

ISWS-74-BUL6017)

BULLETIN 60-7

STATE OF ILLINOIS

DEPARTMENT OF REGISTRATION AND EDUCATION



Public Groundwater Supplies
in Crawford County

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ILLINOIS STATE WATER SURVEY

URBANA

1974

PUBLIC GROUNDWATER SUPPLIES IN CRAWFORD COUNTY

by Dorothy M. Woller

Introduction

This publication presents all available information on production wells used for public groundwater supplies in Crawford County. Bulletin 60, which is divided by county into separate publications, supersedes Bulletin 40 and its Supplements 1 and 2.

The definition of public water supply as contained in the Environmental Protection Act of 1970 was used to determine those water systems and wells to be included. Systems and wells described furnish water for drinking or general domestic use in: 1) incorporated municipalities; 2) unincorporated communities where 10 or more separate lots or properties are being served or are intended to be served; 3) state-owned parks and memorials; and 4) state-owned educational, charitable, or penal institutions.

This report includes separate descriptions for 3 groundwater supply systems furnishing water to 6 municipalities and 2 public water districts in Crawford County. These are preceded by brief summaries of the groundwater geology of the county and the development of groundwater sources for municipal use. An explanation of the format used in the descriptions is also given.

Acknowledgments. This report was prepared under the general direction of Dr. William C. Ackermann, Chief of the Illinois State Water Survey, and John B. Stall, Head of the Hydrology Section. The work was done under the direct guidance of William H. Walker, Hydrologist. Special thanks are given to E. W. Sanderson, Assistant Engineer, and J. P. Gibb, Assistant Hydrologist, who checked all of the data and reviewed the manuscript. Mrs. J. L. Ivens and Mrs. P. A. Motherway edited the manuscript, and Susan L. Scherbroeck typed the camera-copy. The chemical analyses, unless otherwise stated, were made by personnel of the Water Survey Chemistry Section under the supervision of Laurel M. Henley. The analyses made by personnel of the Environmental Protection Agency were under the supervision of John P. Anderson. Grateful acknowledgment also is given to consulting engineers, well drillers, water superintendents, and municipal officials who have provided valuable information used in this report.

Geology

The geology of Crawford County is described generally in Illinois State Geological Survey Circular 225, *Groundwater Geology in South-Central Illinois*. The following brief discussion of geologic conditions in the county is taken largely from that publication. For a more detailed definition of the geology in this portion of the state, the reader is referred to the State Geological Survey which is located on the University of Illinois campus, Urbana.

The unconsolidated materials forming the present day land surface in Crawford County vary greatly in thickness and water-yielding character. Except along the western side and in the northeastern area near the Wabash River, the unconsolidated materials are thin (less than 50 feet) and

consist principally of nonwater-yielding glacial till. Along the Wabash River north of Palestine, thick, permeable deposits of water-bearing sand and gravel are capable of yielding large quantities of groundwater. Thick drift is reported on the western side of the county in buried and partially buried ancient bedrock valleys. These ancient valleys lie near the Embarras River valley in the southwestern part of the county and near Willow Creek and North Fork Embarras River in the northwestern part. Sand and gravel deposits having potential for development of moderate to large supplies are associated with these ancient valleys and the present Embarras River valley. Water-bearing sand and gravel deposits also may be present in some of the small

tributary stream valleys in the county.

Beneath the glacial deposits are the upper bedrock formations of Pennsylvanian age. These rocks consist principally of shale with only thin beds of water-yielding sandstone or creviced limestone. They are capable of producing only limited quantities of water.

Groundwater Development for Municipal Use

Unconsolidated sand and gravel deposits associated with the valleys of the Wabash River and Brushy Creek are tapped as the sources for the three water supply systems in Crawford County. At the Eastern Illinois Water Co. well field near Palestine (which serves Oblong, Palestine, Robinson, and Stoy and the Eaton and Hebron Public Water Districts) and the municipalities of Flat Rock and Hutsonville, there are presently eight municipal wells including emergency wells tapping these aquifers to depths ranging from 32 to 85 ft. Their reported yields range from 75 to 800 gpm depending primarily upon the type of well constructed and the permeability, thickness, and areal extent of the sand and gravel unit tapped by each well. Production from these wells was estimated to be 1,388,000 gpd in 1972. Past and present analyses of water they produce indicate that the iron content ranges from 0.0 to 1.2 mg/l, and the hardness from 129 to 384 mg/l. Groundwater for all the municipal supplies is fluoridated. Water at Hutsonville also is chlorinated. Water from the Eastern Illinois Water Co. well field near Palestine is zeolite softened and chlorinated.

Format

In this publication the descriptions of public groundwater supplies are presented in alphabetical order by place name, as follows: Eaton Public Water District, Flat Rock, Hebron Water District, Hutsonville, Oblong, Palestine, Robinson, Stoy.

At the beginning of each description the U. S. Census of population for 1970 is given for incorporated places. For unincorporated places, the population is estimated on the basis of the number of services or residential units and an assumed number of 3.5 persons per service.

The number of services and quantity of water distributed at each supply are given where available for the earliest and the latest reported values.

Individual production wells for each supply are described in the order of their construction. The description for each well includes the *aquifer tapped, date drilled, depth, driller, legal location, elevation in feet above mean sea level, log, construction features, yield, pumping equipment, and chemical analyses.*

The screen sizes given in this publication are for continuous slot type screens unless stated otherwise. Slot sizes given indicate the width of the slot openings in thousandths of an inch. For example, a 20 slot screen has slot openings 0.020 in. wide and a 100 slot screen has slots 0.100 in. wide. Approximate equivalent slot openings for other types of screens are given in parentheses after the screen designation.

Abbreviations Used

est.....	estimated
ft.....	foot (feet)
gpd.....	gallons per day
gpm.....	gallons per minute
hp.....	horsepower
hr.....	hour(s)
ID.....	inside diameter
in.....	inch(es)
Lab.....	laboratory
me/l.....	milliequivalents per liter
mg/l.....	milligrams per liter
min.....	minute(s)
No.(s).....	number(s)
OD.....	outside diameter
pc/l.....	picocuries per liter
R.....	range
rpm.....	revolutions per minute
T.....	township
TDH.....	total dynamic head

EATON PUBLIC WATER DISTRICT

Eaton Public Water District (est. 700), serving the villages of Eaton and Annapolis and an area known as West Lake, installed a public water supply in 1967. Finished water for this supply is obtained from the Eastern Illinois Water Co. well field near Palestine (*see Robinson*). In 1967 there were 187 services, all metered. In 1972 there were 200 services, all metered; the average daily consumption was 17,400 gpd and the maximum daily consumption was 25,700 gpd.

FLAT ROCK

The village of Flat Rock (504) installed a public water supply in 1958. One well (No. 1) is in use and another well (No. 2) is available for emergencies and pumped about once a week. In 1959 there were 170 services, all metered. In 1972 there were 185 services, all metered; the estimated average and maximum daily pumpages were 28,000 and 29,000 gpd, respectively. The water is fluoridated.

WELL NO. 1, finished in sand and gravel, was completed in September 1956 to a depth of 52 ft by the Layne-Western Co., Aurora. The well is located about 2.5 miles south of town, approximately 30 ft N and 2100 ft E of the SW corner of Section 18, T5N, R11W. The land surface elevation at the well is approximately 450 ft.

A correlated drillers log of Well No. 1 furnished by the State Geological Survey follows:

Formation	Thickness (ft)	Depth (ft)
PLEISTOCENE SERIES		
Top soil	2	2
Brown clay	28	30
Medium sand (loose — brown)	2	32
Medium coarse sand and gravel (loose — brown)	20	52
Cemented sand	5	57

A 20-in. diameter hole was drilled to a depth of 52 ft. The well is cased with 8-in. pipe from 1.5 ft above land surface to a depth of 37 ft followed by 15 ft of 8-in. No. 5 (0.105 in.) Layne bronze shutter screen. The annulus between the hole and casing-screen assembly is filled with puddled clay to a depth of 20 ft and with gravel from 20 to 52 ft.

A production test using one observation well was conducted on September 27-28, 1956, by representatives of the driller, the State Water Survey, and Caldwell-Rhoads Co., Consulting Engineers. After 19.2 hr of pumping at rates of 128 to 132 gpm, the drawdown was 24.0 ft from a nonpumping water level of 9.5 ft below land surface.

The pumping equipment presently installed is a Layne and Bowler oil-lubricated turbine pump set at 30 ft, rated at 90 gpm at about 110 ft TDH, and powered by a 10-hp U. S. electric motor.

The following mineral analysis made by the Environmental Protection Agency (Lab. No. 01074) is for a water sample from the well collected August 24, 1971.

WELL NO. 1, LABORATORY NO. 01074

	mg/l	me/l		mg/l	me/l
Iron	Fe	0.0	Silica	SiO ₂	2.7
Manganese	Mn	0.0	Fluoride	F	0.1
Ammonium	NH ₄	0.06	Nitrate	NO ₃	1.8
Sodium	Na	33	Chloride	Cl	33
Potassium	K	0.3	Sulfate	SO ₄	17
Calcium	Ca	82.4	Alkalinity (as CaCO ₃)	252	5.04
Magnesium	Mg	16	Hardness (as CaCO ₃)	264	5.28
Barium	Ba	0.1	Total dissolved		
Copper	Cu	0.0	minerals		350
Cadmium	Cd	0.00	PH (as rec'd)	7.2	
Chromium	Cr	0.0	Radioactivity		
Lead	Pb	0.00	Alpha	pc/l	0
Mercury	Hg	<0.0005	± deviation		0
Nickel	Ni	0.0	Beta	pc/l	0
Silver	Ag	0.0	± deviation		0
Zinc	Zn	0.0			

WELL NO. 2, finished in sand and gravel, was completed in November 1961 to a depth of 63 ft by the Layne-Western Co., Kirkwood, Mo. This well is used for emergencies and is pumped about once a week. The well is located about 467 ft E of Well No. 1, approximately 25 ft N and 2567 ft E of the SW corner of Section 18, T5N, R11W. The land surface elevation at the well is approximately 450 ft.

A drillers log of Well No. 2 follows:

Formation	Thickness (ft)	Depth (ft)
Brown top soil	1	1
Brown and gray clay, silty	6	7
Brown silty clay	15	22
Brown fine sand	2	24
Brown clay	2	26
Brown fine sand	6	32
Brown clay	2	34
Brown fine to medium sand to coarse sand loose, thin streaks of clay	9	43
Brown fine to coarse sand, thin streaks of finegravel	14	57
Gray fine to coarse sand, thin streaks of finegravel	6	63
Gray clay	1	64
Gray fine to coarse sand, fine gravel	2	66
Gray clay with thin streaks of sand and gravel	11	77

A 20-in. diameter hole was drilled to a depth of 63 ft. The well is cased with 8-in. steel pipe from 2 ft above land surface to a depth of 48 ft followed by 15 ft of 8-in. No. 6 (0.080 in.) Layne bronze shutter screen. The annulus between the hole and casing-screen assembly is filled with puddled clay from 0 to 20 ft and with gravel from 20 to 63 ft.

A production test using one observation well was conducted on December 5, 1961, by representatives of the driller, the village, and the State Water Survey. After 5 hr of

pumping at rates of 112 to 129 gpm, the drawdown was 18.6 ft from a nonpumping water level of 11.5 ft below land surface. Thirty min after pumping was stopped, the water level had recovered to 14.8 ft. On the basis of the production test data, it was estimated that this well would yield 125 gpm (180,000 gpd) on a long-term basis with the pumping level near the top of the well screen.

The pumping equipment presently installed is a Layne and Bowler oil-lubricated turbine pump set at 30 ft, rated at 75 gpm at about 280 ft TDH, and powered by a 10-hp 1800 rpm U. S. electric motor.

A mineral analysis of a sample made by the Environmental Protection Agency (Lab. No. 01070) collected August 20, 1971, showed the water to have a hardness of 129 mg/l, total dissolved minerals of 305 mg/l, and an iron content of 0.0 mg/l.

HEBRON PUBLIC WATER DISTRICT

Hebron Public Water District (est. 287), serving the unincorporated area of New Hebron and approximately a 3-square-mile rural area north of New Hebron, installed a public water supply in 1968. Finished water for this supply is obtained from the Eastern Illinois Water Co. well field near Palestine (*see Robinson*). In 1972 there were 99 services, all metered; the average daily consumption was 10,000 gpd and the maximum daily consumption was 15,000 gpd.

HUTSONVILLE

The village of Hutsonville (544) installed a public water supply in 1936. One well (No. 3) is in use and another well (No. 2) is available for emergency use. In 1951 there were approximately 200 services, all metered. In 1972 there were 270 services, all metered; the estimated average daily pumpage was from 20,000 to 30,000 gpd. The water is chlorinated and fluoridated.

WELL NO. 1, finished in sand and gravel, was completed in 1936 to a depth of 32.5 ft by C. A. Chambers, Hutsonville. This well was abandoned in 1964. The well is located at the intersection of Water and Mechanic Sts., approximately 600 ft S and 2000 ft W of the NE corner of Section 29, T8N, R11W. The land surface elevation at the well is approximately 435 ft.

A drillers log of Well No. 1 follows:

<i>Formation</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Subsoil	5	5
Gravel	15	20
Gravel, coarse	3	23
Coarse gravel and sand (10 ft of water at 25 ft, edge of rock at 27 ft)	7	30
Blue clay or shale	7.5	37.5

A 10-in. diameter hole was drilled to a depth of 35 ft. The well is cased with 10-in. steel pipe from 2 ft above land surface to a depth of 21.8 ft, 7 ft of No. 125 slot Cook screen from 22.5 to 29.5 ft, and with steel pipe from 29.5 to 32.6 ft. The screen was reported to have been pulled and cleaned in 1940. After the screen was pulled, part of the formation caved in, and it was necessary to reduce the number of pump stages.

A production test was conducted by the State Water Survey on March 31, 1936. The well reportedly produced from 153 to 158 gpm for 8 hr with a drawdown of 9.8 ft from a nonpumping water level of 9.5 ft below land surface.

On February 25, 1952, the nonpumping water level was reported to be 16.5 ft below the pump base.

A mineral analysis of a sample (Lab. No. 82498) collected December 1, 1937, showed the water to have a hardness of 358 mg/l, total dissolved minerals of 459 mg/l, and an iron content of 0.2 mg/l.

WELL NO. 2, finished in sand and gravel, was completed in April 1946 to a depth of 36.5 ft below original land surface by Harry Knox, Graysville, Ind. This well is maintained for emergency use. The well is located 25 ft S of Well No. 1, approximately 625 ft S and 2000 ft W of the NE corner of Section 29, T8N, R11W. The land surface elevation at the well is approximately 435 ft.

A 10-in. diameter hole was drilled to a depth of 36.5 ft. Originally the well was cased with 10-in. steel pipe from 1.5 ft above the pumphouse floor to a depth of 36.5 ft below original land surface with the bottom section being perforated. In September 1964, the Layne-Western Co., Kirkwood, Mo., acidized the 10-in. perforated casing and lowered an 8-in. casing and a 5-ft length of screen inside the 10-in. steel pipe. The casing going through the well pit is completely encased in concrete to protect it against surface pollution.

On April 28, 1948, the nonpumping water level was reported to be 20 ft below the pump base. This level was reported to vary with the Wabash River stages.

In 1964, the well reportedly produced 100 gpm with a drawdown of 6 ft from a nonpumping water level of 28 ft below the top of the casing.

The pumping equipment presently installed is a Layne turbine pump rated at 225 gpm at about 180 ft TDH, and powered by a 15-hp U. S. electric motor.

A mineral analysis of a sample (Lab. No. 114507) collected April 28, 1948, after pumping for 10 min at 150 gpm, showed the water to have a hardness of 353 mg/l, total dissolved minerals of 394 mg/l, and an iron content of 0.1 mg/l.

WELL NO. 3, finished in sand and gravel, was completed in July 1958 to a depth of 32 ft by the Layne-Western Co., Kirkwood, Mo. The well is located 100 ft S of the center line of Mechanic St. east of Water St., approximately 645 ft S and 2000 ft W of the NE corner of Section 29, T8N, R11W. The land surface elevation at the well is approximately 435 ft.

A correlated drillers log of Well No. 3 furnished by the State Geological Survey follows:

<i>Formation</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
PLEISTOCENE SERIES		
Gravel fill	1	1
Clay	1	2
Mucky gravel	5	7
Gray coarse sand and gravel	25	32
Limestone boulder		32

A 42-in. diameter hole was drilled to a depth of 9 ft, reduced to 38 in. between 9 and 19 ft, and finished 36 in. in diameter from 19 to 32 ft. The well is cased with 26-in. No. 3 gage Armco iron outer pipe from 5.7 ft above land surface to a depth of 19.3 ft and 12-in. inner pipe from 9 ft above land surface to a depth of 27.4 ft followed by 5 ft (4.6 ft exposed) of 12-in. No. 5 (0.105 in.) Layne stainless steel shutter screen. The annulus is filled with concrete between the wall of the 42-in. hole and the 26-in. casing from the pumphouse floor to a depth of 9 ft and with neat cement in the 38-in. drill hole outside the 26-in. pipe from 9 ft to a depth of 18.5 ft. The annulus between the 36-in. hole and 26-in. casing and the 12-in. casing-screen assembly is filled with gravel from 0 to 32 ft.

The following mineral analysis made by the Environmental Protection Agency (Lab. No. 01101) is for a water sample from the well collected August 25, 1971, after 5 hr of pumping at 150 to 200 gpm.

WELL NO. 3, LABORATORY NO. 01101

	<i>mg/l</i>	<i>me/l</i>		<i>mg/l</i>	<i>me/l</i>			
Iron	Fe	0.0	Silica	SiO ₂	15			
Manganese	Mn	0.1	0.00	Fluoride	F	0.1	0.00	
Ammonium	NH ₄	1	0.06	0.00	Nitrate	NO ₃	13.2	0.21
Sodium	Na	22.5	0.98	Chloride	Cl	3.4	0.96	
Potassium	K	3.2	0.08	Sulfate	SO ₄	59	1.23	
Calcium	Ca	114	5.67	Alkalinity (as CaCO ₃)	292	5.84		
Magnesium	Mg	22.8	1.87	Hardness (as CaCO ₃)	384			
Barium	Ba	0.05		Total dissolved				
Copper	Cu	0.0		minerals	471			
Cadmium	Cd	0.00						
Chromium	Cr	0.0						
Lead	Pb	0.00						
Mercury	Hg	<0.0005						
Nickel	Ni	0.0						
Silver	Ag	0.0						
Zinc	Zn	0.0		PH (as rec'd)	7.3			

A production test was conducted on July 28-29, 1958, by representatives of the driller, the village, the State Water Survey, and Marbry and Johnson, Consulting Engineers. After 24 hr of pumping at rates of 239 to 344 gpm, the drawdown was 9.5 ft from a nonpumping water level of 12.2 ft below the top of the well.

The pumping equipment presently installed consists of a 15-hp 1800 rpm U. S. electric motor, an 8-in., 6-stage Layne oil-lubricated turbine pump (No. 39454) set at 25.7 ft, rated at 300 gpm, and 30 ft of 6-in. column pipe.

OBLONG

The village of Oblong (1860) installed a public water supply in 1926. Finished water for this supply is obtained from the Eastern Illinois Water Co. well field near Palestine (*see Robinson*). In 1950 there were 620 services, all metered (including 30 services in Stoy and 30 services along the highway to Oblong); the estimated average daily consumption was 130,000 gpd. In 1972 there were approximately 1000 services, all metered (including Stoy); the average daily consumption was 146,600 gpd and the maximum daily consumption was 182,500 gpd.

PALESTINE

The town of Palestine (1640) installed a public water supply in 1916. Finished water for this supply is obtained from the Eastern Illinois Water Co. well field situated near the west limits of Palestine (*see Robinson*). In 1954 there were 585 services, all metered; the estimated average daily consumption was 50,000 gpd. In 1972 there were 725 services, all metered; the average daily consumption was 80,000 gpd and the maximum daily consumption was 100,000 gpd.

ROBINSON

The city of Robinson (7178) installed a public water supply in 1896. The water system is owned and operated by the Eastern Illinois Water Co. The well field for this system is located in the Wabash River valley near Palestine,

approximately 6 miles east of Robinson. Two wells (Nos. 9 and 10) are in use and two additional wells (Nos. 5 and 7) are maintained for emergency use. Water from this system also supplies Oblong, Palestine, and Stoy, and the Eaton and Hebron Public Water Districts. In 1950 there were 2558 services, most were metered; the average daily pumpage was 800,000 gpd. In 1972 there was a total of 5078 services, all metered; the average and maximum daily pumpages were 1,340,000 and 1,484,000 gpd, respectively. The water is zeolite softened, chlorinated, and fluoridated.

Water was originally obtained from five wells between 75 and 90 ft deep located in Robinson. These wells were abandoned in 1910 and replaced by a dug well, the first installation in the new well field near Palestine. This well was 28 ft deep and finished in sand and gravel. The well was cased with 24-ft diameter brick walls (14 in. thick) from 2 ft above land surface to a depth of 28 ft. In 1914 the nonpumping water level was reported to be 20 ft below land surface. In 1925 the well was seldom used and was abandoned and filled prior to 1928.

The second well constructed, WELL NO. 1, finished in sand and gravel, was completed in 1916 to a depth of 50 ft. This well was abandoned in 1943 and filled with concrete. The well was located 15 ft W of the dug well, approximately 2500 ft N and 2090 ft E of the SW corner of Section 34, T7N, R11W. The land surface elevation at the well is approximately 450 ft.

A 10-in. diameter hole was drilled to a depth of 50 ft. The well was equipped with 10-in. pipe followed by 16 ft of No. 30 slot Johnson screen to a total depth of 50 ft.

WELL NO. 2, finished in sand and gravel, was completed in 1916 to a depth of 50 ft. This well was abandoned after 1928 and filled with concrete. The well was located 55 ft S of Well No. 1, approximately 2445 ft N and 2090 ft E of the SW corner of Section 34, T7N, R11W. The land surface elevation at the well is approximately 450 ft.

A 10-in. diameter hole was drilled to a depth of 50 ft. The well was equipped with 10-in. pipe followed by 16 ft of No. 30 slot Johnson screen to a total depth of 50 ft.

WELL NO. 3, finished in sand and gravel, was completed in August 1926 to a depth of 60 ft by the Thorpe Concrete Well Co., Alton. This well was disconnected in 1941 but is maintained for water level checking. The well is located 75 ft E of Well No. 1, approximately 2500 ft N and 2165 ft E of the SW corner of Section 34, T7N, R11W. The land surface elevation at the well is approximately 450 ft.

A 36-in. diameter hole was drilled to a depth of 60 ft. Initially the well was cased with 26-in. ID porous concrete casing from the bottom of the 8-ft deep pit to a depth of 60 ft. During rehabilitation in 1953, a 12-ft length of 12-in. casing with a 26-in. steel collar welded to the bottom was inserted inside the 26-in. concrete casing about 2 ft.

The space above the collar was filled with concrete from 7.5 to 10 ft below land surface. The remainder of the pit was filled with sand and gravel.

In 1928, after 2 or 3 hr of pumping, the drawdown was reported to be 3 ft from a nonpumping water level of 34.2 ft below land surface.

In 1938 the nonpumping water level was reported to be 29.2 ft below land surface.

In 1941 the well reportedly produced about 345 gpm for about 8-10 hr per day with a pumping water level of 41.8 ft below land surface.

On January 19, 1948, the well reportedly produced 500 gpm with a drawdown of 7.5 ft from a nonpumping water level of 37 ft below land surface.

A mineral analysis of a sample (Lab. No. 83708) collected June 17, 1938, showed the water to have a hardness of 285 mg/l, total dissolved minerals of 362 mg/l, and an iron content of 0.26 mg/l.

WELL NO. 4, finished in sand and gravel, was completed in April 1941 to a depth of 70.8 ft by the Kelly Well Co., Grand Island, Neb. This well was abandoned in 1963 and sealed in 1965. The well was located about 125 ft S and 60 ft W of Well No. 3, approximately 2375 ft N and 2105 ft E of the SW corner of Section 34, T7N, R11W. The land surface elevation at the well is approximately 450 ft.

A correlated drillers log of Well No. 4 furnished by the State Geological Survey follows:

<i>Formation</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
PLEISTOCENE SYSTEM		
Top soil	3	3
Sand and clay	11	14
Sand, some gravel	32	46
Sand	25	71

A 50-in. diameter hole was drilled to a depth of 18 ft., reduced to 46 in. between 18 and 44 ft, and finished 44 in. in diameter from 44 to 70.8 ft. The well was cased with 17-in. ID by 22-in. OD concrete pipe from 1.7 ft above land surface to a depth of 34.2 ft. A perforated concrete screen of the same size extended from 34.2 to 70.2 ft and a concrete plug extended to 70.8 ft. A 26-in. protective steel casing was placed to a depth of 22 ft below the pump base. The annulus between the 50-, 46-, and 44-in. diameter hole and the casing-screen assembly was filled with concrete from 1.7 ft above land surface to a depth of 18 ft and with gravel from 18 to 70.8 ft.

Upon completion, the driller reported that after pumping at a rate of 625 gpm, the drawdown was 5.2 ft from a nonpumping water level of 24.8 ft below land surface.

On February 14, 1948, the nonpumping water level was reported to be 24 ft below the pump base.

A partial analysis of a sample (Lab. No. 155374) collected August 1, 1961, showed the water to have a hardness of

268 mg/l, total dissolved minerals of 305 mg/l, and an iron content of 0.3 mg/l.

WELL NO. 5, finished in sand and gravel, was completed in January 1948 to a depth of 70 ft by the Kelly Well Co., Grand Island, Neb. This well is available for emergency use at Palestine. The well is located about 40 ft N and 120 ft E of Well No. 4, approximately 2415 ft N and 2225 ft E of the SW corner of Section 34, T7N, R11W. The land surface elevation at the well is approximately 450 ft.

A drillers log of Well No. 5 follows:

<i>Formation</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Top soil	5	5
Gravel	40	45
Sand	25	70
Shale	1	71

A 46-in. diameter hole was drilled to a depth of 70 ft. The well is cased with 17-in. ID by 22-in. OD concrete pipe from 1 ft above land surface to a depth of 26 ft. A perforated concrete screen of the same size extends from 2 ft to 70 ft. A 26-in. protective steel casing was placed from 2 ft above land surface to 20 ft. The annulus between the 26- and 22-in. casings is filled with concrete from 0 to 20 ft.

A production test was conducted by the driller on January 19, 1948. After pumping at rates of 850 to 2000 gpm, the final drawdown was 10.0 ft from a non-pumping water level of 27.0 ft below the pump base. Full recovery was observed within 1.5 hr.

The pumping equipment presently installed is a Fairbanks-Morse oil-lubricated turbine pump set at 60 ft, rated at 250 gpm, and powered by a 20-hp U. S. electric motor.

A mineral analysis of a sample made by the Environmental Protection Agency (Lab. No. 01744) collected September 27, 1971, after pumping for 30 min at 300 gpm, showed the water to have a hardness of 280 mg/l, total dissolved minerals of 326 mg/l, and an iron content of 0.0 mg/l.

WELL NO. 6, finished in sand and gravel, was completed in June 1954 to a depth of 80 ft by the Kelly Well Co., Grand Island, Neb. This well was abandoned in 1961 and the casing top sealed with a metal cap. The well is located about 200 ft E of Well No. 3, approximately 2500 ft N and 2365 ft E of the SW corner of Section 34, T7N, R11W. The land surface elevation at the well is approximately 454 ft.

A drillers log of Well No. 6 follows:

<i>Formation</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Clay dark sand	15	15
Fine sand	5	20
Coarse sand gravel stone	15	35
Sand gravel	4.3	78
Shale	2	80

A 38-in. diameter hole was drilled to a depth of 80 ft. The well is cased with 17-in. ID by 22-in. OD concrete

pipe from 1 ft above land surface to a depth of 43 ft. A perforated 22-in. diameter concrete screen extends from 43 to 80 ft. A 26-in. protective steel casing was placed from 2.1 ft above land surface to a depth of 17 ft. The annulus between the 26- and 22-in. casings is filled with concrete from 0 to 17 ft.

In June 1956, the well reportedly produced 620 gpm with a drawdown of 9.5 ft from a nonpumping water level of 33.0 ft.

WELL NO. 7, finished in sand and gravel, was completed in June 1956 to a depth of 80 ft by the Kelly Well Co., Grand Island, Neb. This well is available for emergency use at Robinson. The well is located about 250 ft SE of Well No. 6, approximately 2425 ft N and 2590 ft W of the SE corner of Section 34, T7N, R11W. The land surface elevation at the well is approximately 454 ft.

A drillers log of Well No. 7 follows:

<i>Formation</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Dark sand and clay	15	15
Fine sand	5	20
Coarse sand, stone	15	35
Gravel and sand	43	78
Shale	2	80

A 38-in. diameter hole was drilled to a depth of 80 ft. The well is cased with 17-in. ID by 22-in. OD concrete pipe from 3 ft above land surface to a depth of 43 ft. A perforated 22-in. diameter concrete screen extends from 43 to 80 ft. A 36-in. protective steel casing was placed from 3 ft above land surface to a depth of 15 ft. The annulus between the 36- and 22-in. casings is filled with concrete from 0 to 15 ft.

Upon completion, the well reportedly produced 800 gpm with a drawdown of 12 ft from a nonpumping water level of 33 ft.

The pumping equipment presently installed is a Fairbanks-Morse turbine pump set at 70 ft, rated at 600 gpm at about 522 ft TDH, and powered by a 125-hp U. S. electric motor.

WELL NO. 8, finished in sand and gravel, was completed in July 1958 to a depth of 83 ft by the Kelly Well Co., Grand Island, Neb. This well was abandoned and sealed in 1966. The well was located about 425 ft SE of Well No. 7, approximately 2175 ft N and 2250 ft W of the SE corner of Section 34, T7N, R11W. The land surface elevation at the well is approximately 450 ft.

A drillers log of Well No. 8 follows:

<i>Formation</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Top soil	3	3
Sand and gravel coarse	39	42
Coarse sand	25	67
Sand and gravel	11	78
Fine sand	5	83
Sand rock	1	84

A 42-in. diameter hole was drilled to a depth of 83 ft. The well was cased with 26-in. ID by 32-in. OD concrete

pipe from 1 ft above land surface to a depth of 46 ft. A perforated 32-in. diameter concrete screen extended from 46 to 82 ft. A 42-in. protective steel casing was placed from 1 ft above land surface to a depth of 15 ft. The annulus between the 42- and 32-in. casings was filled with concrete from 0 to 15 ft.

A partial analysis of a sample (Lab. No. 155375) made in August 1961, showed the water to have a hardness of 304 mg/l, total dissolved minerals of 371 mg/l, and an iron content of 0.6 mg/l.

WELL NO. 9, finished in sand and gravel, was completed in August 1961 to a depth of 84 ft by the Kelly Well Co., Grand Island, Neb. The well is located about 350 ft NW of Well No. 8, approximately 2525 ft N and 2300 ft W of the SE corner of Section 34, T7N, R11W. The land surface elevation at the well is approximately 448 ft.

A drillers log of Well No. 9 follows:

Formation	Thickness (ft)	Depth (ft)
Top soil	3	3
Sand and gravel coarse	20	23
Sand and gravel	10	33
Coarse sand	20	53
Sand and gravel	20	73
Sand and coarse gravel	10	83
Blue clay	1	84

A 42-in. diameter hole was drilled to a depth of 84 ft. The well is cased with 26-in. ID by 32-in. OD concrete pipe from 2 ft above land surface to a depth of 48 ft. A perforated 32-in. OD concrete screen extends from 48 to 84 ft and a concrete plug extends to 84.8 ft. A 36-in. protective steel casing was placed from the land surface to a depth of 16 ft. The annulus between the 36- and 32-in. casings is filled with concrete from 0 to 16 ft.

Upon completion, the well reportedly produced 1500 gpm for 8 hr with a drawdown of 14.5 ft from a nonpumping water level of 19.0 ft below land surface.

The pumping equipment presently installed consists of a 100-hp Westinghouse electric motor, a 12-in., 9-stage Johnston turbine pump set at 70 ft, rated at 600 gpm at about 522 ft TDH, and 50 ft of 8-in. column pipe. A 10-ft section of 8-in. suction pipe is attached to the pump intake.

A mineral analysis of a sample made by the Environmental Protection Agency (Lab. No. 02093) collected October 8, 1971, after pumping for 24 hr at 800 gpm, showed the water to have a hardness of 282 mg/l, total dissolved minerals of 356 mg/l, and an iron content of 0.1 mg/l.

WELL NO. 10, finished in sand and gravel, was completed in February 1966 to a depth of 84 ft by the Layne-Western Co., Kirkwood, Mo. The well is located about 1600 ft SE of Well No. 9, approximately 2100 ft N and 750 ft W of the SE corner of Section 34, T7N, R11W. The land surface elevation at the well is about 443 ft.

A 36-in. diameter hole was drilled to a depth of 84 ft. The well is cased with 16-in. pipe from 1.5 ft above land

surface to a depth of 49 ft followed by 35 ft of 16-in. No. 5 (0.105 in.) Layne stainless steel shutter screen. The annulus between the casing-screen assembly and bore hole is filled with puddled clay from 0 to 20 ft and with 35 tons of Meramec gravel from 20 to 84 ft.

A drillers log of Well No. 10 follows:

Formation	Thickness (ft)	Depth (ft)
Black sandy dirt	5	5
Fine brown sand	10	15
Medium sand and gravel	30	45
Fine brown sand	10	55
Medium sand	10	65
Coarse sand, trace of small gravel	10	75
Medium sand	10	85
Fine gray sand	2.7	87.7

A production test using one observation well was conducted on February 17, 1966, by representatives of the driller, the State Water Survey, and the Eastern Illinois Water Co. After 4 hr of pumping at rates of 912 to 820 gpm, the final drawdown was 7.31 ft from a nonpumping water level of 30.83 ft below land surface. Thirty min after pumping was stopped, the water level had recovered to 31.55 ft. On the basis of the production test data, it was estimated that this well would yield 800 gpm (1,152,000 gpd) on a long term basis.

The pumping equipment presently installed is a Johnston turbine pump set at 67 ft, rated at 800 gpm, and powered by a 125-hp Westinghouse electric motor.

The following mineral analysis made by the Environmental Protection Agency (Lab. No. 02094) is for a water sample from the well collected October 8, 1971, after 24 hr of pumping at 850 gpm.

WELL NO. 10, LABORATORY NO. 02094

	mg/l	me/l		mg/l	me/l
Iron	Fe	0.0	Silica	SiO ₂	16
Manganese	Mn	0.0	Fluoride	F	0.15 0.08
Ammonium	NH ₄	0.03 0.00	Boron	B	0.1
Sodium	Na	10 0.44	Nitrate	NO ₃	18.9 0.30
Potassium	K	2.7 0.07	Chloride	Cl	17 0.48
Calcium	Ca	84 4.19	Sulfate	SO ₄	35 0.73
Magnesium	Mg	20 1.64	Alkalinity (as CaCO ₃)	228	4.56
			Hardness (as CaCO ₃)	294	
Barium	Ba	0.0	Total dissolved		
Copper	Cu		0.0 minerals		
Cadmium	Cd	0.00			
Chromium	Cr	0.0	pH (as rec'd)	7.2	
Lead	Pb	0.00	Radioactivity		
Mercury	Hg	<0.0005	Alpha pc//	0	
Nickel	Ni	0.0	±deviation	0	
Silver	Ag	0.0	Beta pc//	1	
Zinc	Zn	0.0	±deviation	1	

STOY

The village of Stoy (199) installed a public water supply in 1963. Finished water for this supply is obtained from the Eastern Illinois Water Co. well field near Palestine via Oblong (*see Robinson*).