by 8 feet deep which surrounds the well.

In 1934 the starting air pressure was 70 pounds per square inch, which indicated a submergence of 161 feet and a static water level of 75 feet below the well top. This is a recession of 62 feet in 31 years or at a rate of about 2 feet per year.

A production of 250 gallons per minute required an operating pressure of 53 pounds per square inch and represents a drawdown of 38.5 feet.

The water had a residue of 1665, and a total hardness of 261 parts per million, with a trace of iron, as shown by the analysis of sample number 80067, collected January 25, 1934. The water temperature was 77° F. as it issued from the well.

Analysis of Sample Number 80067 from the 1864-Foot Well.

Determinations Made.		Hypothetical Combinations.	
	Pts. per million.		Pts. per million.
Iron.....Fe	trace	Sodium Nitrate.....NaNO ₃	0.8
Manganese..Mn	0.0	Sodium Chloride.....NaCl	409.0
Silica.....SiO ₂	9.0	Sodium Sulfate.....Na ₂ SO ₄	955.3
Turbidity.....	0.0	Sodium Carbonate.....Na ₂ CO ₃	71.0
Calcium.....Ca	66.1	Ammonium Carbonate..(NH ₄) ₂ CO ₃	2.9
Magnesium..Mg	23.4	Magnesium Carbonate..MgCO ₃	81.0
Ammonium..NH ₄	1.1	Calcium Carbonate.....CaCO ₃	150.0
Sodium.....Na	501.4	Calcium Silicate.....CaSiO ₃	17.4
Sulfate.....SO ₄	647.3		
Nitrate.....NO ₃	0.89	Total.....	1687.4
Chloride.....Cl	248.5		
Alkalinity as CaCO ₃			
Phenolphthalein..	12.0		
Methyl Orange...	316.0		
Residue.....	1665.0		
Total Hardness....	261.0		
			98.40

PEORIA UNION STOCK YARDS COMPANY. The Peoria Union Stock Yards located in the northwest quarter of the southeast quarter of Section 17, T. 8 N., R. 8 E. has a well located about 200 feet south and 550 feet east of the center of Section 17.

The well is 68 feet deep and is cased with 58 feet of 12-inch pipe and 10 feet of Johnson 125 slot screen. In September 1934 static water level was 30 feet below the pump base or about 33 feet below normal ground surface.

The well is equipped with a Pomona deep-well turbine pump the assembly of which consists of 40 feet of 6-inch column pipe, six stages

of bowls and 10 feet 7 inches of suction pipe. The pump is direct connected to a Westinghouse 30-horsepower electric motor. It is rated at 400 gallons per minute against a total head of 200 feet when operating at a speed of 1760 revolutions per minute.

When the well was first placed in operation the water had a noticeable taste and odor of sulfur but by 1940 it was reported this had largely disappeared at the end of about eight months operation. The water has a salty flavor at times.

In February 1940 after six hours of pumping the water had a total residue of 2744, and a total hardness of 133.5 parts per million without iron or manganese as shown by the analysis of sample number 87324, collected February 28, 1940.

Analysis of Sample Number 87324 from the 68-Foot Gravel Well.			
Determinations Made.		Hypothetical Combinations.	
	Pts. per million.		Pts. per million. Grs. per gallon.
Iron.....Fe		Sodium Nitrate.....NaNO ₃	4.2 0.24
(filtered at well)..	0.0	Sodium Chloride.....NaCl	1962.0 114.40
(unfiltered).....	0.0	Sodium Sulfate.....Na ₂ SO ₄	269.9 15.74
Manganese..Mn	0.0	Sodium Carbonate.....Na ₂ CO ₃	361.5 21.08
Silica.....SiO ₂	12.5	Ammonium Carbonate..(NH ₄) ₂ CO ₃	3.4 0.20
Turbidity.....	0.0	Magnesium Carbonate..MgCO ₃	37.9 2.21
Color.....	0.0	Calcium Carbonate.....CaCO ₃	88.6 5.17
Odor.....	0.0	Silica.....SiO ₂	12.5 0.73
Calcium....Ca	35.3		
Magnesium..Mg	10.9	Total.....	2740.0 159.77
Ammonium..NH ₄	1.3		
Sodium.....Na	1017.0		
Sulfate.....SO ₄	182.7		
Nitrate.....NO ₃	3.1		
Chloride....Cl	1190.0		
Alkalinity as CaCO ₃			
Phenolphthalein..	0.0		
Methyl Orange...	478.0		
Residue.....	2744.0		
Total Hardness....	133.5		
Free CO ₂ (calc.)....	22.0		
pH = 7.6			

PEOEIA WATEE WORKS COMPANY. The city of Peoria built the original water works in 1868 and operated it until 1889 when it was sold to a group of individuals and it has since been operated as a privately owned enterprise under the name of the Peoria Water Works Company.

As originally constructed by the city the water works pumping station was located on the south side of Grant Street near the river. The water supply was taken directly from the river and delivered into the distribution system without treatment. The new ownership began the reconstruction of the entire property as soon as they took possession and in addition to extending the distribution system, had by 1892, completed the new pumping station and a large dug well on property lying east of the Chicago, Bock Island and Pacific Railroad and north of Lorentz Avenue.

The well, now known as the main well, consists of a circular brick walled well having an inside diameter of 34 feet and a depth of 42 feet 8 inches from the ground surface to the bottom edge of the cast iron cut-

ting shoe. The cutting shoe is seated in the water-bearing gravel and the 3-foot thick brick wall which it supports extends to a height of 10 feet above ground level where it is covered with a conical roof. Inside the brick wall and concentric with it is a perforated steel ring 24 feet in diameter by 5 feet deep below the cutting edge of the cast iron shoe. This perforated ring serves as a large diameter well screen. Inside the 24-foot perforated steel ring but eccentric to it there originally was installed a second perforated steel ring 10 feet in diameter extending 5.5 feet below the bottom of the 24-foot ring or 10.5 feet below the bottom of the cast iron wall shoe. This smaller ring served the dual purpose as a well screen and a suction sump for the pumps which were located in a deep pump pit in the main pumping station nearby. This ring was removed in 1899 when certain repairs were made. Water level in the well fluctuated with the river level.

In the year 1899 improvements were made to this well for the purpose of increasing the production. Within the annular space between the brick wall and the 24-foot steel ring four elliptical steel caisson wells of ½-inch steel plate were sunk. These caissons had a long diameter of 5 feet and a short diameter of 3 feet 10 inches. Each caisson was 19 feet long and extended through the water-bearing gravel to a seat on bedrock at the base of the gravel. The lower 5-foot section of each caisson was perforated with seventy ¾-inch holes per square foot. As originally installed the perforated section of the caissons was equipped on the inside with a well screen of smaller openings than the ¾ inch holes. However, the annular space between the caisson and the screen soon became clogged and the screens were removed.

The average depth of the caisson wells is now 17.5 feet. Bedrock slopes toward the river. They thus extend above the cutting shoe 8 to 18 inches.

Each caisson well was equipped with a centrifugal pump direct connected by a vertical shaft to a Pelton water motor. Water for the Pelton water motor was taken from the high pressure service main at 125 to 130 pounds per square inch pressure. The water from the centrifugal pumps, as well as the spent water from the Pelton motors, was discharged into the suction tank in the well. A report of a test on one of the Pelton motor-centrifugal pumps gave a pump discharge of from 5 to 7½ times as much water as the motors required.

In addition to the installation of the four elliptical wells and their equipment, a steel tank 20 feet in diameter by 12 feet deep was placed inside the 24-foot steel ring to serve as a suction tank for the service pumps. This tank is supported by a grillage of steel I beams resting on 30 columns consisting of 6-inch pipes filled with concrete and founded on bedrock at the base of the gravel.

The bottom of this 20-foot suction tank was placed about 3 feet below the top of the 24-foot diameter steel ring. Four 12-inch valves placed in the tank bottom permit water to enter directly from the large well whenever it was high enough.

This well is still in regular service but the Pelton motors have been removed. All wells which have since been constructed discharge into this same steel tank in the main well.

Water from the main well had a residue of 350 and a total hardness of 302 parts per million without iron or manganese as shown by the analysis of sample number 72386, collected January 30, 1933.

Analysis of Sample Number 72386 from the Main Well.		Hypothetical Combinations.	
Determinations Made.			
	Pts. per million.		Pts. per million. Grs. per gallon.
Iron.....Fe	0.0	Sodium Nitrate.....NaNO ₃	7.7 0.45
Manganese..Mn	0.0	Sodium Chloride.....NaCl	24.0 1.40
Silica.....SiO ₂	16.0	Magnesium Chloride....MgCl ₂	4.8 0.28
Turbidity.....	0.0	Magnesium Sulfate....MgSO ₄	87.8 5.12
Calcium....Ca	74.8	Magnesium Carbonate..MgCO ₃	31.2 1.82
Magnesium..Mg	27.9	Calcium Carbonate....CaCO ₃	187.0 10.90
Ammonium..NH ₄	.03	Silica.....SiO ₂	16.0 0.93
Sodium....Na	11.5		
Sulfate....SO ₄	70.2	Total.....	358.5 20.90
Nitrate....NO ₃	5.8		
Chloride....Cl	18.0		
Alkalinity as CaCO ₃			
Phenolphthalein..	0.0		
Methyl Orange...	224.0		
Residue.....	350.0		
Total Hardness....	302.0		

An additional well at the main pumping station, located about 40 feet northerly of the main well was constructed in 1908. This well, known as the reserve well, is 56 feet deep, the lower 22 feet consisting of a perforated steel screen 12 feet in diameter. At the top of the screen is a concrete and steel bulkhead which forms the floor of a pump pit 34 feet deep. The first 18 feet of this pit is walled with a steel shell 12 feet in diameter and above this to the ground surface the wall is of reinforced concrete.

This well is connected to the main well by two tunnels one from the screen section and one from the pump pit section. It is equipped with an 8-inch and a 10-inch Byron Jackson centrifugal pump direct connected to 25 and 35-horsepower electric motors respectively. These pumps discharge into the suction tank in the main well.

Well number 2 was constructed in 1895 at a location 3340 feet northerly of the main well. It was constructed as an open caisson with a cylindrical brick wall 11 feet in diameter resting on a cast iron shoe. Due to bad quicksand conditions it was not possible to carry the structure deeper than within 8 feet of the top of the bedrock. A steel ring 10 feet in diameter by 5 feet high was placed a few feet lower and sealed to the brick wall with wooden wedges.

Four vertical drive wells with 6-inch Cook screens penetrate to bedrock and eight horizontal drive points with 6-inch and 4-inch Cook screens penetrate the water-bearing materials an average distance of about 8 feet outside the masonry wall at a height of about 12 feet above bedrock.

The original pumping equipment consisted of two identical motor and pump assemblies. Each assembly included two centrifugal pumps arranged in series one above the other some distance apart and powered through the same vertical drive shaft by a Pelton water motor. Later the upper pump was removed and it was then found that the Pelton motor

operated at a higher speed with 30 per cent less water and at the same time the single centrifugal pump delivered the same amount of water as had previously been delivered by the two pumps. The discharge from the pumps and the spent water from the water motors was conducted to the suction tank in the main well through a 24-inch gravity flow pipe line.

At the present time the well is equipped with one Sterling deep-well turbine pump, the assembly of which consists of 40 feet of 10-inch column pipe, and a single 14-inch bowl with no suction pipe. It is direct connected to a 25-horsepower U. S. electric motor operating at a full load speed of 1760 revolutions per minute. This well was not in service in 1939.

Well number 3, completed in 1904, is located about 1250 feet south of the main well. The site was selected after an extended exploration program of the subsurface conditions by a large number of test wells. Since the natural ground level was subject to over-flow by the river except at low stages an embankment was built considerably above the natural surface.

The cylindrical strainer section made of 5/8-inch steel plate and perforated with some 34,000 holes 11/16-inch in diameter is 9 feet in diameter by 21 feet 6 inches high and rests on bedrock at the base of the water-bearing material. On the top of the strainer section is a steel cover or bulkhead which supports the cylindrical brick wall of the pump house. A 14-inch cast iron suction pipe with a length of 20 feet passes through the steel bulkhead into the strainer section while the upper end is attached to the centrifugal pump.

The original pump installation consisted of an 8-inch Byron Jackson centrifugal pump set just above the bulkhead level, connected by a vertical shaft to a 30-inch Pelton water motor set somewhat above the natural ground elevation. Water under pressure from the system was conducted to the water motor through an 8-inch steel pipe.

The discharge from the centrifugal pump was conducted back to the suction tank in the main well through a 20-inch wood stave pipe laid to provide a gravity flow. The spent water from the water motor was also conducted back to the main well in the same pipe. The only change in equipment since this unit was completed has been the substitution of a 25-horsepower Wagner electrical motor for the water motor, and a 12-inch steel pipe from the old wood stave pipe.

Well number 4, completed in 1910, is located about 700 feet south by east of the main well.

The cylindrical strainer section is made of 3/8-inch steel plate 7 feet in diameter by 24 feet high. It is perforated with 15,966 holes one inch in diameter, and the bottom edge rests on bedrock. At the top of the strainer section is a steel cover or bulkhead which supports the cylindrical concrete pump pit and well house. A 10-inch cast iron suction pipe passes through the steel bulkhead into the strainer section, the upper end being attached to the centrifugal pump.

The well is equipped with a Byron Jackson 6-inch centrifugal pump, set just above the bulkhead level, connected by a vertical shaft to a 15-horsepower Wagner electric motor. The discharge from the

pump is conducted to the suction tank at the main well through the 12-inch steel pipe from well number 3.

Well number 5 was completed in 1910 at a site about 1000 feet northerly of the main well. It is similar in construction to wells 3 and 4. The cylindrical strainer section, made of 3/8-inch steel plate, perforated with 15,966 holes one-inch in diameter, is 7 feet in diameter by 12 feet high. It is seated on bedrock. Because of the thin section of the water-bearing material only the lower 7.75 feet is exposed, the upper 4.25 feet being blanked off with steel plates.

At the top of the strainer section is a steel cover plate or bulkhead which supports the cylindrical concrete pump pit and well house. A 10-inch wrought iron suction pipe 20 feet long passes through the steel bulkhead into the strainer section, the upper end being attached to the centrifugal pump.

The well is equipped with a Byron Jackson 6-inch centrifugal pump, set just above the bulkhead level, connected by a vertical shaft to a Wagner 10-horsepower electric motor. The discharge from the pump is conducted to the main suction tank in the well through a 24-inch cast iron pipe line which is also the discharge pipe line for the Sankoty field.

Well number 6 was completed at a site about 1700 feet northerly of the main well but it was never placed in service.

Well number 7 together with wells numbered 8, 9 and 10 is located in the vicinity of Sankoty siding some three miles northerly of the main well. All of these wells are generally spoken of as the Sankoty wells.

Well number 7 is located about 530 feet west and 2080 feet north of the southeast corner of Section 15, T. 9 N., E. 8 E., 4th P. M. It was completed in 1911 to a depth of 92 feet. The cylindrical strainer section, made of 3/8-inch steel plate and perforated with 15,916 holes one inch in diameter, is 7 feet in diameter by 24 feet high and rests on bedrock. At the top of the strainer section is a steel and concrete bulkhead 2 feet thick. Above the bulkhead is a masonry pump pit 4 feet 10 inches in diameter on the inside extending to a height of 59 feet. At this elevation the pit is increased to 6.5 feet by 6.5 feet square for the remaining 10 feet to ground surface. The 10-inch suction pipe passes through the bulkhead into the strainer section, the upper end being attached to a Byron Jackson 8-inch centrifugal pump placed just above the top of the bulkhead. The pump is direct connected by a vertical shaft to a Wagner Electric Company 80-horsepower electric motor located near the top of the pit in the enlarged section.

The pump has a normal delivery capacity of 2100 gallons per minute at a speed of 860 revolutions per minute and discharges into a 24-inch cast iron pipe laid in Galena Eoad which conducts the water to the suction tank in the main well.

The water had a residue of 457, and a total hardness of 397 parts per million without either iron or manganese as shown by the analysis of sample number 69148, collected May 12, 1931.

Analysis of Sample Number 69148 Collected from Well Number 7.
 Determinations Made. Hypothetical Combinations.

	Pts. per million.		Pts. per million.	Grs. per gallon.
Iron.....Fe	0.0	Sodium Nitrate.....NaNO ₃	6.0	0.35
Manganese..Mn	0.0	Sodium Chloride.....NaCl	26.3	1.53
Silica.....SiO ₂	15.0	Sodium Sulfate.....Na ₂ SO ₄	3.6	0.21
Turbidity.....	0.0	Ammonium Sulfate.....(NH ₄) ₂ SO ₄	0.7	0.04
Calcium.....Ca	88.5	Magnesium Sulfate.....MgSO ₄	44.5	2.60
Magnesium..Mg	42.7	Magnesium Carbonate..MgCO ₃	116.8	6.81
Ammonium..NH ₄	0.1	Calcium Carbonate....CaCO ₃	221.5	12.92
Sodium.....Na	13.1	Iron Oxide.....Fe ₂ O ₃	0.0	0.00
Sulfate.....SO ₄	38.5	Manganese Oxide.....MnO	0.0	0.00
Nitrate.....NO ₃	4.4	Silica.....SiO ₂	15.0	0.87
Chloride....Cl	16.0			
Alkalinity as CaCO ₃		Total.....	434.4	25.33
Phenolphthalein..	0.0			
Methyl Orange...	360.0			
Residue.....	457.0			
Total Hardness....	397.0			

Well number 8 located about 375 feet west and 2285 feet north of the southeast corner of Section 15, T. 9 N., R. 8 E., 4th P. M. and about 250 feet northeasterly of well number 7 was completed) in 1914 to a depth of 88 feet.

The cylindrical strainer, made of 3/8-inch steel plate and perforated with 7,983 holes one inch in diameter in two sections, is 7 feet in diameter by 24 feet high and Tests on bedrock. At the top of the strainer is a bulkhead of steel and concrete 2 feet thick. Above the bulkhead is a masonry pump pit 4 feet 10 inches in diameter extending to a height of 59 feet. At this elevation the pit is increased to 6.5 by 6.5 feet square for the remaining 7 feet to ground surface. The 10-inch suction pipe extends through the bulkhead into the strainer section, the upper end being attached to a Byron Jackson 8-inch centrifugal pump placed just above the top of the bulkhead. The pump is direct connected by a vertical shaft to a Wagner Electric Company 80-horsepower electric motor located near the top of the pit in the enlarged

Analysis of Sample Number 69365 from Well Number 8.
 Determinations Made. Hypothetical Combinations.

	Pts. per million.		Pts. per million.	Grs. per gallon.
Iron.....Fe	0.0	Sodium Chloride.....NaCl	38.0	2.22
Manganese..Mn	0.2	Sodium Sulfate.....Na ₂ SO ₄	7.8	0.45
Silica.....SiO ₂	14.0	Sodium Carbonate.....Na ₂ CO ₃	21.7	1.27
Turbidity.....	0.0	Ammonium Carbonate..(NH ₄) ₂ CO ₃	0.5	0.03
Calcium.....Ca	72.1	Magnesium Carbonate..MgCO ₃	129.1	7.53
Magnesium..Mg	37.2	Calcium Carbonate....CaCO ₃	180.0	10.50
Ammonium..NH ₄	0.1	Iron Oxide.....Fe ₂ O ₃	0.0	0.00
Sodium.....Na	26.9	Manganese Oxide.....MnO	0.2	0.01
Sulfate.....SO ₄	5.4	Silica.....SiO ₂	14.0	0.82
Nitrate.....NO ₃	0.0			
Chloride....Cl	23.0	Total.....	391.3	22.83
Alkalinity as CaCO ₃				
Phenolphthalein..	0.0			
Methyl Orange...	354.0			
Residue.....	408.0			
Total Hardness....	333.0			

section. The pump has a normal delivery capacity of 2100 gallons per minute at a speed of 860 revolutions per minute and discharges into the 24-inch cast iron pipe laid in Galena Eoad which conducts the water to the suction tank in the main well.

The water had a residue of 408, a total hardness of 333 and a manganese content of 0.2 parts per million but without iron as shown by the analysis of sample number 69365, collected June 23, 1931.

Well number 9 is located about 360 feet north by a little west of well number 7 and about 260 feet northwesterly of well number 8. It is approximately 590 feet west and 2445 feet north of the southeast corner of Section 15, T. 9 N., R. 8 E., 4th P. M. It was completed in 1923 by the Kelly Well Company of Grand Island, Nebraska to a depth of 95 feet. The well penetrates 55 feet of clay, 29 feet of medium gravel and 11 feet of gravel of large dimensions.

A concrete plug one foot thick resting on bedrock at the bottom of the well supports 26 feet of Kelly concrete screen and 68 feet of blank concrete casing. Both casing and screens have inside diameters of 25 inches and outside diameters of 32 inches. The screen and casing is surrounded with a 3-inch thick envelope of selected and washed gravel from the bottom of the well to a height of about 30 feet.

Upon completion of the well static water level was reported at a depth of 37 feet. The production test gave a rate of discharge of 2100 gallons per minute with a drawdown of 10 feet.

The well is equipped with an American 2-stage, 24-inch deep-well turbine pump rated at 3,000,000 gallons per day against a head of 108 feet. The pump assembly consists of 72 feet of 10-inch column pipe, two stages of 24-inch bowls and 6 feet of 10-inch suction pipe. The bottom of the suction pipe is 5 feet above the concrete plug at the well bottom. The pump is direct connected to a Western Electric Company 100-horsepower motor operating at a full load speed of 720 revolutions per minute.

The water had a residue of 453 and a total hardness of 432 parts per million with no iron or manganese as shown by the analysis of sample number 69149, collected May 12, 1931.

Analysis of Sample Number 69149 from Well Number 9.

Determinations Made.		Hypothetical Combinations.		
	Pts. per million.		Pts. per million.	Grs. per gallon.
Iron.....Fe	0.0	Sodium Nitrate.....NaNO ₃	1.7	0.10
Manganese...Mn	0.0	Sodium Chloride.....NaCl	22.8	1.33
Silica.....SiO ₂	17.0	Sodium Sulfate.....Na ₂ SO ₄	4.3	0.25
Turbidity.....	0.0	Ammonium Sulfate.....(NH ₄) ₂ SO ₄	0.7	0.04
Calcium.....Ca	97.5	Magnesium Sulfate.....MgSO ₄	52.4	3.06
Magnesium...Mg	45.9	Magnesium Carbonate...MgCO ₃	122.2	7.12
Ammonium...NH ₄	0.2	Calcium Carbonate.....CaCO ₃	215.0	12.55
Sodium.....Na	10.8	Calcium Silicate.....CaSiO ₃	33.1	1.93
Sulfate.....SO ₄	45.1	Iron Oxide.....Fe ₂ O ₃	0.0	0.00
Nitrate.....NO ₃	1.3	Manganese Oxide.....MnO	0.0	0.00
Chloride....Cl	14.0			
Alkalinity as CaCO ₃		Total.....	452.2	26.38
Phenolphthalein..	0.0			
Methyl Orange...	360.0			
Residue.....	453.0			
Total Hardness....	432.0			

Well number 10, completed in 1935 by the Kelly Well Company of Grand Island, Nebraska to a depth of 93 feet 2 inches below the pump-house floor, is located about 325 feet north of well number 9 or approximately 590 feet west and 2795 feet north of the southeast corner of Section 15, T. 9 N., R. 8 E. of the 4th P. M. In its construction the well penetrated 2 feet 7 inches of loam, 3 feet 8 inches of sand and clay, 2 feet of clay, 8 feet 4 inches of sand and clay, 40 feet of clay, and 36 feet 1 inch of coarse sand, gravel and stones. Bedrock was found at 92 feet 8 inches below the ground surface.

A concrete plug one foot thick resting on bedrock at the bottom of the well supports 24 feet of Kelly concrete screen and 68 feet of blank concrete casing. Both casing and screen have inside diameters of 25 inches and outside diameters of 32 inches. The casing and screen is surrounded by a 3-inch thick envelope selected washed gravel from the bottom of the well to a height of 73 feet.

The well is equipped with a Peerless 17-inch deep-well turbine pump rated at 2100 gallons per minute at a speed of 870 revolutions per minute against a head of 110 feet. The pump assembly consists of 73 feet of 18-inch column pipe, five stages of bowls having an over-all length of 8 feet 2 inches and 5 feet of 12-inch suction pipe. It is direct connected to a U. S. Electric motor of 75 horsepower.

PERE MARQUETTE HOTEL. The Pere Marquette Hotel is situated on the westerly corner of the intersection of Madison and Main Streets. The well, constructed in 1927 by Mr. Schilling, and located approximately 710 feet south and 490 feet east of the northwest corner of northeast quarter of Section 9, T. 8 N., R. 8 E., 4th P. M. has a depth of 76 feet below the level of the basement floor or 90 feet below the street grade at the corner. It is cased with 66 feet of 10-inch pipe and 10 feet of screen. Sand and gravel was found at 54 feet below street level.

The well is equipped with an A. D. Cook deep-well cylinder pump powered by a 20-horsepower electric motor. The pump is of the double acting type with a 20-inch stroke and discharges at a rate of 200 gallons

Analysis of Sample Number 73504.

Determinations Made.		Hypothetical Combinations.	
	Pts. per million.		Pts. per million.
Iron Fe	0.0	Sodium Nitrate NaNO ₃	36.6
Manganese . . Mn	0.0	Sodium Chloride NaCl	52.6
Silica SiO ₂	17.0	Sodium Sulfate Na ₂ SO ₄	11.4
Turbidity	0.0	Magnesium Sulfate MgSO ₄	179.4
Calcium Ca	121.8	Magnesium Carbonate MgCO ₃	47.2
Magnesium . . Mg	50.0	Calcium Carbonate CaCO ₃	276.2
Ammonium . . NH ₄	0.01	Calcium Silicate CaSiO ₃	33.1
Sodium Na	34.3		
Sulfate SO ₄	155.0	Total	636.5
Nitrate NO ₃	26.5		
Chloride Cl	32.0		
Alkalinity as CaCO ₃			
Phenolphthalein . .	0.0		
Methyl Orange . . .	332.0		
Residue	637.0		
Total Hardness	509.5		37.14

per minute into a pressure storage tank equipped with pressure regulators for controlling the pump operation. The pump operates about 8 hours per day.

The water had a residue of 637 and a total hardness of 509.5 parts per million with no iron or manganese as shown by the analysis of sample number 73504, collected September 16, 1933.

PITSCH'S MARKET. Pitsch's Market is situated at 207 South Madison Street. This is on the west side of the street about one-half block south of Fulton Street.

The well, located approximately 1590 feet north and 110 feet east of the center of Section 9, T. 8 N., R. 8 E., 4th P. M., has a depth of 102 feet below the floor of the pump pit or about 106½ feet below the surface of the alley. It is cased with 96 feet of 4-inch pipe and G feet of screen. Water is obtained from sand and gravel.

The well is equipped with a Myers double-acting deep-well cylinder pump which operates with a 12-inch stroke at a speed of 34 strokes per minute. It is powered by a 3-horsepower Century electric motor. The pump is installed in a small pump pit 4½ feet deep.

The water had a residue of 523, a total hardness of 467, and an iron content of 1.4 parts per million, but no manganese as shown by the analysis of sample number 73486, collected September 12, 1933. The water temperature was 56½° F.

Analysis of Sample Number 7348G.			
Determinations Made.		Hypothetical Combinations.	
	Pts. per million.		Pts. per million. Grs. per gallon.
Iron Fe	1.4	Sodium Nitrate NaNO ₃	21.2 1.24
Manganese . . Mn	0.0	Sodium Chloride NaCl	2.3 0.13
Silica SiO ₂	11.0	Magnesium Chloride MgCl ₂	20.9 1.22
Turbidity	0.0	Magnesium Sulfate MgSO ₄	145.1 8.47
Calcium Ca	108.0	Magnesium Carbonate . . . MgCO ₃	46.0 2.68
Magnesium . . Mg	48.0	Calcium Carbonate CaCO ₃	251.5 14.68
Ammonium . . NH ₄	trace	Calcium Silicate CaSiO ₃	21.5 1.25
Sodium Na	6.6	Iron Oxide Fe ₂ O ₃	2.0 0.12
Sulfate SO ₄	115.7		
Nitrate NO ₃	15.5	Total	510.5 29.79
Chloride Cl	17.0		
Alkalinity as CaCO ₃			
Phenolphthalein . .	0.0		
Methyl Orange . . .	306.0		
Residue	523.0		
Total Hardness . . .	467.0		

PEEMIEE PABST COEPOEATION PLANT NO. 3. This plant is situated in the southwest quarter of Section 22, T. 9 N., R. 8 E., 4th P. M., south of Suberling Avenue and west of Prospect Eoad in Peoria Heights, Illinois.

Until 1939 water was obtained from wells. Wells numbers 1 and 2 were constructed in 1926, by M. Ebert and Son of Washington, Illinois, to a reported depth 331 feet and 335 feet respectively.

Well number 1, located approximately 1230 feet south and 600 feet west of the center of Section 22, penetrated 250 feet of drift, 64 feet

of dry sand and 17 feet of water-bearing sand. It was cased with 313 feet of 12-inch pipe and 18 feet of 11¾-inch Cook screen and equipped with a 125 gallons per minute A. D. Cook deep-well cylinder pump. On test a yield of 190 gallons per minute was obtained.

Well number 2, located approximately 1165 feet south and 485 feet west of the center of Section 22, penetrated 250 feet of drift, 67½ feet of dry sand and 17½ feet of water-bearing sand. It was cased with 317 feet of 12-inch pipe and 18 feet of 11¾-inch A. D. Cook screen and equipped with a 125 gallons per minute A. D. Cook deep-well cylinder pump. On test a yield of 255 gallons per minute was obtained.

The water from well number 2 had a residue of 480, a total hardness of 281.5, an iron content of 2.4, and a manganese content of 2.5 parts per million as shown by the analysis of sample number 80162, collected January 16, 1934 after 4 minutes of pumping.

Analysis of Sample Number 80162 from Well Number 2.

Determinations Made.		Hypothetical Combinations.		
	Pts. per million.		Pts. per million.	Grs. per gallon.
Iron.....Fe		Sodium Nitrate.....NaNO ₃	2.5	0.15
(filtered).....	0.0	Sodium Chloride.....NaCl	46.2	2.69
(unfiltered).....	2.4	Sodium Sulfate.....Na ₂ SO ₄	1.4	0.08
Manganese...Mn	2.5	Sodium Carbonate.....Na ₂ CO ₃	168.5	9.82
Silica.....SiO ₂	10.0	Ammonium Carbonate..(NH ₄) ₂ CO ₃	3.8	0.22
Turbidity.....	12.0	Magnesium Carbonate..MgCO ₃	107.2	6.25
Calcium.....Ca	61.9	Calcium Carbonate.....CaCO ₃	138.0	8.05
Magnesium...Mg	30.9	Calcium Silicate.....CaSiO ₂	19.2	1.12
Ammonium...NH ₄	1.6	Manganese Oxide.....MnO	3.2	0.19
Sodium.....Na	92.4			
Sulfate.....SO ₄	1.0	Total.....	490.0	28.57
Nitrate.....NO ₂	1.7			
Chloride....Cl	28.0			
Alkalinity as CaCO ₃				
Phenolphthalein..	0.0			
Methyl Orange...	428.0			
Residue.....	480.0			
Total Hardness....	281.5			

Wells numbers 3 and 4 were constructed by the American Water Corporation in 1928 and 1929 respectively. Both wells were 320 feet deep. The following is the log of one of them.

Materials.	Thickness in feet.	Depth in feet.
Soil and clay.....	5	5
Yellow clay.....	10	15
Blue clay.....	55	70
Blue clay with some gravel.....	80	150
Hardpan.....	21	171
Hardpan and boulders.....	43	214
Clay.....	4	218
Sand and small boulders (no water).....	57	275
Clay and boulders.....	24	299
Sand and gravel, water bearing.....	19	318
Limestone, bluish.....	2	320

Both wells were cased with 24-inch pipe and screen and equipped with a deep-well cylinder pump but as one of them produced only 30 gallons per minute and the other 40 gallons per minute they were soon

discontinued. Well number 4 has been abandoned as it was in the way of a new building. Well number 3 is located approximately 1570 feet south and 100 feet west of the center of Section 22. It was a short distance south of well number 4.

Well number 5, located approximately 1050 feet south and 775 feet west of the center of Section 22, was constructed by the A. D. Cook Co. in 1935 to a depth of 334 feet. It is of the gravel wall filter type of construction. The 24-inch outer casing has a length of 298 feet while the 15-inch inner casing has a length of 316 feet below which is 15 feet of A. D. Cook 16-inch screen. Static water level was reported as 314 feet below ground surface.

During 1939 and 1940 arrangements were made to purchase water from the village of Peoria Heights and the Peoria Water Works Company.

J. C. PROCTOR HOME. The J. C. Proctor Home is situated on the northerly corner of the intersection of Glendale Avenue and Spring Street.

A well completed in 1933, by M. Ebert & Son of Washington, Illinois, is located approximately 60 feet north of Spring Street and 120 feet west of Glendale Avenue or 1400 feet south and 1180 feet east of the northwest corner of Section 3, T. 8 N., R. 8 E. of the 4th P. M. The well is 123 feet deep below the ground surface. Mr. Ebert reported the well passed through 80 feet of clay before entering sand and gravel and that it is cased with 8-inch pipe. Static water level was 83 feet below the surface.

The well is equipped with a Pomona deep-well turbine pump, the assembly of which consists of 95 feet of column, 12 stages of 8-inch bowls having an over-all length of 8 feet and 15 feet of suction pipe. It is rated at 200 gallons per minute against a head of 250 feet. It is direct connected to a General Electric Company 15-horsepower motor which operates at a full load speed of 1760 revolutions per minute.

Analysis of Sample Number 80002.

Determinations Made.		Hypothetical Combinations.		
	Pts. per million.		Pts. per million.	Grs. per gallon.
Iron.....Fe	1.4	Sodium Nitrate.....NaNO ₃	14.5	0.85
Manganese...Mn	0.1	Sodium Chloride.....NaCl	439.5	25.60
Silica.....SiO ₂	12.0	Sodium Sulfate.....Na ₂ SO ₄	69.6	4.06
Turbidity.....	0.0	Magnesium Sulfate.....MgSO ₄	223.0	13.00
Calcium.....Ca	137.5	Magnesium Carbonate..MgCO ₃	37.5	2.19
Magnesium..Mg	55.9	Calcium Carbonate.....CaCO ₃	323.5	18.85
Ammonium..NH ₄	0.1	Calcium Silicate.....CaSiO ₃	23.2	1.35
Sodium.....Na	199.5	Iron Oxide.....Fe ₂ O ₃	2.0	0.12
Sulfate.....SO ₄	225.2	Manganese Oxide.....MnO	0.1	0.01
Nitrate.....NO ₃	10.6			
Chloride....Cl	206.8	Total.....	1132.9	66.03
Alkalinity as CaCO ₃				
Phenolphthalein..	12.0			
Methyl Orange...	368.0			
Residue.....	1113.0			
Total Hardness....	573.0			

The water had a residue of 1113, a total hardness of 573, an iron content of 1.4, and a manganese content of 0.1 parts per million as shown by the analysis of sample number 80062, collected January 5, 1934.

PROCTOR HOSPITAL. The Proctor Hospital is situated on the northeast corner of the intersection of Fisher and Second Streets.

A well was completed in August 1933 by M. Ebert and Sons of Washington, Illinois at a location approximately 780 feet north and 1430 feet west of the center of Section 9, T. 8 N., R. 8 E., 4th P. M. The well is 97 feet deep below the basement floor or 112 feet deep below the surface of the street intersection which has an elevation of 518.7 feet above mean sea level. It is cased with 82 feet of 8-inch casing and 15 feet of 8-inch screen. Static water level was reported as 78 feet below street level.

The well is equipped with a Pomona deep-well turbine pump, the assembly of which consists of 80 feet of 4½-inch column pipe, 11 stages of 8-inch bowls having an over-all length of 7 feet and a short piece of 4½-inch suction pipe. The pump is rated at 100 gallons per minute against a head of 230 feet and is direct connected to a Westinghouse Electric Company 15-horsepower electric motor which operates at a full load speed of 1750 revolutions per minute.

It was reported that the well when new produced 100 gallons per minute with a drawdown of 23 inches and 200 gallons per minute with a drawdown of 34 inches. The pump discharges into a pressure storage tank equipped with automatic pressure regulators and pump control.

The water had a residue of 722 and a total hardness of 570.5 parts per million without iron or manganese as shown by the analysis of sample number 73501, collected September 12, 1933.

Analysis of Sample Number 73501.

Determinations Made.		Hypothetical Combinations.	
	Pts. per million.		Pts. per million. Grs. per gallon.
Iron Fe	0.0	Sodium Nitrate NaNO ₃	36.6 2.13
Manganese . . Mn	0.0	Sodium Chloride NaCl	24.0 1.40
Silica SiO ₂	16.0	Magnesium Chloride . . . MgCl ₂	15.2 0.89
Turbidity	0.0	Magnesium Sulfate MgSO ₄	271.5 15.80
Calcium Ca	131.6	Calcium Sulfate CaSO ₄	6.1 0.36
Magnesium . . Mg	58.9	Calcium Carbonate CaCO ₃	298.0 17.39
Ammonium . . . NH ₄	0.01	Calcium Silicate CaSiO ₂	30.8 1.80
Sodium Na	19.3		
Sulfate SO ₄	227.1	Total	682.2 39.77
Nitrate NO ₃	26.5		
Chloride Cl	26.0		
Alkalinity as CaCO ₃			
Phenolphthalein . .	0.0		
Methyl Orange . . .	298.0		
Residue	722.0		
Total Hardness . . .	570.5		

PRODUCERS DAIRY, INC. The Producers Dairy, Inc. is located at 112-116 South Globe Street.

Water is supplied the plant by two wells equipped with Pomona deep-well turbine pumps which produce an average of 97,500 gallons per day.

EOSZELL DAIEY COMPANY. The J. D. Eoszell Ice Cream and Dairy Company plant is situated on the easterly corner of the intersection of Washington and Oak Streets. A 10-inch and an 8-inch well are on the property.

The 10-inch well is located approximately 1140 feet south and 635 feet west of the center of Section 9, T. 8 N., E. 8 E. of the 4th P. M., while the 8-inch well is approximately 1100 feet south and 585 feet west of the center of Section 9.

The 10-inch well terminates on top of the shale at a depth of 70 feet below ground surface which is at elevation 475 feet above sea level. It is cased with 50 feet of 10-inch pipe and 20 feet of screen. The well is equipped with a Sterling deep-well turbine pump, direct connected to a 40-horsepower electric motor which operates at a full load speed of 1750 revolutions per minute. It operates 24 hours per day when the smaller unit is down.

The 8-inch well was completed in July 1933 by Chris Ebert of Washington, Illinois to the top of the shale at a depth of 70 feet below ground surface. It is cased with 67 feet of 8-inch pipe and 3 feet of screen. Static water level was reported as 43 feet when the well was finished. The well is equipped with a Sterling deep-well turbine pump, direct connected to a 7½ horsepower electric motor which operates at a full load speed of 1750 revolutions per minute. The pump is rated at 300 gallons per minute and is used about 8 hours per day.

The water had a residue of 706 and a total hardness of 500 parts per million without either iron or manganese as shown by the analysis of sample number 73440. The temperature of the water was 60½° F.

SCHWAB'S DAIEY. The plant of the Schwab's Dairy is located at 1222-1228 Western Avenue.

Water is obtained from a well 124 feet deep at a rate of approximately 35,000 to 40,000 gallons per day.

H. H. SHUFELDT AND COMPANY. The plant of H. H. Shufeldt and Company is situated in the packing house district in the north-west quarter of the southeast quarter of Section 17, T. 8 N., E. 8 E. of the 4th P. M.

The well constructed in 1903 through gravel to a depth of 60 feet is located approximately 775 feet south and 190 feet east of the center of Section 17.

The well is equipped with a direct suction steam pump, the steam cylinder of which has a diameter of 9 inches and the water cylinder a diameter of 6 inches. The pump operated with a 12-inch stroke at 36 strokes per minute or at a theoretical pumping rate of 53 gallons per minute for about 8 hours per day.

The water had a residue of 1124, and a total hardness of 415.5 parts per million without iron or manganese as shown by the analysis of sample number 73452, collected August 30, 1933. The water temperature was 58° F.

The analysis of sample number 74457, collected April 26, 1934 indicates a total residue of 1652 and a total hardness of 442.5 parts per million without iron or manganese.

Analysis of Sample Number 74457 from 60-Foot Well.

Determinations Made.		Hypothetical Combinations.	
	Pts. per million.		Pts. per million. Grs. per gallon.
Iron.....Fe	0.0	Sodium Nitrate.....NaNO ₃	24.6 1.44
Manganese..Mn	0.0	Sodium Chloride.....NaCl	942.0 54.95
Silica.....SiO ₂	18.0	Sodium Sulfate.....Na ₂ SO ₄	263.7 15.38
Turbidity.....	0.0	Ammonium Sulfate.....(NH ₄) ₂ SO ₄	0.7 0.04
Calcium.....Ca	113.0	Magnesium Sulfate.....MgSO ₄	20.5 1.72
Magnesium..Mg	39.0	Magnesium Carbonate..MgCO ₃	114.2 6.66
Ammonium..NH ₄	0.1	Calcium Carbonate.....CaCO ₃	252.5 14.72
Sodium.....Na	462.4	Calcium Silicate.....CaSiO ₃	34.8 2.03
Sulfate.....SO ₄	202.4		
Nitrate.....NO ₃	17.7	Total.....	1662.0 96.94
Chloride....Cl	571.0		
Alkalinity as CaCO ₃			
Phenolphthalein..	0.0		
Methyl Orange...	388.0		
Residue.....	1652.0		
Total Hardness....	442.5		

STEAM MARBLE WORKS. The plant of the Steam Marble Works is situated on the easterly side of N. Adams Street north of Hayward Street.

A well drilled prior to 1912 at a site where the surface elevation was 485 feet above sea level and located approximately 1650 feet east and 600 feet north of the center of Section 3, T. 8 N., R. 8 E., 4th P. M. penetrated 30 feet of gravel before finding bedrock. The well is reported to have penetrated to a depth of 200 feet without finding water.

STUBER AND KUCK COMPANY. The plant of the Stuber and Kuck Company is situated on the easterly side of South Adams Street south of Blaine Street.

A well drilled by Mr. Schilling about 1907 is located approximately 1030 feet south and 810 feet east of the northwest corner of the southwest quarter of Section 17, T. 8 N., R. 8 E. of the 4th P. M. It terminates in gravel at a depth of 65 feet below ground surface which is at

Analysis of Sample Number 73448 from 65-Foot Well.

Determinations Made.		Hypothetical Combinations.	
	Pts. per million.		Pts. per million. Grs. per gallon.
Iron.....Fe	0.0	Sodium Nitrate.....NaNO ₃	73.1 4.26
Manganese..Mn	0.0	Sodium Chloride.....NaCl	17.0 0.99
Silica.....SiO ₂	14.0	Magnesium Chloride....MgCl ₂	22.4 1.31
Turbidity.....	0.0	Magnesium Sulfate.....MgSO ₄	204.7 11.93
Calcium.....Ca	122.0	Magnesium Carbonate..MgCO ₃	5.5 0.32
Magnesium..Mg	48.7	Calcium Carbonate.....CaCO ₃	281.5 16.42
Ammonium..NH ₄	0.01	Calcium Silicate.....CaSiO ₃	27.3 1.59
Sodium.....Na	26.5		
Sulfate.....SO ₄	163.3	Total.....	631.5 36.82
Nitrate.....NO ₃	53.2		
Chloride....Cl	27.0		
Alkalinity as CaCO ₃			
Phenolphthalein..	0.0		
Methyl Orange...	288.0		
Residue.....	642.0		
Total Hardness....	505.0		

elevation 485 feet above sea level. The well is cased with 8-inch pipe with a screen on the lower end.

The well is equipped with a deep-well cylinder pump, the bottom of the working barrel being at a depth of 65 feet. The water which is used for all purposes about the plant had a residue of 642, and a total hardness of 505 parts per million without iron or manganese as shown by the analysis of sample number 73448, collected August 30, 1933.

SULFUR WATER HOUSE BATHING COMPANY. The establishment of the Sulfur Water House Bathing Company was formerly located on the westerly side of N. Adams Street a little north of Hamilton Street. The well is located about 60 feet west of Adams Street and 150 feet north of Hamilton Street in the basement of the garage or approximately 1700 feet east and 1750 feet north of the center of Section 9, T. 8 N., R. 8 E., 4th P. M.

The well as described in U. S. G. S. Bulletin 506 had the following log below a ground surface elevation of 485 feet above sea level.

Materials.	Thickness in feet.	Depth in feet.
Pleistocene—		
Soil	2	2
Sand	10	12
Gravel with boulders	75	87
Pennsylvanian—		
Clay, blue	66	153
Shale, dark	25	178
Shale, blue	48	226
Limestone	3	229
Limestone, soft, light colored	19	248
Sandstone, gray	46	294
Soapstone, hard	8	302
Shale	25	327
Mississippian—		
Limestone	25	352
Limestone, blue, porous	13	365
Limestone, flint	3	368
Limestone, honey combed	1	369
Limestone, flint	7	376
Limestone, porous	15	391
Limestone, sandy	21	412
Limestone, blue	65	477
Devonian—		
Shale, blue	55	532
Limestone, blue	2	534
Shale, blue	194	728
Limestone, blue	46	774
Silurian (niagaran)—		
Sandstone, white	3	777
Limestone, blue with streak of shale	100	877

This same report states that the well flowed 250 gallons per minute in 1912,

At the present time the site is occupied by a garage but the well is still in existence and is located approximately 950 feet south and 1030 feet west of the northeast corner of Section 9, T. 8 N., R. 8 E. of the 4th P. M. The well still flows, most of the water going to waste in the

sewer. A tap on the line about six feet below ground surface provides water in the garage for drinking purposes.

The water had a residue of 3301, a total hardness of 170.5 and an iron content of 0.2 parts per million as shown by the analysis of sample number 80069, collected January 4, 1934. The water had a temperature of 67° F. and a strong sulfur odor and flavor.

Analysis of Sample Number 80069 from the Old Sulfur Water House Well 877 Feet Deep .
Determinations Made. Hypothetical Combinations.

	Pts. per million.		Pts. per million .	Grs. per gallon.
Iron.....Fe	0.2	Sodium Nitrate.....NaNO ₃	0.8	0.05
Manganese...Mn	0.0	Sodium Chloride.....NaCl	2575.2	150.13
Silica.....SiO ₂	8.0	Sodium Sulfate.....Na ₂ SO ₄	299.7	17.47
Turbidity.....	0.0	Sodium Carbonate.....Na ₂ CO ₃	259.0	15.10
Calcium.....Ca	38.3	Ammonium Carbonate..(NH ₄) ₂ CO ₃	4.3	0.25
Magnesium...Mg	18.3	Magnesium Carbonate..MgCO ₃	63.3	3.69
Ammonium...NH ₄	1.7	Calcium Carbonate....CaCO ₃	82.0	4.78
Sodium.....Na	1222.9	Calcium Silicate.....CaSiO ₃	15.7	0.91
Sulfate.....SO ₄	203.0	Iron Oxide.....Fe ₂ O ₃	0.3	0.02
Nitrate.....NO ₃	0.9			
Chloride.....Cl	1562.0	Total.....	3300.3	192.40
Alkalinity as CaCO ₃				
Phenolphthalein..	20.0			
Methyl Orange...	406.0			
Residue.....	3301.0			
Total Hardness....	170.5			

SWIFT AND COMPANY. The plant of Swift and Company is located at 101 Liberty Street.

AVater for condensing purposes in connection with the refrigeration equipment is obtained from a well that is pumped at a rate of 60 gallons per minute over a total of 18 hours during the day.

JOS. SZOLD & SON, INC. Szold's Department Store is located at 2201 South Adams Street.

AVater for use in an air conditioning installation is obtained from a 6-inch well 118 feet deep. The well is equipped with a Pomona deep-well pump which delivers 54° F. water at a rate of 90,000 gallons per day.

THOMAS AND CLARK BAKERY. The plant of Thomas and Clark is situated on the easterly corner of South AVater and Bridge Streets. The well is located approximately 50 feet easterly of Water Street and 110 feet northerly of Bridge Street or 650 feet south and 675 feet east of the center of Section 9, T. 8 N., R. 8 E. of the 4th P. M. It is reported to be 36 feet deep below the basement floor or 44 feet deep below street level and to be cased with 26 feet of 6-inch pipe below which is 3 feet of Cook screen. AVater is obtained from gravel and sand.

The well is equipped with a Chicago, two-stage horizontal centrifugal pump, rated at 25 gallons per minute at 1725 revolutions per minute against a total head of 165 feet. The pump is located in a pit 7 feet deep below the basement floor and takes suction direct from the

well through a 1½-inch suction pipe. The water level in the well changes with river level.

The water had a residue of 730, a total hardness of 513.5 and a manganese content of 0.1 parts per million but no iron as shown by the analysis of sample number 73487, collected September 12, 1933. Water temperature was 62° F. on that date.

Analysis of Sample Number 73487.

Determinations Made.		Hypothetical Combinations.	
	Pts. per million.		Pts. per million. Gra. per gallon.
Iron.....Fe	0.0	Sodium Nitrate.....NaNO ₃	17.9 1.04
Manganese...Mn	0.1	Sodium Chloride.....NaCl	120.5 7.03
Silica.....SiO ₂	10.0	Magnesium Sulfate.....MgSO ₄	196.8 11.48
Turbidity.....	0.0	Calcium Sulfate.....CaSO ₄	64.7 3.78
Calcium.....Ca	140.0	Calcium Carbonate.....CaCO ₃	286.0 16.09
Magnesium...Mg	39.3	Calcium Silicate.....CaSiO ₃	19.2 1.12
Ammonium..NH ₄	trace	Manganese Oxide.....MnO	0.1 0.01
Sodium.....Na	52.2		
Sulfate.....SO ₄	203.0	Total.....	705.2 41.15
Nitrate.....NO ₃	13.3		
Chloride....Cl	73.0		
Alkalinity as CaCO ₃			
Phenolphthalein..	0.0		
Methyl Orange...	286.0		
Residue.....	730.0		
Total Hardness....	513.5		

TOLEDO, PEORIA & WESTERN RAILROAD. The Toledo, Peoria and Western Railroad has two wells located about 150 feet apart in the NW corner of the SE ¼ of the NE ¼ of Section 34, T. 26 N., R. 4 W., 3rd P. M. in East Peoria, Illinois.

The eight-inch well was drilled in 1928 to a depth of 42 feet below ground surface. It is equipped with an electric motor driven Pomona deep-well turbine pump and in November 1933 when pumping alone a rate of 120 gallons per minute was obtained with a drawdown of 13 inches. A rate of 120 gallons per minute was obtained with a drawdown of 4 feet 2 inches when the 10-inch well was producing at a rate of 300 gallons per minute.

The 10-inch well was constructed in 1933 to a depth of 39 feet below ground surface. It is equipped with an electric motor driven Pomona deep-well turbine pump and upon its completion in November 1933 a production rate of 300 gallons per minute was obtained with a drawdown of 9.75 feet when the eight-inch well was idle and a production rate of 300 gallons per minute with a drawdown of 10 feet 10 inches when the eight-inch well was producing 120 gallons per minute.

The water temperature was 53° F. The estimated daily demands from both wells is 115,000 gallons.

HIRAM WALKER & SONS, INC. The plant of Hiram Walker and Sons, Inc. is situated between Water Street and the river at Edmond Street in the southeast quarter of the northeast quarter of Section 17, T. 8 N., R. 8 E. of the 4th P. M. The water supply is obtained from a number of wells.

Well number 1 constructed in the latter part of 1933 by the A. D. Cook Company of Lawrenceburg, Indiana is located about 2040 feet east and 650 feet north of the center of Section 17. At this point the ground surface had an elevation of about 450 feet above sea level. In the construction of the well 8 feet of fill material, 8 feet of yellow clay, 14 feet of dry sand, and 27 feet of water-bearing sand and gravel was penetrated.

The well was cased with 37 feet of 26-inch pipe and 20 feet of Cook red brass screen with 3/16-inch slots. A 15-inch thick filter wall of selected and washed gravel was placed about the screen section.

A preliminary test of the well upon completion gave a production of 3700 gallons per minute with a 7-foot drawdown below a static water level of 29 feet. On October 27 and November 2, 1934 other tests gave a production rate of 1800 gallons per minute with a drawdown of 2 feet below a static level of 31 feet. A water temperature of 67° P. was observed.

At the time of the last tests the well had been equipped with the permanent pump installation consisting of a Cook deep-well turbine pump having an assembly of 40 feet of 10-inch column pipe, three stages of 16-inch bowls with all bronze impellers, and 5 feet 10-inch suction pipe with a metal basket strainer on the end. The pump was direct connected to a 150-horsepower U. S. electric motor having a normal speed of 1800 revolutions per minute. A 1/8-inch air line extends to a depth of 49 feet below the pump base.

Well number 2 located about 2550 feet east and 1100 feet north of the center of Section 17 was completed by the A. D. Cook Company in January 1934. It is 53 feet deep and cased with 33 feet of 26-inch pipe and 20 feet of Cook brass screen with 3/16-inch slots. In the construction of the well 15 feet of fill and cinders, 15 feet of dry gravel, and 23 feet of water-bearing gravel was penetrated. A 15-inch thick filter wall of selected and washed gravel was placed about the screen section.

On preliminary test the well produced 2100 gallons per minute with a drawdown of 2.5 feet from a static water level of 30 feet. No effect on water level in well number 1, some 900 feet distant, was observed during the test.

The well was equipped with a Cook deep-well turbine pump consisting of 40 feet of 10-inch column pipe, three stages of 16-inch bowls, and 5 feet of 10-inch suction pipe with a basket strainer on the bottom. A 1/8-inch air line extends to a depth of 48 feet below the pump base. The pump is direct connected to a 150-horsepower U. S. Electric motor which operates at a normal speed of 1800 revolutions per minute.

Additional tests made on October 27 and November 2, 1934 with the permanent pump installation gave a production rate of 1800 gallons per minute with a drawdown of 2 feet from a static water level of 33 feet.

The water had a residue of 634, a total hardness of 441, an iron content of 0.15 and a manganese content of 0.10 parts per million as shown by the analysis of sample number 74106, collected January 17, 1934, at the end of seven hours' pumping. The water temperature was 52° F. on this date.

Analysis of Sample Number 74106 from Well Number 2, Depth 53 Feet.
Determinations Made. Hypothetical Combinations.

	Pts. per million.		Pts. per million.	Grs. per gallon.
Iron.....Fe	0.15	Sodium Nitrate.....NaNO ₃	9.4	0.55
Manganese..Mn	0.1	Sodium Chloride.....NaCl	28.1	1.64
Silica.....SiO ₂	10.0	Sodium Sulfate.....Na ₂ SO ₄	78.1	4.55
Turbidity.....	0.0	Magnesium Sulfate....MgSO ₄	130.0	7.58
Calcium....Ca	133.2	Calcium Sulfate.....CaSO ₄	102.2	5.95
Magnesium..Mg	26.3	Calcium Carbonate....CaCO ₃	258.0	15.04
Ammonium..NH ₄	0.01	Iron Oxide.....Fe ₂ O ₃	0.2	0.01
Sodium....Na	38.9	Magnesium Oxide.....MnO	0.1	0.01
Sulfate....SO ₄	228.9	Silica.....SiO ₂	10.0	0.58
Nitrate....NO ₃	7.1			
Chloride....Cl	17.0	Total.....	616.1	35.91
Alkalinity as CaCO ₃				
Phenolphthalein..	0.0			
Methyl Orange...	258.0			
Residue.....	634.0			
Total Hardness....	441.0			

Well number 3 was completed in 1934 by the A. D. Cook Company at a location about 2150 feet east and 1320 feet north of the center of Section 17. In the construction of the well 2 feet of fill, 7 feet of yellow clay, 26 feet of dry gravel, 15 feet of water-bearing gravel and 6 feet of water-bearing gravel and boulders was penetrated. Blue clay was found below 56½ feet.

The well is cased with 36 feet of 26-inch pipe and 20 feet of 26-inch Cook red brass screen with 3/16-inch slots. Surrounding the screen is a 15-inch thick filter wall of selected washed gravel.

The well was equipped with a Cook deep-well turbine pump, the assembly of which consisted of 40 feet of 10-inch column pipe, three stages of 16-inch bowls and 5 feet of 10-inch suction pipe with a basket screen on the bottom. A 1/8-inch air line extends to a depth of 48 feet below the pump base.

A preliminary production test made upon completion of the well gave a rate of 2500 gallons per minute with a drawdown of 4 feet below static water level of 30 feet. Additional tests made on October 27 and November 2, 1934 with the permanent pump installation gave a production rate of 1800 gallons per minute with a drawdown of 2 feet from a static water level of 33 feet.

Well number 4 was completed late in 1934 by A. D. Cook Company at a location about 1720 feet east and 330 feet north of the center of Section 17. In the construction of the well 5 feet of fill, 5 feet of sand, gravel and clay, 1 foot of cemented sand and gravel, 16 feet of dry gravel and 26½ feet of water-bearing gravel was penetrated.

ISAAC WALKER HARDWARE COMPANY. The plant of the Isaac Walker Hardware Company is situated on the southerly corner of the intersection of Washington and Oak Streets. The well is located approximately 1320 feet south and 750 feet west of the center of Section 9, T. 8 N., R. 8 E. It is reported to be 100 feet deep below the basement floor which in turn is about 476 feet above mean sea level and 15 feet

below street grade on Washington Street. The well terminates in sand and gravel and is cased with 6-inch casing.

The well is equipped with an A. D. Cook deep-well cylinder pump, the cylinder having a setting of 40 feet below the basement floor. Static water level was reported on August 31, 1933 to be 15 feet below basement floor level. The water is used only for toilet flushing. The pump operates only about one hour per day to keep the pressure tank full.

WILSON PROVISION COMPANY. The plant of the Wilson Provision Company, situated in the northwest quarter of the southeast quarter of Section 17, T. 8 N., E. 8 E. of the 4th P. M., is supplied with water from five wells all situated within a circle of 100-foot diameter and located approximately 240 feet south and 980 feet east of the center of Section 17.

All the wells are 70 feet deep and are cased with 3-inch pipe. Water is obtained from sand and gravel. The wells are all interconnected and are pumped by direct suction with a steam pump for 24 hours per day. The rate of pumping, depending on the demand, varies between 350 and 500 gallons per minute. The water is used only for industrial and drinking purposes, softened river water being used in the boilers.

The water had a residue of 606, and a total hardness of 470.5 parts per million, with a trace of manganese but no iron as shown by the analysis of sample number 80065, collected January 5, 1934. The temperature of the water was 51° F. on this date but on August 31, 1933 it was 58° P.

Analysis of Sample Number 80065.

Determinations Made.		Hypothetical Combinations.		
	Pts. per million.		Pts. per million.	Grs. per gallon.
Iron.....Fe	0.0	Sodium Nitrate.....NaNO ₃	45.0	2.62
Manganese..Mn	trace	Sodium Chloride.....NaCl	31.6	1.84
Silica.....SiO ₂	10.0	Sodium Sulfate.....Na ₂ SO ₄	28.4	1.66
Turbidity.....	0.0	Magnesium Sulfate.....MgSO ₄	186.6	10.88
Calcium.....Ca	126.3	Calcium Sulfate.....CaSO ₄	53.1	3.10
Magnesium..Mg	37.7	Calcium Carbonate.....CaCO ₃	260.0	15.16
Ammonium..NH ₄	0.01	Calcium Silicate.....CaSiO ₃	19.2	1.12
Sodium.....Na	33.8			
Sulfate.....SO ₄	205.6	Total.....	623.9	36.38
Nitrate.....NO ₃	32.8			
Chloride....Cl	19.0			
Alkalinity as CaCO ₃				
Phenolphthalein..	0.0			
Methyl Orange...	260.0			
Residue.....	606.0			
Total Hardness....	470.5			

WATER SUPPLIES OF PEORIA-PEKIN DISTRICT LYING IN TAZEVELL COUNTY.

AMEEICAN DISTILLING COMPANY. The plant of the American Distilling Company at Pekin, Illinois is situated in the westerly part of the south half of the southeast $\frac{1}{4}$ of Section 4, T. 24 N., E. 5 W. of the 3rd P. M., on the east hank of Illinois Eiver.

Prior to 1933 water was obtained from three wells located within 50 feet of each other at a location approximately 1945 feet west and 465 feet north of the southeast corner of Section 4.

Two of the wells now known as the wine room wells were constructed in 1930 by Mr. Schilling of Peoria to a depth of 85 feet where shale was found. They are cased with 65 feet of 12-inch pipe and 20 feet of 12-inch screen. On December 20, 1933 static water level was reported as 21 feet below the well top and the water temperature as 56° F. Each well was pumped by direct suction by a duplex steam pump at a rate of 800 gallons per minute. The pumps were set in a pit and the suction pipes entered the wells at a point 5 feet below the top.

The third well of this group is an open well 6 feet in diameter. It is known as well number 3. Several small steam pumps took direct suction from this well but were operated but little however. All three of these wells have now been abandoned.

The water from the two 85-foot wells had a total residue of 571, a total hardness of 454, a content of iron of 0.1 and of manganese of 0.8 parts per million as shown by the analysis of sample number 74010, collected December 20, 1933.

Analysis of Sample Number 74010 from the Two Older 85-Foot Wells.

Determinations Made.	Pts. per million.	Hypothetical Combinations.	Pts. per million.	Grs. per gallon.
Iron Fe	0.1	Sodium Nitrate NaNO ₃	6.8	0.40
Manganese . . Mn	0.8	Sodium Chloride NaCl	28.1	1.64
Silica SiO ₂	9.0	Sodium Sulfate Na ₂ SO ₄	33.4	1.95
Turbidity	0.0	Ammonium Sulfate (NH ₄) ₂ SO ₄	2.0	0.12
Calcium Ca	118.8	Magnesium Sulfate MgSO ₄	189.0	11.03
Magnesium . . Mg	38.2	Calcium Sulfate CaSO ₄	57.2	3.34
Ammonium . . NH ₄	0.6	Calcium Carbonate CaCO ₃	240.0	14.00
Sodium Na	23.7	Calcium Silicate CaSiO ₃	17.4	1.02
Sulfate SO ₄	215.5	Iron Oxide Fe ₂ O ₃	0.1	0.01
Nitrate NO ₃	4.8	Manganese Oxide MnO	1.0	0.06
Chloride Cl	17.0			
Alkalinity as CaCO ₃		Total	575.0	33.57
Phenolphthalein . .	0.0			
Methyl Orange . . .	240.0			
Residue	571.0			
Total Hardness . . .	454.0			

In 1933 M. Ebert and Son of Washington, Illinois, constructed two wells to a depth of 85 feet which are now known as wells numbers 1 and 2.

Well number 1 is located approximately 1500 feet west and 755 feet north of the southeast corner of Section 4. It is cased with 65 feet of 24-inch pipe and 20 feet of 24-inch screen. The pumping equipment consists of a Peerless deep-well turbine pump direct connected to a 150-horsepower General Electric electric motor. The unit operates at a speed of 1200 revolutions per minute and delivers water at the rate of 2000 gallons per minute.

The water has a total mineral content of 463, a total hardness of 411, and a content of iron of 0.2 parts per million as shown by the analysis of sample number 88358, collected July 15, 1940.

Analysis of Sample Number 88358 from Well Number 1.
Determinations Made.

	Pts. per million.
Turbidity.....	0
Color.....	0
Odor.....	0
Iron..... Fe	
(unfiltered).....	0.2
Chloride... Cl	30.0
Sulfate..... SO ₄	110.5
Alkalinity as CaCO ₃	
Phenolphthalein.....	0.0
Methyl Orange.....	280.0
Calcium... Ca	101.1
Magnesium.. Mg	38.4
Total hardness.....	411.0
Total mineral content.....	463.0
pH = 7.1	

Well number 2 is located approximately 1620 feet west and 675 feet north of the southeast corner of Section 4. It also is cased with 65 feet of 24-inch pipe and 20 feet of 24-inch screen. The well is equipped with a Peerless deep-well turbine pump which delivers at a rate of 1000 gallons per minute.

Well number 3 was a large diameter dug well, but has now been abandoned.

Well number 4 was constructed in 1936 at a site approximately 2060 feet west and 125 feet north of the southeast corner of Section 4 by M. Ebert and Son of Washington, Illinois, to a depth of 80.5 feet. It is cased with 50.5 feet of 20-inch pipe and 30 feet of 20-inch screen. The well is equipped with a Peerless deep-well turbine pump direct connected to a 150-horsepower electric motor. The pump delivers water at the rate of 2500 gallons per minute. On test the well produced 3000 g.p.m. with a drawdown of 20.6 feet.

The water has a total mineral content of 456, a total hardness of 421, and a content of iron of 0.5 parts per million as is shown by the analysis of sample number 88357, collected July 15, 1940.

Analysis of Sample Number 88357 from Well Number 4.
Determinations Made.

	Pts. per million.
Turbidity.....	.20
Color.....	.0
Odor.....	.0
Iron..... Fe	
(filtered).....	.01
(unfiltered).....	.05
Chloride.... Cl	21.0
Sulfate.... SO ₄	105.7
Alkalinity as CaCO ₃	
Phenolphthalein.....	.00
Methyl Orange.....	292.0
Calcium.... Ca	110.9
Magnesium.. Mg	35.0
Total hardness.....	421.0
Total mineral content.....	456.0
pH = 6.9	

W. B. AYDECOTT SALT WELL. This well was drilled prior to 1916. It is located approximately 700 feet west and 500 feet north of the southeast corner of Section 20, T. 24 N., E. 4 W. of the 3rd P. M. The reported depth is 757 feet. The State Geological Survey has a log.

A boiler analysis was made of a sample of water in 1916 and reported by letter dated May 29, 1916 by Dr. Edward Bartow. This sample, number 33625, was reported as containing:

Residue by evaporation.....	10,528 parts per million
Chloride.....	6,500 parts per million
Alkalinity as CaCO ₃	490 parts per million

W. A. BOLEY ICE COMPANY. The plant of the Boley Ice Company, situated at 230 Fayette Street, Pekin, Illinois is supplied with water from a well 104 feet deep constructed by M. Ebert and Son of Washington, Illinois in 1923. The well is located approximately 25 feet west of the west line of Third Street and 100 feet south of the south line of Fayette Street or 460 feet south and 1685 feet west of the northeast corner of Section 3, T. 24 N., R. 5 W. of the 3rd P. M. It is cased with 90 feet of 6-inch casing and 14 feet of 6-inch screen. When completed static water level was 26 feet below the ground surface but it is reported that the stage of the river affects the well water level.

The well is equipped with a Pomona 6-inch two-stage deep-well turbine pump the assembly of which consists of 35 feet of column pipe, two stages of bowls having an over-all length of 3 feet and 3 feet of perforated suction pipe. The pump is direct connected to a 10-horse-power induction motor which operates at a normal speed of 3500 revolutions per minute. The unit is rated to deliver 250 gallons per minute against a total head of 84 feet.

The water had a residue of 364, and a total hardness of 321 parts per million with a trace of iron but no manganese as shown by the analysis of sample number 73995, collected December 19, 1933. It is used for general purposes throughout the plant as well as for the making of ice. A lime soda water softener is used.

Analysis of Sample Number 73995.

Determinations Made.		Hypothetical Combinations.	
	Pts. per million.		Pts. per million. Grs. per gallon.
Iron.....Fe	trace	Sodium Nitrate.....NaNO ₃	25.5 1.49
Manganese..Mn	0.0	Sodium Chloride.....NaCl	12.9 0.75
Silica.....SiO ₂	9.0	Magnesium Chloride...MgCl ₂	4.3 0.25
Turbidity.....	0.0	Magnesium Sulfate....MgSO ₄	71.6 4.18
Calcium.....Ca	75.5	Magnesium Carbonate..MgCO ₃	57.8 3.37
Magnesium..Mg	32.3	Calcium Carbonate....CaCO ₃	173.5 10.12
Ammonium..NH ₄	trace	Calcium Silicate.....CaSiO ₃	17.4 1.02
Sodium.....Na	12.0		
Sulfate.....SO ₄	57.2	Total.....	363.0 21.18
Nitrate.....NO ₃	18.6		
Chloride....Cl	11.0		
Alkalinity as CaCO ₃			
Phenolphthalein..	0.0		
Methyl Orange...	242.0		
Residue.....	304.0		
Total hardness.....	321.0		

CATERPILLAR TRACTOR COMPANY. The water supply for the Caterpillar Tractor Company which is situated in the northeast quarter of Section 32, T. 26 N, R. 4 W. of the 3rd P. M. in East Peoria, Illinois is obtained from seven wells varying in depth from 56 feet to 64 feet below a ground surface elevation of approximately 452 feet above sea level.

Well number 1 was constructed at the time the Holt Manufacturing Company, the predecessor of the Caterpillar Tractor Company, established their plant in East Peoria. The well is located approximately 1750 feet west and 750 feet south of the northeast corner of Section 32, and is reported to be 60 feet deep, though the record of its construction is not available.

Well number 2, also constructed by the Holt Manufacturing Company, is located approximately 1740 feet west and 770 feet south of the northeast corner of Section 32. It is reported to be 59 feet deep but the construction record is not available.

Well number 3 was constructed in 1926 by Mr. Schilling for the Caterpillar Tractor Company. It is located within 30 feet of wells numbers 1 and 2 at the power house and is approximately 1770 feet west and 770 feet south of the northeast corner of Section 32. In its construction the well penetrated the following materials.

Materials.	Thickness in feet.	Depth in feet.
Soil.....	.14	14
Medium gravel.....	.15	15.5
Fine gravel and sand.....	2.5	18
Fine gravel with less sand.....	.7	25
Fine gravel with concrete mixture.....	.9	34
Clay.....	.3	37
Gravel with coarse sand.....	.3	40
Clay and sand.....	.8	48
Gravel, some large.....	.8	56
Clay, blue.....	.17	73

Well number 4 was constructed in 1926 by Mr. Schilling of Peoria. It is located approximately 1660 feet west and 1575 feet south of the

northeast corner of Section 32. In its construction the following materials were penetrated.

Materials.	Thickness in feet.	Depth in feet.
Soil	10	10
Blue clay	18	28
Blue clay and sand	4	32
Gravel	8	40
Dirty sand and gravel	4	44
Clean sand and gravel	16	60
Sand	15	61.5
Clean sand and gravel	2	63.5

The well is equipped with an Ingersall-Kand single-stage centrifugal pump that draws water by direct suction from the well at a rate of 400 gallons per minute. The pump is direct connected to a 20-horsepower electric motor which operates at a full load speed of 1765 revolutions per minute.

The water had a residue of 1406, and a total hardness of 779 parts per million with no iron or manganese as shown by the analysis of sample number 73492, collected September 12, 1933.

Analysis of Sample Number 73492 from Well Number 4.

Determinations Made.		Hypothetical Combinations.	
	Pts. per million.		Pts. per million.
Iron Fe	0.0	Sodium Chloride NaCl	47.9
Manganese Mn	0.0	Sodium Sulfate Na ₂ SO ₄	435.4
Silica SiO ₂	14.0	Magnesium Sulfate MgSO ₄	362.9
Turbidity	0.0	Calcium Sulfate CaSO ₄	108.9
Calcium Ca	191.0	Calcium Carbonate CaCO ₃	374.3
Magnesium Mg	73.5	Calcium Silicate CaSiO ₃	27.3
Ammonium NH ₄	trace		
Sodium Na	168.2	Total	1356.7
Sulfate SO ₄	660.0		79.06
Nitrate NO ₃	0.2		
Chloride Cl	29.0		
Alkalinity as CaCO ₃			
Phenolphthalein	0.0		
Methyl Orange	374.0		
Residue	1406.0		
Total Hardness	779.0		

Well number 5 was drilled in 1928 by Mr. Schilling of Peoria to a depth of 64 feet. It is located approximately 1350 feet east and 665 feet south of the northwest corner of Section 32. A log of the materials penetrated is as follows:

Materials.	Thickness in feet.	Depth in feet.
Till material	12	12
Black earth	3	15
Yellow clay	13	28
Blue clay and sand	2	30
Blue clay	9	39
Blue clay and sand	9	48
Sand and fine gravel	3	51
Coarse gravel	5	56
Coarse clean gravel	8	64

Well number 6 was drilled in 1928 by Mr. Schilling of Peoria to a depth of 64 feet. It is located 1300 feet east and 625 feet south of the northwest corner of Section 32. A log of the material penetrated is as follows:

Materials.	Thickness in feet.	Depth in feet.
Till.....	12	12
Black earth.....	3	15
Yellow clay.....	13	28
Blue clay and sand.....	2	30
Blue clay.....	9	39
Blue clay and sand.....	9	48
Sand and fine gravel.....	3	51
Coarse gravel.....	5	56
Coarse clean gravel.....	8	64

The suction pipes from wells numbers 5 and 6 are joined together outside the small pump house and the single pipe within the pump house serves as a common suction pipe for two Ingersall Rand single stage centrifugal pumps, each rated at 400 gallons per minute. Each pump is direct connected to a 20-horsepower electric motor which operates at a full load speed of 1765 revolutions per minute. Each pump, however, has a separate discharge pipe.

The water from wells 5 and 6 had a residue of 790, a total hardness of 492, and an iron content of 3.0 parts per million without manganese, as shown by the analysis of sample number 73493, collected September 12, 1933, from the discharge of one of the pumps.

Analysis of Sample Number 73493 from Wells Numbers 5 and 6.

Determinations Made.		Hypothetical Combinations.	
	Pts. per million.		Pts. per million.
Iron..... Fe	3.0	Sodium Nitrate..... NaNO ₃	3.4
Manganese... Mn	0.0	Sodium Chloride..... NaCl	198.9
Silica..... SiO ₂	15.0	Sodium Sulfate..... Na ₂ SO ₄	77.5
Turbidity.....	25.0	Ammonium Sulfate..... (NH ₄) ₂ SO ₄	1.3
Calcium..... Ca	116.8	Magnesium Sulfate..... MgSO ₄	150.5
Magnesium... Mg	48.8	Magnesium Carbonate... MgCO ₃	63.3
Ammonium... NH ₄	0.3	Calcium Carbonate..... CaCO ₃	267.2
Sodium..... Na	104.2	Calcium Silicate..... CaSiO ₃	29.0
Sulfate..... SO ₄	176.5	Iron Oxide..... Fe ₂ O ₃	4.3
Nitrate..... NO ₃	2.2		
Chloride..... Cl	120.6	Total.....	795.4
Alkalinity as CaCO ₃			46.39
Phenolphthalein...	0.0		
Methyl Orange...	342.0		
Residue.....	790.0		
Total Hardness....	492.0		

Well number 7 was constructed in 1930 to a final depth of 51.5 feet. It is located approximately 1785 feet west and 675 feet south of the northeast corner of Section 32. A log of the material penetrated is as follows:

Materials.	Thickness in feet.	Depth in feet.
Soil.....	14	14
Gravel minimum.....	4	18
Blue clay.....	6	24
Sand and gravel.....	6½	30½
Sand and clay.....	5½	36
Gravel, fine.....	4	40
Coarse sand.....	4	44
Coarse gravel some 4".....	7½	51½
For five feet below bottom thin layers of sand, clay and gravel were found.		

CENTRAL ILLINOIS LIGHT COMPANY. The well at the Central Illinois Light Company at East Peoria is located in the basement of the building at a point about 595 feet west and 585 feet south of the northeast corner of Section 32, T. 26 N., E. 4 W. of the 3rd P. M., in East Peoria, Illinois. It was constructed in August, 1937, by M. Ebert and Son of Washington, Illinois, to a depth of 63 feet below the basement floor and is cased with 3-inch pipe. The basement floor is at elevation 455.6 feet above mean sea level and 7 feet below ground level. The well penetrated sandy loam and sand for most of the depth, but at the bottom a fine gravel was penetrated.

The well is equipped with a "Burk turbine" which takes direct suction through a 2½-inch suction pipe. Static water level is 8 feet below the basement floor level and a drawdown of one foot takes place when pumping at 4 gallons per minute for a 12-hour period. The pump operates intermittently throughout a 24-hour day. The water is used for cooling the electrical equipment.

The water had a residue of 640, and a total hardness of 400 parts per million without iron or manganese, as shown by the analysis of sample number 86337, collected September 16, 1939.

Analysis of Sample Number 86337 from Well at
Central Illinois Light Company Plant.
Determinations Made.

	Pts. per million.
Iron..... Fe	
(filtered).....	0.0
(unfiltered).....	0.0
Manganese..... Mn	0.0
Turbidity.....	2
Odor.....	0
Color.....	0
Chloride.... Cl	78.0
Sulfate.... SO ₄	144.4
Alkalinity as CaCO ₃	
Phenolphthalein.....	0.0
Methyl Orange.....	292.0
Residue.....	640.0
Total Hardness.....	400.7

COEN PRODUCTS REFINING COMPANY. The Corn Products Refining Company at Pekin, Illinois, is situated northwesterly of the Chicago and Illinois Midland Railroad in the southwest quarter of Section 3 and the southeast quarter of Section 4, T. 24 N., R. 5

W., 3rd P. M. Water is supplied from two groups of wells. One group of twelve wells is located in a pit 16 feet wide by 30 feet long by 12 feet deep. This group is situated approximately 500 feet east and 650 feet north of the southwest corner of Section 3.

The wells were all constructed by M. Ebert and Son of Washington, Illinois, about 1913 and vary in depth from 78 feet to 90 feet below ground level. Each well is cased with 8-inch pipe and has 40 feet of 8-inch screen in the bottom.

The wells are connected into a single suction header, which in turn is connected to a steam engine powered horizontal centrifugal pump. Static water level in 1933 was reported as 15 feet below the pit floor or 27 feet below ground surface, and in that year the daily extraction varied between 900,000 and 1,250,000 gallons.

The water from this group had a residue of 482 and a total hardness of 395.5 parts per million without iron or manganese, as shown by the analysis of sample number 74008, collected December 20, 1933, from the discharge pipe of the common pump. The temperature of the water was 56° P.

Analysis of Sample Number 74008 from a Group of Twelve Wells.				
Determinations Made.		Hypothetical Combinations.		
	Pts. per million.			
		Pts. per million.	Grs. per gallon.	
Iron.....Fe		Sodium Nitrate.....NaNO ₃	28.9	1.69
(filtered).....	0.0	Sodium Chloride.....NaCl	19.9	1.16
(unfiltered).....	0.0	Sodium Sulfate.....Na ₂ SO ₄	0.7	0.04
Manganese..Mn	0.0	Magnesium Sulfate.....MgSO ₄	159.6	9.31
Silica.....SiO ₂	9.0	Magnesium Carbonate..MgCO ₃	4.6	0.27
Turbidity.....	0.0	Calcium Carbonate.....CaCO ₃	242.5	14.15
Calcium.....Ca	103.1	Calcium Silicate.....CaSiO ₃	17.4	1.02
Manganese..Mg	33.6			
Ammonium..NH ₄	trace	Total.....	473.6	27.64
Sodium.....Na	15.9			
Sulfate.....SO ₄	127.9			
Nitrate.....NO ₃	21.2			
Chloride....Cl	12.0			
Alkalinity as CaCO ₃				
Phenolphthalein..	0.0			
Methyl Orange...	248.0			
Residue.....	482.0			
Total Hardness....	395.5			

The second group consists of four wells located in a circular pit approximately 460 feet east and 475 feet north of the southwest corner of Section 3, T. 24 N., R. 5 W., 3rd P. M. This pit is 14 feet in diameter by 25 feet deep and the four wells are arranged around the wall. All wells are joined to a common suction and are pumped by a horizontal centrifugal pump at a rate of 700,000 to 800,000 gallons per day.

The wells are all about 80 feet deep below the ground surface and are cased with 8-inch pipe and with 40 feet of 8-inch screen in the lower portion. Static water level was reported in 1933 as about 27 feet below the ground surface, or two feet below the floor of the pit.

The water had a residue of 476, a total hardness of 384, an iron content of 0.1, and manganese 0.1 parts per million, as shown by the

analysis of sample number 73992, collected from the discharge pipe of the pump December 20, 1933.

Analysis of Sample Number 73992 from a Group of Four Wells.
Determinations Made. Hypothetical Combinations.

	Pts. per million.		Pts. per million.	Grs. per gallon.
Iron.....Fe	0.1	Sodium Nitrate.....NaNO ₃	17.0	0.99
Manganese..Mn	0.1	Sodium Chloride.....NaCl	16.4	0.96
Silica.....SiO ₂	9.0	Sodium Sulfate.....Na ₂ SO ₄	15.6	0.91
Turbidity.....	0.0	Magnesium Sulfate.....MgSO ₄	148.2	8.64
Calcium.....Ca	95.3	Magnesium Carbonate..MgCO ₃	19.4	1.13
Magnesium..Mg	35.5	Calcium Carbonate.....CaCO ₃	223.0	13.00
Ammonium..NH ₄	trace	Calcium Silicate.....CaSiO ₃	17.4	1.02
Sodium.....Na	16.1	Iron Oxide.....Fe ₂ O ₃	0.1	0.01
Sulfate.....SO ₄	129.4	Manganese Oxide.....MnO	0.2	0.01
Nitrate.....NO ₃	12.4			
Chloride....Cl	10.0	Total.....	457.3	26.67
Alkalinity as CaCO ₃				
Phenolphthalein..	0.0			
Methyl Orange...	246.0			
Residue.....	476.0			
Total Hardness....	384.0			

CREVE COEUR. The public water supply system of Creve Coeur, Illinois, was established in 1937. In that year a 6-inch test well was drilled to a depth of 78 feet by M. Ebert and Son of Washington, Illinois at a site approximately 2800 feet north and 600 feet west of the southeast corner of Section 1, T. 25 N., R. 5 W. of the 3rd P. M. The driller reported no sand or gravel but that the well penetrated tough blue clay containing a little sand at the bottom.

A production test of two hours' duration indicated that the test well would produce continuously 135 gallons per minute with a drawdown of only 10 feet from a static level of 21 feet below the ground surface.

Analysis of Sample Number 81704 from 78-Foot Test Well.
Determinations Made. Hypothetical Combinations.

	Pts. per million.		Pts. per million.	Grs. per gallon.
Iron.....Fe		Sodium Nitrate.....NaNO ₃	19.5	1.14
(filtered).....	0.0	Sodium Chloride.....NaCl	24.6	1.43
(unfiltered).....	0.0	Sodium Sulfate.....Na ₂ SO ₄	5.0	0.29
Manganese..Mn	0.0	Magnesium Sulfate.....MgSO ₄	974.0	56.80
Silica.....SiO ₂	10.0	Calcium Sulfate.....CaSO ₄	337.0	19.64
Turbidity.....	0.0	Calcium Carbonate.....CaCO ₃	425.1	24.78
Calcium.....Ca	271.0	Silica.....SiO ₂	10.0	0.58
Magnesium..Mg	196.9			
Sodium.....Na	16.6	Total.....	1795.2	104.66
Sulfate.....SO ₄	1018.0			
Nitrate.....NO ₃	14.2			
Chloride....Cl	15.0			
Alkalinity as CaCO ₃				
Phenolphthalein..	0.0			
Methyl Orange...	430.0			
*Residue.....	2037.0			
Total Hardness....	1487.0			

* High residue due to water of crystallization.

However the water was unsatisfactory because of its high mineral content.

The water had a residue of 2037, and a total hardness of 1487 parts per million without iron or manganese as shown by the analysis of sample number 81704, collected August 2, 1937 at the time of the test.

At the time test well number 1 was being drilled work was in progress on the Peoria lock and dam on the east side of the river in Section 12. It had been observed that much pumping was required to dewater the cofferdams and that the contractor had been able to get a satisfactory well for construction use at a depth of 43 feet. This well was located, about 150 feet westerly of the Peoria and Pekin Union Railroad, approximately 3200 feet west and 2600 feet north of the southeast corner of Section 12, T. 25 N., R. 5 W. of the 3rd P. M.

The water from this well had a residue of 552, and a total hardness of 437.5 parts per million without either iron or manganese as shown by the analysis of sample number 82302, collected November 10, 1937.

Analysis of Sample Number 82302.

Determinations Made.		Hypothetical Combinations.		
	Pts. per million.		Pts. per million.	Grs. per gallon.
Iron.....Fe	0.0	Sodium Nitrate.....NaNO ₃	6.8	0.40
Manganese...Mn	0.0	Sodium Chloride.....NaCl	1.8	0.10
Silica.....SiO ₂	14.0	Sodium Sulfate.....Na ₂ SO ₄	44.7	2.61
Turbidity.....	0.0	Magnesium Sulfate....MgSO ₄	155.8	9.08
Color.....	0.0	Magnesium Carbonate..MgCO ₃	29.1	1.70
Odor.....	0.0	Calcium Carbonate....CaCO ₃	273.8	15.94
Calcium.....Ca	109.4	Silica.....SiO ₂	14.0	0.82
Magnesium...Mg	39.8			
Ammonium...NH ₄	trace	Total.....	526.0	30.65
Sodium.....Na	17.0			
Sulfate.....SO ₄	155.0			
Nitrate.....NO ₃	4.9			
Chloride....Cl	1.0			
Alkalinity as CaCO ₃				
Phenolphthalein..	0.0			
Methyl Orange...	308.0			
Residue.....	552.0			
Total Hardness....	437.5			

Since the quality of the water from this construction camp well was so superior to that found in the village test well number 1 a test well was drilled in the near vicinity at a site approximately 2700 feet west and 2500 feet north of the southwest corner of Section 12, T. 25 N., R. 5 W., of the 3rd P. M. This test well, number 2, was 80 feet deep and cased with 68 feet of 6-inch pipe and 12 feet of number 25-slot screen. On test the well produced 125 gallons per minute with a drawdown of 12.5 feet below a static water level of 13 feet below ground surface.

On the strength of this showing a permanent well was constructed in 1937 by M. Ebert and Son at the same location to a depth of 91 feet. It is cased with 71 feet of 15-inch pipe and 20 feet of 15-inch Johnson screen. The upper 10 feet of the screen has number 20 slots while the lower 10 feet has number 25 slots. Static water level was 19 feet below ground surface and was lowered 11 feet with a pumping rate of 200 gallons per minute.

The well is equipped with a 20-stage, 8-inch Fairbanks-Morse deep-well turbine pump, the assembly of which consists of 30 feet of 6-inch column pipe, 15 feet of bowls, 10 feet of 6-inch suction pipe and 2 feet of strainer. The pump is direct connected to a Fairbanks-Morse 40-horsepower electric motor.

Water is pumped from the well directly into the distribution system and a 100,000-gallon elevated steel tank located on high ground in the village. The plant was put into service May 1, 1938 and on July 21, 1938 the average daily pumpage had reached 75,000 to 80,000 gallons, the discharge meter indicating a pumping rate of 290 gallons per minute.

The water had a residue of 647, and a total hardness of 485.5 parts per million, without iron or manganese as is shown by the analysis of sample number 83853, collected July 21, 1938.

Analysis of Sample Number 83853 from Creve Coeur Village Well 91 Feet Deep.
Determinations Made. Hypothetical Combinations.

	Pts. per million.		Pts. per million.	Grs. per gallon.
Iron..... Fe		Sodium Nitrate..... NaNO ₃	7.7	0.45
(filtered).....	0.0	Sodium Chloride..... NaCl	18.1	1.05
(unfiltered).....	0.0	Sodium Sulfate..... Na ₂ SO ₄	41.2	2.40
Manganese... Mn	0.0	Magnesium Sulfate.... MgSO ₄	214.0	12.48
Silica..... SiO ₂	22.0	Magnesium Carbonate.. MgCO ₃	25.3	1.47
Turbidity.....	0.0	Calcium Carbonate.... CaCO ₃	278.1	16.22
Color.....	0.0	Silica..... SiO ₂	22.0	1.28
Odor.....	0.0			
Calcium..... Ca	111.3	Total.....	606.4	35.35
Magnesium... Mg	50.5			
Ammonium... NH ₄	trace			
Sodium..... Na	22.5			
Sulfate..... SO ₄	198.6			
Nitrate..... NO ₃	5.7			
Chloride.... Cl	11.0			
Alkalinity as CaCO ₃				
Phenolphthalein..	0.0			
Methyl Orange...	308.0			
Residue.....	647.0			
Total Hardness....	485.5			

EAST PEORIA. The public water supply system of East Peoria, Illinois, was established in 1916. The water works station is located on property on the southerly corner of the intersection of East Washington Street and Bloomington Road approximately 1650 feet west and 1550 feet north of the southeast corner of Section 33, T. 26 N., R. 4 W., of the 3rd P. M. Four wells were constructed on the AVashington Street side of the station. Each was 25 feet deep and cased with 13 feet of 6-inch casing and 12 feet of Cook, 6-inch, number 10-slot screens. They penetrate 2 to 3 feet of loam and 22 to 23 feet of water-bearing sand and gravel. In 1917 the static or nonpumping water level was reported as 6 or 8 feet below the ground surface.

The original pump installation consisted of two Goulds 8¼-inch by 10-inch triplex pumps. The piping was so arranged that water could be drawn by suction by either or both pumps and discharged either into the surface storage reservoir or the distribution system. The arrange-

merit also permitted the drawing of water from the surface reservoir and discharging it into the distribution system by either or both pumps.

In 1918 four additional wells were constructed on the same side of the pumping station. These were all 25 feet deep, three being cased with 19 feet of 6-inch pipe and 6 feet of 6-inch Cook screen and the fourth with 19 feet of 8-inch pipe and 6 feet of 8-inch Cook screen. These wells were all connected into a single suction header and could be pumped as desired by the original triplex pumps. In 1922 the average daily pumpage was about 210,000 gallons per day.

In 1927 four additional wells were constructed by John Cummings of East Peoria. They are located on the southerly side of the plant or Bloomington Street and are all 6 inches in diameter and between 25 and 30 feet deep. Static water level in May, 1938, was reported as 11½ feet below ground surface.

All twelve wells are so interconnected that they can all be pumped simultaneously or in groups as desired.

In 1930 the Kelly Well Company of Grand Island, Nebraska, constructed a well to a depth of 30 feet, but it since has been abandoned.

The original installation of Goulds triplex pumps have been discontinued and pumping is generally done by a centrifugal pump powered by a Diesel engine. A 5-stage Sterling deep-well turbine pump set in a pit is used as a standby unit.

The old original surface storage reservoir at the plant was abandoned in 1931 upon the completion of a new 1,000,000 gallon concrete storage tank about 3,000 feet south of the pumping station on top of the bluff. The pumps now discharge directly into the distribution system and the storage tank, which floats on the line. The average daily pumpage for 1938 was 350,000 gallons and for 1939, 700,000 gallons.

The water from the village supply had a residue of 425, a total hardness of 320, and an iron content of 0.2 parts per million without manganese, as shown by the analysis of sample number 36134, collected at the pumping station December 13, 1916.

Analysis of Sample Number 36134 from Village Supply.

Determinations Made.		Hypothetical Combinations.		
	Pts. per million.		Pts. per million.	Grs. per gallon.
Iron Fe	0.2	Potassium Nitrate KNO ₃	6.7	0.39
Alumina Al ₂ O ₃	6.4	Sodium Nitrate NaNO ₃	2.1	0.12
Calcium Ca	86.8	Sodium Chloride NaCl	8.3	0.48
Magnesium Mg	25.6	Sodium Sulfate Na ₂ SO ₄	30.2	1.76
Ammonium NH ₄	0.0	Magnesium Sulfate MgSO ₄	53.7	3.12
Sodium Na	13.7	Magnesium Carbonate MgCO ₃	37.6	2.19
Potassium K	2.6	Calcium Carbonate CaCO ₃	210.8	12.64
Sulfate SO ₄	63.2	Iron Oxide Fe ₂ O ₃	0.4	0.02
Nitrate NO ₃	5.6	Alumina Al ₂ O ₃	0.7	0.04
Chloride Cl	5.0	Silica SiO ₂	12.4	0.72
Alkalinity as CaCO ₃				
Methyl Orange	298.0	Total	368.8	21.52
Residue	425.0			
Total Hardness	320.0			

HERSCHEL MANUFACTURING COMPANY. The Herschel Manufacturing Company, situated in East Peoria, Illinois, has two wells located about 20 feet apart and approximately 2260 feet east and 500 feet north of the southwest corner of Section 29, T. 26 N., R. 4 W. of the 3rd P. M.

Analysis of Sample Number 73496 from both Wells.

Determinations Made.		Hypothetical Combinations.	
	Pts. per million.		Pts. per million. Grs. per gallon.
Iron..... Fe	0.0	Sodium Nitrate..... NaNO ₃	1.7 0.10
Manganese.. Mn	0.0	Sodium Chloride..... NaCl	118.7 6.92
Silica..... SiO ₂	10.0	Sodium Sulfate..... Na ₂ SO ₄	10.0 0.58
Turbidity.....	0.0	Magnesium Sulfate.... MgSO ₄	163.8 9.55
Calcium..... Ca	122.0	Magnesium Carbonate.. MgCO ₃	68.7 4.01
Magnesium.. Mg	52.8	Calcium Carbonate.... CaCO ₃	288.5 16.78
Ammonium.. NH ₄	trace	Calcium Silicate..... CaSiO ₃	19.2 1.12
Sodium..... Na	50.4		
Sulfate..... SO ₄	137.2	Total.....	670.6 39.06
Nitrate..... NO ₃	1.5		
Chloride.... Cl	72.0		
Alkalinity as CaCO ₃			
Phenolphthalein..	0.0		
Methyl Orange...	370.0		
Residue.....	660.0		
Total Hardness....	522.5		

Both wells, constructed in 1920, are 64 feet deep and cased with 42 feet of 12-inch pipe and 22 feet of 12-inch screen. It was reported in 1933 that a pumping rate of 600 gallons per minute produced a drawdown of 8 feet below a static level of 12 feet in each well.

A centrifugal pump, rated at 600 gallons per minute, direct connected to a 75-horsepower Westinghouse electric induction motor having a full load speed of 1170 revolutions per minute, draws water from both wells through a common suction pipe or header.

Analysis of Sample Number 85962 from Well Number 3.

Determinations Made.		Hypothetical Combinations.	
	Pts. per million.		Pts. per million. Grs. per gallon.
Iron..... Fe		Sodium Nitrate..... NaNO ₃	1.7 0.10
(filtered).....	0.0	Sodium Chloride..... NaCl	574.0 33.47
(unfiltered).....	0.78	Sodium Sulfate..... Na ₂ SO ₄	118.0 6.88
Manganese.. Mn	0.0	Magnesium Sulfate.... MgSO ₄	81.9 4.78
Silica..... SiO ₂	16.0	Magnesium Carbonate.. MgCO ₃	37.4 2.18
Turbidity.....	8.0	Calcium Carbonate.... CaCO ₃	287.7 16.78
Color.....	0.0	Silica..... SiO ₂	16.0 0.93
Odor.....	0.0		
Calcium..... Ca	115.0	Total.....	1116.7 65.12
Magnesium.. Mg	27.4		
Ammonium.. NH ₄	trace		
Sodium..... Na	264.5		
Sulfate..... SO ₄	145.0		
Nitrate..... NO ₃	1.1		
Chloride.... Cl	348.0		
Alkalinity as CaCO ₃			
Phenolphthalein..	0.0		
Methyl Orange...	332.0		
Residue.....	1147.0		
Total Hardness....	400.0		

The water had a residue of 660 and a total hardness of 522.5 parts per million without iron or manganese, as shown by the analysis of sample number 73496, collected September 14, 1933.

Well number 3, constructed in 1938 to a depth of 63 feet, is located in the northwest quarter of the northeast quarter of Section 32, T. 26 N., R. 4 W., 3rd P. M. It is equipped with a Pomona deep-well turbine pump rated at 300 gallons per minute.

The water had a residue of 1147.0, a total hardness of 400.0, and an iron content of 0.78 parts per million without manganese, as shown by the analysis of sample number 85962, collected July 6, 1939.

HOME LAUNDRY. The plant of the Home Laundry in Pekin, Illinois, situated at 119 Elizabeth Street, is supplied with water from a well constructed in 1932 by M. Ebert and Son of Washington, Illinois, to a depth of 98 feet below ground surface. The well is located approximately 215 feet east of the east line of Second Street and 60 feet north of the north line of Elizabeth Street, or 1000 feet north and 1400 feet west of the southeast corner of Section 34, T. 25 N., R. 5 W. of the 3rd P. M. The well is reported to have penetrated gravel and sand for the full depth. It is cased with 4-inch pipe and when completed static water level was 25 feet below the surface.

The well is equipped with a 4-inch A. D. Cook deep-well turbine pump direct connected to a 5-horsepower electric motor and operates at a full load speed of 3450 revolutions per minute. The pump is rated at 60 gallons per minute. The pump discharges into a pressure tank equipped with a pressure regulator which automatically controls the operation of the pump. The water is softened in an Elgin water softener.

The raw water had a residue of 625 and a total hardness of 548 parts per million without iron or manganese, as shown by the analysis of sample number 80058, collected January 6, 1934. The temperature after ten minutes of pumping was 59° P.

Analysis of Sample Number 80058.

Determinations Made.		Hypothetical Combinations.	
	Pts. per million.		Pts. per million. Grs. per gallon.
Iron..... Fe	0.0	Sodium Nitrate..... NaNO ₃	39.1 2.28
Manganese... Mn	0.0	Sodium Chloride..... NaCl	50.9 2.97
Silica..... SiO ₂	11.0	Magnesium Chloride... MgCl ₂	99.4 5.80
Turbidity.....	0.0	Magnesium Sulfate.... MgSO ₄	102.4 5.96
Calcium..... Ca	131.0	Magnesium Carbonate.. MgCO ₃	26.6 1.55
Magnesium... Mg	53.8	Calcium Carbonate.... CaCO ₃	308.5 17.98
Ammonium... NH ₄	trace	Calcium Silicate..... CaSiO ₃	21.5 1.25
Sodium..... Na	30.6		
Sulfate..... SO ₄	81.5	Total.....	648.4 37.79
Nitrate..... NO ₃	28.3		
Chloride.... Cl	105.0		
Alkalinity as CaCO ₃			
Phenolphthalein..	0.0		
Methyl Orange...	340.0		
Residue.....	625.0		
Total Hardness....	548.0		

LAKESIDE DAIRY. The plant of the Lakeside Dairy is situated at 405 Margaret Street, Pekin, Illinois. A well, located approximately 120 feet east of the east line of Fourth Street and 90 feet north of the north line of Margaret Street, or 50 feet west and 875 feet north of the southeast corner of Section 34, T. 25 N., R. 5 W. of the 3rd P. M., was constructed in 1930 by M. Ebert and Son of Washington, Illinois, to a depth of 93 feet below ground surface or 85 feet below the basement floor. The well is cased with 3-inch pipe and when completed static water level was 22 feet below ground surface.

The well is equipped with a Myers deep-well cylinder pump rated at 17 gallons per minute. It is belt connected to a 3-horsepower electric motor. The pump discharges into a pressure tank equipped with an automatic pressure regulator.

The water had a residue of 594 and a total hardness of 428.5 parts per million, with only a trace of iron but no manganese, as shown by the analysis of sample number 73993, collected December 20, 1933.

Analysis of Sample Number 73993.

Determinations Made.		Hypothetical Combinations.		
	Pts. per million.		Pts. per million.	Grs. per gallon.
Iron.....Fe	trace	Sodium Nitrate.....NaNO ₃	45.9	2.68
Manganese...Mn	0.0	Sodium Chloride.....NaCl	94.1	5.48
Silica.....SiO ₂	9.0	Sodium Sulfate.....Na ₂ SO ₄	5.0	.29
Turbidity.....	0.0	Magnesium Sulfate.....MgSO ₄	134.3	7.83
Calcium.....Ca	106.3	Magnesium Carbonate...MgCO ₃	43.0	2.51
Magnesium...Mg	39.6	Calcium Carbonate.....CaCO ₃	251.0	14.63
Ammonium...NH ₄	0.2	Calcium Silicate.....CaSiO ₃	17.4	1.02
Sodium.....Na	51.0			
Sulfate.....SO ₄	110.6	Total.....	590.7	34.44
Nitrate.....NO ₃	33.7			
Chloride....Cl	57.0			
Alkalinity as CaCO ₃				
Phenolphthalein..	0.0			
Methyl Orange...	302.0			
Residue.....	594.0			
Total Hardness....	428.5			

MORAN'S MAEKETS. One of the Moran Markets in Pekin, Illinois, is situated at 321 Court Street. A well for this store, located approximately 180 feet west of the west line of Capitol Street and 110 feet north of the north line of Court Street, or approximately 1000 feet north and 875 feet west of the southeast corner of Section 34, T. 25 N., R. 5 W. of the 3rd P. M., was constructed in 1930 by M. Ebert and Son of Washington, Illinois, to a depth of 72 feet. It is cased with 4-inch casing.

The well is equipped with a Myers deep-well cylinder pump rated at 17 gallons per minute, which is belt connected to a 3-horsepower electric motor. The water is discharged into a pressure tank and the pump is automatically controlled by a pressure device on the tank.

The water had a residue of 637, a total hardness of 519 and an iron content of 0.1 parts per million, with a trace of manganese, as shown by the analysis of sample number 74000, collected December 19, 1939.

Analysis of Sample Number 74000.

Determinations Made.		Hypothetical Combinations.		
	Pts. per million.		Pts. per million.	Grs. per gallon.
Iron.....Fe	0.1	Sodium Nitrate.....NaNO ₃	68.0	3.96
Manganese..Mn	trace	Sodium Chloride.....NaCl	62.6	3.65
Silica.....SiO ₂	10.0	Magnesium Chloride...MgCl ₂	59.0	3.44
Turbidity.....	0.0	Magnesium Sulfate...MgSO ₄	153.0	8.92
Calcium.....Ca	125.8	Magnesium Carbonate..MgCO ₃	13.5	0.79
Magnesium..Mg	49.9	Calcium Carbonate....CaCO ₃	298.0	17.38
Ammonium..NH ₄	trace	Calcium Silicate.....CaSiO ₃	19.2	1.12
Sodium.....Na	43.0	Iron Oxide.....Fe ₂ O ₃	0.1	0.01
Sulfate.....SO ₄	122.0			
Nitrate.....NO ₃	49.6	Total.....	673.4	39.27
Chloride....Cl	82.0			
Alkalinity as CaCO ₃				
Phenolphthalein..	0.0			
Methyl Orange...	314.0			
Residue.....	637.0			
Total Hardness....	519.0			

The other Moran Market in Pekin, Illinois, is situated at 404 Court Street. A well for this store, located approximately 80 feet east of the east line of Fourth Street and 15 feet south of the south line of Church Street, or 250 feet west and 520 feet north of the southeast corner of Section 34, was constructed in 1929 by M. Ebert and Son of Washington, Illinois, to a depth of 90 feet below ground level, or 80 feet below basement floor level. It is cased with 4-inch casing and when completed static water level was 30 feet below the surface. The well is equipped with a Myers deep-well cylinder pump.

NOEL FUNERAL HOME. The Noel Funeral Home in Pekin, Illinois, is situated at 40G Elizabeth Street at Pekin. A well was constructed in 1933 by M. Ebert and Son of Washington, Illinois, to a depth of 81½ feet. It penetrated sand and gravel for the entire depth, a red sand being noted at the bottom, and is cased with 77.5 feet of 4-inch casing and 4 feet of 4-inch Cook screen. When completed static water level was 32 feet below ground surface. The river level was reported as very low at this time.

The well is equipped with a deep well turbine pump, the assembly of which consists of 60 feet of column pipe, 7 stages of 4-inch bowls and 12 feet of 4-inch suction pipe. It is rated at 43 gallons per minute. The pump is direct connected to a 3-horsepower electric motor. The water is used for air cooling in summer and wasted. The temperature was reported to be 51 to 52° F. on March 8, 1934.

PEKIN MINERAL SPRINGS PARK. The first and apparently for a long time the only deep well in Pekin, Illinois, was located in the Mineral Springs Park in the southeasterly part of the city. The well is located approximately 1250 south and 1250 feet west of the northeast corner of Section 2, T. 24 N., R. 5 W. of the 3rd P. M. This well was drilled to a reported depth of 990 feet or more. The water was salty and had a strong sulfur taste and odor and was used in the open air swimming pool.

In 191G Chris Ebert of Washington, Illinois, drilled a second well close by to a depth of 1000 feet. The following is a log of the formations penetrated as reported by Mr. Ebert:

Materials.	Thickness in feet.	Depth in feet.
Sand and gravel.....	147	147
White shale.....	26	173
Black boulders.....	3	176
Fire clay.....	7	183
White shale.....	12	195
Blue shale.....	17	212
White shale.....	28	240
Fire clay.....	5	245
White shale.....	15	260
Dark shale.....	59	319
Flint lime.....	5	324
Fire clay.....	2	326
White shale.....	12	338
Lime.....	19	357
White shale.....	63	420
Fire clay.....	4	424
Dark lime.....	19	443
White lime.....	52	495
Sand.....	24	519
Lime.....	211	730
Dark shale.....	189	919
Lime.....	11	930
Sandstone, sulfur water.....	35	965
White shale.....	8	973
Lime.....	27	1000

The well was originally cased with 10-inch pipe from the surface to a depth of 163 feet 10 inches and with 181 feet of 8-inch pipe the bottom end of which was set at a depth of 341. Ground surface is approximately 530 feet above sea level.

The well flowed when first constructed but later a Sterling deep well turbine pump was installed.

The water, together with that from the first well, was used to supply the large open air swimming pool and also for indoor tub baths.

Analysis of Sample Number S0762 from The 1000-Foot Well.

Determinations Made.		Hypothetical Combinations.	
	Pts. per million.		Pts. per million.
Iron.....Fe	trace	Sodium Nitrate..... NaNO_3	2.6
Manganese...Mn	0.0	Sodium Chloride..... NaCl	2210.0
Silica..... SiO_2	7.0	Sodium Sulfate..... Na_2SO_4	394.1
Turbidity.....	0.0	Sodium Carbonate..... Na_2CO_3	354.7
Calcium.....Ca	29.0	Ammonium Carbonate... $(\text{NH}_4)_2\text{CO}_3$	4.3
Magnesium...Mg	11.8	Magnesium Carbonate... MgCO_3	40.9
Ammonium... NH_4	1.7	Calcium Carbonate..... CaCO_3	72.6
Sodium.....Na	1151.0	Silica..... SiO_2	7.0
Sulfate..... SO_4	267.0		
Nitrate..... NO_3	1.8	Total.....	3086.2
Chloride.....Cl	1340.0		
Alkalinity as CaCO_3			
Phenolphthalein...	0.0		
Methyl Orange...	460.0		
Residue.....	3164.0		
Total Hardness....	121.0		

In the winter the wells flowed sufficiently to provide all the water wanted, but in the summer time pumps were used.

The water had a residue of 3104 and a total hardness of 121 parts per million, with a trace of iron but no manganese, as shown by the analysis of sample number 80762, collected February 24, 1934, from well number 2. Analysis of sample 66053, collected March 17, 1930, from the same well was very similar.

In 1934 well number 3 was drilled for the Pekin Park District by Layne-Western Company of Chicago at a location approximately 250 feet east and 1300 feet south of the northwest corner of Section 1, T. 25 N., R. 5 W. of the 3rd P. M. This well is 1080 feet deep.

A 24-hour production test, made in January 1935, indicated a yield of 845 gallons per minute with a drawdown of 141 feet below a static water level of 20 feet below ground surface. The water temperature was 72° F.

The water had a residue of 3457 and a total hardness of 138 parts per million without iron or manganese as shown by the analysis of sample number 75504, collected December 20, 1934 at the end of 24 hours of pumping.

Analysis of Sample Number 75504 from 1080-Foot Well.

Determinations Made.		Hypothetical Combinations.	
	Pts. per million.		Pts. per million. Grs. per gallon.
Iron.....Fe	0.0	Sodium Nitrate.....NaNO ₃	1.7 0.10
Manganese..Mn	0.0	Sodium Chloride.....NaCl	2509.1 146.28
Silica.....SiO ₂	11.0	Sodium Sulfate.....Na ₂ SO ₄	378.0 22.04
Turbidity.....	5.0	Sodium Carbonate.....Na ₂ CO ₃	368.0 21.46
Calcium.....Ca	29.8	Ammonium Carbonate..(NH ₄) ₂ CO ₃	4.8 0.28
Magnesium..Mg	15.4	Magnesium Carbonate..MgCO ₃	53.6 3.12
Ammonium..NH ₄	1.8	Calcium Carbonate....CaCO ₃	74.6 4.35
Sodium.....Na	1270.0	Silica.....SiO ₂	11.0 0.64
Sulfate.....SO ₄	256.0		
Nitrate.....NO ₃	1.1	Total.....	3400.8 198.27
Chloride....Cl	1522.0		
Alkalinity as CaCO ₃			
Phenolphthalein..	14.0		
Methyl Orange...	490.0		
Residue.....	3457.0		
Total Hardness....	138.0		

PEKIN ROSE GARDEN. A well was constructed for the Pekin Eose Garden of Pekin, Illinois, in 1931, by M. Ebert and Son of Washington, Illinois, to a depth of 65.5 feet. It is located approximately 1690 feet east and 250 feet north of the southwest corner of Section 36, T. 25 N., R. 5 W., of the 3rd P. M.

The well penetrated nonwater-bearing material until coarse gravel was entered at a depth of 59.5 feet. The bottom of the well is on shale. The well; is cased with 59.5 feet of 6-inch pipe and 6.5 feet of screen. When completed the static water level was 43 feet below the surface.

The well is equipped with a 6-inch Pomona deep-well turbine the assembly of which consists of 50 feet of 4-inch column pipe, 7 stages of bowls having an over-all length of 9 feet and 6 feet of suction pipe. The pump is direct connected to a 10-horsepower induction electric motor

which operates at a full load speed of 2900 revolutions per minute. At a speed of 2900 revolutions per minute the pump delivers 90 gallons per minute against a total head of 327 feet. At this rate of production the drawdown is 8 feet below static level.

The water had a residue of 697, a total hardness of 567.5, an iron content of 1.1 and a manganese content of 0.2 parts per million as shown by the analysis of sample number 74007, collected December 19, 1933.

Analysis of Sample Number 74007.

Determinations Made.		Hypothetical Combinations.	
	Pts. per million.		Pts. per million. Grs. per gallon.
Iron.....Fe	1.1	Sodium Nitrate.....NaNO ₃	1.7 .10
Manganese...Mn	0.2	Sodium Chloride.....NaCl	24.5 1.43
Silica.....SiO ₂	8.0	Sodium Sulfate.....Na ₂ SO ₄	39.1 2.28
Turbidity.....	5.0	Magnesium Sulfate.....MgSO ₄	290.0 16.92
Calcium.....Ca	130.7	Calcium Sulfate.....CaSO ₄	6.8 .40
Magnesium...Mg	58.7	Calcium Carbonate....CaCO ₃	308.0 17.96
Ammonium...NH ₄	.02	Calcium Silicate.....CaSiO ₃	15.7 .91
Sodium.....Na	22.8	Iron Oxide.....Fe ₂ O ₃	1.6 .09
Sulfate.....SO ₄	263.0	Manganese Oxide.....MnO	.3 .02
Nitrate.....NO ₃	1.1		
Chloride....Cl	15.0	Total.....	687.7 40.11
Alkalinity as CaCO ₃			
Phenolphthalein..	0.0		
Methyl Orange...	308.0		
Residue.....	697.0		
Total Hardness....	567.5		

When prospecting for water test wells were drilled to the east of the present well but no water formations were found.

PEKIN WATER WORKS COMPANY. The Pekin Water Works Company plant is located mainly on a piece of property at the southwest corner of the intersection of Broadway and Capitol Avenue and was placed in service in 1886.

The early wells were in two groups—those in the so-called well house and those in the pump pit. The well house is a circular brick building 29 feet 4 inches in diameter and 25 feet deep below the top edge of the brick wall or about 24 feet deep below the ground surface. Inside of this structure, between 1886 and 1904, there was constructed fifteen tubular wells. All were 60 feet deep below the well house floor except number 10 which was 103 feet deep. All were cased with 6-inch pipe and 10 to 12 feet of 6-inch screens except number 12 which was cased with 4-inch pipe and screen and numbers 6 and 14 which were cased with 8-inch pipe and screens.

During the year 1892 four wells were constructed in the bottom of the pump pit. All were 50 to 55 feet deep and of small diameter except one which had a 5-inch casing and screen.

All the fifteen wells in the well house were connected into a single suction header that extended through the tunnel that connected the well house with the pump pit. The four wells in the pump pit were also connected into this same header. Water was drawn from the wells by direct suction by three direct action steam pumps set on the bottom of the pump pit.

In 1927 the Kelly Well Company of Grand Island, Nebraska, constructed a large diameter well at a point westerly of the circular well house, and which is now known as well number 1. This well is located approximately 1350 feet west and 200 feet south of the northeast corner of Section 3, T. 24 N., R. 5 W., of the 3rd P. M. This well has a total depth of 89 feet 7 inches below ground surface and penetrated the following materials:

Top soil	4.00 feet
Sand and gravel.....	6.00 feet
Fine sand	18.00 feet
Coarse sand and gravel.....	27.00 feet
Coarse sand	15.00 feet
Medium sand	10.00 feet
Coarse sand	9.60 feet
Total	89.60 feet

It is cased with Kelly Well Company concrete casing and screen the outside diameter of which is 32 inches and the inside diameter 25 inches. In the bottom was placed a concrete plug 8 inches thick which supported a screen section 52 feet 11 inches high and above which was 37 feet of blank casing. An envelope of selected washed gravel, of a thickness of 5 inches, was placed about the screen section and casing to a little above static water level. On test the well produced 390 gallons per minute with a drawdown of 11 inches below a static water level of 28 feet.

The well is equipped with two Allis-Chalmers centrifugal pumps set in a pump pit. Each has an 8-inch suction and 6-inch discharge and is rated at 1320 gallons per minute against a head of 185. The pumps are direct connected to 100-horsepower Allis-Chalmers electric motors. The piping and valves are so arranged that the pumps may be operated singly, in parallel or in series. This well has always been a good producer and in 1938 furnished most of the water required by the city. It was then being operated about 8 hours per day.

The water had a residue of 490 and a total hardness of 403.5 parts per million without iron or manganese as shown by the analysis of sample number 77079, collected November 25, 1935. The temperature of the water was 54° to 56° F.

Analysis of Sample Number 77079.

Determinations Made.		Hypothetical Combinations.		
	Pts. per million.		Pts. per million.	Grs. per gallon.
Iron.....Fe	0.0	Sodium Nitrate.....NaNO ₃	30.6	1.78
Manganese..Mn	0.0	Sodium Chloride.....NaCl	3.5	0.20
Silica.....SiO ₂	20.0	Magnesium Chloride...MgCl ₂	33.4	1.95
Turbidity.....	0.0	Magnesium Sulfate....MgSO ₄	111.4	6.47
Calcium.....Ca	91.3	Magnesium Carbonate..MgCO ₃	40.0	2.33
Magnesium..Mg	42.5	Calcium Carbonate....CaCO ₃	228.8	13.35
Sodium.....Na	9.7	Silica.....SiO ₂	20.0	1.17
Sulfate.....SO ₄	88.6			
Nitrate.....NO ₃	22.1	Total.....	467.7	27.25
Chloride....Cl	27.0			
Alkalinity as CaCO ₃				
Phenolphthalein..	0.0			
Methyl Orange...	276.0			
Residue.....	490.0			
Total Hardness....	403.5			

In 1931 the Kelly Well Company constructed well number 2, to a depth of 91 feet 8 inches at a site about 30 feet east of Mechanic Street and 50 feet north of Fayette Street or approximately 1900 feet west and 250 feet south of the northeast corner of Section 3, T. 24 N., R. 5 W., of the 3rd P. M. The well penetrated the following materials:

Top soil	3.0 feet
Sand and gravel.....	22.0 feet
Fine sand	11.0 feet
Coarse sand, gravel and clay balls.....	9.0 feet
Sand and gravel.....	28.0 feet
Coarse sand	7.0 feet
Medium sand	11.65 feet
Total	91.65 feet

An 8-inch concrete plug in the bottom supports a screen section 45 feet 9 inches long above which is 45 feet 9 inches of blank casing. The screen and casing are of the Kelly Well Company design and have outside diameters of 32 inches and inside diameters of 25 inches. An envelope of selected washed gravel having a thickness of 3 inches was placed about the screen and casing to above static water level. Static water level was found at a depth of 34 feet below ground surface. The production test gave a yield of 2200 gallons per minute with a drawdown of 6 feet 2 inches.

The well is equipped with an Aurora Pump Company deep well turbine pump the assembly of which consists of 40 feet of 10-inch column pipe, 3 stages of 15-inch bowls having an over-all length of 4.57 feet and 10 feet of 10-inch suction pipe. The pump is rated at 1400 gallons per minute at a speed of 1750 revolutions per minute against a head of 300 feet. A small air pipe for measuring water levels extends to a depth of 58 feet 33/8 inches below the center of the air gage. The pump is direct connected to a 150 horsepower Westinghouse electric motor which operates at a full load speed of 1750 revolutions per minute. In 1938 this unit was operated about one hour each day.

Analysis of Sample Number 77078.

Determinations Made.		Hypothetical Combinations.		
	Pts. per million.			
Iron.....Fe		Sodium Nitrate.....NaNO ₃	30.6	1.78
(unfiltered).....	0.0	Magnesium Nitrate.....MgNO ₃	8.2	0.48
Manganese..Mn	0.0	Magnesium Chloride....MgCl ₂	39.1	2.28
Silica.....SiO ₂	22.0	Magnesium Sulfate.....MgSO ₄	142.6	8.32
Turbidity.....	0.0	Magnesium Carbonate..MgCO ₃	4.2	0.24
Calcium....Ca	106.8	Calcium Carbonate....CaCO ₃	267.3	15.59
Magnesium..Mg	41.3	Silica.....SiO ₂	22.0	1.28
Ammonium..NH ₄	0.0			
Sodium....Na	8.3	Total.....	516.0	29.97
Sulfate.....SO ₄	113.8			
Nitrate....NO ₃	29.2			
Chloride....Cl	29.0			
Alkalinity as CaCO ₃				
Phenolphthalein..	0.0			
Methyl Orange...	272.0			
Residue.....	556.0			
Total Hardness....	437.0			

The water had a residue of 556 and a total hardness of 437 parts per million without iron or manganese as shown by the analysis of sample number 77078, collected November 25, 1935. The temperature of the water was 54° to 56° P.

Well number 3 was constructed in 1937 by the Kelly Well Company to a depth of 100 feet at a location on the east side of the water works property at the southwest corner of the intersection of Capitol Street and Broadway, or about 1180 feet west and 200 feet south of the northeast corner of Section 3, T. 24 N., R. 5 W., of the 3rd P. M. The well penetrated the following materials:

Top soil	5.0 feet
Sandy clay	17.0 feet
Gravel	33.0 feet
Coarse gravel	10.0 feet
Fine sand	21.0 feet
Sand	14.0 feet
Total	100.0 feet

In the bottom is a concrete plug 8 inches thick which supports 52 feet of Kelly concrete well screen and 45 feet 10 inches of blank concrete casing. Both casing and screen have outside diameters of 32 inches and inside diameters of 25 inches. The entire length of the screen and some 10 feet of the blank casing is surrounded by an envelope 5 inches thick of selected washed gravel.

The well is equipped with an Aurora Pump Company deep well turbine pump consisting of 42 feet of 12-inch column pipe, 7 stages of 18-inch bowls having an over-all length of 10.6 feet and 10 feet of 12-inch suction pipe. The pump is rated at 3600 gallons per minute at a speed of 1150 revolutions per minute against a head of 300 feet. The pump is direct connected to a Westinghouse Electric Company electric motor of 250 horsepower which operates at a full load speed of 1150 revolutions per minute. This unit operates about half an hour per day.

The production test indicated a yield of 2400 gallons per minute with a drawdown of 9 feet below a static water level of 36 feet below the ground surface. The water level in well number 1 which is about 175 feet distant was lowered one foot.

PEOEIA MINERAL COMPANY WELL. One of the old deep wells in the Peoria area is the flowing well, formerly owned by the Peoria Mineral Company, drilled about 1900. This well is located approximately 1500 feet east and 750 feet south of the northwest corner of Section 23, T. 26 N., E. 4 W., of the 3rd P. M. The elevation of the ground surface is about 475 feet above sea level.

The log of the well as furnished by the contractor and published in U. S. G. S. Bulletin 506, page 17, is as follows:

Materials.	Thickness in feet.	Depth in feet.
Pleistocene—		
Loam	4	4
Sand and gravel	97	101
Pennsylvanian—		
Clay, blue	40	141
Limestone, black	6	147
Coal and slate	4	151
Clay, blue (shale)	50	201
Coal and slate	20	221
Soapstone	55	276
Slate	104	380
Sandstone, gray	10	390
Mississippian—		
Slate	5	395
Limestone, white	10	405
Limestone, porous	81	486
Devonian and lower carboniferous—		
Slate	213	699
Limestone, gray with zinc	85	784
Shale, white with zinc	10	794
Limestone, porous, white	43	837
Silurian—		
Limestone, flinty	43	880
Limestone, white	21	901
Limestone, porous	39	940
Limestone, white, porous, quartz	80	1020
Limestone, gray	80	1100
Ordovician—		
Cincinnati—		
Slate	85	1185
Limestone, black	6	1191
Slate	59	1250
Limestone, black	10	1260
Slate	38	1298
Galena-Trenton—		
Limestone	20	1318
Sandstone	23	1341
Sandstone, coarse	26	1367
Trenton	130	1497

The 10-inch casing protrudes above the ground surface 7 feet. The top of the pipe is fitted with a plate reducer with a 1½-inch hole. The water in the well is under sufficient pressure to cause a jet to rise approximately 14 feet above the orifice or 21 feet above ground. It is estimated the discharge is at a rate of 160 gallons per minute. It is reported by local residents that the well has flowed like this since it was completed.

Because of its high mineral content the water has never been used for any purpose. It had a residue of 1446, a total hardness of 210 and an iron content of 0.3 parts per million without manganese as shown by the analysis of sample number 80073, collected January 4, 1934.

Analysis of Sample Number 80073 from a Plowing Well 1497 Feet Deep.
 Determinations Made. Hypothetical Combinations.

	Pts. per million.		Pts. per million.	Grs. per gallon.
Iron.....Fe	.3	Sodium Nitrate.....NaNO ₃	2.5	.15
Manganese..Mn	0.0	Sodium Chloride.....NaCl	402.5	23.48
Silica.....SiO ₂	10.0	Sodium Sulfate.....Na ₂ SO ₄	819.7	47.80
Turbidity.....	0.0	Sodium Carbonate.....Na ₂ CO ₃	40.3	2.35
Calcium....Ca	51.2	Ammonium Carbonate (NH ₄) ₂ CO ₃	0.5	.03
Magnesium..Mg	19.9	Magnesium Carbonate..MgCO ₃	69.2	4.04
Ammonium..NH ₄	.1	Calcium Carbonate....CaCO ₃	111.5	6.50
Sodium.....Na	441.8	Calcium Silicate.....CaSiO ₃	19.2	1.12
Sulfate.....SO ₄	555.0	Iron Oxide.....Fe ₂ O ₃	.4	.02
Nitrate.....NO ₃	1.7			
Chloride....Cl	244.0	Total	1465.8	85.49
Alkalinity as CaCO ₃				
Phenolphthalein..	0.0			
Methyl Orange...	232.0			
Residue.....	1446.0			
Total Hardness....	210.0			

QUAKER OATS COMPANY. The plant of the Quaker Oats Company at Pekin is situated in the northeast quarter of the northeast quarter of Section 9, T. 24 N., R. 5 W. of the 3rd P. M. Water is supplied by two wells constructed by the Kelly Well Company of Grand Island, Nebraska.

Well number 1 was constructed in 1924 to a depth of 51 feet below ground surface at a site 470 feet west and 283 feet south of the northeast corner of Section 9.

The well penetrated the following materials:

Clay	3.0 feet
Sand and gravel.....	12.0 feet
Coarse gravel	4.0 feet
Sand and gravel.....	8.0 feet
Clay	2.0 feet
Gravel and stones.....	4.0 feet
Gravel	2.0 feet
Coarse sand	16.0 feet
Total	51.0 feet

A concrete plug 8 inches thick supports 25 feet of Kelly screen and 13 feet 9 inches of plain concrete casing. The top of the concrete casing terminates 11 feet 3 inches below ground surface at the bottom of a pump pit. The screen and casing are of concrete of the regular Kelly design with external diameters of 32 inches and an internal diameter of 25 inches. An envelope of selected washed gravel 3 inches thick surrounds the screen and the blank casing. When completed static water level was 17 feet below ground surface.

The well is equipped with a direct suction double acting duplex steam pump set close to the well in a pit 14 feet deep. A 12-inch suction pipe extends into the well. Static water level in 1933 was reported as 5 feet below the floor of the pit or 8 feet below the center line of the pump piston.

The water had a residue of 679, a total hardness of 519, an iron content of 6.0 and a manganese content of 0.2 parts per million as shown by the analysis of sample number 74004, collected December 20, 1933.

Analysis of Sample Number 74004 from Well Number 1.

Determinations Made.		Hypothetical Combinations.		
	Pts. per million.		Pts. per million.	Grs. per gallon.
Iron.....Fe		Sodium Nitrate.....NaNO ₃	3.4	0.20
(filtered).....	0.0	Sodium Chloride.....NaCl	77.8	4.54
(unfiltered).....	6.0	Ammonium Chloride....NH ₄ Cl	2.7	0.16
Manganese..Mn	0.2	Magnesium Chloride...MgCl ₂	14.8	0.86
Silica.....SiO ₂	9.0	Magnesium Sulfate....MgSO ₄	193.3	11.28
Turbidity.....	57.5	Calcium Sulfate.....CaSO ₄	49.0	2.86
Calcium.....Ca	137.3	Calcium Carbonate....CaCO ₃	292.0	17.03
Magnesium..Mg	42.8	Calcium Silicate.....CaSiO ₃	17.4	1.02
Ammonium..NH ₄	1.0	Iron Oxide.....Fe ₂ O ₃	8.6	0.50
Sodium.....Na	31.5	Manganese Oxide.....MnO	0.3	0.02
Sulfate.....SO ₄	189.2			
Nitrate.....NO ₃	2.4	Total.....	659.3	38.47
Chloride....Cl	60.0			
Alkalinity as CaCO ₃				
Phenolphthalein..	0.0			
Methyl Orange...	292.0			
Residue.....	679.0			
Total Hardness....	519.0			

Well number 2 was constructed in 1929 to a depth of 77 feet 10 inches at a location 403 feet south and 402 feet west of the northeast corner of Section 9. The well penetrated the following materials:

Surface material, clay and sand, 28.00 feet
Coarse sand and gravel..... 29.85 feet

A concrete plug 8 inches thick in the bottom supports 34 feet 8 inches of Kelly Well Company screen and 25 feet 6 inches of blank casing. The top of the casing terminates at the bottom of a pump pit 17 feet deep. An envelope of selected washed gravel 5 inches thick surrounds the screen and the lower 14.5 feet of the blank casing. The casing and screens are of concrete of the standard Kelly design with an external diameter of 32 inches and an internal diameter of 25 inches. When completed static water level was 18 feet below the surface or one foot below the floor of the pump pit.

Analysis of Sample Number 73994 from Well Number 2.

Determinations Made.		Hypothetical Combinations.		
	Pts. per million.		Pts. per million.	Grs. per gallon.
Iron.....Fe	trace	Sodium Nitrate.....NaNO ₃	11.9	.69
Manganese..Mn	0.1	Sodium Chloride.....NaCl	14.6	.85
Silica.....SiO ₂	9.0	Sodium Sulfate.....Na ₂ SO ₄	32.7	1.91
Turbidity.....	0.0	Magnesium Sulfate....MgSO ₄	75.8	4.42
Calcium....Ca	90.2	Magnesium Carbonate..MgCO ₃	48.5	2.83
Magnesium..Mg	29.3	Calcium Carbonate....CaCO ₃	210.5	12.28
Ammonium..NH ₄	trace	Calcium Silicate.....CaSiO ₃	17.4	1.02
Sodium.....Na	19.5	Manganese Oxide.....MnO	0.1	0.01
Sulfate.....SO ₄	82.8			
Nitrate.....NO ₃	8.4	Total.....	411.5	24.01
Chloride....Cl	9.0			
Alkalinity as CaCO ₃				
Phenolphthalein..	0.0			
Methyl Orange...	268.0			
Residue.....	404.0			
Total Hardness....	346.0			

Well number 2 is equipped with two direct suction double acting duplex steam pumps connected to the same 12-inch suction pipe. These pumps are set in a pit 17 feet deep. Static water level was reported in 1933 to be about 5 feet below the floor of the pit. When in operation the pumps draw the water level down to 24 feet below the center line of the pistons.

The water from well number 2 had a residue of 404, a total hardness of 346, and a content of manganese of 0.1 parts per million with a trace of iron as shown by the analysis of sample number 73994, collected December 20, 1933.

SOLDWEDEL CREAMERY. The Soldwedel Creamery Company of Pekin Illinois has two plants, one at 10 South Third Street and one at 9 North Fifth Street.

A well was constructed at the South Third Street plant in 1930, by M. Ebert and Son of Washington, Illinois, to a depth of 103 feet. It is reported that the well penetrated gravel and sand for the entire depth. Below a depth of 100 feet the sand was fine. The well was cased with 4-inch pipe and when finished static water level was 25 feet below the ground surface.

The well is equipped with a 4-inch Cook deep well turbine pump which is rated at 50 gallons per minute.

The water had a residue of 580 and a total hardness of 502 parts per million with a trace of manganese as shown by the analysis of sample number 73999, collected December 19, 1933.

Analysis of Sample Number 73999.

Determinations Made.		Hypothetical Combinations.		
	Pts. per million.			
Iron.....Fe	0.0	Sodium Nitrate.....NaNO ₃	33.1	1.93
Manganese..Mn	trace	Sodium Chloride.....NaCl	42.1	2.45
Silica.....SiO ₂	7.0	Magnesium Chloride...MgCl ₂	83.8	4.89
Turbidity.....	0.0	Magnesium Carbonate..MgCO ₃	35.5	2.07
Calcium.....Ca	117.3	Magnesium Sulfate.....MgSO ₄	94.5	5.51
Magnesium..Mg	50.7	Calcium Carbonate.....CaCO ₃	282.0	16.43
Ammonium..NH ₄	0.02	Calcium Silicate.....CaSiO ₃	13.4	.78
Sodium.....Na	25.5			
Sulfate.....SO ₄	75.4	Total.....	584.4	34.06
Nitrate.....NO ₃	23.9			
Chloride....Cl	88.0			
Alkalinity as CaCO ₃				
Phenolphthalein..	0.0			
Methyl Orange...	324.0			
Residue.....	580.0			
Total Hardness....	502.0			

The well at the North Fifth Street plant was constructed in 1933, by M. Ebert and Son of Washington, Illinois, to a depth of 76 feet. It is located approximately 100 feet west and 200 feet north of the southeast corner of Section 34, T. 25 N., R. 5 W., of the 3rd P. M. The well penetrated gravel formations for the entire depth and is cased with 4-inch pipe. When completed static water level was 25 feet below ground surface.

The water had a residue of 503 and a total hardness of 434.5 parts per million with a trace of iron and 0.1 parts per million of manganese as shown by the analysis of sample number 74001, collected December 19, 1933.

Analysis of Sample Number 74001.

Determinations Made.		Hypothetical Combinations.	
	Pts. per million.		Pts. per million. Grs. per gallon.
Iron.....Fe	trace	Sodium Nitrate.....NaNO ₃	55.2 3.22
Manganese..Mn	0.1	Magnesium Nitrate....Mg(NO ₃) ₂	8.9 0.52
Silica.....SiO ₂	9.0	Magnesium Chloride...MgCl ₂	32.4 1.89
Turbidity.....	0.0	Magnesium Sulfate....MgSO ₄	144.0 8.40
Calcium.....Ca	108.1	Magnesium Carbonate..MgCO ₃	4.2 0.24
Magnesium..Mg	40.0	Calcium Carbonate....CaCO ₃	255.0 14.87
Ammonium..NH ₄	trace	Calcium Silicate.....CaSiO ₃	17.4 1.02
Sodium.....Na	15.0		
Sulfate.....SO ₄	115.0	Total.....	517.1 30.16
Nitrate.....NO ₃	47.9		
Chloride....Cl	24.0		
Alkalinity as CaCO ₃			
Phenolphthalein..	0.0		
Methyl Orange...	260.0		
Residue.....	503.0		
Total Hardness....	434.5		

STANDARD BRANDS. The plant of the Standard Brands at Pekin is situated in the northeast quarter of Section 9, T. 24 N., E. 5 W., 3rd P. M. Water is supplied from four wells, the minimum distance between any two of these being about 200 feet (1 and 2) while the maximum distance is about 590 feet (1 and 4).

Well number 1 is located approximately 638 feet south and 439 feet west of the northeast corner of Section 9.

It is 76 feet deep and penetrates the following materials:

Top soil	4.0 feet
Sand, gravel and clay.....	11.0 feet
Sand, gravel and boulders.....	17.0 feet
Coal	1.0 feet
Hardpan	3.0 feet
Boulders	2.0 feet
Sand	2.0 feet
Coarse sand and gravel.....	8.0 feet
Sand and gravel.....	8.0 feet
Sand	2.0 feet
Fine sand	8.0 feet
Sand	10.0 feet
Total	76.0 feet

Shale was found at a depth of 76 feet.

A concrete plug one foot thick in the bottom of the well supports 40 feet of Kelly concrete screen and 35 feet of blank concrete casing. Both screen and casing sections have internal diameters of 25 inches and external diameters of 32 inches. An envelope of selected washed gravel 5 inches thick surrounds the screen and the lower portion of the blank casing.

When completed static-water level was 20 feet below ground level. The average ground level is approximately 469 feet above sea level.

According to the contractor a production of 450 gallons per minute with a drawdown of 3 feet was obtained when the well was completed in 1926. In December 1933 it was reported that this well which was in service 22 hours per day was producing at a rate of 1500 gallons per minute.

The well was equipped with a Layne-Bowler deep-well turbine pump, the assembly of which consisted of 57.5 feet of 12-inch column pipe, two stages of 24-inch bowls having an over-all length of 3.5 feet and one foot of suction pipe. The pump is powered by a Terry steam turbine which operates at a speed of 1200 revolutions per minute on a steam pressure of 160 pounds per square inch.

The water had a residue of 397, a total hardness of 345, and a manganese content of 0.3 parts per million with a trace of iron as shown by the analysis of sample number 74006, collected December 19, 1933. The water had a temperature of 55° P.

Analysis of Sample Number 74006 from Well Number 1.		Hypothetical Combinations.	
Determinations Made.			
	Pts. per million.		
Iron.....Fe	trace	Sodium Nitrate.....NaNO ₃	12.8
Manganese...Mn	0.3	Sodium Chloride.....NaCl	31.5
Silica.....SiO ₂	9.0	Sodium Sulfate.....Na ₂ SO ₄	21.3
Turbidity.....	0.0	Magnesium Sulfate....MgSO ₄	79.4
Calcium.....Ca	87.0	Magnesium Carbonate..MgCO ₃	51.9
Magnesium...Mg	31.1	Calcium Carbonate....CaCO ₃	202.5
Ammonium...NH ₄	trace	Calcium Silicate.....CaSiO ₃	17.4
Sodium.....Na	22.8	Manganese Oxide.....MnO	0.4
Sulfate.....SO ₄	77.8		
Nitrate.....NO ₃	9.3	Total.....	417.2
Chloride.....Cl	19.0		24.34
Alkalinity as CaCO ₃			
Phenolphthalein..	0.0		
Methyl Orange...	264.0		
Residue.....	397.0		
Total Hardness....	345.0		

Well number 2 was constructed in 1926 by the Kelly Well Company of Grand Island, Nebraska to a final depth of 76 feet at a site 725 feet south and 589 feet west of the northeast corner of Section 9.

The well penetrated the following materials:

Till materials	2.0 feet
Medium sand	12.0 feet
Coarse sand	4.0 feet
Coal .....	.5 feet
Coarse sand and gravel.....	20.5 feet
Sand, coal and boulders.....	9.0 feet
Clay and rock.....	2.0 feet
Coarse sand	13.0 feet
Medium sand	13.0 feet
Total	76.0 feet

Shale was found at a depth of 76 feet.

A concrete plug one foot thick in the bottom supports a screen section 40 feet long and 35 feet of blank casing. The casing and screen sections are of the Kelly Well Company design and are made of concrete with an inside diameter of 25 inches and an outside diameter of 32

inches. An envelope of selected washed gravel 5 inches thick surrounds the screen section and the lower portion of the blank casing. When completed the static water level was 20 feet below the ground surface.

On test the well gave a production of 450 gallons per minute with a drawdown of 3 feet. In December 1933 it was reported this well was producing at a rate of 1200 gallons per minute for about 10 hours per day. It was equipped with a Layne-Bowler deep well turbine pump, the assembly of which consisted of 57.5 feet of 12 inch column pipe, two stages of 24-inch bowls having an over-all length of 3.5 feet and one foot of suction pipe. The pump is powered by a Terry steam turbine which operates at a speed of 1200 revolutions per minute on a steam pressure of 160 pounds per square inch.

Well number 3 was constructed in 1928 by the Kelly Well Company of Grand Island, Nebraska to a final depth of 74 feet at a location 918 feet south and 935 feet west of the northeast corner of Section 9.

The well penetrated the following materials:

Top soil	4.0 feet
Dry sand and gravel.....	17.0 feet
Coarse sand and gravel.....	23.0 feet
Medium coarse sand and gravel.....	22.0 feet
Medium sand and gravel.....	8.0 feet
Total	74.0 feet

White clay was found at 74 feet.

A concrete plug 8 inches thick in the bottom supports a screen section 41 feet long and 31 feet of blank casing. The screen and casing are of concrete of the standard Kelly design with an outside diameter of 32 inches and an inside diameter of 25 inches. An envelope of selected washed gravel 3 inches thick surrounds the screen and the lower 8 to 10 feet of the casing. When completed static water level was 21 feet below the ground surface. In 1933 the reported production rate of this well was 1800 gallons per minute.

The well is equipped with a Layne-Bowler deep-well turbine pump, the assembly of which consists of 57.5 feet of 12-inch column pipe, two stages of 24-inch bowls having an over-all length of 3.5 feet and one foot

Analysis of Sample Number 73996 from Well Number 3.

Determinations Made.		Hypothetical Combinations.	
	Pts. per million.		Pts. per million. Grs. per gallon.
Iron..... Fe	trace	Sodium Nitrate..... NaNO ₃	16.2 0.94
Manganese.. Mn	0.6	Sodium Chloride..... NaCl	18.1 1.05
Silica..... SiO ₂	10.0	Sodium Sulfate..... Na ₂ SO ₄	27.0 1.57
Turbidity.....	0.0	Magnesium Sulfate..... MgSO ₄	77.6 4.53
Calcium..... Ca	91.6	Magnesium Carbonate.. MgCO ₃	53.6 3.12
Magnesium.. Mg	31.2	Calcium Carbonate.... CaCO ₃	212.5 12.40
Ammonium.. NH ₄	trace	Calcium Silicate..... CaSiO ₃	19.2 1.12
Sodium..... Na	20.2	Manganese Oxide..... MnO	0.8 0.05
Sulfate..... SO ₄	80.2		
Nitrate..... NO ₃	12.0	Total.....	425.0 24.78
Chloride.... Cl	11.0		
Alkalinity as CaCO ₃			
Phenolphthalein..	0.0		
Methyl Orange...	276.0		
Residue.....	411.0		
Total Hardness....	357.0		

of suction pipe. The pump is powered with a Terry steam turbine which operates at a speed of 1200 revolutions per minute on a steam pressure of 160 pounds per square inch. The pump operates about 22 hours per day.

The water had a residue of 411, a total hardness of 357 and a manganese content of 0.6 parts per million with a trace of iron as shown by the analysis of sample number 73996, collected December 19, 1933.

Well number 4 was constructed in 1931 by the Kelly Well Company of Grand Island, Nebraska to a final depth of 69.75 feet at a location 998 feet south and 1291 feet west of the northeast corner of Section 9.

The well penetrated the following materials:

Top soil	2.0 feet
Coarse sand and gravel.....	33.0 feet
Coarse sand	21.0 feet
Medium sand	13.75 feet
Total	69.75 feet

Shale was found at a depth of 69.75 feet below general ground surface.

A concrete plug 8 inches thick in the bottom of the well supports a screen section 43 feet long and 26 feet of casing. The screen and casing are of the standard Kelly design, of concrete with an outside diameter of 32 inches and an inside diameter of 25 inches. An envelope of selected washed gravel 5 inches thick surrounds the screen and the lower 10 feet of the blank casing. When completed static water level was 25.5 feet below ground surface. On test the well produced at a rate of 1890 gallons per minute with a drawdown of 18.25 feet.

The well is equipped with a Layne-Bowler deep-well turbine pump the assembly of which consists of 57.5 feet of 12-inch column pipe, two stages of 24-inch bowls having an over-all length of 3.5 feet and a one foot length of suction pipe. The pump is direct connected to a 225-horsepower Synchronous electric motor which operates at a normal speed of 1200 revolutions per minute.

In 1933 the well was reported to produce at the rate of 1500 gallons per minute.

Well number 5 was completed in 1935 by A. D. Cook, Inc. of Lawrenceburg, Indiana to a final depth of 79 feet at a location 792 feet west and 664 feet south of the northeast corner of Section 9.

The well penetrated the following materials:

Cinder fill	2.00 feet
Clay	5.00 feet
Dry sand	21.00 feet
Sand and gravel, water-bearing.....	20.00 feet
Coarse sand, water-bearing.....	7.00 feet
Fine sand, water-bearing.....	1.50 feet
Coarse sand and gravel water-bearing.....	22.50 feet
Total	79.00 feet

The well was cased with 60 feet of 26-inch pipe below which was 20 feet of 26-inch Cook red brass screen with 3/16-inch slots. When completed the well had a net depth of 78.5 feet from the top of the casing to top of the concrete plug in the bottom of the screen. Static water

level was 29 feet below the ground surface and upon test a production of 2475 gallons per minute was obtained.

The water had a residue of 531, a total hardness of 423.5, an iron content of 2.4 and a manganese content of 2.4 parts per million as shown by the analysis of sample number 76473, collected August 6, 1935.

Analysis of Sample Number 76473 from Well Number 5.

Determinations Made.		Hypothetical Combinations.	
	Pts. per million.		Pts. per million. Grs. per gallon.
Iron.....Fe		Sodium Nitrate.....NaNO ₃	6.0 0.35
(filtered).....	trace	Sodium Chloride.....NaCl	14.6 0.85
(settled 1 hr.)....	1.3	Sodium Sulfate.....Na ₂ SO ₄	32.7 1.91
(unsettled).....	2.4	Ammonium Sulfate.....(NH ₄) ₂ SO ₄	6.6 0.38
Manganese..Mn	2.4	Magnesium Sulfate....MgSO ₄	95.8 5.58
Silica.....SiO ₂	9.0	Magnesium Carbonate..MgCO ₃	45.6 2.66
Turbidity.....	10.0	Calcium Carbonate....CaCO ₃	290.2 16.90
Color.....	0.5	Manganese Oxide.....MnO	3.1 0.18
Odor.....	0.0	Silica.....SiO ₂	9.0 0.52
Calcium....Ca	115.9		
Magnesium..Mg	32.4	Total.....	503.6 29.33
Ammonium..NH ₄	1.8		
Sodium....Na	17.9		
Sulfate....SO ₄	103.1		
Nitrate....NO ₃	4.6		
Chloride...Cl	9.0		
Alkalinity as CaCO ₃			
Phenolphthalein..	0.0		
Methyl Orange...	344.0		
Residue.....	531.0		
Total Hardness....	423.5		

STAEK & SON ICE COMPANY. The plant of the Stark & Son Ice Company is situated at 304 Illinois Street, Pekin, Illinois. A well, located approximately 160 feet east and 1660 feet south of the northwest corner of Section 35, T. 25 N., R. 5 W., of the 3rd P. M. was constructed in 1928, by H. B. Smith of San Jose, Illinois, to a depth of 75 feet. Soil, clay and a little hardpan was penetrated in the top 11 feet and sand and gravel for the rest of the depth. The well is cased with 65 feet of 4-inch pipe and 10 feet of 4-inch, number 12-slot Cook screen. When finished static water level was 35 feet below the surface.

In 1931 Eobert Narin of Pekin constructed a second well for the ice company, at a site about 30 feet south of the first well, to a depth of 77.5 feet. It penetrated the following formations:

Top soil	10.0 feet
Hardpan	1.0 feet
Sand and gravel.....	66.5 feet
Total	77.5 feet

The well was cased with 63.5 feet of 6-inch pipe and 12 feet of 6-inch screen. When completed static water level was 35 feet below the ground surface. It is equipped with a 6-inch Sterling deep well turbine pump, the assembly of which consists of 65 feet of column pipe and 3 stages of 6-inch bowls. The pump is direct connected to a 15-horsepower electric motor.

The water temperature was reported on March 7, 1934 as 52° F.

SUPER-POWER COMPANY. The plant of the Super-Power Company at Pekin Illinois is situated in the S. W. $\frac{1}{4}$ of Section 9, T. 24 N., R. 5 W., 3rd P. M. The water needs of the station are supplied by seven wells scattered rather widely over the property.

Well number 1, located 980 feet east and 1920 feet north of the southwest corner of Section 9, was constructed to a depth of 78 feet by the Ohio Drilling Company. In it was installed 24-inch casing and 40 feet of 24-inch screen. When completed static water level was reported as 19 feet below the ground surface. A 125-horsepower electric motor supplies power for a deep well turbine pump rated at 1000 gallons per minute.

Well number 2, constructed by the Ohio Drilling Company to about the same depth and in the same manner as well number 1, is located 980 feet east and 2155 feet north of the southwest corner of Section 9.

Well number 3, located 642 feet east and 1880 feet north of the southwest corner of Section 9, was also constructed by the Ohio Drilling Company in a similar manner to the previous wells.

Well number 4, located 180 feet east and 1920 feet north of the southwest corner of Section 9, was constructed in 1928 by the Ohio Drilling Company to a depth of 60 feet, at which depth shale was encountered. The well is cased with 24-inch pipe and 40 feet of 24-inch screen. When completed static water level was reported as 19 feet below ground surface. The pumping rate was reported as 500 gallons per minute.

The water had a residue of 292, a total hardness of 271, and an iron content of 0.1 parts per million without manganese as shown by the analysis of sample number 74005, collected December 20, 1933.

Analysis of Sample Number 74005 from Well Number 4.

Determinations Made.		Hypothetical Combinations.		
	Pts. per million.			
Iron.....Fe	0.1	Sodium Nitrate.....NaNO ₃	14.5	0.85
Manganese..Mn	0.0	Sodium Chloride.....NaCl	13.4	0.78
Silica.....SiO ₂	8.0	Sodium Sulfate.....Na ₂ SO ₄	7.8	0.45
Turbidity.....	0.0	Magnesium Sulfate....MgSO ₄	50.0	2.91
Calcium.....Ca	65.2	Magnesium Carbonate..MgCO ₃	56.1	3.27
Magnesium..Mg	26.3	Calcium Carbonate....CaCO ₃	149.5	8.72
Ammonium..NH ₄	trace	Calcium Silicate.....CaSiO ₃	15.7	0.91
Sodium.....Na	11.7	Iron Oxide.....Fe ₂ O ₃	0.1	0.01
Sulfate.....SO ₄	45.1			
Nitrate.....NO ₃	10.6	Total.....	307.1	17.90
Chloride....Cl	8.0			
Alkalinity as CaCO ₃				
Phenolphthalein..	0.0			
Methyl Orange...	216.0			
Residue.....	292.0			
Total Hardness....	271.0			

Well number 5, located 500 feet east and 1375 feet north of the southwest corner of Section 9, was constructed in 1930 by the Ohio Drilling Company to a depth of 60.5 feet. The following materials were penetrated:

Gravel, sand and clay.....	13.5 feet
Sand and clay.....	4.5 feet
Sand and gravel.....	5.5 feet
Gravel and sand.....	11.0 feet
Gravel.....	10.5 feet
Gravel and sand.....	15.5 feet
Total	60.5 feet

Shale was found at a depth of 60.5 feet.

The well was cased with 24-inch pipe and 40 feet of 24-inch screen.

Well number 6, located 180 feet east and 1130 feet north of the southwest corner of Section 9, was constructed by the Ohio Drilling Company. It was cased with 24-inch pipe and 40 feet of 24-inch screen.

Well number 7, located 500 feet east and 875 feet north of the southwest corner of Section 9, was constructed by the Ohio Drilling Company, to a depth of 60 feet. It was cased with 24-inch pipe and 40 feet of 24-inch screen.

The water had a residue of 265, and a total hardness of 254 parts per million without iron or manganese as shown by the analysis of sample number 74002, collected December 20, 1933.

Analysis of Sample Number 74002 from Well Number 7.

Determinations Made.		Hypothetical Combinations.	
	Pts. per million.		Pts. per million. Grs. per gallon.
Iron.....Fe	0.0	Sodium Nitrate.....NaNO ₃	16.2 0.95
Manganese..Mn	0.0	Sodium Chloride.....NaCl	9.9 0.58
Silica.....SiO ₂	7.5	Sodium Sulfate.....Na ₂ SO ₄	5.0 0.29
Turbidity.....	0.0	Magnesium Sulfate.....MgSO ₄	45.2 2.64
Calcium.....Ca	64.1	Magnesium Carbonate MgCO ₃	47.7 2.78
Magnesium..Mg	22.9	Calcium Carbonate....CaCO ₃	147.6 8.61
Ammonium..NH ₄	trace	Calcium Silicate.....CaSiO ₃	14.5 0.85
Sodium.....Na	9.9		
Sulfate.....SO ₄	39.7	Total.....	236.1 16.70
Nitrate.....NO ₃	12.0		
Chloride....Cl	6.0		
Alkalinity as CaCO ₃			
Phenolphthalein..	0.0		
Methyl Orange...	204.0		
Residue.....	265.0		
Total Hardness....	254.0		

GEOEGE TEAEGEE WELL. A well was constructed for George Traeger, of Pekin, Illinois, by H. B. Smith of San Jose, Illinois, in 1918 to a depth of 80 feet. It is located approximately 1400 feet west and 200 feet south of the northeast corner of Section 3, T. 24 N., R. 5 W., of the 3rd P. M. The well penetrated a few feet of earth and then sand and gravel to the bottom. It is cased with 4-inch pipe.

The well is equipped with an iron hand pump having a 2½-inch by 14-inch cylinder set at the end of 50 feet of drop pipe. Below the cylinder is 18 feet of suction pipe. The pump has a stroke of 6 inches. Static water level is 60 feet below ground surface. The water is medium hard.

THEODORE UBBAN WELL. A well was constructed for Theodore Ubban of Pekin, Illinois, by H. B. Smith of San Jose, Illinois, in 1918 to a depth of 90 feet. It is located approximately 2800 feet east and 3100 feet north of the southeast corner of Section 2, T. 24 N., E. 5 W., of the 3rd P. M.

The well is equipped with a single action hand pump having a 2½-inch by 14-inch cylinder set on the end of 60 feet of drop pipe. There is 18 feet of suction pipe below the cylinder. The water is good and of medium hardness.

VORIS WELL. A well spoken of as the Voris well or the Bailey well, drilled in 1860, is located approximately 300 feet northerly and 300 feet westerly of the intersection of Eoutes 150 and 116 or 650 feet north and 1000 feet east of the southwest corner of the northwest quarter of Section 33, T. 26 N., E. 4 W., of the 3rd P. M.

A log of the well as reported in the U. S. G. S. Bulletin 506, page 15, is as follows:

Materials.	Thickness in feet.	Depth in feet.
Pleistocene—		
Alluvial soil of river bottom	4	4
Sand	4	8
Gravel (boulder drift)	20	28
Pennsylvanian—		
Clay shale	59	87
Slate, bituminous	3	90
Fire clay	15	105
Clay shale	15	120
Coal	4	124
Clay shale	34	158
Shale, sandy and argillaceous, very hard	34	192
Sandstone	4	196
Limestone, nodular, argillaceous	6	202
Sandstone, compact, fine grained	5	207
Shale, hard, dark blue, sandy	25	232
Coal	3	235
Shale, sandy, argillaceous	25	260
Shale, bituminous with bands of limestone	57	317
Mississippian—		
Cherty rock	44	361
Hard siliceous rock, mainly chert (possibly chert and limestone mixed)	33	394
Sandstone, fine grained	65	459

It is further noted that the Silurian limestone (Niagaran) was gray and porous at a depth of 774 feet.

Above ground the casing was reduced to 3 inches and the hydrostatic pressure was sufficient to cause this pipe to flow full.

The well was always known as the "sulfur well" because of the strong sulfur odor of the water. So far as is known the water was never used.

Sometime during 1936 or 1937 the well was capped and earth filling placed over it so that it is not now visible.