STATE OF OHIO

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF WATER

# WATER RESOURCES OF LICKING COUNTY, OHIO


BULLETIN 36

Columbus, Ohio

1960

**STATE OF OHIO**
MICHAEL V. DiSALLE, *Governor*

**DEPARTMENT OF NATURAL RESOURCES**
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**DIVISION OF WATER**
C. V. YOUNGQUIST, *Chief*

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# WATER RESOURCES OF LICKING COUNTY, OHIO

By
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Prepared in cooperation with the
UNITED STATES GEOLOGICAL SURVEY

Bulletin 36
Columbus, Ohio
1960



The F. J. Heer Printing Company
Columbus 16, Ohio
1961
Bound by the State of Ohio

## NATURAL RESOURCES COMMISSION

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# WATER RESOURCES OF LICKING COUNTY, OHIO

By George D. Dove

## ABSTRACT

Licking County, the third largest county in Ohio, covers a rectangular area of 686 square miles, or 439,040 acres, in the east-central part of the State. It occupies parts of two physiographic provinces, the Kanawha section of the Appalachian Plateau in the east and the Till Plains section of the Central Lowlands in the west, and its average altitude is about 1,000 feet. The Licking River, formed at Newark by the junction of North Fork Licking River, South Fork Licking River, and Raccoon Creek, is the principal river in the county.

The average annual temperature in Licking County is 51.2° F. The hottest month is July, with an average temperature of 73.6° F, and the coldest month is January, with an average temperature of 29.3° F. The average annual precipitation is 40.5 inches. The wettest year of record was 1929, with 53.29 inches, and the driest year was 1930, with 27.69 inches.

Of 1,038 water wells investigated in Licking County 632 were for domestic use, 44 were for stock, 217 for domestic and stock, 3 for irrigation, 26 for industrial or municipal purposes, 110 were abandoned, 3 were for observation purposes, and 3 were for public use. Five of the thirteen incorporated municipalities in the county depend on ground water for their public supply. The city of Newark, which has nearly 50 percent of the county's population, obtains its water from the North Fork Licking River.

Licking County is drained by the Licking River, Wakatomika Creek, Jonathan Creek, and tributaries of Big Walnut Creek and Little Walnut Creek. These streams, with the exception of the tributaries of Big Walnut and Little Walnut Creeks, lie within the drainage basin of the Muskingum River. The Licking River and its tributary streams have fairly high sustained dry-weather flows and are not subject to extreme droughts or floods.

The mean flow of the Licking River at Toboso, 1921-53, was 692 cfs (cubic feet per second), the mean flow of Wakatomika Creek near Frazeysburg, 1936-53, was 157 cfs, and the mean flow of the Licking River near Newark, 1939-52, was 576 cfs. Expressed as cubic feet per second per square mile, the mean flows of these streams are slightly above the average mean flows of Ohio streams having 10 years or more of record.

Prior to the glacial or Pleistocene epoch the northern and western parts of Licking County were drained by a large Teays-stage river. This river entered the county immediately east of Homer and flowed southwestward past Homer to Johnstown and thence southward past Pataskala into Fairfield County. The central and eastern parts of Licking County also were drained by a Teays-stage river, called the Cambridge River. The Cambridge River flowed west from Hanover to Newark and thence south past Hebron into Fairfield County.

Four times within the past million years, climatic changes have resulted in the formation of great ice sheets, or glaciers, which covered vast areas of Canada and the northern United States. As these glaciers advanced and retreated they left thick deposits of clay, silt, sand, and gravel.

During Deep-stage time the principal drainage changes in Licking County occurred after the breaching of low drainage divides at Utica and Granville. When the drainage divide at Utica was breached, the large Teays-stage river that had entered Licking County near Homer started to flow again and was diverted southward past Utica to Newark. This newly revived Deep-stage river was called the Utica River. A Teays-stage tributary stream that formerly flowed west from Granville was reversed in Deep-stage time and the river, breaching the drainage divide at Granville, flowed eastward to Newark. At Newark this tributary stream from Granville, and the Utica River, joined the main Deep-stage stream, which was called the Newark River. The Newark River flowed south past Hebron into Fairfield County.

The largest supplies of ground water in Licking County are obtained from outwash deposits in the valleys of North Fork Licking River, South Fork Licking River, and Raccoon Creek. Wells drilled to bedrock in the North Fork and South Fork Licking River valleys in Newton and Newark Townships penetrate three layers of outwash sand

and gravel. The first or upper layer of sand and gravel occurs at the surface and has a maximum thickness of about 55 feet near the center of the valley. Wells that tap this aquifer yield up to 150 gpm (gallons per minute). The second sand-and-gravel aquifer in these valleys is about 40 feet thick and occurs at a depth of 90 to 95 feet below the land surface. The third layer of sand and gravel is about 30 feet thick and occurs at a depth of about 175 feet below the land surface. Each of these lower aquifers may yield up to 500 gpm of water.

Outwash sand and gravel deposits in Raccoon Creek valley are about 100 feet thick, and are favorably situated to receive recharge from Raccoon Creek. The city of Granville pumps as much as 300,000 gpd (gallons per day) from these deposits without noticeable lowering of the water table.

Consolidated rocks of sedimentary origin, belonging to the Pennsylvanian and Mississippian systems, are exposed at the land surface in Licking County. These rocks are conglomerate, sandstone, siltstone, shale, limestone, flint, coal, and clay. The Pennsylvanian system is represented by outcrops of the Pottsville and Allegheny formations. Small supplies of water for stock and domestic purposes are obtained from a few wells drilled into these Pennsylvania sediments in the eastern part of the county. The Mississippian system is represented by the Logan formation, Cuyahoga formation, Sunbury shale, Berea sandstone, and Bedford shale. Wells drilled into the Cuyahoga formation yield up to 100 gpm. Smaller yields are available from the Logan formation and Berea sandstone.

Adequate supplies of ground water for farm and domestic needs are available practically everywhere in Licking County. In the western part of the county, however, some wells must be drilled through thick deposits of glacial drift to bedrock. Owing to the expense of such deep drilling, many property owners in these areas obtain water from dug wells.

In upland areas in the central and eastern parts of Licking County most ground-water supplies are obtained from the consolidated rocks of Pennsylvanian and Mississippian ages, wells generally yielding 5 to 25 gpm each. The village of Utica, pumps 100,000 gpd from 2 wells drilled into the Cuyahoga formation.

Ground-water samples collected from 20 wells in the principal aquifers in Licking County had a range of pH values from 5.4 to 7.9. Those samples from wells in the consolidated rocks had pH values of less than 7. The iron content was fairly high in all samples except one, which was from a well in sand and gravel in St. Albans Township. The waters tested ranged in hardness from 39 to 610 ppm (parts per million) and contained dissolved solids in amounts ranging from 97 to 772 ppm. The streams in Licking County contain, in varying but lesser amounts, the same mineral constituents found in the ground water.

# INTRODUCTION

## PURPOSE AND SCOPE OF THE INVESTIGATION

This report describes the results of a water-resource investigation made by the U. S. Geological Survey as part of a statewide program conducted in cooperation with the Ohio Department of Natural Resources, Division of Water. The report is intended as a guide for the development of industrial, municipal, and domestic water supplies in Licking County, Ohio. Similar water-resource reports have been published by the Division of Water for Butler, Clark, Cuyahoga, Franklin, Greene, Hamilton, Madison, Montgomery, Summit, and Tuscarawas Counties. In addition, information circulars on water resources have been published for Jackson, Pike, Ross, and Scioto Counties. Figure 1 shows the area described in this report, and those described in previous reports.

The Ohio Department of Natural Resources was represented in this investigation by Herbert B. Eagon, Director, and C. V. Youngquist, Chief, Division of Water, and the Ground Water Branch, U. S. Geological Survey, was represented by A. N. Sayre, Chief, Washington, D. C., and S. E. Norris, District Geologist, Columbus, Ohio. The Quality of Water Branch, U. S. Geological Survey, was represented by S. K. Love, Chief, Washington, and W. L. Lamar, District Chemist, Columbus. The Surface Water Branch, U. S. Geological Survey, was represented by J. V. B. Wells, Chief, Washington and L. C. Crawford, District Engineer, Columbus.

Field investigations to determine the availability and quality of water in Licking County were begun in November 1951 and, with minor interruptions, continued through March 1954. These investigations included an inventory of wells, pumping tests of wells and collection of water-level records in the South Fork Licking River valley, collection and analysis of samples of ground water and surface water, and geophysical studies of the buried valleys. Records of streamflow in Licking County have been collected on a continuing basis since 1921.

## PREVIOUS INVESTIGATIONS

One of the earliest geologic reports on Licking County was written by J. W. Foster (1838).[1] Foster gave a general description of the consolidated rocks in the county and included a geologic cross section of Franklin, Licking, and Muskingum Counties. M. C. Read (1878) described both the consolidated and the unconsolidated deposits in Licking County and presented geologic sections of the Pennsylvanian and Mississippian rocks. Frank Leverett (1902) described and mapped the Illinoian and Wisconsin glacial deposits in the county. Frank Carney (1906) described the geology of Perry Township. Carney (1909) also presented the results of a stratigraphic study in Mary Ann Township, in which he included two geologic sections of the Mississippian rocks. Jesse E. Hyde (1915) divided the rocks of the Logan and Cuyahoga formations of central and southern Ohio into five lithologic provinces. Two of Hyde's provinces, the Toboso and the Granville, include parts of central and southern Licking County respectively. Hyde described the Berne member as the top of the Cuyahoga formation, though later (1921) he described the Berne member as the base of the Logan formation. Wilbur Stout, Karl Ver Steeg, and G. F. Lamb (1943) discussed ground-water conditions at specific localities in Licking County and, in general terms, the water-bearing properties of the consolidated and unconsolidated deposits. George W. White (Cross and Bernhagen, 1949 studied the Licking River basin to determine the relationship of the geology to the varying streamflow within the basin. R. H. Crombie (1952) described the geology of the consolidated rocks in Madison, Hanover, and Newark Townships, and presented 32 geologic sections of the Pennsylvanian and Mississippian rocks. George Franklin (1953) described the geology of the consolidated rocks in Mary Ann, Perry, and Fallsburg Townships, and included 29 geologic sections of the Pennsylvanian and Mississippian rocks in Licking County.

## DIVISION OF WORK

Earl E. Webber, Hydraulic Engineer of the Surface Water Branch, U. S. Geological Survey, made streamflow measurements, collected samples of the water, and greatly aided the author in preparing the surface-water section of this report. Chemical analyses of 20 samples of ground water and 10 samples of surface water were made in the Columbus laboratory of the Quality of Water Branch of the Survey.

Earth-resistivity and seismic refraction determinations were made by personnel of the Geophysics Branch, U. S. Geological Survey, to aid in locating

[1] Years in parentheses refer to publications listed in the references.


LEGEND

AREA DESCRIBED IN THIS REPORT

AREAS DESCRIBED IN PREVIOUS REPORTS

Figure 1.- Map of Ohio showing locations of the areas described in this and previous reports.

and mapping the glacial and preglacial buried valleys in the county. Raymond E. Miller and Richard McCullough, Geophysicists, made the earth-resistivity measurements (the former made the interpretations), and W. E. Davis and R. N. Hazelwood, Geophysicists, made the seismic refraction determinations.

## ACKNOWLEDGEMENTS

The author expresses his appreciation to the residents of Licking County who provided important information about their water supplies, and who permitted geophysical work on their property. Much helpful information was provided by the well drillers in the Licking County area, especially Mr. C. A. Beinhower, and the late Mr. George Applegate. Appreciation is expressed to officials of the municipalities and industrial concerns who cooperated by supplying information about pumpage and use of water in Licking County, and who allowed pumping tests to be made and water-level recording gages to be installed on wells on their properties. Thanks are extended to Mr. James T. Holden, County Engineer, who permitted seismic refraction determinations to be conducted along the roads in Licking County.

The author is indebted to Richard P. Goldthwait, Professor of Geology at Ohio State University and Geologist of the Ohio Division of Water, who accompanied him in the field for a week, and who on numerous other occasions offered helpful suggestions in the preparation of the section on the surficial geology. Field discussions with Mr. George Franklin, graduate student at the university, were very helpful in this study of the consolidated rocks in the county. Mr. Earl Webber, Engineer, Surface Water Branch, U. S. Geological Survey, made low-flow measurements on the surface streams in the county. The author is indebted also to Mr. Edward J. Schaefer, Consulting Hydrologist, for making available the data on the Rockwell Spring and Axle Co. pumping test.

# GEOGRAPHY

## LOCATION AND SIZE OF THE AREA

Licking County is near the center of the State of Ohio just north and east of 39°55′ N. latitude and 82°10′ W. longitude. Newark, the county seat, is near the center of the county, about 35 miles east of Columbus, the State capital. On topographic maps of the U. S. Geological Survey, Licking County occupies all or parts of the East Columbus, Frazeysburg, Fredericktown, Gambier, Granville, Newark, Thornville, Thurston, Westerville, and Zanesville quadrangles. The county is roughly rectangular in shape, extending approximately 23 miles north and south and 30 miles east and west. It is the third largest county in Ohio, being surpassed in size only by Ashtabula and Ross Counties, and contains 26 townships having a total area of 686 square miles, or 439,040 acres.

## TOPOGRAPHY AND DRAINAGE

Licking County occupies parts of two physiographic provinces (Fenneman, 1946)[2]. The eastern part is in the Kanawha section of the Appalachian Plateaus province, and the western part is in the Till Plains section of the Central Lowland province. In Licking County the approximate demarcation between these provinces is a north-south line through Jacksontown and Utica, passing about a mile east of Granville.

The average altitude in Licking County is about 1,000 feet. The topography of the county ranges from steep-sided valleys and ridges in the east to gently undulating plains in the west. The valley floors in the eastern half, or Kanawha section, of Licking County range from 800 to 900 feet in altitude and lie 200 to 300 feet below the tops of the surrounding hills. In the western half of the county, the Till Plains section, the topography generally is flat. The highest altitude in the county, 1,360 feet, is about 5 miles east of Johnstown, in Liberty Township. The drainage in the western part of the county is poorly developed and, with the exception of Raccoon Creek, the streams flow in shallow, narrow valleys. Raccoon Creek flows in a steep-sided, preglacial, Teays-stage valley.

Licking County is drained by the Licking River, Wakatomika Creek, Jonathan Creek, and tributaries of Big Walnut Creek and Little Walnut Creek. These streams, except the tributaries of Big and Little Walnut Creeks which are a part of the Scioto River drainage, are in the drainage basin of the Muskingum River. The Licking River, the principal river in the county, is formed by the junction of North Fork Licking River, South Fork Licking River, and Raccoon Creek at Newark. The Licking River and its tributaries drain an area of 780 square miles, and flow eastward across the county at an average gradient of about 3⅓ feet per mile.

Buckeye Lake, at the southern edge of Licking County, was formed in 1832 by damming several small tributaries of the South Fork Licking River. The lake formerly was used as a feeder reservoir for the Ohio State Canal, which paralleled the South Fork Licking River and Licking River, but now is maintained for recreation and to regulate the flow of the South Fork Licking River.

## CLIMATE

The first weather station in Licking County was established by the U. S. Weather Bureau at Granville in 1837. Temperature measurements only were recorded at this station until 1849, when precipitation measurements were begun. The station was not operated from 1857 to 1882, and only intermittent records were kept from 1882 to 1889. From 1889 until 1934 temperature and precipitation measurements were kept almost without interruption. Table 1 lists the locations, dates of operation, and other information pertaining to weather stations in Licking County.

The climatic data in this report are from the records of the U. S. Weather Bureau and Bulletin 15 of the Ohio Division of Water (Sanderson, 1950). The average annual temperature and precipitation readings given in table 2, are based on 38 years of record (1895-1934) at Granville and 17 years of record (1935-52) at Newark.

The average annual temperature in Licking County is 51.2° F. The hottest month is July, with an average temperature of 73.6° F, and the coldest month is January, with an average temperature of 29.3° F. The extreme range of temperature for the period of record is 132°—from 106° to -26° F. These extreme temperatures were recorded at Newark on July 14, 1936, and February 3, 1951, respectively.

The average annual percipitation in Licking County is 40.55 inches. The wettest year on record was 1929, with a total percipitation of 53.29

[2] Fenneman, N. M., 1946, Physical divisions of the United States: U. S. Geol. Survey map.

TABLE 1.—Index of climatalogical records, Licking County

| Station | Location: Latitude (north) | Location: Longitude (west) | Altitude (feet above sea level) | Period of record: Temperature | Period of record: Precipitation |
|---|---|---|---|---|---|
| Croton | ........ | ........ | 1,139 | Mar. 1860—Mar. 1863 | |
| Granville | 40°06′ | 82°31′ | 1,110 | Jan. 1837—Apr. 1852 | Sept. 1849—Mar. 1857 |
| | | | | Jan. 1854—Feb. 1857 | Nov. 1882—Sept. 1886 |
| | | | | Jan. 1883—Sept. 1886 | |
| | | | | Jan. 1889— 1891 | Jan. 1889— 1891 |
| Granville | 40°06′ | 82°31′ | 960 | 1891—Oct. 1934 | 1891—Dec. 1934 |
| Gratiot | 39°59′ | 82°16′ | 1,000 | Apr. 1889—Sept. 1913 | Aug. 1889—Sept. 1913 |
| Newark | ........ | ........ | 825 | Jan. 1855—Apr. 1855 | July 1861—Aug. 1863 |
| | | | | Jan. 1860—Aug. 1863 | |
| Newark | 40°05′ | 82°25′ | 835 | Oct. 1934—present | Oct. 1934—present |
| Pataskala | 39°59′ | 82°38′ | 1,050 | July 1892—Sept. 1930 | July 1892—Sept. 1930 |
| Toboso | 40°02′ | 82°13′ | 789 | Dec. 1912—Dec. 1930 | Dec. 1912—Nov. 1930 |

inches, and the driest year was 1930, with precipitation of 27.69 inches. June has the highest average monthly precipitation, 4.29 inches, and February has the lowest, 2.45 inches. The monthly and annual precipitation at Granville and Newark are listed in tables 3 and 4.

The average growing season in Licking County ranges from 150 days in the northeast to 158 days in the south. The average dates of the last killing frosts are May 2 at Newark and Pataskala, in the central and southwestern part of the county, and May 3 at Toboso, in the southeastern part. The average dates of the first killing frosts are October 7 at Pataskala, October 8 at Toboso, and October 9 at Newark.

## ECONOMIC DEVELOPMENT

### Population

The population of Licking County in 1950 was 70,645. There were 36,928 people classed as urban and 33,717 classed as rural. Newark, the county seat, had a population of 34,275 in 1950, which represented an increase of 2,788, or 8.8 percent, since 1940. Other principal towns in Licking County and their populations in 1950 are: Alexandria, 464; Buckeye Lake, 1,401; Hartford, 356; Granville, 2,653; Hanover, 308; Hebron, 864; Johnstown, 1,220; Pataskala, 928; and Utica, 1,510.

TABLE 2.—Average temperature, in degrees Fahrenheit, at Granville, Ohio, 1895-1934.

| | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | Average annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average | 29 | 29 | 40 | 50 | 61 | 69 | 74 | 72 | 66 | 53 | 41 | 31 | 51 |
| Average max. | 57 | 60 | 72 | 82 | 88 | 93 | 96 | 94 | 91 | 83 | 69 | 59 | 79 |
| Average min. | –3 | –3 | 11 | 23 | 33 | 42 | 48 | 46 | 35 | 25 | 15 | 1 | 23 |
| Highest | 73 | 74 | 85 | 90 | 97 | 100 | 105 | 104 | 99 | 97 | 77 | 73 | 90 |
| Lowest | –23 | –25 | –3 | 8 | 26 | 34 | 40 | 39 | 24 | 15 | 0 | –22 | 9 |

Average temperature, in degrees Fahrenheit, at Newark, Ohio, 1935-1952

| | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | Average annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average | 30 | 31 | 41 | 50 | 61 | 70 | 73 | 72 | 65 | 54 | 41 | 31 | 52 |
| Average max. | 60 | 61 | 74 | 82 | 88 | 94 | 95 | 95 | 92 | 84 | 73 | 59 | 79 |
| Average min. | –2 | –2 | 11 | 22 | 30 | 40 | 47 | 43 | 33 | 23 | 14 | –2 | 22 |
| Highest | 76 | 69 | 85 | 90 | 93 | 101 | 106 | 101 | 99 | 90 | 81 | 66 | 88 |
| Lowest | –21 | –26 | –3 | 16 | 23 | 35 | 41 | 38 | 25 | 18 | 6 | –21 | 11 |

### Agriculture

According to the census of agriculture, there were 3,457 farms in Licking County in 1950, comprising 372,232 acres or 84.6 percent of the total land area. The total value of farm products sold in 1950 was $11,298,343, of which $2,471,844 was from crops, $4,575,771 was from livestock, and $3,307,898 was from the sale of dairy products.

### Mineral Resources

The mineral resources of economic importance in Licking County are sand and gravel, shale, oil, and gas. In 1952 eight companies produced 299,333 tons of sand and gravel from pits in the valleys of Raccoon Creek, North Fork Licking River, and Licking River. Of this total, 28,532 tons was used for railroad ballast, 187,013 tons was used for highway construction, and 83,788

**TABLE 3.—Monthly and annual precipitation, in inches, at Granville. 1895-1934**

| Year | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1895 | 4.73 | 0.49 | 2.28 | 2.00 | 2.26 | 1.99 | 2.15 | 3.43 | 2.04 | 1.25 | 5.44 | 5.29 | 33.35 |
| 1896 | 2.88 | 2.41 | 3.25 | 2.75 | 2.73 | 5.54 | 5.89 | 3.49 | 6.64 | .96 | 4.13 | 2.73 | 43.40 |
| 1897 | 1.96 | 3.94 | 6.56 | 3.39 | 4.34 | 3.52 | 5.37 | 4.05 | .69 | .58 | 7.98 | 2.97 | 45.35 |
| 1898 | 5.99 | 2.62 | 8.09 | 4.13 | 6.39 | 3.09 | 1.83 | 4.73 | 1.51 | 3.46 | 3.00 | 3.58 | 48.42 |
| 1899 | 2.41 | 1.84 | 5.40 | 2.44 | 3.15 | 4.72 | 5.47 | 1.95 | 2.62 | 1.94 | 1.99 | 3.19 | 37.12 |
| 1900 | 2.85 | 3.79 | 2.89 | 3.08 | 1.56 | 2.42 | 4.55 | 3.80 | 3.12 | 2.15 | 3.79 | 1.34 | 35.34 |
| 1901 | 2.51 | .74 | 2.18 | 2.97 | 4.01 | 4.04 | 3.21 | 5.28 | 3.41 | .38 | 1.13 | 3.49 | 33.35 |
| 1902 | 1.09 | .71 | 3.22 | 2.20 | 1.43 | 7.67 | 3.38 | 1.55 | 2.97 | 3.06 | 3.33 | 4.01 | 34.62 |
| 1903 | 2.66 | 5.27 | 4.15 | 3.94 | 3.56 | 2.71 | 2.07 | 1.50 | .99 | 2.44 | 2.47 | 3.04 | 34.80 |
| 1904 | 3.85 | 2.46 | 5.79 | 3.90 | 2.94 | 3.78 | 8.02 | 1.96 | .91 | 2.49 | .18 | 4.62 | 40.90 |
| 1905 | 1.50 | 1.65 | 2.26 | 2.66 | 4.32 | 3.58 | 1.94 | 3.42 | 3.58 | 5.40 | 2.88 | 2.58 | 35.77 |
| 1906 | 2.42 | 1.23 | 5.24 | 1.62 | 2.70 | 6.00 | 6.33 | 5.22 | 2.62 | 3.07 | 2.49 | 3.73 | 42.67 |
| 1907 | 5.74 | .70 | 7.49 | 2.77 | 4.34 | 3.06 | 5.34 | 2.52 | 6.48 | 2.19 | 1.90 | 3.09 | 45.62 |
| 1908 | 1.98 | 4.72 | 7.11 | 3.27 | 4.97 | 2.89 | 4.05 | 2.83 | .31 | 1.42 | 1.21 | 2.62 | 37.38 |
| 1909 | 3.89 | 6.32 | 3.31 | 4.29 | 6.47 | 6.39 | 3.17 | 6.13 | 1.43 | 3.00 | 1.84 | 3.78 | 50.02 |
| 1910 | 5.58 | 5.98 | .18 | 2.98 | 4.84 | 2.43 | 2.82 | 1.48 | 3.84 | 4.68 | 1.46 | 2.68 | 38.95 |
| 1911 | 6.08 | 1.73 | 2.33 | 5.28 | 1.08 | 2.65 | 2.48 | 5.27 | 5.11 | 5.51 | 3.25 | 5.06 | 45.89 |
| 1912 | 2.05 | 2.19 | 4.41 | 4.42 | 3.70 | 2.72 | 5.48 | 2.95 | 5.30 | 1.85 | 1.56 | 2.73 | 39.36 |
| 1913 | 7.62 | 2.63 | 8.29 | 3.86 | 2.92 | 1.69 | 6.07 | 3.01 | 3.01 | 3.86 | 2.93 | 1.23 | 47.12 |
| 1914 | 1.23 | 3.88 | 2.46 | 3.43 | 2.33 | 3.02 | 2.20 | 5.36 | 1.28 | 4.06 | 2.62 | 4.26 | 36.13 |
| 1915 | 3.49 | 2.23 | 2.04 | 1.65 | 3.87 | 5.74 | 5.21 | 4.92 | 5.15 | 1.94 | 3.25 | 5.13 | 44.62 |
| 1916 | 5.28 | 1.19 | 5.63 | 2.19 | 4.93 | 7.34 | 1.85 | 4.03 | 1.20 | 2.33 | 2.86 | 3.79 | 42.62 |
| 1917 | 3.90 | .83 | 3.75 | 3.45 | 2.36 | 6.40 | 4.76 | 1.35 | 1.09 | 3.39 | .32 | 1.71 | 33.31 |
| 1918 | 4.28 | 3.02 | 1.95 | 2.74 | 5.74 | 1.25 | 3.59 | 3.05 | 3.60 | 2.79 | 2.37 | 3.30 | 37.68 |
| 1919 | 2.06 | .89 | 4.95 | 3.07 | 5.20 | 1.39 | 5.83 | 2.38 | 1.47 | 5.45 | 4.58 | 2.90 | 40.17 |
| 1920 | 2.55 | 1.50 | 2.86 | 6.49 | 2.11 | 2.90 | 5.30 | 6.67 | 2.64 | 1.62 | 1.85 | 1.82 | 38.31 |
| 1921 | 2.36 | 1.96 | 6.38 | 4.60 | 4.33 | 2.27 | 1.95 | 5.67 | 2.54 | | 5.43 | 3.78 | |
| 1922 | 1.62 | .97 | 3.67 | 3.37 | 5.87 | 4.94 | 3.07 | 5.27 | 1.80 | | 2.25 | 2.27 | |
| 1923 | 3.70 | 2.39 | 2.95 | 3.10 | 3.20 | 3.13 | 5.03 | 6.04 | 3.78 | 1.70 | 2.60 | 7.20 | 44.82 |
| 1924 | 4.40 | 1.36 | 3.32 | 2.18 | 5.08 | 8.53 | 2.41 | 1.30 | 4.11 | | 1.96 | 3.32 | |
| 1925 | .98 | 3.00 | 2.45 | 1.83 | 3.59 | 3.14 | 3.73 | 2.67 | 3.40 | 4.76 | 4.01 | .73 | 34.29 |
| 1926 | 2.77 | 1.85 | 2.59 | 3.68 | 1.80 | 1.68 | 5.23 | 3.79 | 5.36 | 4.82 | 3.25 | 2.89 | 39.71 |
| 1927 | 4.20 | 1.90 | 3.59 | 3.88 | 6.16 | 4.23 | 5.38 | 1.57 | 1.64 | .83 | 6.06 | 4.56 | 44.00 |
| 1928 | 2.04 | 3.55 | 3.60 | 3.70 | 1.41 | 9.00 | 6.97 | 6.03 | 1.33 | 2.69 | 3.38 | 2.28 | 45.98 |
| 1929 | 4.30 | 3.49 | 2.78 | 5.50 | 6.81 | 5.52 | 3.50 | 4.36 | 3.38 | 5.45 | 4.63 | 3.67 | 53.39 |
| 1930 | 4.63 | 3.02 | 3.07 | 2.30 | 1.89 | 1.48 | .84 | 2.45 | 3.57 | 1.07 | 1.93 | 1.44 | 27.69 |
| 1931 | 1.12 | 2.50 | 1.97 | 4.76 | 3.56 | 3.47 | 3.54 | 6.55 | 4.52 | 2.47 | 3.89 | 4.08 | 43.43 |
| 1932 | 6.80 | 1.37 | 3.06 | 2.36 | .75 | 3.78 | 7.38 | 1.50 | 3.11 | 3.00 | 3.59 | 3.89 | 40.59 |
| 1933 | 2.40 | 2.16 | 6.44 | 5.22 | 6.27 | 2.05 | 2.71 | 3.06 | 6.59 | 1.84 | 1.83 | 3.00 | 43.21 |
| 1934 | 2.24 | 1.05 | 2.80 | 1.96 | .47 | 6.67 | 3.72 | 5.83 | 2.21 | .58 | 1.61 | 1.25 | 30.39 |
| Average | 3.35 | 2.39 | 3.92 | 3.34 | 3.64 | 3.97 | 4.10 | 3.71 | 3.01 | 2.72 | 2.93 | 3.23 | 40.27 |

**TABLE 4.—Monthly and annual precipitation, in inches, at Newark. 1935-1952**

| Year | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1935 | 2.38 | 1.47 | 2.81 | 1.49 | 5.14 | 3.41 | 4.49 | 8.09 | 2.31 | 1.56 | 2.70 | 3.07 | 38.92 |
| 1936 | 1.64 | 2.57 | 3.21 | 3.17 | 2.27 | 1.64 | 3.61 | 3.47 | 3.63 | 4.84 | 3.38 | 2.67 | 36.10 |
| 1937 | 11.24 | 1.19 | 1.32 | 2.91 | 4.87 | 8.39 | 5.61 | 5.03 | 1.02 | 3.11 | 1.43 | 3.73 | 49.85 |
| 1938 | 2.47 | 2.87 | 5.22 | 4.20 | 5.36 | 2.47 | 4.56 | 4.73 | 5.45 | .63 | 2.60 | 1.46 | 42.02 |
| 1939 | 2.74 | 4.92 | 2.99 | 4.57 | .87 | 9.71 | 3.72 | 2.69 | .84 | 3.79 | .96 | 1.50 | 39.30 |
| 1940 | 1.68 | 3.75 | 3.73 | 7.12 | 5.75 | 4.39 | 2.26 | 4.68 | 1.68 | 1.76 | 3.68 | 2.95 | 43.43 |
| 1941 | 2.13 | .37 | .61 | .94 | 3.95 | 6.02 | 5.37 | 2.34 | .62 | 5.07 | 2.18 | 2.45 | 32.05 |
| 1942 | 1.55 | 2.42 | 2.78 | 2.39 | 4.10 | 6.33 | 2.64 | 2.28 | 3.80 | 2.13 | 3.46 | 4.23 | 38.11 |
| 1943 | 2.18 | 2.22 | 5.34 | 3.07 | 5.76 | 3.90 | 4.63 | 4.17 | .55 | 2.67 | 1.78 | 1.00 | 37.27 |
| 1944 | .71 | 2.11 | 6.82 | 4.46 | 4.21 | 3.78 | 1.75 | 4.08 | 1.15 | 1.23 | 1.55 | 3.40 | 35.25 |
| 1945 | 1.54 | 3.18 | 9.11 | 5.06 | 4.78 | 3.65 | 3.83 | 1.11 | 4.11 | 2.69 | 3.57 | 1.79 | 44.42 |
| 1946 | .71 | 4.20 | 4.26 | 1.48 | 5.53 | 5.99 | 5.41 | 2.94 | .88 | | | | |
| 1947 | 5.27 | .68 | 1.10 | 5.83 | 6.69 | 6.23 | 3.94 | 2.81 | 3.81 | 1.36 | 2.37 | 1.43 | 41.52 |
| 1948 | 2.50 | 3.10 | 4.47 | 6.18 | 3.56 | 5.03 | 4.38 | 1.21 | 4.54 | 2.02 | 3.91 | 2.48 | 43.18 |
| 1949 | 5.97 | 3.12 | 3.71 | 2.28 | 3.42 | 5.97 | 5.14 | 3.08 | 3.42 | 1.08 | 2.94 | 2.64 | 47.78 |
| 1950 | 9.65 | 3.70 | 2.76 | 4.07 | 3.51 | 5.71 | 5.60 | 1.36 | 1.71 | 1.98 | 4.97 | 2.93 | 47.95 |
| 1951 | 4.04 | 4.31 | 5.51 | 3.03 | 3.65 | 5.90 | 2.87 | .21 | 3.09 | 1.52 | 4.74 | 5.04 | 43.91 |
| 1952 | 6.73 | 2.18 | 4.27 | 4.72 | 3.13 | 2.55 | 2.82 | 2.79 | 2.92 | .76 | 1.48 | 2.30 | 36.66 |
| Average | 3.62 | 2.69 | 3.89 | 3.72 | 4.25 | 5.06 | 4.04 | 3.17 | 2.53 | 2.25 | 2.81 | 2.65 | 41.04 |

tons was used for building. In 1952 the Bowerston Shale Co. quarried 6,180 tons of shale at Hanover, for the use in the manufacture of common clay products. A sandstone of poor quality, the Byer member of the Logan formation, formerly was quarried south of the city of Newark for building stone.

The site of the first well drilled for oil or gas in Licking County was at the western edge of the city of Newark. Drilled about 1885, the well was about 1,450 feet deep and, as described by Bownocker (1903, p. 107), "was drilled 900 feet into the shales that underlie the Berea sandstone." In October 1886, another well was drilled for oil or gas, at the Everett Glass Co. in Newark. This well was temporarily abandoned at 2,240 feet because of a heavy flow of brine, but was drilled later to a depth of 2,385 feet, where drillers reported an encouraging show of gas. By 1912, about 600[3] oil or gas wells had been drilled in Licking County, of which 475 were active and 125 were abandoned. Between 1912 and 1952, approximately 4,700 wells were drilled in search of oil and gas. In 1952, 65 oil and gas wells were drilled, of which 20 were dry, 4 produced gas, 27 produced oil, and 14 produced oil and gas.

[3] From records of the Ohio Fuel Gas Co., Columbus, Ohio.

### Industrial Development

According to the Ohio Department of Industrial Relations, Licking County had 75 manufacturing concerns in 1952, which employed 10,351 persons and had an annual payroll of $35,955,416. Owens-Corning Fiberglass Corp., which in 1952 employed 3,351 persons, is the largest single employer in the county. Industrial operations include petroleum refining, primary refining of aluminum, and the manufacture of glassware, heating and cooking apparatus, and motor-vehicle parts and accessories.

## WATER UTILIZATION

In this investigation data were obtained on 1,038 water wells in Licking County. Of the wells surveyed, 632 were for domestic use, 44 were for stock, 217 were for both domestic and stock, 3 were for irrigation, and 26 were for industrial and municipal purposes, 110 were abandoned, 3 were for observation purposes, and 3 were for public use. Records of these wells are given in table 17, and their locations are shown on plate 1. Graphic logs of 332 wells are shown on figure 35.

### Municipal Supplies

Six of the 13 incorporated municipalities in Licking County have municipal water supplies.

Granville, Utica, Johnstown, Pataskala, and Hebron depend wholly upon ground water; Newark, which has about 50 percent of the total population of the county, gets its water from the North Fork Licking River.

The municipal water system at Newark was established in 1886, when 2 brick-lined wells, 20 feet in diameter and 21 feet deep, were dug about a mile north of the city. Later this supply was supplemented by 24, four-inch wells, drilled at about the same location. In 1925 a perforated horizontal conduit was extended into the shallow gravels beneath the North Fork Licking River to collect water by gravity flow.

At present (1958) the Newark water supply is obtained from the North Fork Licking River. The capacity of the system is about 9 mgd (million gallons per day) and the average demand is about 8.9 mgd. Plans are to increase the capacity of the system to 15 mgd.

Granville's water supply comes from 4 wells drilled in the unconsolidated sand and gravel deposits of the Raccoon Creek valley. The wells range from 90 to 125 feet in depth and are pumped for 9 hours a day at an average rate of 185,000 gpd (gallons per day) in the summer, and 14 hours a day at an average rate of 300,000 gpd in the winter. The initiation of the larger pumping rate coincides with the return of students to Denison University at Granville.

Utica obtains its water supply from 3 wells drilled just east of the city into sandstones of the Cuyahoga formation. The wells are 148, 200, and 212 feet deep. Two of the wells are pumped 5 hours daily for a combined yield of about 100,000 gpd. The third well is kept in reserve.

The public water supply at Johnstown is from 2 wells, 309, and 320 feet deep, drilled into sand and gravel. The wells are pumped on alternate days, 9 hours daily, to yield an average of 80,000 gpd.

Pataskala obtains its water supply from 2 wells drilled into sand and gravel south of the city. The wells are 106 and 153 feet deep, and together yield about 50,000 gpd.

The public water supply at Hebron is derived from 2 wells just south of the city in the South Fork Licking River valley. The wells are 155 and 156 feet deep, and are drilled into glacial sands and gravels. They are pumped at a combined rate of 65,000 to 70,000 gpd.

### Industrial Supplies

Water for industrial purposes in Licking County is supplied either from the municipal systems or from privately owned wells. The water is used for a wide variety of purposes, such as petroleum refining, air conditioning, sand and gravel washing, and manufacture of fiberglass products. The greatest demand for water by a single industry in Licking County is 4½ mgd supplied by the Newark municipal system for the manufacture of fiberglass products. Ground water supplied for industry from privately owned wells in the valleys of Raccoon Creek, North Fork Licking River, South Fork Licking River, and Licking River totals about 3½ mgd.

### Domestic Supplies

The rural residents of Licking County and those in communities not served by municipal water systems obtain water from privately owned wells or springs. Most farms have a well for household use near the house, and a well or spring for stock use near the barn. Sufficient water for these purposes is available generally in Licking County. The average daily withdrawal from any individual household or stock well probably does not exceed 150 or 200 gallons. In a few areas rainwater is stored in cisterns to supplement the supply from shallow dug wells.

# SURFACE-WATER RESOURCES

## STREAMFLOW RECORDS

Streamflow records are essential in the study and design of any system that has to do with the use and control of surface water. They are used in the investigation, design, or operation of water supplies, pollution of streams, water-power and flood-control projects, and navigation improvements. The records are used also by courts in the settlement of disputes arising from the use, regulation, or control of water.

Streamflow is governed by climate and drainage-basin characteristics. The climatic factors, such as precipitation, temperature, and wind, vary from day to day, whereas drainage-basin characteristics, such as area, topography, geology, and vegetation are for the most part permanent. The mean flow of a stream for a long period of time is largely a function of mean precipitation and mean temperature. The variations of flow are quite large, and streamflow records for at least 10 years are needed to predict the magnitude and duration of future flows. Flows larger or smaller than those recorded may occur, however, because of the variability of nature.

Stream gaging in Ohio is done by the U. S. Geological Survey in cooperation with the Ohio Division of Water and the Corps of Engineers, U. S. Army. Table 5 lists the gaging stations in Licking County and vicinity and gives their locations, periods of record, and drainage areas upstream from the station. The locations of the gages in Licking County are shown on figure 2. The data collected at the stations consist of continuous records of stage, periodic measurements of discharge, and supplementary information. Continuous records are maintained of the Licking River stages near Newark and at Toboso by means of recording gages. The stream stages at the other stations in the county are measured periodically. Discharge measurements are made periodically with a current meter, by standard methods outlined in textbooks and also in Water Supply Paper 888 of the U. S. Geological Survey (Corbett and others, 1943). Daily mean discharges for these stations are included in water-supply papers of the U. S. Geological Survey on surface water supply of the United States which are published annually. Methods of analyzing streamflow records are discussed in the following sections of this report.

The mean flow of the Licking River at Toboso from 1921 to 1953 was 692 cfs[4] (cubic feet per second) or 1.03 cfs per square mile. The average discharge of Wakatomika Creek near Frazeysburg, Muskingum County, from 1936 to 1953 was 157 cfs, and the average discharge of the Licking River near Newark from 1939 to 1953 was 576 cfs. When expressed as cfs per square mile, the mean flow near Newark and Frazeysburg was slightly higher than at Toboso. The average discharge throughout Ohio at streamflow stations having 10 years or more of record is about 0.9 cfs per square mile.

As reported by Cross and Bernhagen (1949, p. 19), George W. White[5] studied the Licking River basin to determine the relation of the geology to the variations in streamflow within the basin. According to White, the tributaries of the Licking River flow through regions of ground moraine and end moraine composed largely of till. The lower part of the North Fork Licking River and the Licking River flow through regions com-

[4] One cubic foot per second is equivalent to 448.83 gpm (gallons per minute) or .646 mgd.

[5] Head of the Department of Geology, University of Illinois.

TABLE 5.—Stream-gaging stations in Licking County and vicinity

| Number * | Station and location | County | Period of record | Drainage area (square miles) |
|---|---|---|---|---|
| 3 | Wakamika Creek near Frazeysburg | Muskingum | 1936 - | 140 |
| 9 | South Fork Licking River near Hebron | Licking | 1939 - 48 | 133 |
| 12 | Raccoon Creek at Granville | Licking | 1939 - 48 | 83 |
| 13 | North Fork Licking River at Utica | Licking | 1939 - 48 | 114 |
| 14 | Licking River near Newark | Licking | 1939 - | 536 |
| 18 | Licking River at Toboso | Licking | 1921 - | 672 |
| 19 | Licking River at Dillon | Muskingum | 1939 - | 754 |

* See figure 2.

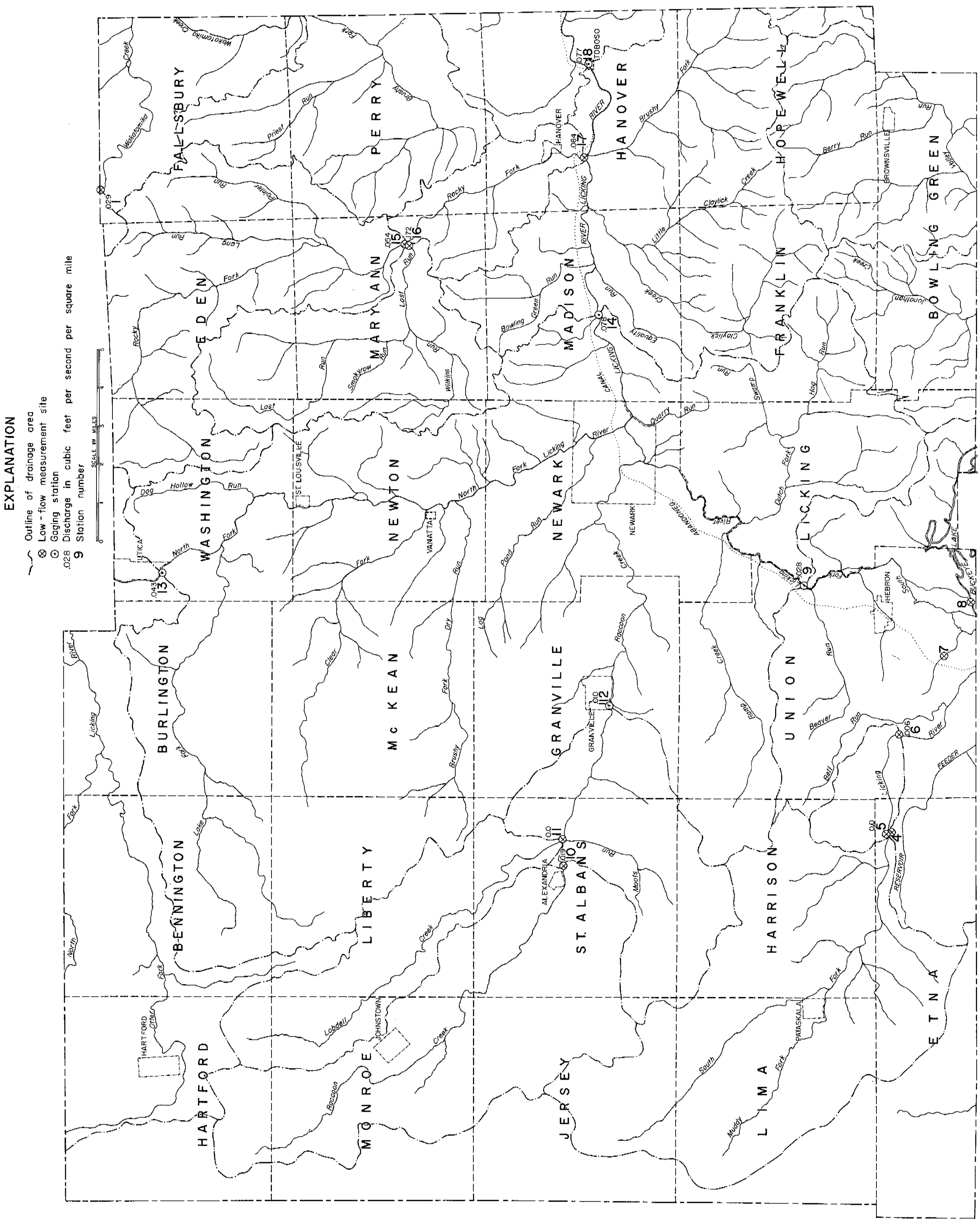


Figure 2. - Map of Licking County showing locations of stream-gaging stations and sites at which low-flow measurements were made August 9-10, 1944, and September 9, 1953.

posed of kame-terrace and valley-train deposits. An increase in the flow of the North Fork Licking River at Vanatta is credited by White to the presence there of a low, previously unrecognized sand-and-gravel outwash fan overlying the valley-train deposits.

The fairly high sustained flow of Wakatomika Creek near Frazeysburg, Muskingum County, is caused by storage in the glacial and bedrock deposits which underlie the headwater areas.

## FLOW-DURATION CURVES

The distribution of streamflow between extremes of flood and drought is shown conveniently by means of flow-duration curves. In the diagrams, which reveal the frequency of occurrence of various rates of flow, the discharge is plotted in the order of its magnitude and against the percentage of time that the flow is equaled or exceeded. Thus the shape of the flow-duration curve becomes an indication of the natural storage within a basin. Duration curves with gentle slopes identify basins having high sustained base flows and low peak discharges; curves with steep slopes indicate streams having low base flows and high peak discharges. For example, the flow-duration curve for a stream flowing from a basin of bare, impermeable rock would be steep, and would indicate high flood peaks and low sustained dry-weather flow, whereas the curve for a stream flowing from a basin containing thick permeable sand and gravel deposits would be fairly flat or horizontal, showing low flood peaks and high sustained dry-weather flow. The duration-curve method of studying the regimen of streamflow is advantageous in that it gives a great deal of information in a small diagram, although all chronological sequence is lost. To make a more complete study of the low-flow characteristics of a basin, duration curves should be used in conjunction with hydrographs of daily flows, mass curves, and storage-required curves.

The flow-duration curves for the main stem Licking River near Newark and at Toboso (figs. 3 and 4) show above-average dry-weather flows as compared to the other streams in Ohio. Duration curves for the North Fork Licking River, South Fork Licking River, and Raccoon Creek figs. 5 to 7) show dry-weather flows that are slightly below the average of the other streams in Ohio.

## MINIMUM-FLOW AND UNIT-STORAGE CURVES

Although flow-duration curves illustrate the low-flow characteristics of streams, they do not as previously stated take into account the chronology or sequence of events. In the study of drought flows it is important to know the lowest mean flows that have occurred in consecutive periods of various lengths, and the minimum flows that may be expected, on the average, in any year, and for longer periods. Minimum discharges of record for consecutive periods ranging from 1 day to 7 years were computed for the gaging station on the Licking River at Toboso and ploted on figure 8a. Also shown are the minimum flows for selected periods of 1 day to 6 months that have been exceeded in 50 and 75 percent of the years. Curve Q-50 shows the average minimum flows that may be expected 50 percent of the time or about once in 2 years, and curve Q-75 shows the average minimum flows that may be expected about once in 4 years.

Another method of showing the regimen of streamflow is by the unit-storage or storage-required curve, figure 8b. In this method, the minimum flows recorded at a gaging station are tabulated for periods of 1 day to 7 years. The differences between these minimum flows and the quantities needed to maintain arbitrarily selected draft rates equal the storage required. For purposes of comparison, the regulated flows are plotted in cubic feet per second per square mile, and the required storage is plotted in millions of cubic feet per square mile. Auxiliary scales are provided for ease of conversion to other terms. Such analyses are important factors in the design of storage reservoirs. It should be emphasized, however, that the analyses shown are but preliminary steps in the design of a reservoir system, and many other factors, such as evaporation, seepage, dead storage, and channel storage, should be considered in addition to the minimum flow available at gaging stations.

The statewide average storage required to maintain a regulated flow of 0.5 cfs per square mile, adjusted to the 25-year base period (1921-45), is 14.3 million cubic feet per square mile. Extremes of 30 and 5.2 million cubic feet per square mile are required on the Blanchard River near Findlay and the Cuyahoga River near Hiram respectively. The unit-storage curve on figure 8b is for the Licking River at Toboso. The curve for this station is about average, in that 13.2 million cubic feet per square mile is required to maintain a regulated flow of 0.5 cfs per square mile.

## DROUGHTS

A drought may be defined as a weather or climatic condition such that supplies of water available in nature are insufficient to meet the needs

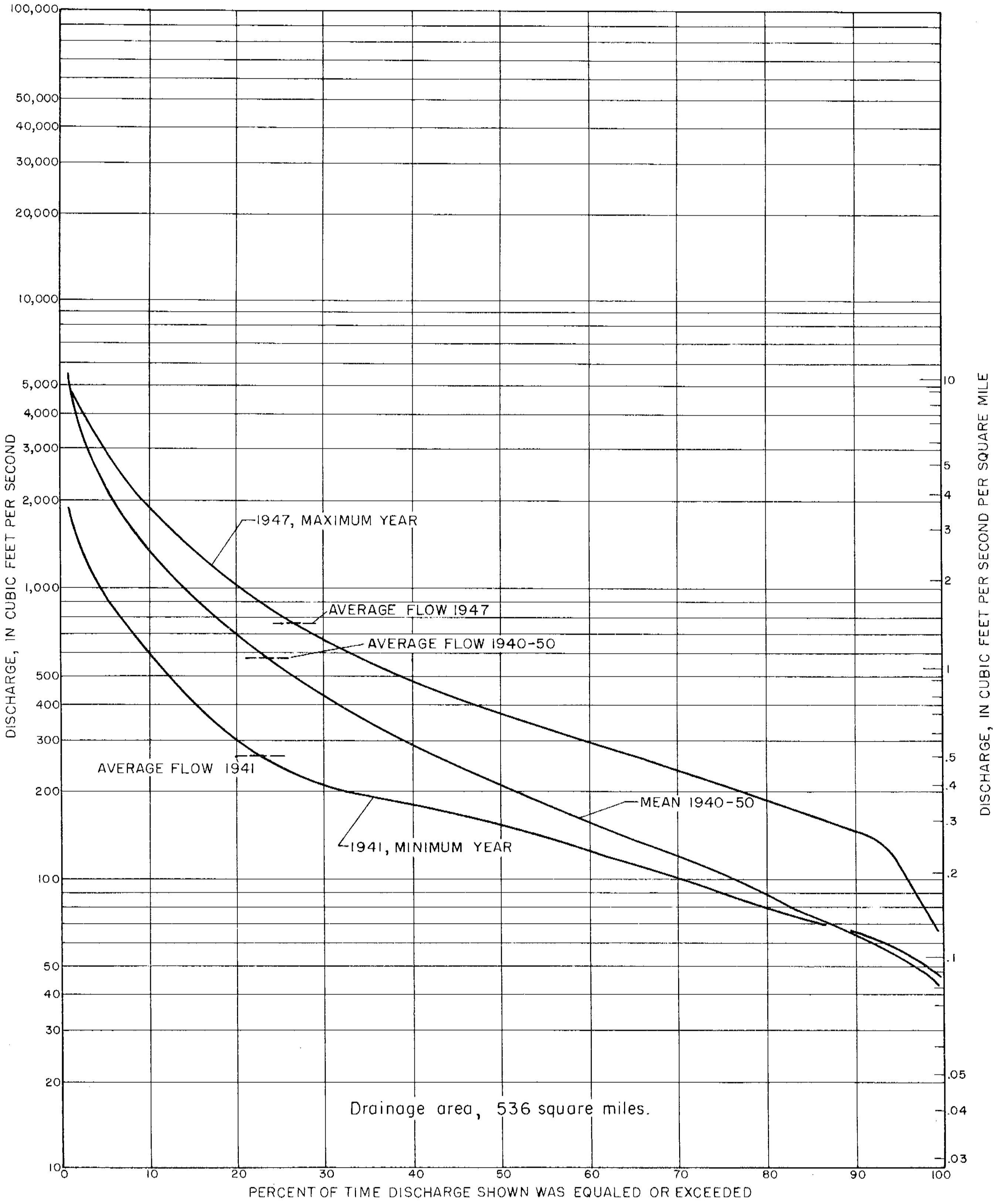


Figure 3. Duration curves, Licking River near Newark, Ohio.

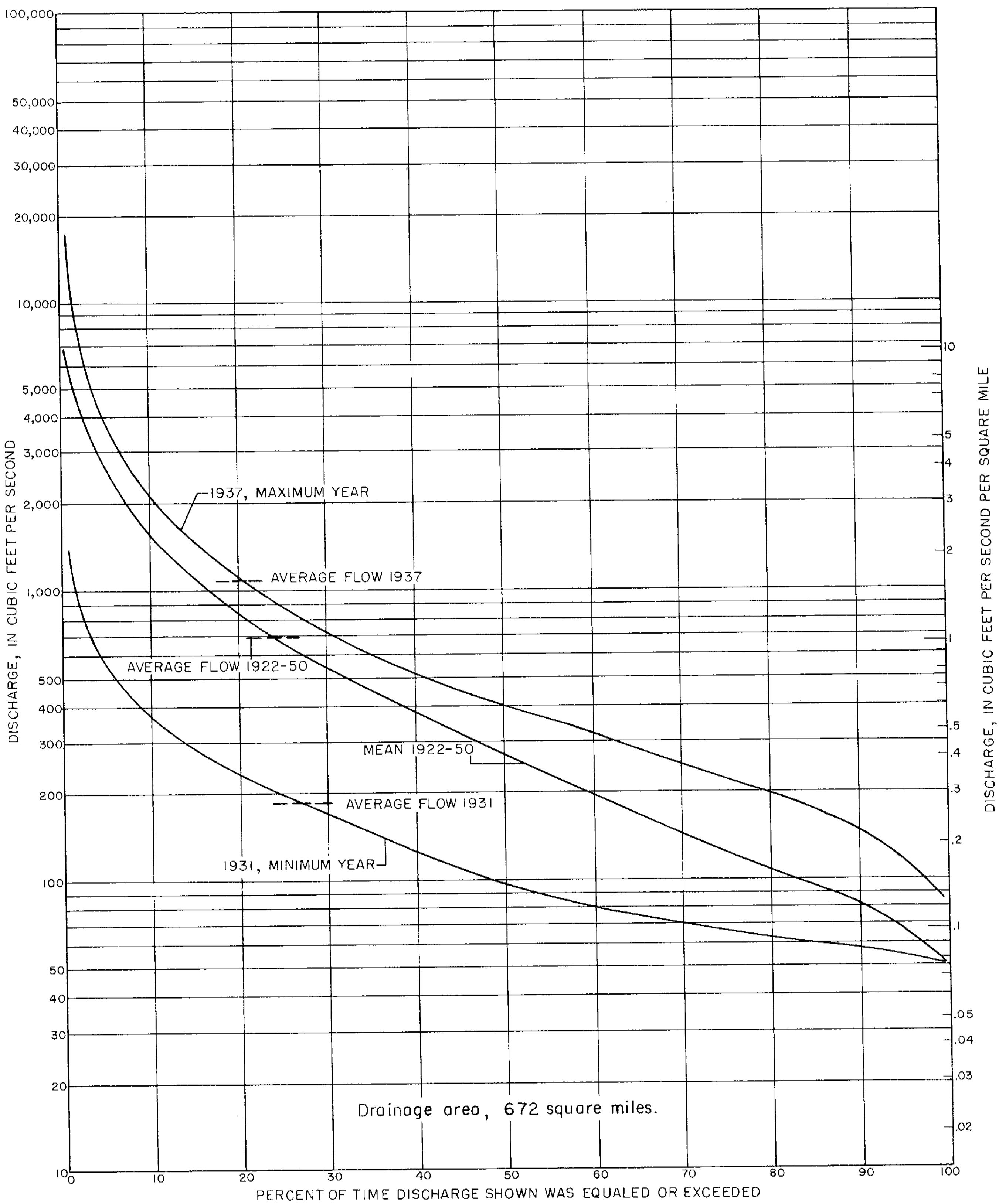


Figure 4. Duration curves, Licking River at Toboso, Ohio.

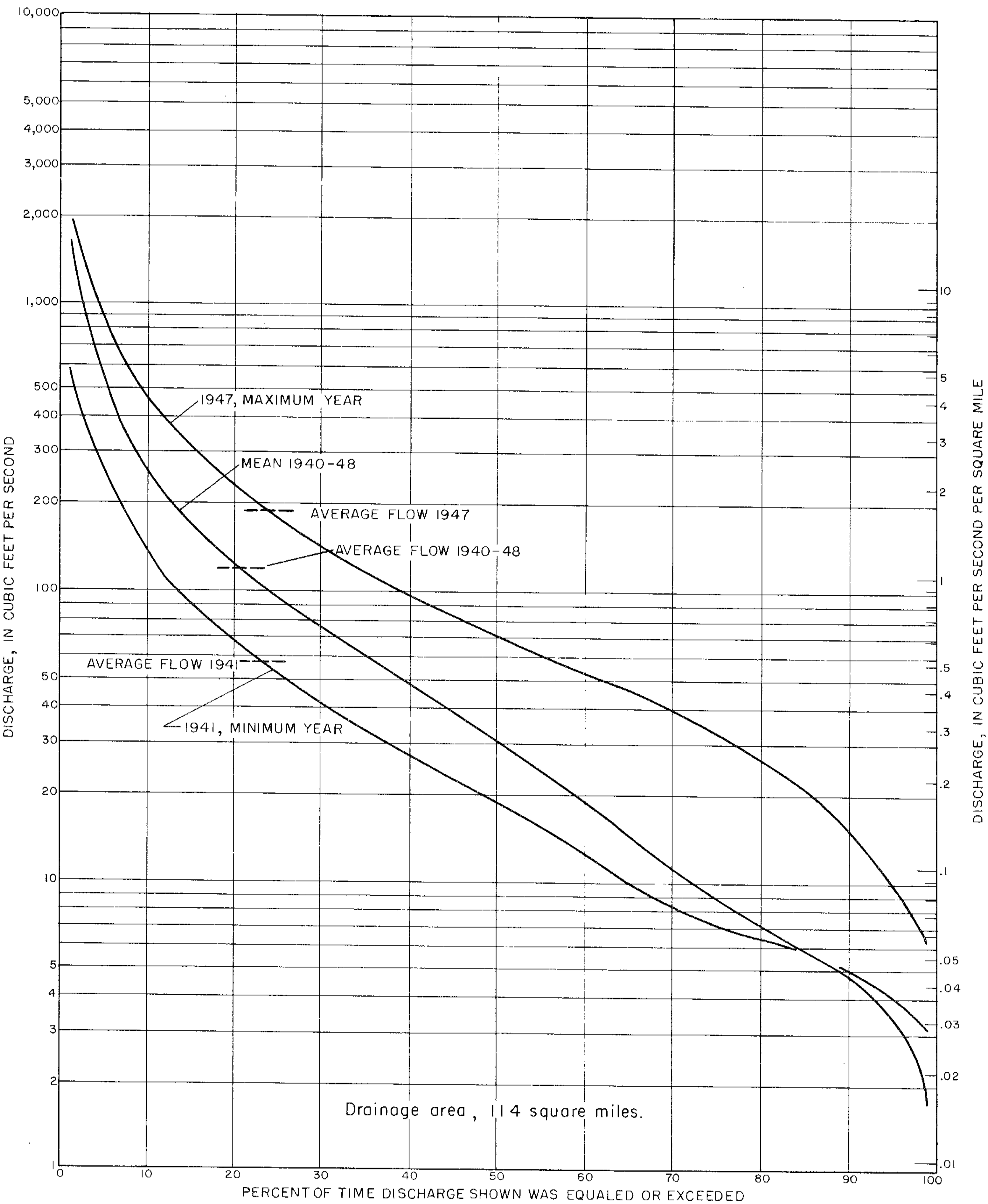


Figure 5. Duration curves, North Fork Licking River at Utica, Ohio.

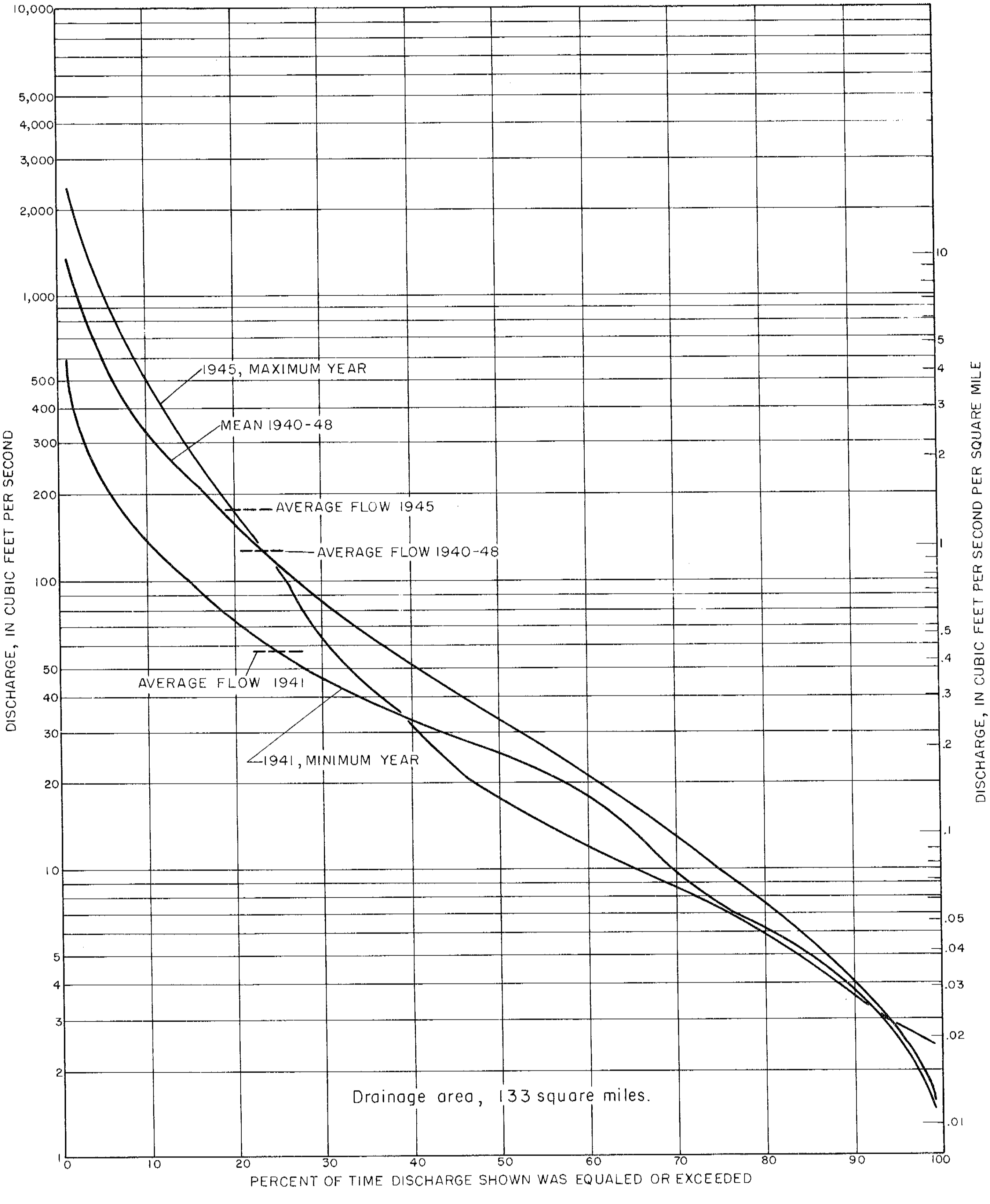


Figure 6. Duration curves, South Fork Licking River near Hebron, Ohio. (Flow regulated by Buckeye Lake.)

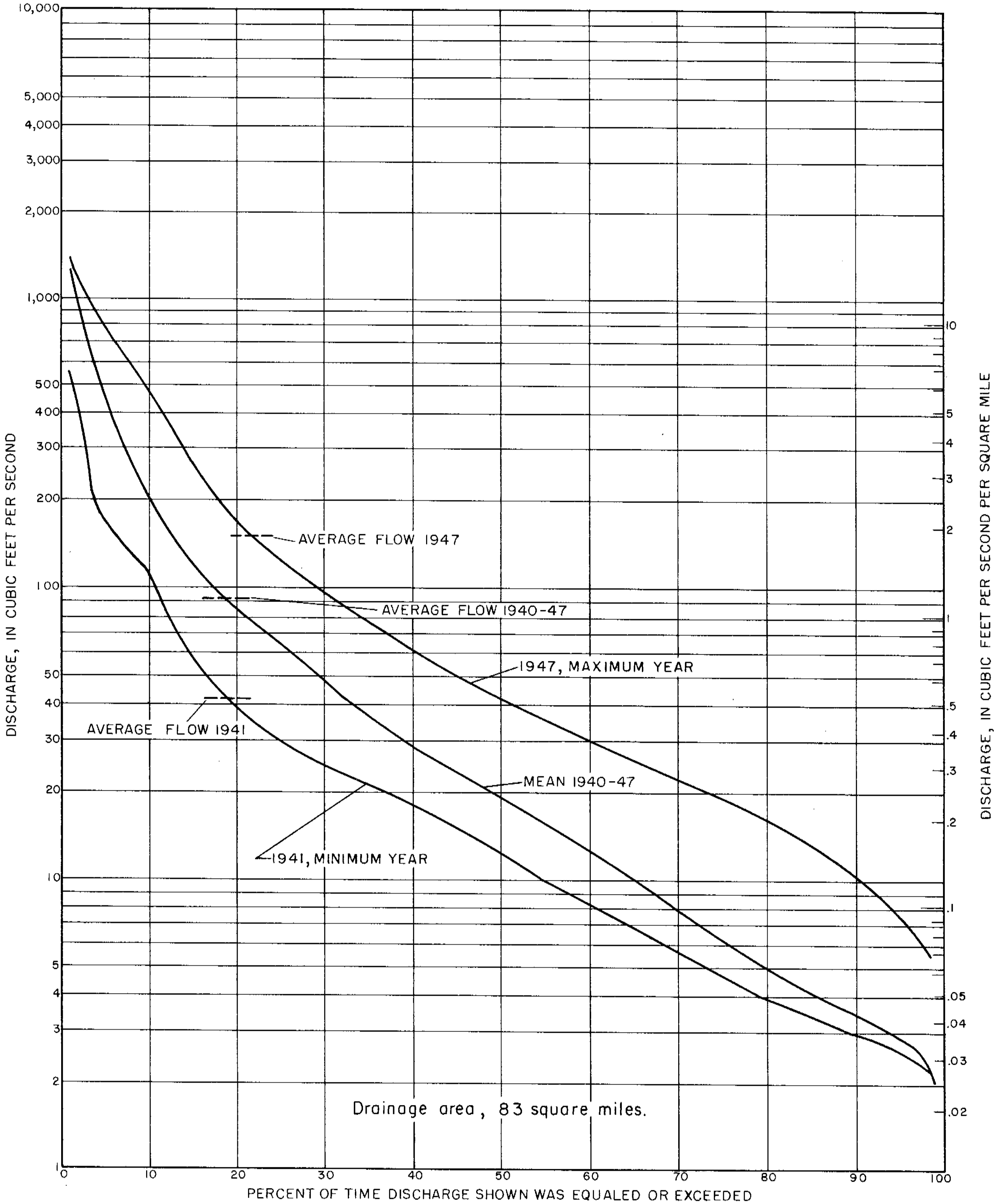


Figure 7. Duration curves, Raccoon Creek at Granville, Ohio.

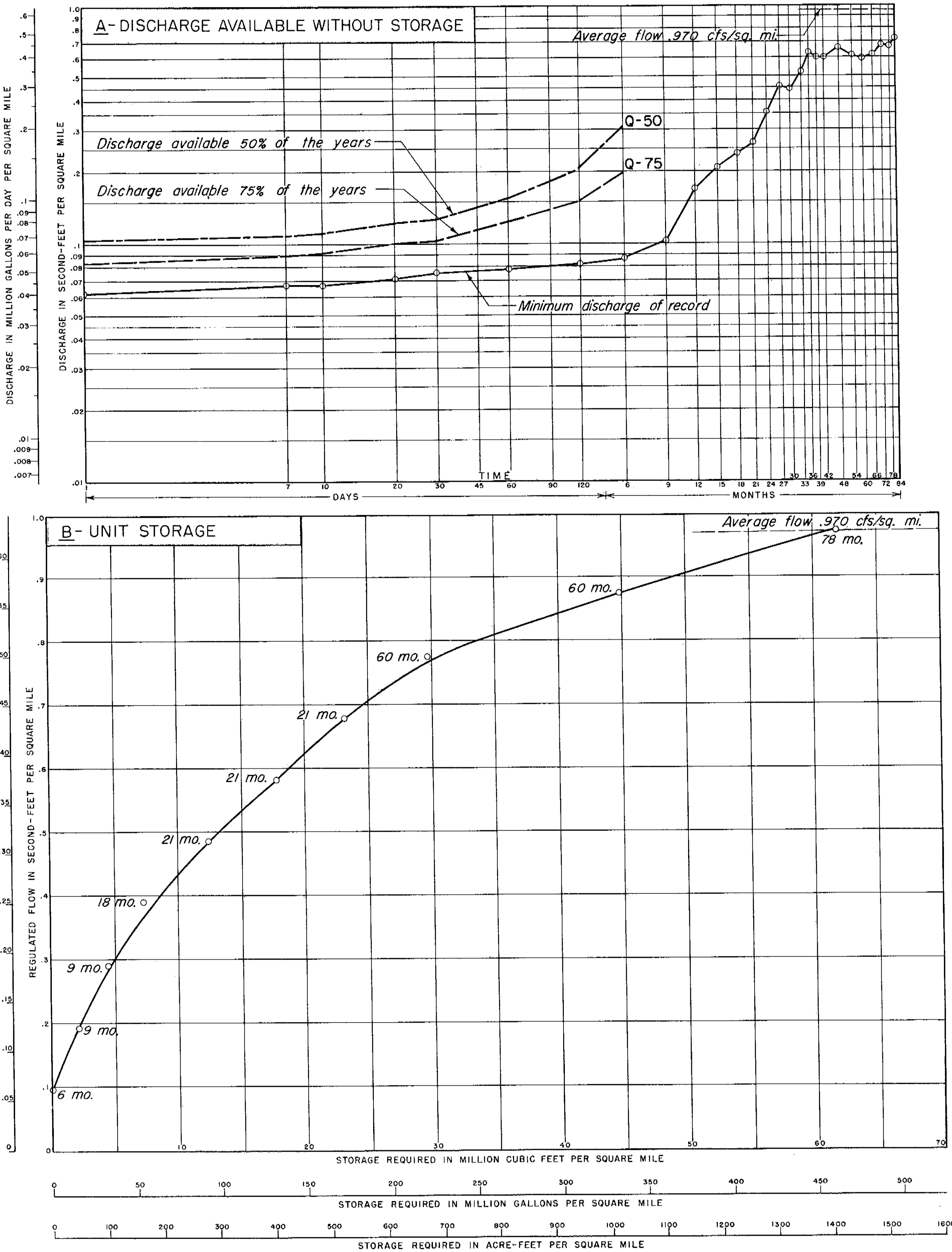


Figure 8. Discharge available without storage and unit storage curve, Licking River at Toboso, Ohio.
Period of record: Sept. 1921 to Sept. 1946.

of established plant and animal life (Cross and Webber, 1950). The primary cause of droughts is lack of precipitation, but an unsatisfactory distribution of rainfall throughout the year may be as distastrous as a shortage in total amount. Ohio is subject to occasional serious droughts. Some have been 5 to 6 years in length. Short term droughts are usually more pronounced in August and September, near the end of the growing season. Table 6 lists the droughts that have occurred in Ohio in the 71 years of record (1883-1954) of annual precipitation.

Streamflow records are important in the study of droughts, as they shed light on the areal distribution, frequency, and relative magnitude of drought effects. Most streamflow records in Ohio are too short to give very reliable information on

**TABLE 6.—Droughts in Ohio**

| Order of severity | Calendar Year | Annual precipitation (inches) |
|---|---|---|
| 1 | 1934 | 26.61 |
| 2 | 1930 | 26.74 |
| 3 | 1895 | 28.46 |
| 4 | 1953 | 28.64 |
| 5 | 1894 | 29.72 |
| 6 | 1901 | 31.43 |
| 7 | 1941 | 31.44 |
| 8 | 1900 | 32.92 |
| 9 | 1944 | 33.36 |
| 10 | 1889 | 33.45 |
| 11 | 1936 | 33.52 |

the frequency of severe droughts without extensive analysis that is beyond the scope of this report. The low-flow frequency curves (fig. 9) and the flow characteristics discussed in previous sections of this report show the fairly high sustained flows and the infrequency of severe droughts in the Licking River basin area for the period of records.

## FLOODS

Flood-frequency plots for the major streams in Licking County are shown on figures 10 to 14. On these figures, the greatest discharges occurring in each water year[6] are plotted against the computed recurrence interval in years. The U. S. Geological Survey considers regional flood-frequency studies to be more reliable than studies based on individual station records. However, no regional flood-frequency records are avaliable, and the method used in this report, based on individual station records, is for the purpose of indicating the probable frequency of floods in the range experienced during the period of record. At the present time there is no comprehensive flood formula that integrates the major factors such as drainage area, rate of rainfall, type of topography, type of soil, or condition of soil due to antecedent rain.

The Licking River drainage is not presently included in the Muskingum River basin flood-control system. The reservoir at Buckeye Lake, however, does offer a slight control on the flow of the South Fork Licking River.

Licking County never has had an outstanding flood comparable to the 1913 flood in the Miami Valley at Dayton and below. A major flood could occur in Licking County, however, if a storm of high intensity were centered over the entire drainage area and the ground were frozen or nearly saturated at the time of the storm.[7]

## LOW-FLOW MEASUREMENTS

The discharge of a stream that is equaled or exceeded 90 percent of the time, usually expressed in cubic feet per second per square mile, has been selected arbitrarily as a dry-weather-flow index. (Cross and Bernhagen, 1949). Dry-weather-flow indices have been computed for all gaging stations in Ohio not affected by artificial storage. The gaging stations on the Mad River, which is located in the western part of the State, have the highest indices in Ohio, more than 0.3 cfs per square mile.

Discharge measurements were made at miscellaneous sites on August 9-10, 1944, and September 9, 1953, to obtain additional data on the low-flow characteristics of the streams in Licking County. The measurements are listed in table 7; the locations of the measuring points in Licking County are shown on figure 2. During dry weather the flow of a stream is derived almost entirely from ground-water sources; therefore, these measurements indicate in a general way the water-bearing characteristics of the shallow deposits in the drainage basin above the gaging stations. For example, the streams in the western part of Licking County have lower dry-weather flow indices than those in the eastern half of the county. This difference may be explained by the fact that the streams in the west have their headwaters in areas of relatively impermeable till deposits, whereas the streams in the east have

[6] October 1 to September 30.

[7] Since this report was written, a major flood occurred in the Licking River valley, January 21-22, 1959. Cross, W. P. and Brooks, H. P., 1959, Flood of January-February 1959 in Ohio: U. S. Geol. Cic. 418, p. 8.

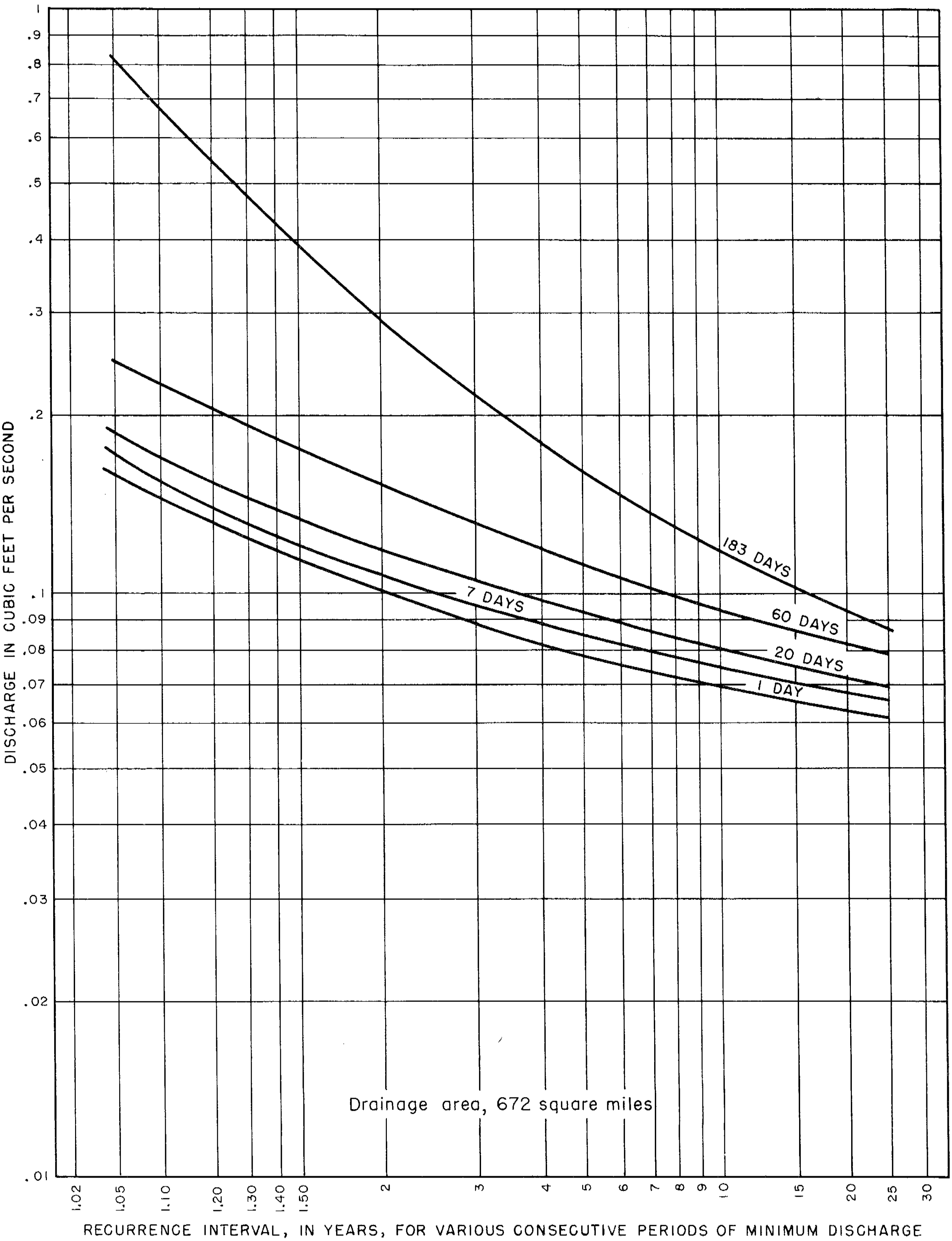


Figure 9. Low-flow-frequency curve, Licking River at Toboso, Ohio.

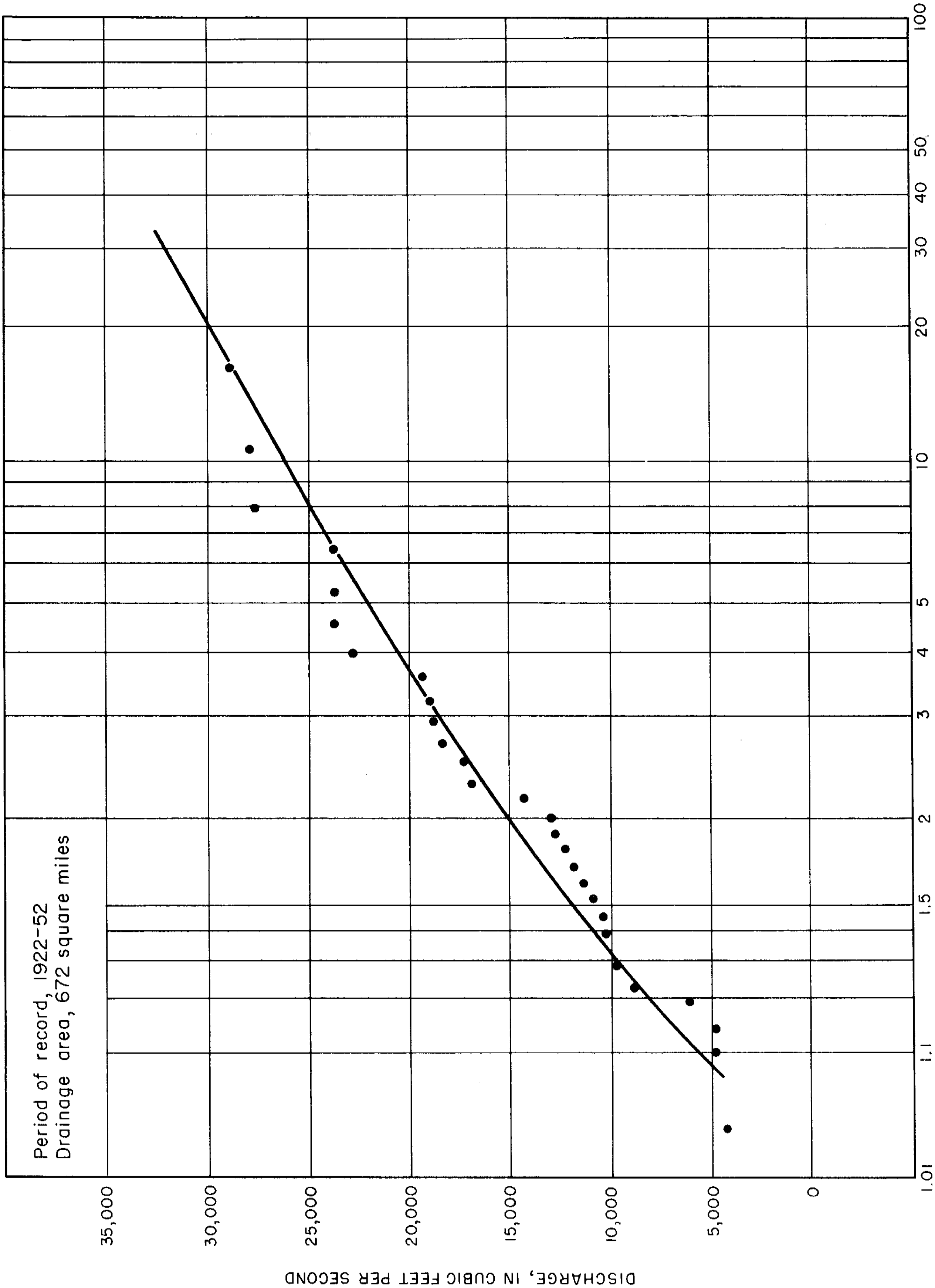


Figure 10. Flood-frequency curve, Licking River at Toboso, Ohio.

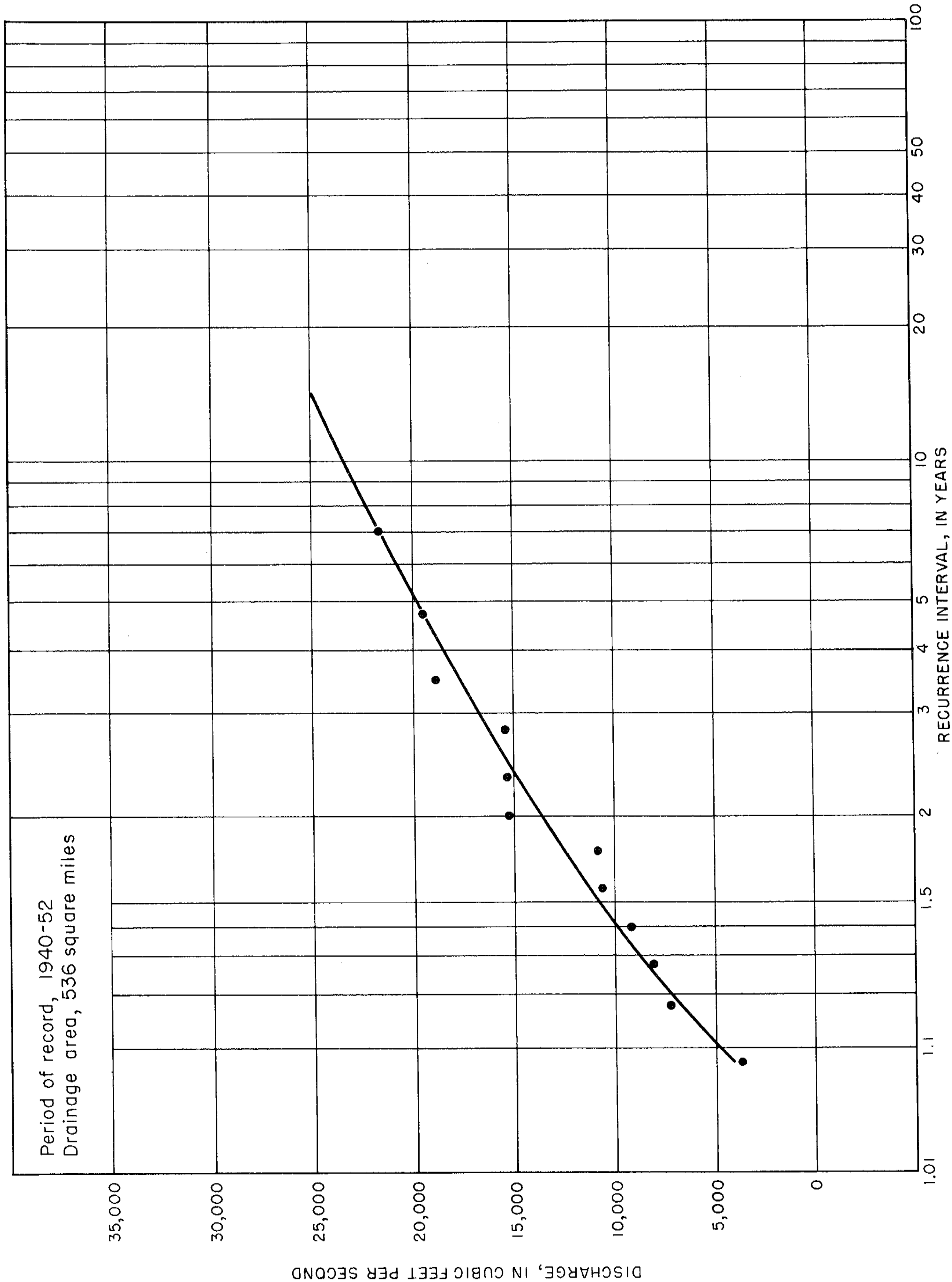


Figure 11. Flood-frequency curve, Licking River near Newark, Ohio.

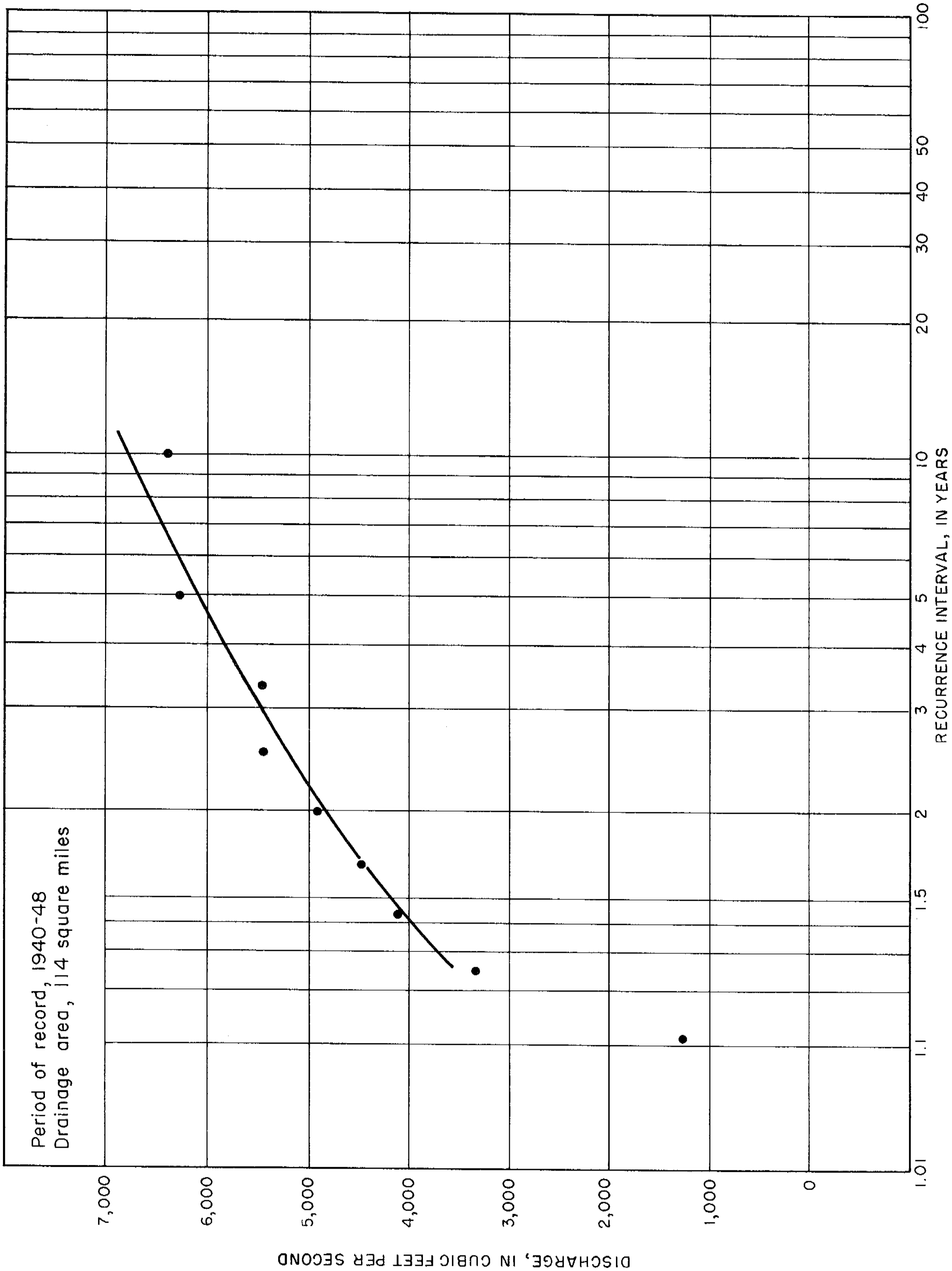


Figure 12. Flood-frequency curve, North Fork Licking River at Utica, Ohio.

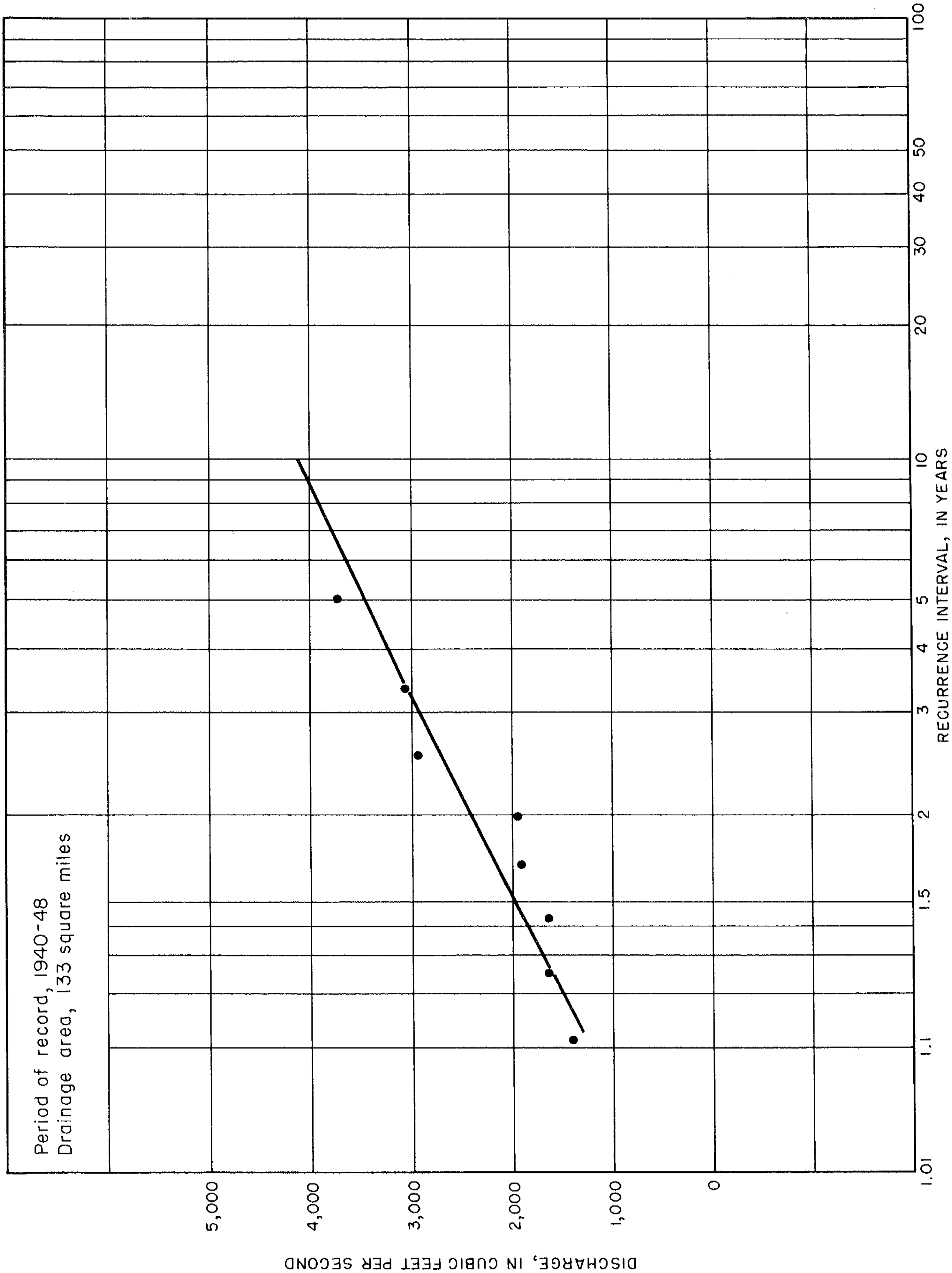


Figure 13. Flood-frequency curve, South Fork Licking River near Hebron, Ohio.

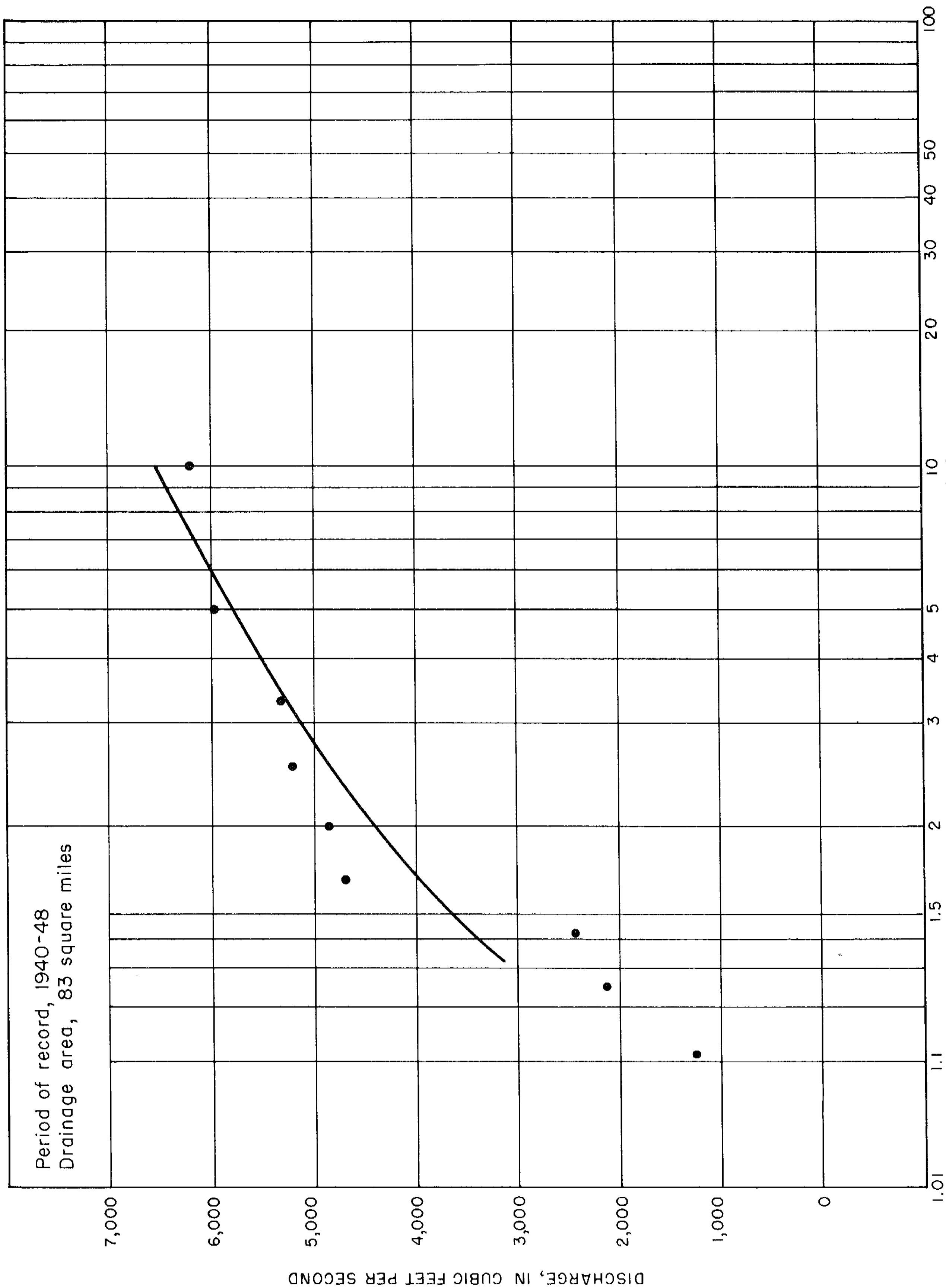


Figure 14. Flood-frequency curve, Raccoon Creek at Granville, Ohio.

their headwaters in areas of permeable sands, gravels, and sandstones. The relatively high dry-weather-flow index of Lost Run may be explained by the presence of the permeable outwash sands and gravels near the Newton-Mary Ann Township line. Low-flow measurements thus serve in a general way to indicate possible areas of ground water availability.

**TABLE 7.—Low-flow measurements of streams in Licking County and vicinity**

| Site Number | Stream | Location | Date | Drainage area (sq. mi.) | Flow (cfs) | Flow index (cfs per sq. mi.) |
|---|---|---|---|---|---|---|
| 1 | Wakatomika Creek | At Knox-Licking County line | 9- 9-53 | 43.1 | 1.27 | 0.029 |
| [a]2 | Brushy Fork | At mouth, Muskingum County | 9- 9-53 | 27.6 | .59 | .021 |
| 3 | Wakatomika Creek | At gaging station near Frazeysburg, Muskingum County | 8- 9-44<br>8-10-44 | 140 | [b]3.9 | 0.028 |
| | | | 9- 9-53 | — | 3.57 | .026 |
| 4 | Reservoir Feeder | At Kirkersville | 9- 9-53 | — | 0 | — |
| 5 | South Fork Licking River | 100 ft. below reservoir feeder at Kirkersville | 9- 9-53 | 51.4 | 0 | 0 |
| 6 | South Fork Licking River | At bridge on U.S. 40, 1 mi. W. of Luray | 9- 9-53 | 56.5 | .34 | .006 |
| 7 | Discharge from U.S. Fish Hatchery | 0.8 mi. upstream from South Fort Licking River | 9- 9-53 | — | [b]3.06 | — |
| 8 | Buckeye Lake Outlet | At outlet gates of Buckeye Lake | 9- 9-53 | — | 0 | — |
| 9 | South Fork Licking River | At former gaging station near Hebron | 8- 9-44 | 133 | [c]1.83 | .014 |
| | | | 8-10-44<br>9- 9-53 | | [b]3.66 | .028 |
| 10 | Raccoon Creek | 0.8 mi. above Lobdell Creek, at Alexandria | 9- 9-53 | 40.8 | .78 | .019 |
| 11 | Lobdell Creek | At mouth | 9- 9-53 | 19.5 | 0 | 0 |
| 12 | Raccoon Creek | At former gaging station at Granville | 8- 9-44<br>8-10-44 | 83.0 | 1.54 | .019 |
| | | | 9- 9-53 | | .79 | .010 |
| 13 | North Fork Licking River | At former gaging station at Utica | 8- 9-44<br>8-10-44 | 114 | 1.46 | .013 |
| | | | 9- 9-53 | | 4.92 | .043 |
| 14 | Licking River | At gaging station near Newark | 8- 9-44<br>8-10-44 | 536 | 46.8 | .087 |
| | | | 9- 9-53 | | 41.7 | .078 |
| 15 | Rocky Fork | Above lost Run | 9- 9-53 | 46.1 | 2.48 | .054 |
| 16 | Lost Run | At mouth | 9- 9-53 | 23.0 | 3.95 | .172 |
| 17 | Rocky Fork | At mouth near Hanover | 8- 9-44<br>8-10-44 | 78.9 | 6.35 | .080 |
| | | | 9- 9-53 | | 6.59 | .084 |
| 18 | Licking River | At gaging station at Toboso | 8- 9-44<br>8-10-44 | 672 | 62.7 | .093 |
| | | | 9- 9-53 | | 51.8 | .077 |
| [a]19 | Licking River | At gaging station at Dillon, Muskingum County | 8- 9-44<br>8-10-44 | 754 | [b]62 | .082 |
| | | | 9- 9-53 | | 55.2 | .073 |
| [a]20 | Jonathan Creek | 0.5 mi. above Valley Run, near Glenford, Perry County | 9- 9-53 | 27.1 | 1.45 | .054 |
| [a]21 | Valley Run | 0.5 mi. above mouth, near Glenford, Perry County | 9- 9-53 | 28.9 | .02 | .001 |

[a] Not shown on map.
[b] Flow regulated by Buckeye Lake.
[c] Mean daily discharge.

# GROUND-WATER RESOURCES

## GENERAL PRINCIPLES OF GROUND-WATER HYDROLOGY

The rocks that form the crust of the earth are not solid throughout but generally contain numerous openings called voids or interstices. These interstices are of primary concern in ground-water hydrology as they form the receptacles that hold and transmit all the water found beneath the surface of the land. The interstices may differ greatly in size, shape, arrangement, interconnection, and continuity according to the character, distribution, and structure of the rocks in which they occur. For the most part, however, they are small, irregular in shape, and interconnected. Being interconnected, they permit water to move from one opening to another.

Water in the interstices of rocks is controlled principally by two forces, gravity and molecular attraction. Gravity causes water to move in response to hydraulic gradients; that is, it is the force that causes water to flow from springs, or to enter wells, and to issue from flowing wells. The molecular forces, adhesion between molecules of different kinds and cohesion between molecules of the same kind, tend to resist flow. In rocks having large openings, gravity is the major controlling force in the movement of water, and in rocks having very small openings molecular attraction is the chief controlling force.

In rock-forming or geologic processes, the interstices of an unconsolidated porous deposit, such as silt, sand, or gravel, may become compacted and filled with mineral matter deposited as a result of solution by percolating water. When this occurs, the formation may become highly impermeable. Conversely, a relatively soluble rock such as limestone, though originally dense, may have part of its substance removed through the solvent action of percolating water. Large openings may result also from fracturing, shrinkage, or other deformation of the consolidated rocks.

One of the most productive water-bearing materials is a coarse, well-sorted gravel, in which the spaces between adjacent fragments are large and interconnected. A gravel deposit readily absorbs water, stores it in large quantities, and yields it freely to wells. Sand or sandstone deposits generally are more continuous and widespread than gravel deposits, but they compare unfavorably with gravel beds in that they have smaller interstices which conduct water less readily and give up a smaller proportion to wells.

The poorest water-yielding material is clay. The voids between individual clay particles are so small that molecular force largely predominates. Moreover, clay is very soft and plastic when wet and any joints or other openings formed in it are readily closed, even under slight pressure. Clay deposits, however, may yield usable quantities of water to shallow dug wells with large infiltration areas and considerable storage capacity.

### Porosity

The porosity of a rock is its property of containing open spaces or interstices. Porosity may be expressed quantitatively as the ratio of the interstitial volume of a rock to its total volume. When all the interstices of a rock are filled, the rock is saturated. Therefore, the porosity of a saturated rock is equal to the percentage of its total volume that is occupied by water.

The porosity of a rock depends on the shape, arrangement, degree of assortment, cementation, and compaction of the constituent particles, and also on the removal of mineral matter through solution by percolating water and on fracturing of the rocks, which results in joints and other openings. If other conditions are the same, the size of the grains has no effect on the relative porosity of a deposit. A material composed of small grains of uniform size and shape has the same porosity as one composed of large grains of uniform size and shape.

In most sedimentary deposits the constituent particles are irregular in shape and nonuniform in size. Small particles occupying the spaces between larger ones greatly reduce the porosity of the deposit. Primary pore spaces in sandstone, siltstone, shale, and limestone generally have been partially or completely closed by compaction and cementation in the rock-forming processes. Although large solution channels and fractures may be formed later in these deposits, rarely are such openings abundant enough to give a high porosity to an otherwise dense rock.

### Specific Yield and Specific Retention

Only part of the water in a saturated deposit can be withdrawn through wells and springs.

Much of the water is held in the rock against the force of gravity by molecular attraction. The volume of water thus retained is proportional to the aggregate area of the rock surface with which it is in contact. Fine-grained deposits such as silt and clay usually have greater porosity than coarse sand and gravel, but owing to the greater aggregate grain surface in contact with the water they contain, silt and clay retain much more and yield much less water than do coarse sand and gravel.

The volume of water that is free to drain by gravity from a saturated rock, expressed as a percentage of the total volume of the rock, is called specific yield. The volume of water that is held in the rock by molecular attraction, expressed as a percentage of the total volume of the rock, is called specific retention.

### Source and Occurrence of Ground Water

When rain, snow, sleet, or hail falls on the land some of the water flows directly into surface streams, some evaporates, and the remainder seeps into the ground. Of the water that seeps into the ground, a part is held in the unsaturated zone or zone of aeration and subsequently is transpired by plants. This water is called suspended or vadose water. The remaining water moves downward to the zone of saturation, and is called phreatic or ground water.

When a well is drilled into the zone of saturation, water enters the casing and rises to a level coincident with the so-called pressure-head-indicating or piezometric surface. Where the upper surface of the zone of saturation is unconfined, the piezometric surface is at the same elevation as the upper limit of the zone of saturation and the ground water is said to be under water-table conditions. The water table, which conforms in a general way to the shape of the land surface, is not static but fluctuates with daily, seasonal, and yearly variations in precipitation, withdrawals from wells, and other factors. The piezometric surface in wells that penetrate confined beds, which are those bounded above and below by relatively impermeable layers, may be above the upper surface of the zone of saturation, below this surface, or coincident with this surface. Ground water thus confined under pressure is said to occur under artesian conditions. The occurrence of ground water under both confined and water-table conditions is illustrated in figure 15.

### Recharge

Recharge to a ground-water reservoir may occur in several ways. The principal sources of recharge are rain or snow falling on the intake area, seepage from streams, subsurface inflow

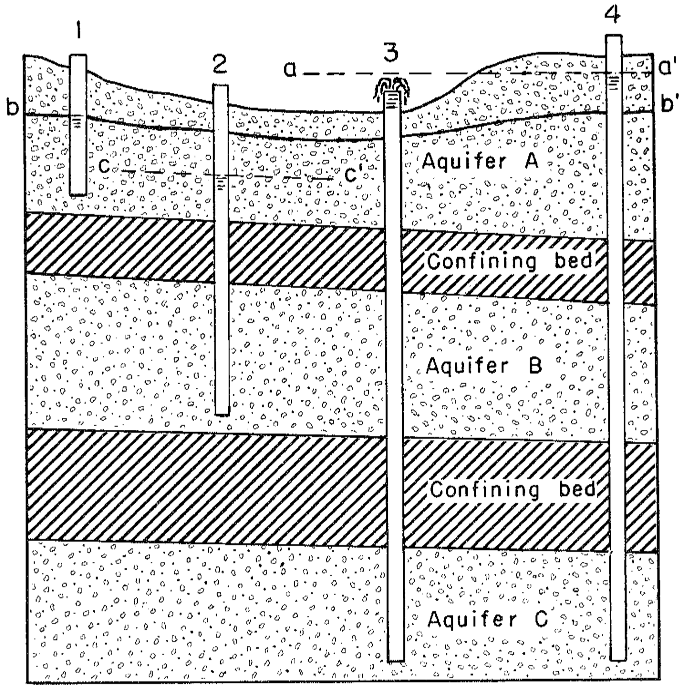


Figure 15.-- Sketch showing the occurrence of ground water under water-table and confined conditions. a-a' is the piezometric surface of aquifer C, and wells 3 and 4 are artesian wells. b-b' is the water table, and well 1 is a water-table well. c-c' is the piezometric surface of aquifer B, and well 2 is an artesian well.

from adjacent areas, and vertical leakage through relatively impermeable confining beds above or below.

The average annual precipitation in Licking County is 40.5 inches. The bulk of this either flows directly to surface streams, evaporates or is transpired by plants. The small remaining part reaches the zone of saturation, in which it moves slowly toward streams, springs, or wells, or toward areas where it is discharged by evapotranspiration. The amount of water added to or discharged from a ground-water reservoir is reflected in the fluctuations of the water levels in wells. Continuous water-level records of three wells in Licking County are shown in figure 16.

One important source of recharge to ground-water reservoirs in Ohio is the induced infiltration of streamflow. A stream that contributes recharge in this way is a special case of what is known as an influent, or losing, stream. That is a stream that stands higher than the water table and contributes water to the zone of saturation. Recharge from influent streams in Licking County is confined to the outwash sand and gravel in the valley of Raccoon Creek near Granville. Here pumping from the municipal well field has lowered the water table in the outwash materials beneath the level of Raccoon Creek, thereby inducing water to flow from the stream into the aquifer.

Where recharge to a well field is not derived locally from precipitation, or the induced infiltration of streamflow, sub-surface inflow from adjacent areas may contribute to the ground-water supply. For example, many wells drilled into the shallow sand and gravel deposits in the Newark Valley do not receive recharge from the nearby North Fork or South Fork Licking Rivers, and receive only small increments of recharge locally from precipitation. The bulk of the recharge to these wells is subsurface inflow from adjoining areas on the north and west. Similarly, much of the recharge to the confined sands and gravels in the Newark Valley is subsurface inflow from the Cuyahoga formation, which crops out along the valley walls. Vertical leakage through the relatively impermeable confining beds also contributes recharge to the buried sand and gravel in the Newark Valley. Vertical leakage is the only source of recharge to lenses or pockets of sand and gravel interbedded in the morainal deposits in western Licking County.

### Movement of Ground Water

Ground water, in response to the prevailing hydraulic gradient, percolates slowly through the ground to an area of discharge such as a surface stream, spring, or pumped well. The direction of ground-water movement between recharge and discharge areas can be determined by drawing contour maps of the piezometric surface. A piezometric map is a graphic representation of the hydrostatic pressure in an aquifer. Free or unconfined ground water always moves downward to points of lower elevation. Artesian or confined water, being under pressure, moves from recharge to discharge areas in response to the differences in head.

Over long periods of time, under natural conditions, ground-water recharge is approximately equal to discharge. Pumping a well alters the normal flow of ground water. The water level in the vicinity of the well is drawn down in the shape of an inverted cone with its apex at the pumped well. As pumping continues the cone expands until either a hydraulic gradient is established between the recharge area and the pumped well sufficent to replenish the amount of water being pumped, or sufficient water is diverted from some area of discharge to balance the pumpage. For example, if a surface-water body, such as a stream or lake, is intercepted by the cone of influence, a ground-water gradient may be established between the well and the surface water, and water will flow from that source to the pumping well. If infiltration from such a source can keep pace with the demands of the pumped well, further growth of the cone of influence will cease.

When two or more wells are developed in the same formation, the cone of influence of one well may overlap that of a neighboring well. When this interference occurs, a part of the area of drainage which formerly was tributary to each well must then be shared with the interfering well. The amount and extent of interference depend on the rate of pumping from each well, the spacing between wells, and the hydrologic regimen of the aquifer in which the wells are finished. The observed effect on a well in Newark Township caused by pumping 3 wells located 3,000 feet away is shown on figure 26. The location of the wells is shown on plate 1.

### Hydraulic Properties of the Water-Bearing Materials

A water-bearing formation that yields water to wells or springs in sufficient quantities to make it a practical source of supply is called an aquifer. A crude measure of the water-yielding ability of an aquifer is the specific capacity of a well. The specific capacity usually is expressed in gallons per minute per foot of drawdown and is applied only to wells in which the drawdown varies approximately as the yield. If a well has a constant rate of discharge of 50 gpm (gallons per minute) and a maximum drawdown of 5 feet, the specific capacity could be stated as 10 gpm per foot of drawdown. The hydraulic properties of an aquifer may be expressed more precisely in terms of coefficients of transmissibility, permeability, and storage. Controlled pumping tests are made to obtain the data required to compute those coefficients, which are then used in making quantitative estimates of water available in the aquifer, and of future water-level decline that will result from pumping.

The coefficient of permeability is defined by Meinzer (Wenzel, 1942, p. 7) as the rate, in gallons per day, at which water at a temperature of 60° F will flow through a cross-sectional area of 1 square foot under a hydraulic gradient of 100 percent. The field coefficient of permeability is the same as that defined by Meinzer except that it is measured at the prevailing ground-water temperature. The coefficient of transmissibility may be defined as the rate of flow of water, in gallons per day, through a vertical strip of the aquifer 1 foot wide and extending the full saturated thickness under a hydraulic gradient of 1 foot per foot at the prevailing temperature of the water. The coefficient of transmissibility is equal to the average field coefficient of permeability multiplied by the thickness of the aquifer, in feet. The coefficient of storage of an aquifer is defined as the volume of water it releases from or takes into storage per unit surface area of the aquifer per unit change in the component of head normal to that surface.

The values of the coefficients of transmissibility and storage may be calculated by the nonequilibrium formula advanced by Theis (1935, p. 519-524) and described by Wenzel (1942, p. 87- 91) or by the modified nonequilibrium formula described by Cooper and Jacob (1946, p. 526-534).

The nonequilibrium formula is based on the following assumptions: that the aquifer is homogeneous and istotropic (transmits water equally well in all directions), and infinite in areal extent; that it is confined between impermeable beds; that the discharge from the pumped well is constant; that the coefficient of storage is constant; and that the water is released from storage instantaneously with a decline in the artesian head.

Generally none of these conditions are completely fulfilled in nature. However, adjustments may be made in the formula that will partly compensate for the natural conditions. For example, an aquifer of infinite areal extent never is found in nature. Although some large aquifers may satisfy this assumption for all practical purposes, the limiting effects of hydrologic boundaries must be taken into account in investigating the hydraulic properties of most ground-water reservoirs. Hydrologic boundaries may be either positive in nature, such as a surface stream or pond, or negative such as bodies of clay or shale. The nonequilibrium formula may be used for the finite aquifer if adjustment for the effect of hydrologic boundaries is made by the use of the image-well theory. The use of the image-well theory in finite aquifers is described by Ferris (1951, p. 247-259).

### Fluctuations of Ground-Water Levels

An observation-well program was begun in Licking County in August 1951, when a recording gage was installed on well 120[8] in Newark Township. Recording gages were later installed on wells 90L and 107L, also in Newark Township. Wells 120 and 107L were drilled in the shallow sand and gravel deposits that immediately underlie the land surface in the Newark Valley. The water in these deposits occurs under water-table conditions. Recharge to these sands and gravels is derived principally from local precipitation. Well 90L was drilled through a relatively impermeable layer of clay to an underlying confined deposit of sand and gravel in the Newark Valley. Water in confined sand and gravel occurs under artesian conditions. Recharge to sand and gravel is derived by leakage through the overlying clay layer and subsurface inflow from the valley walls. Additional data on these wells are given in table 8, and their locations are shown on plate 1.

Hydrographs of wells 120, 107L, and 90L are shown on figure 16. The decline in the water level in well 120 between April 1952 and December

**TABLE 8.—Data on observation wells in Licking County**

| Well no. | State designation | Date recording gage installed | Depth of well (feet) | Approximate distance to nearest pumping (miles) |
|---|---|---|---|---|
| 120 | Li-1 | 8-31-51 | 65 | 0.9 |
| 107L | Li-2 | 11-28-52 | 23 | .04 |
| 90L | Li-3 | 7-13-54 | 133 | .28 |

[8] Well numbers identify wells listed in table 17 and shown on plate 1; the letter "L" after the number indicates that a log of the well is shown on figure 35. Wells are numbered consecutively by townships, beginning with the number 1 in each township.

1955 was caused by below-normal precipitation for this period. The effects of deficient precipitation are obscured in well 107L by the effect of pumping at the nearby Pure Oil Co., whose shallow wells are about 210 feet from the observation well. The pumping rate at the shallow well field from May to December 1953 was about 350 gpm. This rate was reduced to about 210 gpm in December. Precipitation continued to be below average in 1954 and 1955, and the wells in the shallow well field were pumped at about 150 gpm in 1954 and about 100 gpm in 1955. Precipitation was above average in 1956, and the wells were pumped only intermittently. Owing to the short period of record of well 90L, the effects of deficient rainfall between 1952 and 1955 are not shown. The above-normal precipitation in 1956, however, is represented by a 1-foot rise in water level in the well.

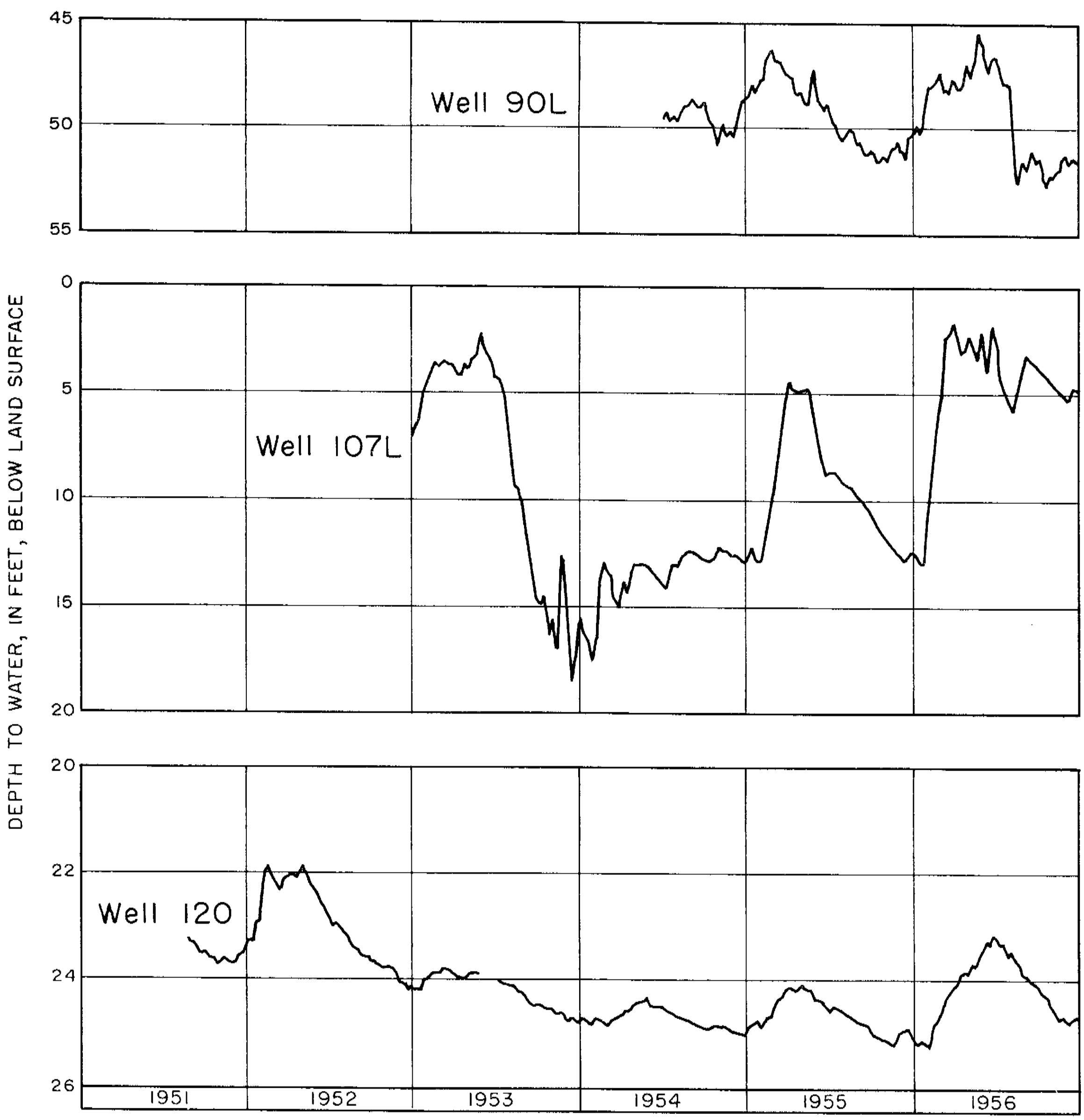


Figure 16. Graphs showing water-level trends in observation wells in Newark Township, Licking County, Ohio.

# GEOLOGY AND WATER-BEARING PROPERTIES OF THE GLACIAL AND ALLUVIAL DEPOSITS[9]

### Teays-Stage Drainage System

The Teays is the earliest recognizable drainage system in Ohio, and all streams in existence at that time are referred to as "Teays Stage" streams. The Teays drainage system preceded the Pleistocene glacial epoch and is thought to be of late Tertiary age. The Teays River, the master stream of the system, flowed across Ohio in a northwesterly direction in a course that lay southwest of Licking County (fig. 17).

During Teays time Licking County was drained by two large rivers, which cut broad channels in the bedrock to depths of 300 to 400 feet below the levels of the surrounding uplands (fig 18). These rivers joined in northwestern Fairfield County, from which place the river formed by the confluence of these two streams flowed southwest to the Teays River in Pickaway County. The drainage channels of these ancient streams later were

[9] Although this report is a cooperative product of the State of Ohio Department of Natural Resources Division of Water and the U. S. Geological Survey, the geologic nomenclature does not necessarily follow that of the U. S. Geological Survey.


Figure 17. Teays-stage drainage in Ohio.

partly or wholly filled with glacial debris, but from their shapes and the drainage pattern, shown by the approximate bedrock contours on plate 1, their former courses have been deduced.

The northern and western parts of Licking County were drained by the western river which entered the county east of Homer, flowed southwestward past Homer to Johnstown, and thence southward past Pataskala into Fairfield County. At a point near Jersey, about midway between Johnstown and Pataskala, this river was joined by a major tributary from the direction of Granville. Formerly, it was thought that this western river, called the Groveport River by Stout, Ver Steeg, and Lamb (1943, p. 66), entered Licking County near Utica and flowed southward to Newark to a junction with a west-flowing tributary from Hanover. This concept is not consistent with present data, which reveal that a drainage divide or col existed at Utica at that time.

The central and eastern parts of Licking County were drained by a Teays tributary, called the Cambridge River by Stout, and others (1943, p. 55), that flowed westward from Hanover to Newark. At Newark this river was joined by a south-flowing tributary from Utica and an eastward-flowing tributary from Granville. From Newark the Cambridge River flowed southward past Hebron into Fairfield County. In Fairfield County the Cambridge River continued south past Millersport, and then swung west in Violet Township, where it was confluent with the south-flowing river from the Johnstown area in Licking County. The waters from the confluence of these two rivers then flowed southwestward through the southeast corner of Franklin County into Pickaway County, where they joined the Teays River.

### Pleistocene History

Four times within the past million years climatic changes have resulted in the formation of great ice sheets or glaciers which covered vast areas of Canada and the northern United States. These great ice sheets were formed when snow accumulated to great depths and gradually became compacted into glacial ice. As more and more snow fell upon the ice sheets and became compressed into glacial ice, the pressure forced the basal ice outward and the ice front advanced. Periods of advance were interrupted by warmer intervals during which the rate of melting was greater than the rate of accumulation and the ice front retreated. The four major glacial advances and the respective periods of ensuing retreat have been named, from oldst to youngest, as follows: Nebraskan, Aftonian; Kansan, Yarmouth; Illinoian, Sangamon; Wisconsin, Recent.

As the glacial ice flowed it gouged valleys, deepened lakes, dammed rivers, eroded the tops from hills, transported large boulders, some of them for many miles, and ground rocks, stones, and soil into a mixture of fine sand, silt, and clay. Glacial deposits of Illinoian and Wisconsin ages are present in Ohio, and drainage changes involving some of the buried Teays-stage valleys indicate the probability that at least one glacier older than the Illinoian stage invaded the State.

The Illinoian glacier is thought to have retreated from Licking County about 200,000 years ago (Kay, 1931). Illinoian deposits occur at the surface in the eastern part of the county and no doubt are present under the more recent Wisconsin deposits in the west.

The Wisconsin glacier was split by highlands in the vicinity of Bellefontaine, Logan County, into two masses or lobes. These lobes advanced down two main valleys, the Scioto Valley in central Ohio and the Miami Valley in western Ohio. Ice of the Scioto lobe invaded Licking County at least three times. Plate 2 shows the approximate limits of the Illinoian and Wisconsin ice advances in Licking County. The Illinoian and early Wisconsin glacial boundaries are taken in part from maps of George W. White on file at Ohio State University.

### Deep-Stage Drainage System

The Teays drainage system was disrupted by a pre-Illinoian glacial advance into central Ohio (Stout, and others, 1943, p. 78). This early glacier blocked the general northward drainage in Ohio, thus causing the ponding of waters and the formation of lakes in the valleys of the Teays River and its tributaries. The lake stage lasted until the waters trapped in the valleys established new outlets south of the glacial border. The courses of the new streams were along the old Teays valleys, some flowing in the opposite direction to the Teays-Stage stream, or across what were formerly low drainage divides. The new drainage system established at the end of the lake stage was called "Deep Stage" because the streams cut narrow valleys many feet deeper than the levels of Teays-Stage streams.

The principal drainage changes in Licking County during Deep-Stage time were reduction of the drainage divides at Utica and Granville. When the drainage divide at Utica was breached, the large river that had entered Licking County near Homer in Teays time was diverted southward past

Utica to Newark. This Deep-Stage river was called the Utica River (Stout, and others, 1943, p. 83). After the Deep-Stage drainage was established through the Utica col, that part of the Teays-Stage valley extending from Homer to Johnstown was abandoned. The tributary stream west of Granville reversed its flow in Deep-Stage time and, breaching the drainage divide at Granville, flowed eastward to the main stem at Newark. The pre-Illinoian (Deep-Stage) drainage in Licking County is shown on figure 19.

The major river in Licking County during Deep-Stage time entered the county east of Hanover and following the course of the older Teays-Stage Cambridge River southward into Fairfield County. Called by Lamborn (1932, p. 451) the Newark River, the Deep-Stage stream received at Newark the waters of the Utica River and the tributary from the Granville area. The Newark River deepened its valley 70 to 80 feet below the levels established in Teays time. It ceased to flow when the Deep-Stage drainage system was blocked by the Illinoian glacier, possibly the first ice sheet to cover Licking County.

The most important drainage diversion caused by the Illinoian glacier in Licking County was at Hanover, where outwash, as much as 360 feet thick, was deposited in the valley, blocking the Deep-Stage drainage to the west. When the glacier retreated, water ponded between the ice front and an outwash dam, overflowed a former divide south of Hanover, and established the present eastward drainage of the Licking River. In central Mary Ann Township, an Illinoian-stage kame was deposited across a southwest-trending stream valley. The water trapped in the valley north of the kame eventually breached a low drainage divide and flowed eastward to Rocky Fork Run. The water south of the kame continued to flow to the west in the established direction.

During the remainder of the glacial epoch the drainage in Licking County remained much the same as it was at the end of the Illinoian ice advance. The major drainage changes which occurred in post-Illinoian time were along the North Fork Licking River where all the tributaries from the east were blocked by drift of more recent age.

A glacial dam was formed across the mouth of a valley in west-central Mary Ann Township during Wisconsin time. The waters trapped to the east of this dam breached a low drainage divide in the eastern part of the township and flowed eastward, in a reversed direction, to join the drainage of Rocky Fork Run. In eastern Washington Township, Wisconsin morainal deposits blocked the westward drainage of a small tributary to the Utica River and diverted the stream across a low drainage divide in the northeast corner of the township into Rocky Fork Run. Melt water from the Wisconsin ice filled this valley with more than 250 feet of fine silt and clay.

### Glacial Deposits

Glacial deposits are of two major types: materials deposited directly by the ice, called till; and materials deposited by melt water from the ice, called outwash. Till is an unstratified, heterogeneous mixture of clay, silt, sand, gravel, and boulders that is commonly called hardpan or clay by well drillers. It occurs principally as till plain, or ground moraine, and as end moraine. Although till is the predominant deposit of end moraines and ground moraines, the thicker morainal deposits in Licking County contain lenses or pockets of water-sorted sand and gravel. Outwash is stratified or sorted silt, sand, and gravel deposited by melt water flowing from the ice. Outwash occurs principally in the form of kames, kame terraces, valley trains, and outwash plains. The types and distribution of glacial deposits in Licking County are shown on plate 2.

#### Till

Illinoian till commonly is exposed in stream valleys and plastered against the sides of hills in the eastern part of Licking County, where it ranges in thickness from a few feet to more than 150 feet. Illinoian till is generally very thin on the summits of the hills, and in many places only scattered erratics, pebbles foreign to the local bedrock, are found. The thickest and most extensive exposed deposits of Illinoian till are in the valleys in Hopewell and Bowling Green Townships. The till has been leached of its carbonate minerals to depths of 10 to 13 feet, is highly weathered, and ranges in color from light orange red to yellow brown. No exposures of unleached, unoxidized Illinoian till were found in Licking County.

Ice of the earliest (Tazewell) substage of Wisconsin glaciation advanced farther to the east in Licking County than any of the succeeding Wisconsin ice invasions. Till deposited by this early Wisconsin ice is exposed at the surface at many places east of the Newark Valley in the area extending from Washington Township south to the Perry County Line. West of the Newark Valley early Wisconsin till is presumed to be present under cover of younger deposits. Plate 2 shows the areal extent of the earliest Wisconsin ice

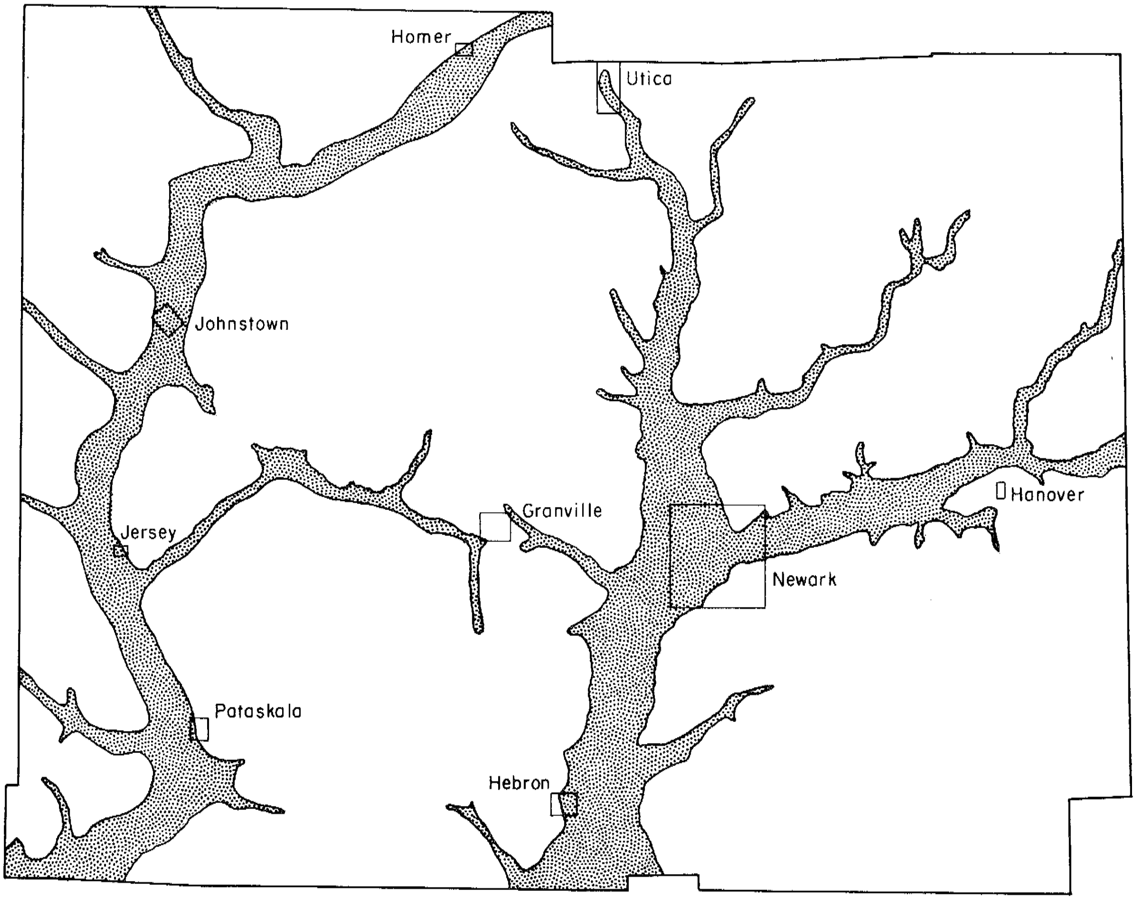


Figure 18. Preglacial (Teays stage) drainage in Licking County, Ohio.

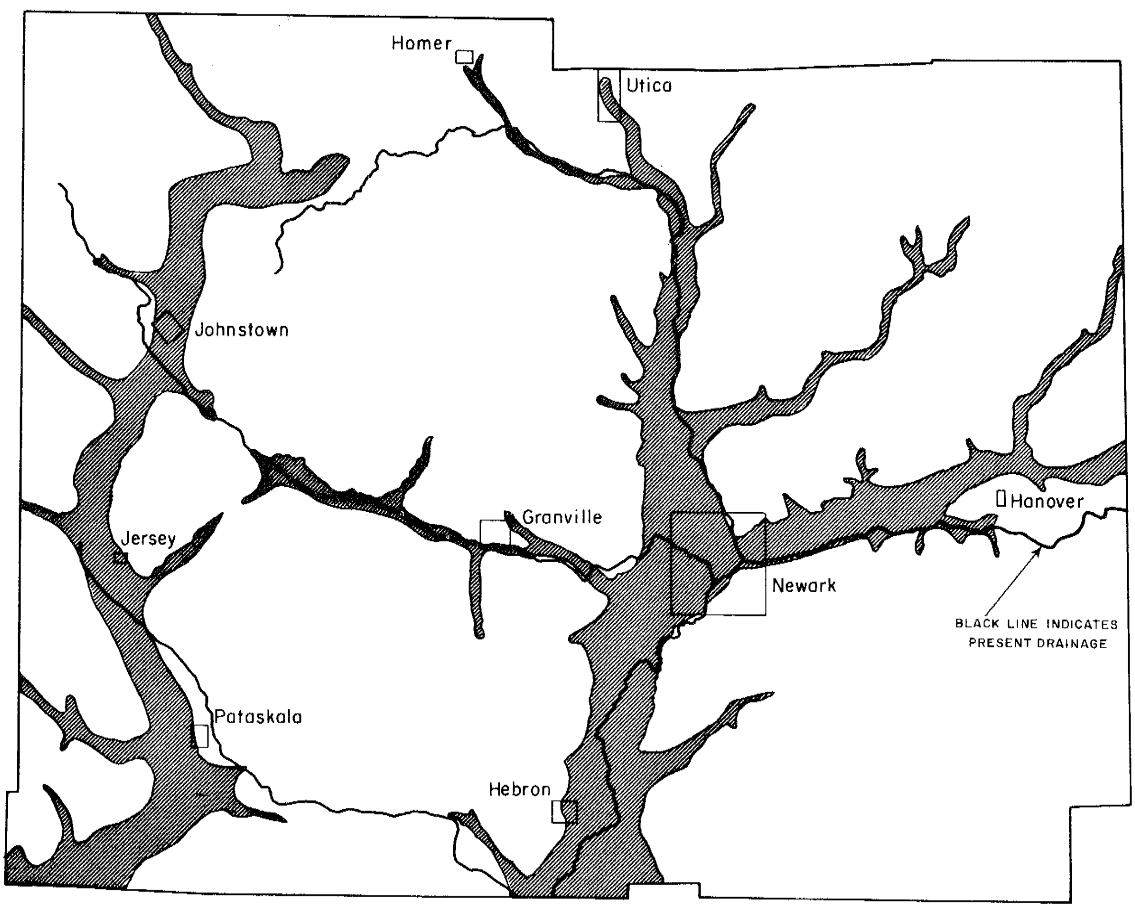


Figure 19. Pre-Illinoian (Deep stage) drainage in Licking County, Ohio.

sheet in Licking County. The earliest Wisconsin till is silty to silty and sandy in texture and contains a large number of siltstone and sandstone fragments. It is blue to blue gray where fresh, but in most of the exposures in Licking County it is weathered light yellow to brown. The calcium carbonate has been leached to depths of 4 to 6 feet by weathering.

Till deposited by the second, or middle, Wisconsin ice advance (early Cary) occurs at the surface in a north-south-trending belt that extends in width from Alexandria eastward to Newark. The till ranges from a light-yellow or drak-brown clay to a light-yellow silt. The clay-rich till contains many small pebbles of black shale and sandstone, and has been leached of carbonates to depths of 3 to 3½ feet. The silty till contains a large number of siltstone and sandstone pebbles, and has been leached of carbonates to depths of 4 to 4½ feet. Middle Wisconsin till has been oxidized to depths of 13 to 20 feet, the deeper oxidation usually is associated with the silty till.

Till deposited by the third, or latest, Wisconsin ice advance (middle Cary) in Licking County is very similar in appearance to till left by the middle Wisconsin ice. It ranges in composition from clayey to silty, and is oxidized to depths of 7 to 11 feet. The clay-rich till has been leached of carbonates to depths of 2 to 2½ feet, and the silty till has been leached of carbonates to depths of 3 to 4 feet.

### Ground-moraine deposits

Ground-moraine deposits are more than 300 feet thick at many places in western Licking County. Such thick deposits probably represent drift of more than one glacier, as wells drilled into them penetrate a zone of oxidized yellow clay separating two unoxidized layers of blue clay. Ground moraine in Hartford, Monroe, and Lima Townships completely obscures the underlying bedrock topography producing a flat to gently rolling plain. In the central and eastern parts of Licking County the ground moraine is thinner, is more deeply eroded, and generally conforms to the surface of the underlying bedrock. Figure 20 is a photograph of a typical till deposit in Burlington Township.

### End-moraine deposits

End moraines are deposits of drift that accumulated along the border of an ice sheet when the ice front remained relatively stationary for a time. These deposits generally consist of till in the form of hummocky ridges which may rise either gently or abruptly above the level of the surrounding drift. End moraines may be a few hundred feet to as much as several miles wide, and several to many miles long.

The end moraines in Licking County, all of which were formed by the Wisconsin glacier, are hummocky ridges 10 to 30 feet or more above the general level of the land. The middle Wisconsin (early Cary) end moraine in central Licking County lies below the crests of the bedrock hills against which it rests.

The earliest formed and most easterly end moraine in Licking County, deposited by the first Wisconsin (Tazewell) ice advance, extends from the Knox County line southward, passing to the east of Utica and Hebron to the Perry County line (see plate 2). This moraine is extremely discontinuous, or patchy. In the southeastern part of Washington Township morainal deposits of the first Wisconsin stage blocked the former westward drainage of a tributary of the North Fork Licking River and created a small lake in which fine silt and sand was deposited. The lake drained when the water dammed by the moraine overflowed a divide in north-central Eden Township and joined the drainage of Rocky Fork. End moraine deposits of the earliest Wisconsin ice advance also blocked the westward course of another former tributary of the North Fork Licking River in southeastern Newton Township and forced the waters over a low divide in east-central Mary Ann Township. Subsequent drainage was eastward to Lost Run and Rocky Fork.

End-moraine deposits of the early Wisconsin stage form a gentle ridge that extends from Buckeye Lake north to the South Fork Licking River in Licking Township. The ridge is about a mile wide and is fairly well defined on the west, but on the east side it grades imperceptibly into the surrounding ground moraine.

End-moraine deposits of the second, or middle, Wisconsin (early Cary) stage extend south from Homer to Buckeye Lake (see plate 2). These deposits are not continuous, but are broken in areas where they are covered by later Wisconsin deposits or in areas in which they lose their identity because they reflect the underlying preglacial valleys and bedrock highlands. End moraine deposited by ice of the middle Wisconsin stage in Liberty, McKean, and Burlington Townships contains numerous masses of late Wisconsin drift. As stated previously, the tills deposited by the middle and early Wisconsin ice sheets are very similar; therefore, a separation will not be possible until a detailed study is made of the surface soils. In Union Township the undulating and hummocky

Figure 20.-- Till exposed $2\frac{1}{2}$ miles west of Utica along State Road 62, Burlington Township. The depth of oxidation in the till is about 8 feet below the top of the deposit, and is shown by the natural line (arrow) of contact.

topography, characteristic of end moraines, is missing in areas that are underlain by preglacial valleys. This feature of the topography was very helpful to the author in reconstructing the preglacial drainage systems.

The third, or youngest, Wisconsin end moraine (middle Cary) in Licking County extends from Hartford (Croton Post Office) south to Johnstown, thence southeast, passing to the east of Pataskala, to the Fairfield County line (plate 2). This moraine does not mark the greatest extension of the late Wisconsin glacier, however, as ice from this advance left a thin veneer of till over parts of the end-moraine deposits of the second Wisconsin advance in Liberty, McKean, and Burlington Townships. In St. Albans and Harrison Townships end-moraine deposits of the latest Wisconsin ice merge with deposits of the second Wisconsin advance to form a composite end moraine that in places is over 7 miles wide. The approximate line of contact between the deposits where known is shown on plate 2.

### Water-bearing properties

Owing to the poor permeability of its clay or silt components, till yields water very slowly to wells. For this reason most of the wells drilled in till areas in Licking County do not bottom in till but are drilled into thin, water-laid sand and gravel deposits generally associated with the till. These sand and gravel deposits, termed "gravel streaks," or "pockets" by drillers, probably were laid down by small melt water streams at the bottom of the ice and were covered later by till deposited by the overlying ice. Such sand and gravel deposits generally are of small extent and thickness and are recharged by slow percolation of water through the surrounding till; however, yields from these gravel streaks or pockets usually are adequate for domestic and stock supply.

Shallow dug wells are common in the till deposits. These wells offer the advantages of a large infiltration area, a large storage capacity, and comparatively inexpensive construction. However, the water level in these shallow wells is usually so low in the summer that many wells go dry in extended periods of drought. The yields of shallow dug wells in till deposits are usually adequate for hand pumps, but seldom are sufficient to supply power pumps. Cisterns commonly are used to supplement dug wells.

In the northern part of the county near Homer and in the southern part of the county near Hebron till deposits overlie outwash sand and gravel laid down as valley trains by melt water from the Wisconsin and Illinoian glaciers. Later,

Figure 21.-- Kame deposit exposed along State Highway 161, at the western edge of Granville.

ice of the Wisconsin glacier readvanced and deposited till over the stratified materials. Wells drilled in these areas penetrate as much as 100 feet or more of till before reaching the underlying sand and gravel. Water in the confined sand and gravel occurs under artesian pressure and rises above the base of the confining till layer. Water supplies from these deposits generally are adequate for small industrial or municipal requirements.

### Outwash Deposits

Outwash deposits consist chiefly of silt, sand, and gravel, and can be divided into ice-contact deposits and proglacial deposits. Ice-contact outwash deposits were laid down in immediate contact with the ice, and include kames and kame terraces. Proglacial outwash deposits were laid down beyond the margins of the ice, and include valley trains and outwash plains.

#### Kames and kame-terrace deposits

Kames are hummocky deposits of silt, sand, and gravel formed at the edges of the glaciers as the ice melted or retreated from an area in an irregular manner. A kame-terrace deposit is a stratified accumulation of silt, sand, and gravel deposited by streams flowing between an ice sheet and an adjacent valley wall. The most extensive kame and kame-terrace deposits in Licking County were left by melt water from the Illinoian glacier along the northern edge of the Licking River valley in Madison Township (pl. 2). These deposits, which consist of coalescing kames that grade into two short terraces, are about half a mile wide and 6 miles long. Another prominent group of kames was deposited in Hartford Township by melt water from the third Wisconsin glacier (pl. 2). Figure 21 shows a typical kame exposed in Granville Township.

#### Valley-train deposits

Valley-train deposits are relatively long, narrow bodies of outwash which slope away from the site of the former ice sheet. They are concentrated in definite channels, the boundaries of which are the sides of valleys or former walls of glacial ice. At Hanover and in the southeast corner of Newton Township, outwash sand and gravel completely buried the valleys in which they were deposited. These deposits are relatively wide but are confined on the north and south by highlands adjacent to the valleys. Owing to their relatively great width, they may be considered to be outwash plains by some geologists. However because they are confined between the highland areas they are classed as valley-train deposits in this report.

Figure 22. -- Stratified valley-train deposits in the valley of Raccoon Creek, one mile east of Granville.

Figure 23. -- Terraced outwash deposits in the valley of Raccoon Creek, $\frac{1}{2}$ mile east of Granville.

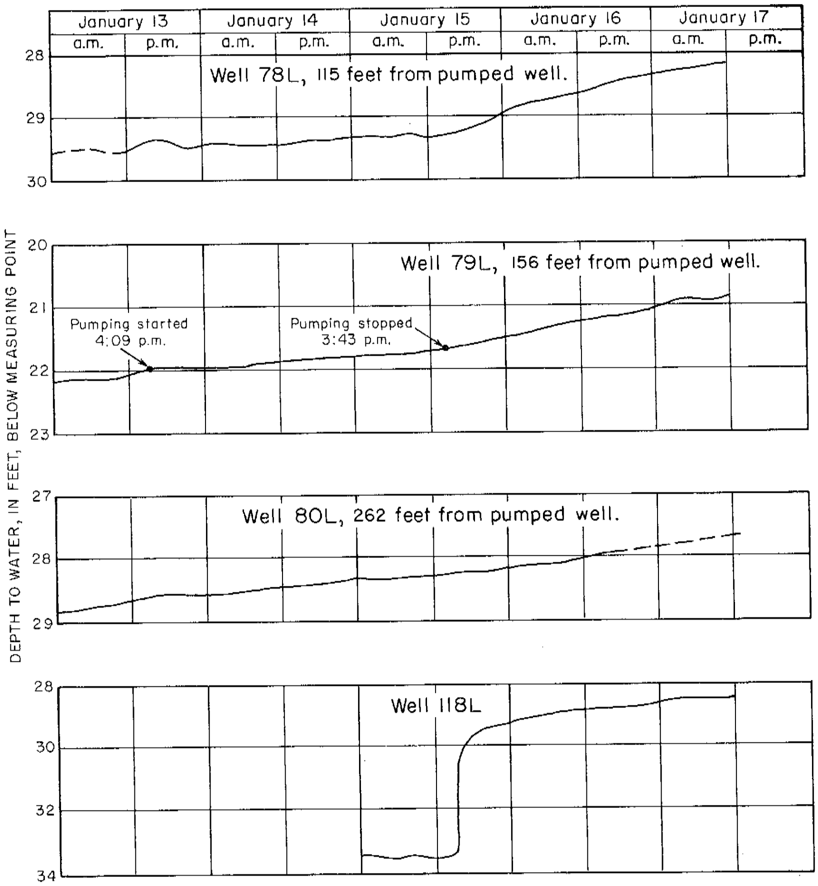


Figure 24. Fluctuations of water levels caused by pumping well 118L at 72 gpm, January 1953.

The principal valley-train deposits in Licking County are in the valleys of Raccoon Creek, North Fork Licking River, South Fork Licking River, and Licking River. (pl. 2) Figure 22 shows a typical valley train exposed in the valley of Raccoon Creek. Materials deposited in these valleys range in size from silt or fine sand to coarse gravel. Intercalated with the valley-train deposits are layers and lenses of till, which represent advances and retreats of the ice fronts. These layers of till affect the vertical movement of ground water in the valleys.

Most of the valley-train deposits in Licking County are terraced. Terracing occurred whenever streams from the melting ice were so underloaded that, instead of depositing additional sand and gravel, they trenched or eroded the deposits already laid down. Repeated glaciation resulted in the formation of several terraces at successively lower levels. Two terrace levels are recognized in the valleys of the South Fork and North Fork Licking Rivers, and three terrace levels in the valleys of Raccoon Creek and the Licking River. Figure 23 shows typical terraced outwash deposits in the valley of Raccoon Creek.

### Water-bearing properties

The valley-train deposits are the major sources of ground water in Licking County. Wells drilled into them range in depth from 32 feet to 254 feet, as changing conditions during their deposition produced variations in character, thickness, and water-bearing properties. In the valleys of North Fork and South Fork Licking Rivers the outwash deposits are separated by two widespread layers of till, each about 50 feet thick. These till layers occur at depths of about 30 to 60 feet and about 110 to 130 feet, respectively, below the general land surface. Most home and farm wells are finished in the valley-train deposits found above the upper till layer. These shallow sand and gravel deposits range between 30 and 55 feet in thickness and contain free or unconfined water. The permeability of the sand and gravel, determined from pumping tests conducted in Newark Township, is about 760 gpd per square foot. Larger water supplies, for industrial purposes generally are obtained from the confined sand and gravel deposits 90 and 175 feet below the general land surface. These sand and gravel deposits are highly stratified and consequently allow greater flow in a horizontal direction than in a vertical direction. Because of this directional difference in permeability, wells that penetrate only a small part of the water-bearing formations may be relatively inefficient. The water moving vertically to the well moves in a less permeable path than water moving in a horizontal direction. The condition will be reflected in an increase in drawdown in the well.

Valley-train deposits in the valley of Raccoon Creek are about 100 feet thick, and are underlain by an extensive layer of till. The outwash sand and gravel generally is coarser than the valley-train deposits found in the valleys of North Fork Licking River, South Fork Licking River, and Licking River. The sand and gravel forms the bed of Raccoon Creek and the deposits are open to recharge by river infiltration. The city of Granville pumps as much as 300,000 gpd of water from these deposits. Without conducting detailed pumping tests it is difficult to estimate the maximum amounts of water that can be pumped from these sands and gravels or what effect such pumping would have on ground-water levels in the area.

Data on the valley-train deposits in the Licking River valley are few. It is reported, however, that well 3 in Madison Township is pumped at the rate of 250 gpm, 7 hours a day, during the summer. This well reportedly flows during the winter. Well 53, at the Madison Township school, reportedly penetrated 206 feet of outwash sand and gravel without obtaining sufficient water. Water for the school was finally obtained from the underlying Cuyahoga formation.

Kame deposits generally are coarse textured and permeable; however, these conditions alone are not sufficient to insure large yields of ground water. The deposits must also be extensive and lie substantially below the water level in the aquifer. The kame deposits in Licking County, with the exception of the Illinoian kame deposits in the Licking River valley east of Newark, are at higher levels than the surrounding terrain, and are of limited areal extent.

Wells drilled into the Illinoian kame deposits in Madison Township range in depth from 97 to 186 feet. The static water level in these wells averages about 31 feet below the land surface. The maximum yield of the sand and gravel in the kame deposits is conjectural since no large supplies have been developed from them. The specific capacity of a domestic well drilled into these deposits is about 1½ gpm per foot of drawdown. This is not indicative of available yields, however, as these wells generally are of small diameter and are not equipped with screens.

### Pumping tests

Three pumping tests were made to determine the hydraulic properties of the glacial outwash sand and gravel in the valleys of South Fork Licking River and North Fork Licking River. The tests were made during 1953 and 1954, using wells owned by the Rockwell Spring and Axle Co. and the Pure Oil Co. Water levels were measured in several observation wells at each test site, and the results of the tests were analyzed by the nonequilibrium and modified nonequilibrium formulas.

In running pumping tests to determine the transmissibility of an aquifer, the observed drawdowns in wells must sometimes be adjusted for the effect of partial penetration by the pumped well. This is important because the productivity of a well depends largely on the degree to which it penetrates a water-producing bed. The distribution of head in the vicinity of a partially penetrating well is modified according to the degree of penetration. Water levels measured in nearby observation wells during pumping tests should therefore be adjusted for the effect before an attempt is made to determine the transmissibility or permeability of the aquifer. Adjustments for the partial penetration of a pumped well are discussed by Wenzel (1942, p. 109) and outlined by Jacob (1945, p. 169-175).

**Rockwell Spring and Axle Co. (shallow) test.**—A pumping test was run on the shallow sand and gravel aquifer in the Newark valley, Newark Township, on January 13-17, 1953. The aquifer is near the surface and consists of 30 feet of sand and gravel overlain by 25 feet of less permeable silt, sand, and gravel. Only the lower 25 feet of the aquifer is saturated, and the water occurs under water-table conditions. The aquifer is recharged by precipitation and by subsurface inflow from adjacent areas on the north.

Pumping was stopped in the well field approximately 16 hours before the start of the test, to allow water levels to stabilize. The wells used in the test, Nos. 118L, 78L, 79L, and 80L, are in Newark Township. Data on these wells are given in table 9 and their locations are shown on plate 1.

Test pumping was begun in well 118L at 4:09 p.m. on January 13 and was continued at a relatively constant rate of 72 gpm for about 48 hours. Water-level measurements in wells 78L and 118L were made with a weighted steel tape, and recording gages were installed on wells 79L and 80L. The pump was stopped at 3:43 p.m., January 15, and the water level in the aquifer was allowed to recover. The effect on water levels in wells 78L,

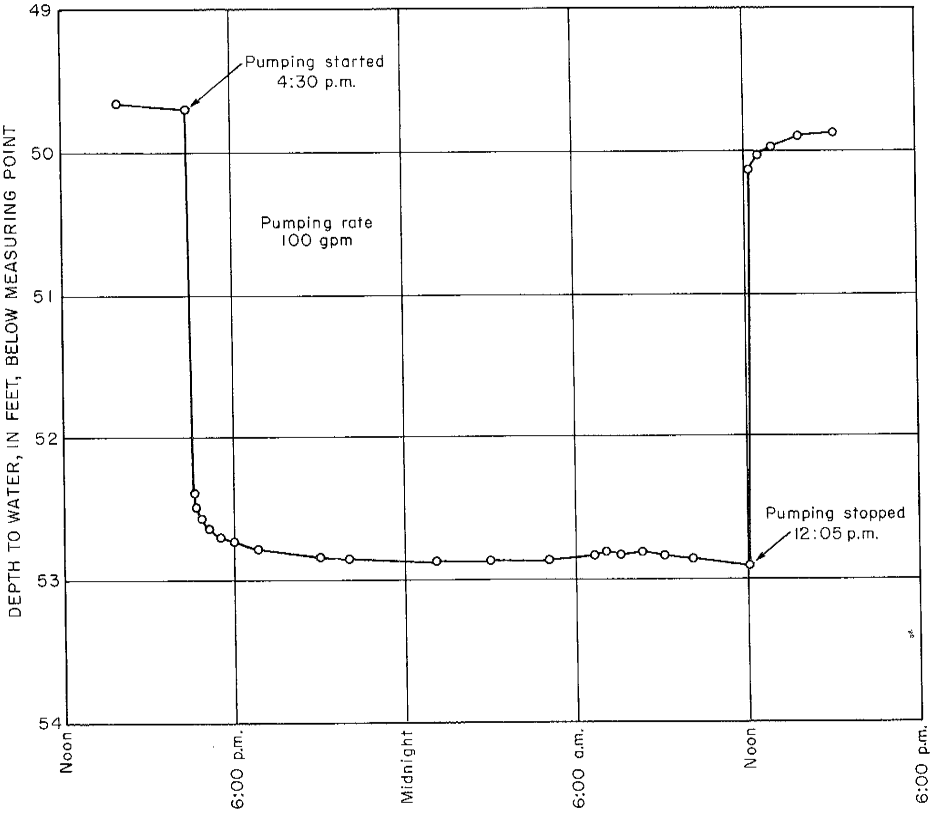


Figure 25. Drawdown and recovery curves for well 47L at the Rockwell Spring and Axle Co.

**TABLE 9.—Wells used in Rockwell Spring and Axle Co. (shallow) test**

| Well no. | Depth of well (feet) | Casing diameter (inches) | Distance from pumped well (feet) |
|---|---|---|---|
| 78L | 56 | 6 | 115 |
| 79L | 50 | 6 | 156 |
| 80L | 55 | 6 | 262 |
| 118L | 53 | 6 | pumped well |

79L and 80L caused by starting and stopping the pump in well 118L are shown on figure 24.

The results of the test were analyzed by the Theis nonequilibrium formula (Theis, 1935). The average coefficients of transmissibility and storage computed were 19,000 gpd per foot, and 0.1, respectively. The coefficient of transmissibility divided by the thickness of the saturated materials (25 feet) gives an average field coefficient of permeability of 760 gpd per square foot.

**Rockwell Spring and Axle Co. (deep) test.**—Mr. Edward J. Schaefer, Consulting Hydrologist, made a pumping test of the deeply buried sand and gravel in the Newark Valley on October 21 and 22, 1953.

The aquifer lies at a depth of about 175 feet below the general land surface and is composed of approximately 30 feet of outwash sand and gravel overlain by a relatively impermeable layer of till. The water occurs in the sand under artesian pressure. Recharge to the aquifer is principally by subsurface inflow from the adjacent valley walls and by vertical leakage from the overlying till.

The pumped well, No. 47L, Newark Township (pl. 1) is 206 feet deep, has a screen 10 feet long and a casing 6 inches in diameter. As no nearby wells were available for observation, all measurements of drawdown and recovery of the water level were made in the pumped well. The well penetrated the water-bearing formation only partially; therefore corrections in the observed drawdowns had to be made before the transmissibility of the aquifer could be calculated.

Test pumping was started at 4:30 p. m., October 21, and was continued at a rate of 100 gpm for approximately 20 hours. The pump was turned off at 12:05 p. m. on October 22 and water levels in the aquifer were allowed to recover. The drawdown and recovery of the water level in well 47L are shown on figure 25.

The results of the test were analyzed by the modified nonequilibrium formula (Cooper and

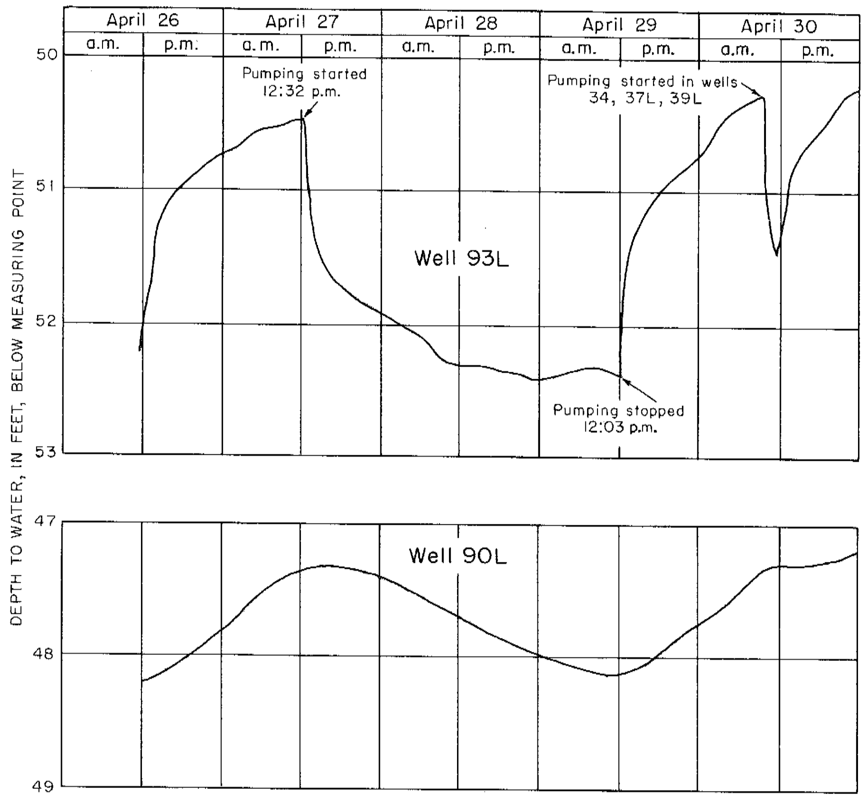


Figure 26. Fluctuations of water levels in nearby wells caused by pumping well 94L at 210 gpm, April 1954.

Jacob, 1946). The coefficient of transmissibility was computed to be 71,000 gpd per foot, and the field coefficient of permeability about 2,400 gpd per square foot. The coefficient of storage was not calculated for this test.

**Pure Oil Co. test.**—A pumping test was made at the Heath Refinery, in Newark Township, April 26-30, 1954. The aquifer, which consists of glacial outwash sand and gravel, averages 40 feet in thickness and its top is about 95 feet below the general land surface. Water in the aquifer occurs under artesian conditions.

Recording gages were installed on wells 90L and 93L at the plant to measure drawdown and recovery of water levels in the aquifer. No measurements could be taken in the pumped well, No. 94L, because of the manner in which the pump was installed. The effects on water levels in the aquifer caused by pumping from well 94L are shown in wells 90L and 93L (fig. 26).

Pumping in the well field was stopped approximately 24 hours before the start of the test, to allow water levels to become relatively stable, and arrangements were made to have the neighboring plants maintain a constant pumping rate during the test. Pumping in well 94L was begun at 12:32 p. m. on April 27 and was continued at a relatively constant rate of 210 gpm for about 48 hours. The pump was stopped at 12:03 p. m. on April 29, and water levels in the aquifer were allowed to recover. The recovery portion of the hydrograph (fig. 26) is modified by interference due to the pumping of wells at the nearby U. S. Air Force Depot. These wells, Nos. 34, 37L, and 39L, were pumped for 3½ hours at a combined rate of 1,200 gpm. Records of all the wells used are given in table 10 and their locations are shown on plate 1.

**TABLE 10.—Wells used in the Pure Oil Co. Heath Refinery pumping test**

| Well no. | Depth of well (feet) | Casing diameter (inches) | Distance from pumped well (feet) |
|---|---|---|---|
| 34 | 131 | 26 | 3,000 |
| 37L | 146 | 26 | 3,000 |
| 39L | 167 | 26 | 3,000 |
| 90L | 133 | 6 | 1,500 |
| 93L | 128 | 26 | 320 |
| 94L | 138 | 26 | Pumped well |

The results of the tests were analyzed by the nonequilibrium formula (Theis, 1935). The computed average coefficients of transmissibility and storage were 68,000 gpd per foot and 1.4 x

$10^{-3}$, respectively. The average field coefficient of permeability was 1,700 gpd per square foot.

### Lake Deposits

Small lakes were formed in Washington, Union, and Perry Townships (pl. 2) when drift from the Wisconsin and Illinoian glaciers blocked the streams, causing fine silt and sand to be deposited from melt waters. The lake in Perry Township (pl. 2) was formed by the Illinoian glacier which blocked the drainage south of Brushy Fork. Lakes in Washington and Union Townships were formed by the damming action that resulted from the Wisconsin glacier.

The lake deposits in Perry Township should yield adequate amounts of water for small industrial or municipal use. The lake deposits in Union and Washington Townships, however, are a poor source of water, and wells in these areas generally obtain water from the underlying deposits.

### Recent River Alluvium

Recent alluvium in Licking County consists mostly of silt and sand deposited by the present streams during times when they have overflowed their channels. The alluvium generally is thin, has a low permeability, and is not an important source of water. A few people living along the Licking River in Newark and Madison Townships draw water from driven wells in the alluvium. Most drilled wells, however, go through the alluvium and tap the outwash sand and gravel that underlies most of the major streams in Licking County.

## GEOLOGY AND WATER-BEARING PROPERTIES OF THE CONSOLIDATED ROCKS

Consolidated rocks of sedimentary origin, belonging to the Pennsylvanian and Mississippian systems, are exposed extensively in Licking County. These rocks include conglomerate, sandstone, siltstone, shale, limestone, flint, coal, and clay. They generally yield water suitable for most uses but rocks older than the Mississippian system do not yield potable water in Licking County. A generalized section of the rocks of the Pennsylvanian and Mississippian systems together with their thickness, character, and water-bearing properties is given in table 11. The rocks are listed in descending order as they are penetrated by the drill.

The stratigraphic nomenclature of the Ohio Division of Geological Survey, Department of Natural Resources, is used in this report. Accordingly, in the Mississippian system, the Black Hand is called a member of the Cuyahoga formation, and the boundaries of the Logan formation are expanded to include the Berne member.

### Rocks of the Pennsylvanian System

The Pennsylvanian system in Licking County is comprised of the Allegheny and Pottsville formations. Rocks of these formations have a low regional dip slightly south of east, and rest unconformably on the underlying Mississippian rocks in most of the eastern third of the county (pl. 3). The unconformity between the Mississippian and Pennsylvanian systems represents a break in deposition for a considerable period of time, during which crustal forces elevated the rocks above the waters of the sea, and erosion completely removed the upper formation (Maxville limestone) of the Mississippian system and cut deep valleys in the underlying (Logan) formation. Figure 27 is a photograph of Pennsylvanian sedimentary rocks in an eroded channel in the Logan formation.

Sandstone, shale, coal, limestone, flint, and conglomerate of the Allegheny and Pottsville formations have an aggregate maximum thickness of about 225 feet in Licking County. The sandstones are reddish to light gray, and range from medium grained to conglomeratic in texture. Because of their greater resistance the sandstones form the most prominent exposures of Pennsylvanian age in the county. The shales, which are easily eroded, range from brown and red to orange on fresh surfaces and to a dark brown or black where weathered. The coal and limestone units, being very thin and impure, have no economic importance. Outcrops of the coal and limestone are usually covered by debris from the overlying shale.

The Vanport limestone member of the Allegheny formation is the highest stratigraphic unit of the Pennsylvanian system in Licking County. The Vanport member is exposed in Franklin and Hopewell Townships, where it is represented by beds of flint and shaly limestone (fig. 28). The flint beds have an average thickness of 5 or 6 feet and are the thickest in Ohio. The flint was quarried by Indians who formerly inhabited the Licking County area, and was used for making weapons and tools. These aborigines dug a number of pits which may still be seen along Flint Ridge in Hopewell Township. The flint was valu-

TABLE 11.--GENERALIZED SECTION OF THE ROCKS OF PENNSYLVANIAN AND MISSISSIPPIAN AGE IN LICKING COUNTY

| System | Formation | Member | Character of material | Thickness (feet) | Water-bearing properties |
|---|---|---|---|---|---|
| Pennsylvanian | Allegheny | Vanport limestone to Brookville coal | Medium to coarse-grained sandstone; conglomerate; carbonaceous, siliceous, and argillaceous shale; thin and impure coal and limestone; siliceous clay, and flint. | 0-225 | Small supplies of water are obtained from Pennsylvanian sandstones in the eastern part of the county. The Pennsylvanian sediments are above the water table in most parts of the county and water is usually obtained from the underlying Mississippian formations. |
| | Pottsville | Homewood sandstone to Harrison | | | |
| Unconformity | | | | | |
| Mississippian | Logan | Vinton | Fine to medium-grained sandstone, silty to sandy shale, and fine-grained silt-stone. | 0-270 | Generally adequate water supplies for farm and domestic requirements. Average yield to wells is about 10 gpm. In some areas the Logan formation is comparatively thin and lies above the water table. In these areas wells are drilled into the underlying Cuyahoga formation. |
| | | Allensville | Fine to coarse-grained sandstone and siltstone with some shale beds. | | |
| | | Byer | Alternating fine-grained sandstone and siltstone with some shale beds. | | |
| | | Berne | Highly limonitic coarse to medium-grained sandstone, conglomerate, and shale. | | |
| | Cuyahoga | Black Hand | Massive coarse-grained sandstone and conglomerate in the Toboso province; fine-grained sandstone, siltstone, and shale in the Granville province. | 0-570 | The Cuyahoga formation is the most productive of the consolidated rock aquifers in the county. Yields to wells range from 5 to more than 100 gpm. |
| | | Raccoon shale | Alternating beds of sandstone, siltstone, and shale. In the Granville province the sandstone and siltstone beds in the lower part of the Raccoon shale become thicker and more numerous. | | |
| | Sunbury shale | | Fissile, black to brown bituminous shale. | 24-100 | Not a source of water in Licking County. Most water supplies are obtained from the overlying deposits. |
| | Berea sandstone | | Fine-grained thick-bedded sandstone. | 0-80 | Wells generally yield ample supplies of water for domestic and farm use. Most wells in Licking County obtain water from the over-lying deposits. An oil well drilled in Madison Township encountered brackish water in the Berea sandstone. |
| | Bedford shale | | Red or blue clayey shale. | 20-100 | No wells inventoried in Licking County ob-tain water from the Bedford shale. In other areas in the state yields to wells are very small and in some the formation may be completely unproductive. |

Figure 27.-- Pennsylvanian shales lying in an eroded channel of the Logan formation 4 miles southeast of Newark, in Franklin Township.

able also to the early white settlers of the area as it furnished a fine article for making millstones.

The contact between the Pottsville and Allegheny formation is assumed to be at the base of the Brookville coal, though this distinction is largely arbitrary. There is no sharp line of demarcation between the two formations, and fossils in the upper beds of the Pottsville are very similar to those near the base of the Allegheny formation. The Brookville coal is not well exposed in Licking County, being covered by detritus from the overlying rocks; therefore, no attempt was made in this report to differentiate between members of the Pottsville and Allegheny formations.

The Harrison is the basal member of the Pottsville formation in Licking County. The Harrison member lies at the irregular contact of the Mississippian and Pennsylvanian systems and, in many places, contains materials from the rocks of both systems. The Harrison member is composed of angular siliceous fragments and well-rounded quartz pebbles cemented by iron compounds locally called "peanut stone" by the residents of eastern Licking County. In places the Harrison member is composed of a brecciated mass of siliceous fragments cemented by iron compounds. The siliceous fragments appear to be pieces of the Maxville limestone which have been replaced by silica (Stout, 1918, p. 48). In many areas where the contact of the Pennsylvanian and Mississippian systems is concealed, its position can be closely approximated by the presence of flint nodules from the Harrison member scattered about the surface.

**Water-bearing properties**

Small supplies of water for stock and domestic purposes are obtained from a few wells drilled into the Pennsylvanian rocks in eastern Licking County. The Pennsylvanian sandstone beds from which water is obtained are thin and generally lie well above drainage. In many areas the sandstone beds are missing from the section and wells must be drilled into the underlying Mississippian rocks to obtain sufficient water for domestic use.

**Rocks of the Mississippian System**

Conglomerate, sandstone, siltstone, and shale of the Mississippian system are about 700 to 800 feet in aggregate thickness in Licking County. These rocks have a regional dip of 25 to 40 feet per mile to the southeast and strike north 16° to 20° east. They are overlain unconformably by the Pottsville formation of Pennsylvanian age and overlie unconformably the Ohio shale of

Figure 28.-- Flint phase of the Vanport limestone member of the Allegheny formation along State Highway 668, in Hopewell Township.

Middle Devonian age. Exposures of the Mississippian rocks are confined to the uplands in the central and eastern parts of the county. In western Licking County, and in stream valleys in other parts of the county, the Mississippian rocks are covered by a thick mantle of glacial drift.

The Mississippian system in Ohio has been divided into six stratigraphic units. In descending order they are: Maxville limestone, Logan formation, Cuyahoga formation, Sunbury shale, Berea sandstone, and Bedford shale. The Maxville limestone is not present in Licking County, having been removed by erosion in pre-Pennsylvanian time.

The Logan formation, Cuyahoga formation, Sunbury shale, Berea sandstone, and Bedford shale make up what formerly was known as the Waverly group. The Waverly group in central and southern Ohio was divided into five provinces or facies, of deposition, by Hyde (1915). Extending from Licking County southward to the Ohio River, these provinces are the Toboso, Granville, Hocking Valley, Scioto Valley, and Vanceburg. Two of the provinces, the Toboso and Granville, are in Licking County. Each of Hyde's provinces is composed of distinct lithologic members that may be traced over the entire province in which they occur and in some places can be traced into adjacent provinces. The axial trend of the provinces is from northwest to southeast and does not correspond to the direction of either dip or strike.

### Logan Formation

The Logan formation is the youngest of the Mississippian deposits in Licking County. Conglomerate, sandstone, siltstone, and shale beds of the Logan formation are exposed along the walls of valleys and cap some of the hills in the eastern two-thirds of the county. The thickness of the Logan formation differs greatly because of the erosion surface at the top; it is greatest, 270 feet, in Bowling Green Township. The formation is not present in the western third of Licking County. The lithology of the Logan formation is the same in both the Toboso and the Granville provinces. The formation is divided into four members which are, in descending order, the Vinton, Allensville, Byer, and Berne.

Alternating layers of sandstone, siltstone, and shale make up the Vinton member. The sandstones are brown to gray and are fine to medium grained. The brown color usually is associated with limonitic beds. Locally the siltstones grade into very fine grained sandstone. The siltstones range from tan to gray; gray being the predominant color of the unweathered rocks. The

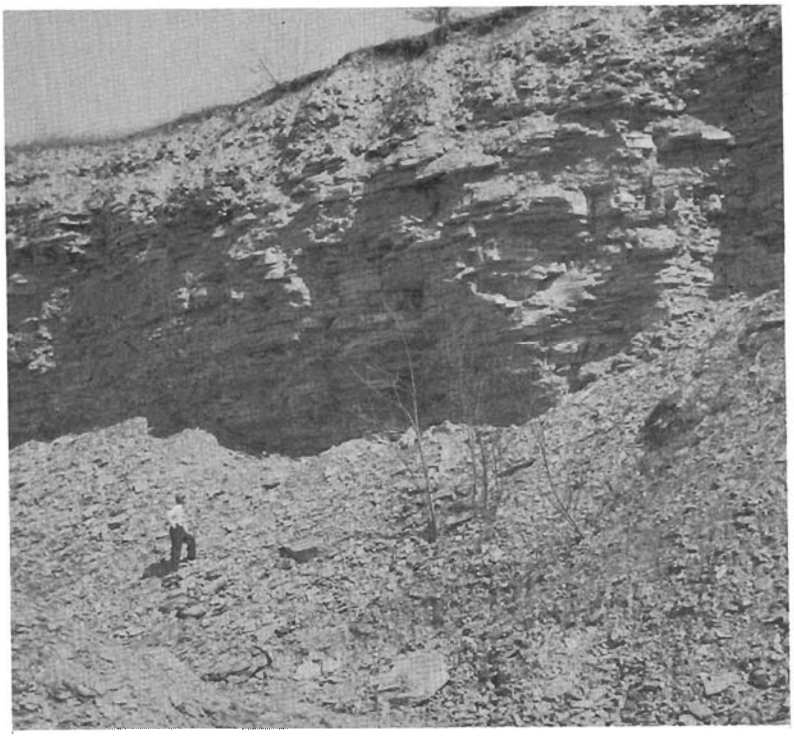

Figure 29.-- Upper shale in the Vinton member of the Logan formation at the Bowerston Shale Co. quarry along State Highway 16, in Hanover Township.

shales of the Vinton member are greenish gray to brown, and range from tough, blocky sandy shale to soft silty fissile shale. A shale bed in the Vinton member (fig. 29) is quarried at Hanover, for the manufacture of common clay products.

The Allensville member is composed of conglomerate, sandstone, siltstone, and shale. The conglomerate and sandstone are red on a fresh surface and are altered to rust red on weathered exposures. Coarse red sandstones characterize the Allensville. The siltstones and shales are tannish gray to light brown where fresh and darker brown where weathered. In Licking County the Allensville member is conformably overlain by the Vinton member and underlain by the Byer member. In areas where the coarse red sandstones are absent, the finer grained sandstone and siltstone of the Allensville member cannot be distinguished from siltstone and sandstone beds in the Vinton and Byer members.

The Byer member is made up principally of alternating layers of fine-grained sandstone and siltstone, although shale beds also are common. The sandstone and siltstone beds of the Byer member range from tan gray to blue gray on fresh surfaces and to olive drab or brown where weathered. The shales are gray to gray brown or tan on fresh surfaces and dark brown where weathered. The sandstones and siltstones are massively bedded, and weather into blocks about 3 inches thick. Ordinarily, the Byer member is less limonitic than the overlying Allensville member, and is darker and more massively bedded than the Vinton member. Sandstones of the Byer member formerly were quarried at Newark and used for building stone.

The Berne member consists of conglomerate, sandstone, and thin beds of shale. The pebbles in the conglomerate are quartz and quartzite which range from one-fourth inch to more than 2 inches in diameter. At most localities in Licking County the pebbles range from one-fourth to one-half an inch in diameter. The conglomerate is highly limonitic, in places having veins of pure limonite running through it. The sandstones are tan to dark brown and coarse to medium grained. The shales are usually dark brown and generally are quite sandy. Figure 30 shows the contact between the basal conglomerate of the Berne member of the Logan and sandstone of the Black Hand member of the underlying Cuyahoga formation.

### Water-bearing properties

Sandstone and siltstone beds of the Logan formation yield moderate quantities of water to wells in upland areas of central and eastern Lick-

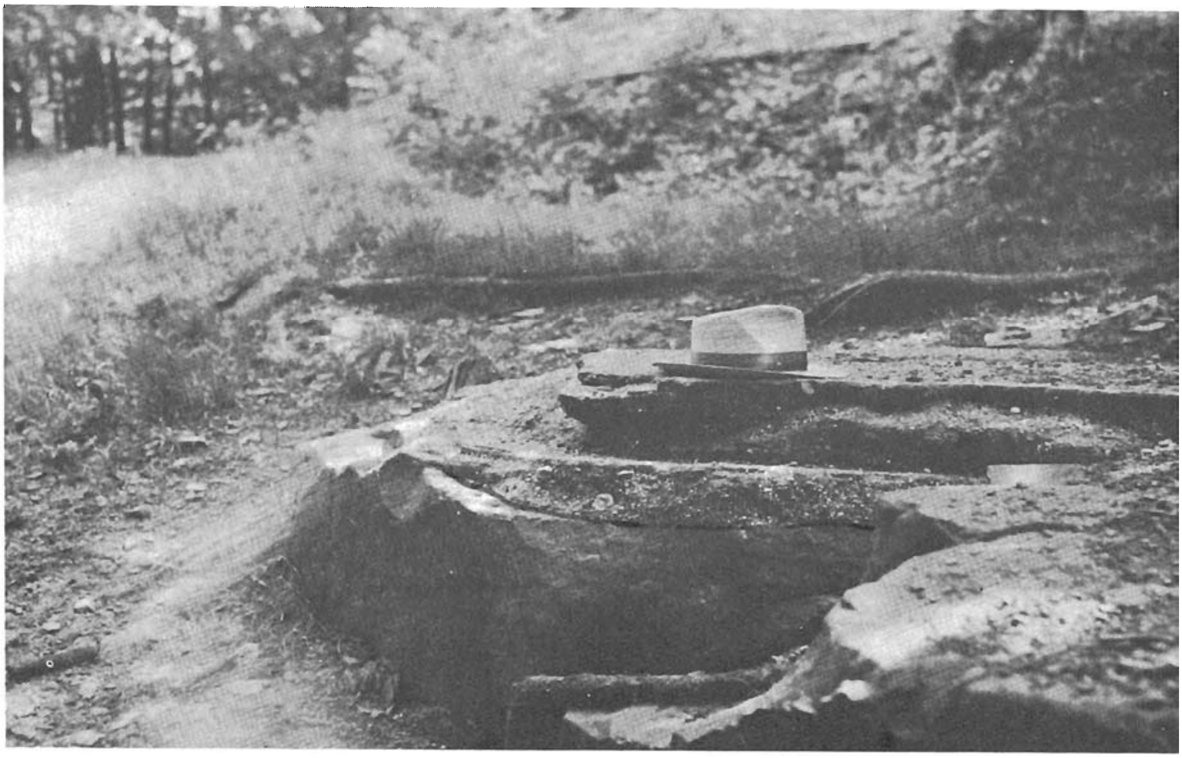

Figure 30.-- Irregular contact (inked line) between the Berne member of the Logan formation (above) and the Black Hand member of the Cuyahoga formation (below), 2 miles south of Hanover.

ing County. Yields of 10 gpm are common, and a few wells yield more than 25 gpm. Samples of water collected from three wells in the Logan had an average hardness of 136 ppm (parts per million) and were low in iron, dissolved solids, and fluoride. The average temperature of the water was 53° F. In areas where the Logan formation is compartively thin and lies above drainage, wells ordinarily are drilled into the underlying Cuyahoga rocks.

### Cuyahoga Formation

The Cuyahoga formation is represented in Licking County by the Black Hand and the Raccoon shale members, which are present in both the Toboso and Granville provinces. The aggregate thickness of the Black Hand sandstone and the Raccoon shale is about 570 feet. The deposits predominating in the Toboso province are coarse sandstone and conglomerate which are underlain by alternating layers of sandstone and shale. Figure 31 shows a typical exposure of the coarse-grained, massively bedded Black Hand member of the Cuyahoga formation in the Toboso province. In the Granville province the conglomerates are absent, the sandstones are much finer grained and thinner bedded, and siltstones and shales predominate. Figure 32 shows a typical exposure of fine grained sandstone and shale of the Black Hand member of the Cuyahoga formation in the Granville province. The change from the coarse sediments in the Toboso province to the finer grained sediments in the Granville province is gradational, as shown by the logs of three wells drilled for oil or gas [10] (table 12), hence, no exact line can be drawn between the two provinces.

The type locality of the Black Hand member is the post-glacial gorge of the Licking River at Hanover, in the Toboso province (Hyde 1915). Here the Black Hand member is a prominently cross-bedded coarse-grained massive sandstone and conglomerate. It ranges from red to yellow and buff on fresh surfaces, and to a dark gray or black where weathered. The quartz pebbles in the conglomerate beds range from one-fourth to 1 inch in diameter, the average diameter being less than one-half inch. In the Granville province the siltstones and sandstones are medium to thick bedded and range from light brown to gray. The shales are silty and range from tan to gray.

The Raccoon shale underlies the Black Hand member of the Cuyahoga formation in both the Toboso and the Granville provinces. Wells drilled into the Raccoon shale penetrate alternating lay-

[10] Numbers referring to oil and gas wells have prefix of G.

Figure 31.-- Typical massive sandstone of the Black Hand member of the Cuyahoga formation in Hyde's Toboso province, 1 mile west of Hanover.

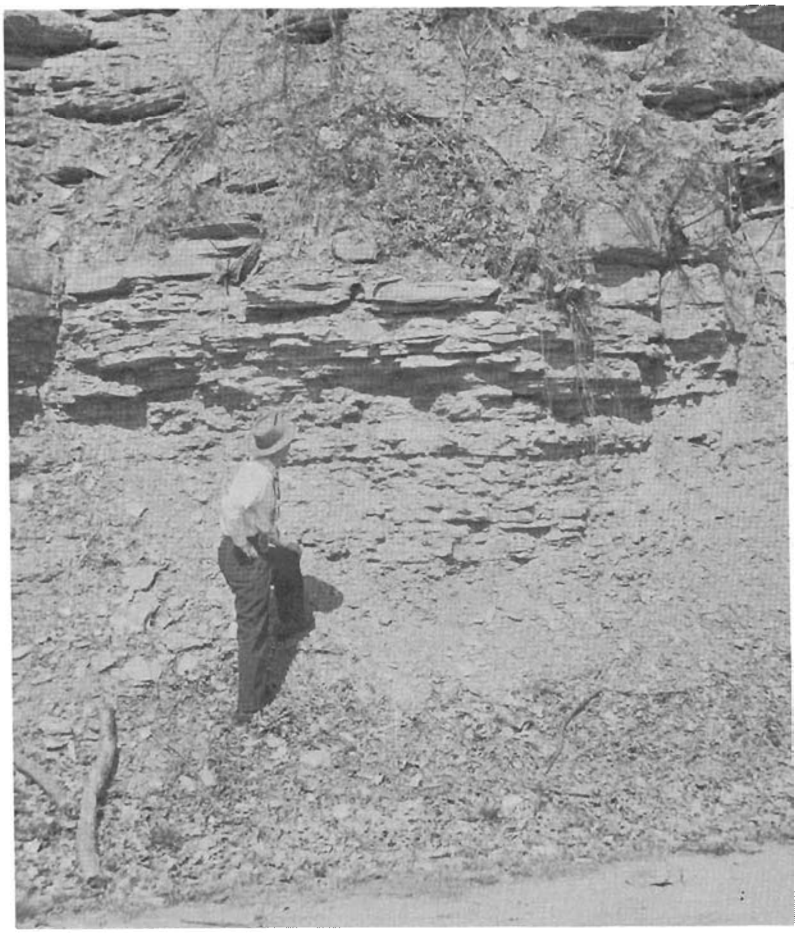

Figure 32.-- Exposure of the fine-grained sandstone and shale of the Black Hand member of the Cuyahoga formation in Hyde's Granville province, 3 miles east of Granville.

**TABLE 12.—Well logs.**
**(Location of wells shown on plate 1)**

Well G-1, 2½ miles south-southeast of Toboso, in Hopewell Township; altitude, 880 feet.

| System | Formation | Member | Rock Type | Depth (feet) |
|---|---|---|---|---|
| Mississippian | Logan | Vinton | Siltstone or silty shale | 0- 42 |
| | | | Sandstone | 42- 50 |
| | | | Siltstone or silty shale | 50- 90 |
| | | Allensville | Sandstone | 90- 110 |
| | | Byer | Siltstone or silty shale | 110- 175 |
| | Cuyahoga | Black Hand | Sandstone | 175- 420 |
| | | Raccoon shale | Shale | 420- 720 |
| | Sunbury | | Black shale | 720- 765 |
| | Berea | | Coarse sandstone ("grit" of drillers) gray | 765- 777 |
| | | | Silty shale | 777- 779 |
| | Bedford | | Red shale | 779- 811 |
| Devonian | Ohio | | Shale | 811-1955 |

Well G-2, oil well 2 miles east of Newark, in Madison Township; altitude 880 feet.

| System | Formation | Member | Rock Type | Depth (feet) |
|---|---|---|---|---|
| Mississippian | | | Unknown | 0- 42 |
| | Cuyahoga | Black Hand | Silty sandstone | 42- 267 |
| | | Raccoon shale | Blue shale | 267- 467 |
| | Sunbury | | Black shale | 467- 554 |
| | Berea | | Sandstone | 554- 570 |
| | Bedford | | Red shale | 570- 610 |

Well G-3, gas well 1½ miles south of Granville, in Granville Township; altitude 1,075 feet.

| System | Formation | Member | Rock Type | Depth (feet) |
|---|---|---|---|---|
| Quaternary | | | Clay | 0- 30 |
| Mississippian | Logan, Cuyahoga, Sunbury | | Alternating siltstone and shale ("slate" of well drillers) | 30- 602 |
| | Berea | | Sandstone | 602- 612 |
| Mississippian | Bedford | | Shale | 612-1116 |
| Devonian | Ohio | | | |

ers of shale, siltstone, and sandstone. West of Granville, shales in the lower part of the Raccoon shale are thinner and less numerous and the siltstone and sandstone beds are more massive than they are east of Granville. The top of the Raccoon shale is exposed along the South Fork Licking River 4 miles east of Pataskala, in Harrison Township, and along Raccoon Creek 3 miles west of Granville. The shales are platy and silty and range from blue to gray.

### Water-bearing properties

The Cuyahoga formation is the most productive of the consolidated-rock aquifers in Licking County, yielding 5 gpm to more than 100 gpm. The largest supplies are obtained from the coarse-grained sandstones of the Black Hand member; however, adequate supplies for domestic use are available also from the fine-grained sandstone and siltstone lenses in the Raccoon shale member.

The average temperature of the water from 52 wells in the Cuyahoga formation is 53° F. The hardness in 3 samples ranged from 178 to 610 ppm, and averaged 404 ppm. Dissolved solids ranged from 336 to 772 ppm, and averaged 527 ppm. The iron content was 6.1 ppm in a sample from well No. 1 in Monroe Township. In the other two samples analyzed the iron content was 0.24 and 0.26 ppm.

### Sunbury Shale

The Sunbury shale is not exposed in Licking County, and the character, thickness, and color of this shale, and of the formations that underlie it, are known only from records of oil and gas wells and from exposures in adjoining Delaware and Franklin Counties. It is a fissile, black to brown bituminous shale, ranging in thickness from 100 feet in northeast Newton Township to 24 feet in northeast Licking Township. The average thickness is 40 feet in Licking County. The Sunbury shale is underlain conformably by the Berea sandstone.

### Water-bearing properties

The Sunbury shale is not a source of water in Licking County. Most wells obtain water from the overlying rocks. In the western part of the county, however, a few wells are drilled through the Sunbury shale to obtain water in the Berea sandstone.

### Berea Sandstone

The Berea sandstone is a fine-grained massive sandstone, commonly called "grit" by many well drillers. It has an average thickness of about 10 feet in Licking County, but may be as much as

80 feet thick locally. In northeastern Newton Township the Berea sandstone is missing and the Sunbury shale rests directly on the Bedford shale. The Berea is not exposed at the surface in Licking County, though it occurs beneath the glacial drift which fills north-south-trending valley in the western part of the county.

### Water-bearing properties

At most places in Licking County adequate supplies of water for farm or domestic use are available from rocks of the Cuyahoga and Logan formations or from glacial deposits which overlie these deposits. For this reason only a few wells have been drilled into the Berea sandstone. These wells, in Etna and Jersey Townships, yield ample supplies of water for domestic needs. The temperature of the water in one well tapping the Berea sandstone in Jersey Township is 56° F. Samples of water from the Berea sandstone were not collected in Licking County, but analyses of water from five wells in adjoining Franklin County show an average hardness of 369 ppm.

## Bedford Shale

The Bedford shale, the oldest formation of Mississippian age in the State, is a soft red and blue or gray shale, commonly called "red rock" by drillers. The Bedford shale has an average thickness of 30 to 40 feet in Licking County, but may range locally from 20 to more than 100 feet.

### Water-bearing properties

No wells inventoried in Licking County obtain water from the Bedford shale, hence, its water-bearing properties in the county are not well known. In other areas of the State, however, yields from wells drilled into the Bedford shale are very small, and in some instances the formation may be completely unproductive.

# GEOPHYSICAL INVESTIGATIONS

The most productive aquifers in Ohio are the sand and gravel deposits of glacial origin that partly or wholly fill ancient valleys. In some areas these valleys contain thick deposits of fine sand, silt or clay in which it is difficult to develop wells. It therefore becomes an essential part of a water resources investigation to map these ancient valleys, determine their age, and learn the origin and character of the deposits they contain.

Because of the great thickness of the glacial drift in parts of Licking County, logs of existing wells do not reveal the buried bedrock topography in much detail. Test wells could have been drilled in areas where information was scarce or wanting, but this would have involved great expense and time. As stated by Norris and Spicer, 1958, p. 203, "about 25 points could be examined by the resistivity method at the cost of the average drill hole, . . ."

## ELECTRICAL-RESISTIVITY MEASUREMENTS

An electrical earth-resistivity survey was made in Licking County during the spring of 1952 in an effort to determine the thickness of the glacial drift in several areas where little or no information was available from well records. A detailed discussion of the theory of electrical resistivity is beyond the scope of this report, but briefly stated, an electric current is passed through the earth and the resistance offered to this flow of current by the underlying materials is measured and interpreted. The electrical resistivity of a material, usually measured in ohm-centimeters, is related to its porosity and the chemical character of its fluid content. Geological materials transmit an electric current by electro-chemical phenomena. If a material contains relatively pure water, its resistivity is much greater than it would be if it contained water having high mineral content. A porous sand or gravel, for example, has a high resistivity compared to a relatively dense shale or clay. The locations of the resistivity measurements in Licking County are shown on plate 1.

The success of resistivity prospecting in determining the thickness of glacial drift depends to a great extent on the electrical contrast between the bedrock and the overlying glacial drift. The resistivity of shale may be so similar to that of glacial till or clay that it is difficult to distinguish one material from the other. It may also be difficult to separate an unconsolidated sand from a sandstone on the basis of their electrical properties. In order that results might be as accurate as possible, test measurements of the resistivity of each of the geologic formations in Licking County were made in areas where they are exposed. The lithologic as well as the electrical characteristics of a formation may vary however in the distance between the point at which the formation was tested and the site at which the measurement to determine the depth to bedrock was taken. In some areas interference caused by surface conductors such as metal fences, railroad tracks, and buried pipe lines make it impossible to obtain measurements.

The earth resistivity measurements were made with a Gish-Rooney type instrument. Electrode contact between the instrument and the earth was obtained by driving copper-clad steel rods into the ground and connecting them to the instrument with insulated wire carried on portable reels. (See fig. 33.) Good electrode contact between the rods and the ground was possible during the investigation because the ground was kept moist by fairly abundant rainfall. Care had to be taken, however, to avoid leakage of current between the reels and the ground.

Depth profiles were made throughout this study to get information as to the character and thickness of the materials beneath the surface. Electrodes were set in the earth in accordance with the modification of the Wenner arrangement proposed by Lee (1929). Measurement of potential were made both by Wenner (1915) and by Lee (1929) techniques, giving three measurements at each profile. The largest errors evident in the depth to bedrock determinations were in areas where thick gravel layers immediately overlie the bedrock surface. Gravel has a very high resistivity, and its occurrence above the bedrock of low resistivity makes it difficult to obtain an accurate depth to bedrock interpretation using theoretical curves for correlation. For this reason an empirical interpretation was necessray. The interpretation was begun by dividing the county into sections and plotting the Wenner configuration curves of each section as a group. The curves of each group were then compared in relation to one another. When resistivities, relation of electrical layers, quality of curve, and surface elevation were taken into consideration, a qualitative relationship between the apparent resistivity curves was determined. To illustrate the changes in drift thickness and to give an approximate bedrock depth determination, a quantitative result for each field curve was arrived at by using well logs and all available geologic information. The interpretations of the results obtained at 41 sites are given in table 13.

## SEISMIC REFRACTION MEASUREMENTS

Refraction measurements were made at 13 sites in Licking County during the winter of 1954. The

**TABLE 13.—Estimation of depths to bedrock from apparent resistivity curves.**

| Township | Site no. | Depth to bedrock (feet) | Bedrock |
|---|---|---|---|
| Burlington | R-20 | 250 | Shale |
| | R-34 | 210 | Sandstone |
| | R-41 | 100 | Shale |
| Etna | R- 9 | 320 | Shale |
| | R-10 | 105 | Shale |
| | R-13 | 200 | Sandstone |
| Granville | R-29 | 270 | Shale |
| | R-32 | 250 | Shale |
| | R-33 | 250 | Shale |
| | R-38 | 200 | Shale |
| Hanover | R-21 | 275 | Sandstone |
| Harrison | R- 8 | 100 | Shale |
| | R-12 | 124 | Shale |
| | R-37 | 135 | Sandstone |
| Hartford | R-17 | 125 | Sandstone |
| | R-18 | 150 | Sandstone |
| | R-28 | 205 | Sandstone |
| Jersey | R-15 | 180 | Sandstone |
| | R-25 | 225 | Sandstone |
| | R-26 | 175 | Sandstone |
| Licking | R- 5 | 160 | Sandstone |
| Lima | R-11 | 125 | Shale |
| | R-14 | 208 | Shale |
| | R-27 | 108 | Shale |
| Madison | R-22 | 225 | Sandstone |
| | R-23 | 220 | Sandy shale |
| Mary Ann | R-39 | 80 | Sandstone |
| | R-40 | 80 | Sandstone |
| Monroe | R-16 | 185 | Sandstone |
| | R-19 | 375 | Sandstone |
| Newark | R- 3 | 250 | Sandstone |
| | R- 4 | 285 | Shale |
| | R-24 | 200 | Sandy shale |
| Newton | R- 2 | 240 | Shale |
| | R-30 | 280 | Shale |
| Perry | R-36 | 30 | Sandstone |
| Union | R- 6 | 310 | Sandstone |
| | R- 7 | 310 | Sandstone |
| | R-31 | 280 | Shale |
| | R-35 | 165 | Sandstone |
| Washington | R- 1 | 120 | Sandstone |

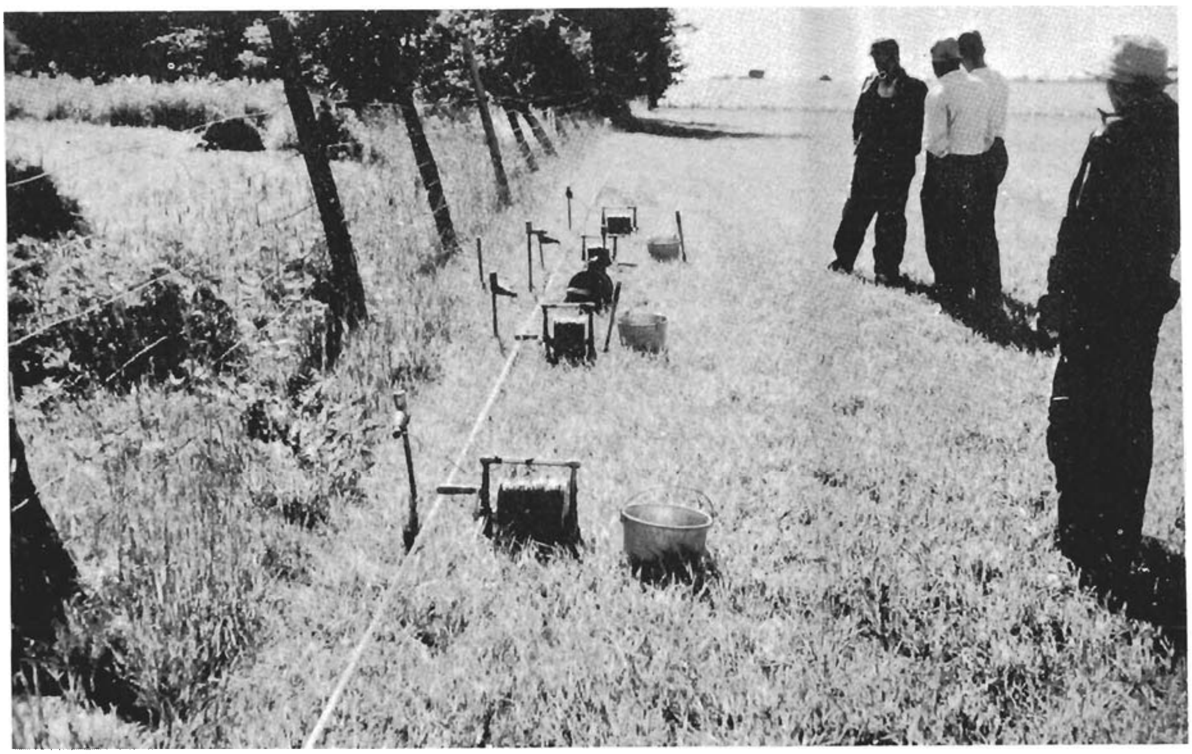

Figure 33.-- Copper-clad steel rods and reels of insulated wire used in obtaining resistivity measurements. The buckets are filled with water which is used to wet the soil around the rods and thereby obtain a better electrode contact.

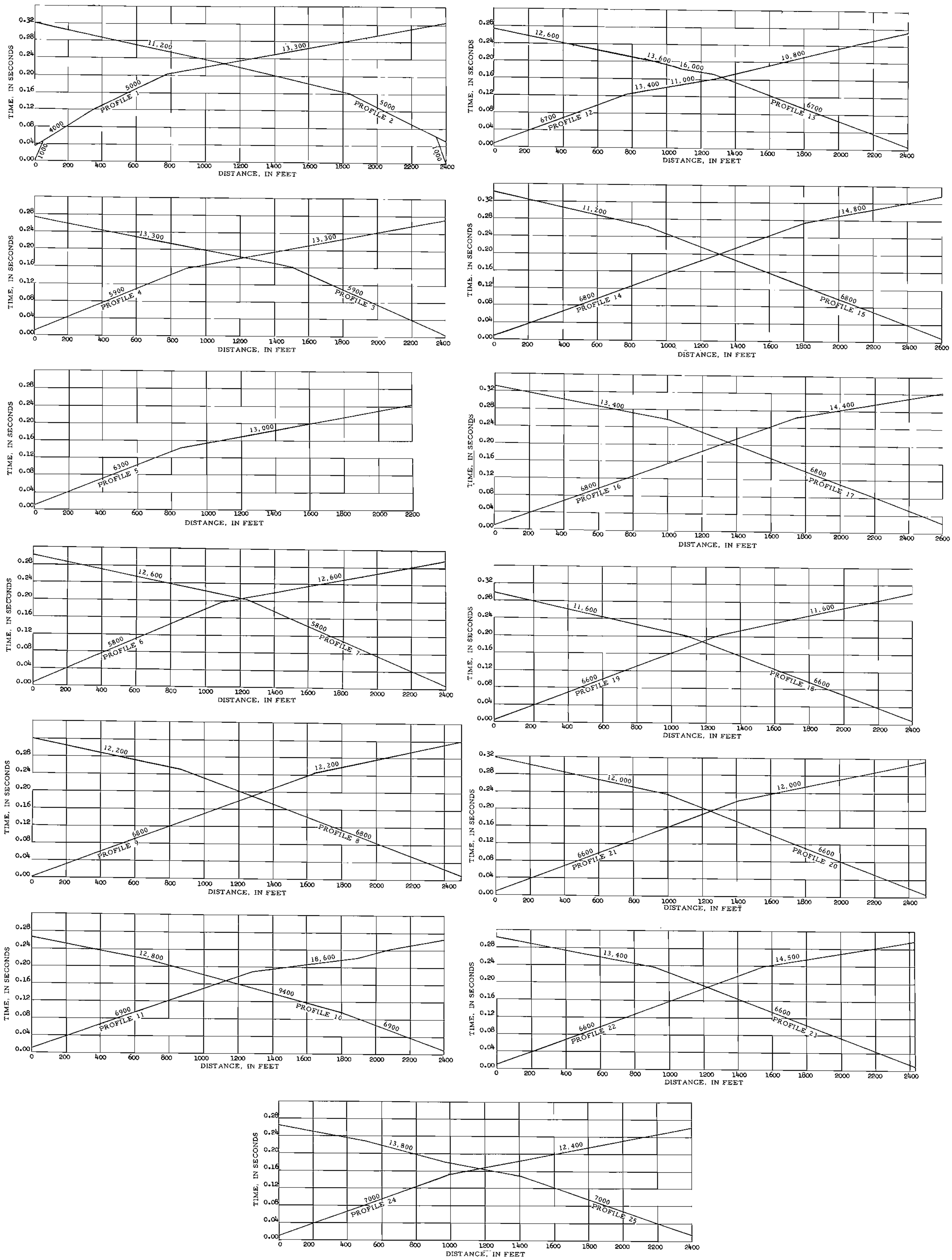


Figure 34. Time-distance curves of seismic profiles in Licking County, Ohio.

work was done by the Geophysics Branch of the U. S. Geological Survey to determine the depths to bedrock, as a further aid in locating the buried glacial and preglacial valleys. The locations at which refraction measurements were made in Licking County are shown on plate 1.

In methods of refraction exploration an explosive charge is fired at or near the surface of the ground. Seismic, or shock, waves created by the explosion are both reflected and refracted by the underlying formations. The waves travel at different velocities along the various formations and are picked up by vibration sensitive detectors called geophones. The geophones convert the waves into electrical impulses that are then transmitted to a recording unit which charts the electrical waves produced by the explosion. Travel time versus distance is then plotted from this chart as a distance-time curve and a straight line is drawn through the plotted points. The slope of this line represents the velocity of the seismic wave. (See fig. 34.) The depth and nature of the refracting material or formation may be determined from the time-distance curves (Heiland, 1951). The depths to bedrock are given in table 14.

A portable twelve-trace seismograph instrument was used to make the measurements in Licking County. The shot points of individual profiles were 2,400 feet apart, with geophones spaced every 200 feet between the points. The locations of the shot points were controlled by deep ditches along the roads, drainage tile, gas lines, and boulders encountered in drilling, but wherever possible they were 100 feet from the end geophone of the profile. The average charge of explosive contained 16 pounds of 60 percent dynamite and was fired in the bottom of a hole 30 to 35 feet deep.

**TABLE 14.—Depth to bedrock as estimated from seismic refraction measurements.**

| Site No. | Township | Shot point | Depth to bedrock (feet) |
|---|---|---|---|
| 1- 2 | Hanover | 1 | 260 |
| | | 2 | 180 |
| 3- 4 | Bowling Green | 3 | 285 |
| | | 4 | 290 |
| 5 | Union | 5 | 275 |
| 6- 7 | | 6 | 335 |
| | | 7 | 340 |
| 8- 9 | Monroe | 8 | 440 |
| | | 9 | 450 |
| 10-11 | | 10 | 100 |
| | | 11 | 480 |
| 12-13 | Hartford | 12 | 160 |
| | | 13 | 300 |
| 14-15 | | 14 | 525 |
| | | 15 | 430 |
| 16-17 | Bennington | 16 | 540 |
| | | 17 | 500 |
| 18-19 | | 18 | 340 |
| | | 19 | 360 |
| 20-21 | | 20 | 415 |
| | | 21 | 400 |
| 22-23 | | 22 | 480 |
| | | 23 | 440 |
| 24-25 | Hartford | 24 | 260 |
| | | 25 | 300 |

The bedrock consists of alternating layers of sandstone and shale and differs in thickness from place to place. The refracting surface therefore, may be at or several feet below the bedrock surface, depending on the character and thickness of the individual stratum. For this reason, the determinations of depths to bedrock may not be exact enough to determine valley gradients, but they are adequate to determine roughly the configuration of the bedrock surface.

# CHEMICAL QUALITY OF THE WATER

Chemical analysis of 20 samples of ground water and 10 samples of surface water in Licking County was made by the Quality of Water Branch, U. S. Geological Survey. The dissolved mineral constitutents in the water are reported in parts per million. "Parts per million (ppm)" is a measure of the concentration of a constituent by weight in a million parts of the water by weight. For example, a water may contain one part of iron, by weight, to one million parts of the water, by weight. To convert parts per million to grains per gallon, divide parts per million by 17.12.

## SOURCE AND SIGNIFICANCE OF MINERAL CONSTITUENTS IN NATURAL WATERS

The section of this report explaining the "source and significance of the mineral constituents in natural waters" is adapted from publications by the Geological Survey. All natural waters contain dissolved minerals. The concentration of these minerals is usually of such significance in the utilization of the water. The quantity of dissolved constituents is determined principally by the type of rocks and soils through or over which the water flows and the duration of contact with these materials.

### Silica ($SiO_2$)

Silica is dissolved from practically all rocks. It affects the usefulness of water because it contributes to the formation of boiler scale. Some silica in water is advantageous when zeolite softening is employed, as it prevents the deterioration of the zeolite materials by inhibiting the solution of the silica from the zeolite.

### Iron (Fe) and Manganese (Mn)

Iron is found in natural waters since it is present in practically all rocks and is dissolved from iron pipes. A high content of iron causes reddish-brown stains on porcelain or enameled ware and on clothing. It is also objectionable in water used for many industrial purposes, particularly the manufacture of food, carbonated beverages, beer, textiles, dyed fabrics, high-grade paper, and ice. The Federal drinking-water standards state that iron and manganese together should not exceed 0.3 ppm. Manganese is less abundant in nature than iron, and its presence in natural waters is not so widespread. It has about the same objectionable characteristics as iron. Iron and manganese both may be removed by appropriate treatment of water.

### Calcium (Ca) and Magnesium (Mg)

Calcium and magnesium make water hard and are largely responsible for the formation of boiler scale. Calcium is dissolved from practically all rocks, but especially from limestone, dolomite, and gypsum. Magnesium is dissolved principally from dolomite.

### Sodium (Na) and Potassium (K)

Sodium and potassium are dissolved from practically all rocks. However, they make up only a small part of the dissolved mineral matter in most waters in humid regions. Natural waters that contain only 3 or 4 ppm of the two together are likely to carry as much potassium as sodium. As the total quantity of these constituents increases, the proportion of sodium generally becomes greater.

Small quantities of sodium and potassium have little effect on the suitability of the water for most purposes. Water that contains more than 50 or 100 ppm of sodium or potassium may cause foaming in steam boilers, and water having large quantities of sodium salts if used for irrigation may be injurious to crops and soils.

### Bicarbonate ($HCO_3$) and Carbonate ($CO_3$)

Bicarbonate and carbonate occur in water largely through the action of dissolved carbon dioxide, which enables the water to dissolve carbonates of calcium and magnesium. Carbonate is not present in appreciable quantities in most natural waters. Bicarbonates and carbonates in solution are beneficial in increasing the hydrogen-ion concentration, thus tending to make water less corrosive, and in aiding the coagulative process for the removal of suspended matter from water. Bicarbonate, however, may break down in steam boilers and hot water systems releasing corrosive carbon dioxide.

### Sulfate ($SO_4$)

Sulfate is dissolved from rocks and soils, and in large quantities from gypsum and deposits of sodium sulfate. Sulfate in water containing calcium and magnesium causes the formation of hard scale in steam boilers and may increase the cost, or influence the choice, of the method of softening the water.

### Chloride (Cl)

Small quantities of chloride have little effect on the use of water. Large quantities in water that contains considerable calcium or magnesium, or both, increase the corrosive activity of the water. Foaming and priming in steam boilers is caused by large quantities of soluble salts such as sodium chloride. A salty taste can usually be detected in water that contains more than 250 ppm of chloride.

### Fluoride (F)

Fluoride has been reported present in the rocks of the earth's crust to about the same extent as chloride. However, the quantity present in natural waters is usually much less than that of chloride. When the fluoride concentration in drinking water exceeds about 1.5 ppm a condition known as dental fluorosis or mottled enamel becomes noticeable in the teeth of children during calcification or formation of the teeth. However, a smaller concentration of fluoride is considered beneficial by medical authorities.

### Nitrate ($NO_3$)

Nitrate is derived from decaying organic matter, sewage, nitrate fertilizer, and nitrates in soils. A high nitrate content in water may indicate previous contamination by sewage or other organic matter, as it represents the final stage of oxidation in the nitrogen cycle. Nitrate in boiler water is of benefit in the inhibiting of intercrystalline cracking of boiler steel. A nitrate content in excess of about 44 ppm in drinking water has been associated with cyanosis in infants.

### Dissolved Solids

The quantity reported as dissolved solids (the residue on evaporation) consists primarily of the dissolved mineral constituents, but it also includes the organic matter and water of crystallization when dehydration is incomplete. Water containing less than 500 ppm of dissolved solids generally may be used without special treatment for domestic and many industrial purposes. Water with more than 1,000 ppm of dissolved solids is likely to be unsuitable for most purposes.

### Hardness

Hardness of water is caused primarily by calcium and magnesium. The hardness caused by bicarbonate or carbonate of calcium and magnesium is called carbonate hardness; the remainder of the hardness is called noncarbonate hardness. Water of a hardness up to 60 ppm is considered soft, and in this range of hardness is satisfactory for most purposes. Water with hardness in the range of 60 to 120 ppm may be considered moderately hard, but not so hard as to interfere seriously with its use for many purposes. Water of a hardness ranging from 120 to 200 ppm is considered hard, and is not satisfactory for many industrial purposes. Water having a hardness of more than 200 ppm may be considered very hard and, although it may be used for domestic purposes it is not generally satisfactory.

### Specific Conductance

The specific conductance of a water is a measure of its ability to conduct an electric current. Water with chemicals or minerals that ionize in solution will conduct an electric current. The greater the concentration of chemicals and degree of ionization the greater the conductivity of the solution.

### pH

The degree of acidity or alkalinity of water is indicated by the hydrogen-ion concentration and is commonly reported as pH. A pH value of 7.0 indicates that the water is neither acid nor alkaline. Values progressively lower than 7.0 denote increasing acidity and values higher than 7.0 denote alkalinity. The pH is of importance in determining the corrosive properties of water and indicating the proper conditions for coagulation in water-purification plants.

### Color

In a water analysis the term "color" refers to the appearance of water that is free from suspended matter. Natural color in water is caused almost entirely by organic matter extracted from decomposing vegetation. Color is expressed in units of the platinum-cobalt scale (Hazen, 1892). The unit of color is that produced by one milligram of platinum per liter of water, dissolved as platinic chloride, with the addition of enough cobalt chloride to give a color matching the shade of natural water. A color of 10 to 20 is noticeable, but it is not objectionable.

TABLE 15.--CHEMICAL ANALYSES OF GROUND WATER IN LICKING COUNTY, OHIO
(Analyzed by Quality of Water Branch, U. S. Geological Survey. Chemical constituents in parts per million)

| Township | Well number | Date of collection | Temperature (°F) | Silica ($SiO_2$) | Iron (Fe) | Calcium (Ca) | Magnesium (Mg) | Sodium (Na) | Potassium (K) | Bicarbonate ($HCO_3$) | Sulfate ($SO_4$) | Chloride (Cl) | Fluoride (F) | Nitrate ($NO_3$) | Dissolved solids (residue on evaporation at 180° C) | Hardness as $CaCO_3$: Calcium, magnesium | Hardness as $CaCO_3$: Non-carbonate | Specific conductance (micromhos at 25° C) | pH | Color |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bowling Green | 4 | 12-13-54 | 56 | 12 | 0.33 | 67 | 24 | 16 | 5.9 | 263 | 53 | 9.4 | 0.2 | 22 | 339 | 264 | 50 | 559 | 7.6 | 3 |
| Burlington | 6 | 5-26-53 | 55 | 12 | 1.3 | 62 | 29 | 39 | .6 | 306 | 92 | 4.2 | 1.1 | 1.9 | 390 | 272 | 23 | 646 | 7.9 | 2 |
| Etna | 1 | 4- 1-53 | 55 | 11 | *a/ | 90 | 32 | 14 | 2.1 | 366 | 69 | 3.5 | .4 | 5.6 | 403 | 356 | 56 | 684 | 7.4 | 5 |
| Fallsbury | 3 | 5-26-53 | 58 | 10 | .90 | 25 | 10 | 4.6 | 2.5 | 130 | 7.2 | 1.1 | .2 | 1.0 | 120 | 104 | 0 | 231 | 7.3 | 2 |
| Granville | 3 | 6-26-53 | 55 | 11 | 2.4 | 64 | 29 | 5.2 | 1.4 | 272 | 49 | 5.8 | .1 | .6 | 306 | 280 | 56 | 519 | 7.6 | 1 |
| Hanover | 1 | 5-26-53 | 57 | 10 | .24 | 40 | 19 | 24 | 6.8 | 33 | 136 | 42 | .0 | 9.8 | 336 | 178 | 151 | 512 | 6.6 | 1 |
| Hanover | 17 | 12-13-54 | 58 | 14 | .82 | 8.1 | 4.6 | 9.6 | 4.1 | 9 | 28 | 114 | .1 | 9.3 | 97 | 39 | 32 | 158 | 5.4 | 3 |
| Hanover | 21 | 5-26-53 | 57 | 9.9 | 2.4 | 44 | 14 | 18 | .8 | 250 | .5 | 6.5 | .1 | .2 | 214 | 168 | 0 | 397 | 7.7 | 2 |
| Harrison | 3 | 4- 1-53 | 54 | 14 | .26 | 126 | 45 | 11 | .5 | 379 | 144 | 36 | .0 | .5 | 610 | 500 | 189 | 905 | 6.5 | 0 |
| Licking | 18 | 6-26-53 | 53 | 18 | .67 | 75 | 34 | 43 | .8 | 440 | 44 | 3.8 | .2 | 1.1 | 429 | 328 | 0 | 736 | 7.7 | 2 |
| Madison | 2 | 5-26-53 | 64 | 14 | *b/ | 49 | 34 | 56 | .3 | 362 | 58 | 19 | .5 | 3.1 | 411 | 260 | 0 | 701 | 7.8 | 1 |
| Monroe | 1 | 4- 1-53 | 53 | 16 | 6.1 | 161 | 51 | 28 | 4.1 | 435 | 284 | 3.0 | 1.1 | 4.0 | 772 | 610 | 255 | 1, 120 | 6.8 | 0 |
| Newark | 47 | 10-22-53 | 53 | 15 | 1.2 | 71 | 25 | 37 | 1.1 | 368 | 37 | 9.4 | .5 | .0 | 383 | 278 | 0 | 639 | 7.1 | 3 |
| Newark | 97 | 12- 6-52 | 55 | 9.8 | 2.3 | 91 | 24 | 4.5 | 2.1 | 281 | 96 | 7.2 | .1 | .1 | 378 | 328 | 96 | 611 | 7.6 | 3 |
| Newark | 118 | 1-14-53 | 56 | 13 | 1.7 | 154 | 46 | 5.5 | 1.9 | 442 | 202 | 8.8 | .0 | .1 | 657 | 575 | 211 | 972 | 7.1 | 0 |
| St. Albans | 4 | 4- 1-53 | 55 | 10 | .07 | 102 | 34 | 6.5 | 2.9 | 382 | 59 | 12 | .0 | 12 | 440 | 392 | 81 | 739 | 7.3 | 0 |
| St. Albans | 5 | 4- 1-53 | 50 | 15 | *c/ | 76 | 28 | 5.0 | .8 | 340 | 31 | 1.6 | .2 | .4 | 331 | 303 | 26 | 556 | 7.4 | 0 |
| Union | 8 | 5-26-53 | 53 | 17 | .72 | 39 | 25 | 73 | .3 | 324 | 20 | 50 | .2 | 1.0 | 388 | 200 | 0 | 686 | 7.7 | 3 |
| Union | 31 | 5-26-53 | 56 | 15 | 2.3 | 90 | 42 | 25 | .7 | 342 | 162 | 3.0 | 1.2 | .2 | 536 | 398 | 117 | 799 | 7.8 | 1 |
| Washington | 1 | 5-26-53 | 51 | 14 | 2.8 | 64 | 34 | 18 | 1.5 | 348 | 40 | 3.5 | .4 | .1 | 350 | 298 | 14 | 602 | 7.7 | 1 |

| *Samples turbid when collected | a/ Fe | a/ Mn | b/ Fe | b/ Mn | c/ Fe | c/ Mn |
|---|---|---|---|---|---|---|
| In solution when analyzed | 1.7 | 0.02 | 0.11 | 0.20 | 0.30 | 0.00 |
| In sediment when analyzed | 5.8 | .01 | 1.49 | .05 | .89 | .02 |
| | 7.5 | 0.03 | 1.6 | 0.25 | 1.2 | 0.02 |

# QUALITY OF WATER IN LICKING COUNTY

### Ground Water

Water samples were collected from 20 wells distributed in the principal aquifers in Licking County. The wells sampled that tap unconsolidated glacial materials range in depth from 38 to 257 feet, and those that tap the consolidated rocks range in depth from 38 to 219 feet. Their locations are shown on plate 1. The results of the chemical analyses of the samples are given in table 15 and are summarized below.

The pH of the samples ranged from 5.4 to 7.9. All samples which had a pH of less than 7 were from wells in the consolidated rocks. Iron was present in all samples in concentrations ranging from 0.07 to 6.1 ppm, and manganese was present in several samples in amounts up to 4.8 ppm. All but two of the samples, from well 1 in Hanover Township and well 4 in St. Albans Township, contained concentrations of iron and manganese that were greater than the limit recommended in the Federal drinking-water standards. Hardness of the waters ranged from 39 to 610 ppm, and dissolved solids, from 97 to 772 ppm. The softest water, which had 39 ppm of hardness, and the hardest water, which had 610 ppm, were taken from wells in the consolidated rocks. All samples from wells in the unconsolidated glacial materials had a hardness of more than 120 ppm. Most samples, however, contained less than 500 ppm of dissolved solids.

### Surface Water

Streams are fed by direct runoff and groundwater outflow. Surface waters, therefore, usually contain in varying but smaller amounts the same mineral constituents that are found in ground water. In addition, surface water ordinarily contains suspended solids such as silt, clay, sand, and organic material derived from the natural decomposition of soil and polluting wastes. During periods of low flow the concentration of dissolved mineral constituents in streams is higher than during periods of high flow, because the greater portion of the water at low flow is from ground water. Also, at low flow, there is less water to dilute any pollutants.

Samples of water from the surface streams in Licking County were collected on December 9, 1953, during a period of low streamflow. The samples therefore are more mineralized than they would be if collected during periods of average streamflow. The results of the chemical analyses are given in table 16.

TABLE 16.--CHEMICAL ANALYSES OF THE SURFACE WATER COLLECTED ON DECEMBER 9, 1953 IN LICKING COUNTY, OHIO
(Analyzed by Quality of Water Branch, U. S. Geological Survey. Chemical constituents in parts per million)

| Collection Point | Temperature (°F.) | Silica ($SiO_2$) | Iron (Fe) | Calcium (Ca) | Magnesium (Mg) | Sodium (Na) | Potassium (K) | Bicarbonate ($HCO_3$) | Sulfate ($SO_4$) | Chloride (Cl) | Fluoride (F) | Nitrate ($NO_3$) | Dissolved solids (residue on evaporation at 180° C) | Hardness as $CaCO_3$ | | Specific conductance (micromhos at 25° C) | pH | Color |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | Calcium, magnesium | Non-carbonate | | | |
| Raccoon Creek at Granville | 42 | 6.2 | 0.07 | 76 | 26 | 9.8 | 1.7 | 282 | 73 | 7.5 | 0.1 | 0.1 | 339 | 297 | 65 | 571 | 7.7 | 4 |
| Wakatomika Creek near Fallsburg | 39 | 4.7 | .14 | 42 | 12 | 11 | 1.7 | 180 | 20 | 8.2 | .1 | .1 | 189 | 155 | 7 | 340 | 7.8 | 2 |
| Rocky Run at Hanover | 41 | 6.8 | .06 | 45 | 14 | 4.3 | 1.7 | 179 | 24 | 5.4 | .1 | 1.2 | 191 | 170 | 23 | 334 | 7.5 | 4 |
| Licking River at Toboso | 41 | 9.3 | .03 | 69 | 22 | 33 | 9.6 | 229 | 82 | 40 | .7 | 8.2 | 387 | 262 | 75 | 663 | 7.3 | 3 |
| Licking River near Newark | 43 | 9.2 | .04 | 70 | 28 | 34 | 11 | 254 | 100 | 39 | .9 | .4 | 418 | 290 | 82 | 714 | 7.1 | 8 |
| North Fork Licking River near Utica | | 6.4 | .03 | 78 | 28 | 14 | 1.9 | 304 | 70 | 5.8 | .5 | .1 | 355 | 311 | 61 | 594 | 7.8 | 2 |
| South Fork Licking River near Hebron | 40 | 1.0 | .03 | 44 | 16 | 8.4 | 2.3 | 161 | 43 | 8.3 | .3 | .2 | 203 | 177 | 44 | 367 | 7.2 | 6 |
| Wakatomika Creek* near Frazeysburg | 39 | 5.2 | .15 | 22 | 15 | 12 | 1.3 | 142 | 17 | 11 | .1 | .1 | 154 | 118 | 0 | 280 | 7.5 | 5 |
| Licking River* at Dillon | 41 | 6.2 | .01 | 70 | 22 | 30 | 6.9 | 246 | 77 | 38 | .4 | 3.2 | 375 | 268 | 64 | 641 | 7.6 | 5 |
| Jonathan Creek* near Glenford | 41 | 10 | .01 | 72 | 25 | 8.2 | 1.1 | 296 | 36 | 9.1 | .1 | .2 | 308 | 285 | 40 | 527 | 7.8 | 1 |

*Stations located outside of Licking County

# WATER RESOURCES BY TOWNHIPS

The water resources in Licking County are not uniform but differ principally with changes in geology and bedrock topography. The following discussion of water resources by townships is meant to supplement and explain the ground-water map (pl. 1). In general, patterns on the map distinguish the geologic formations (shown in pls. 2 and 3) whose water-bearing properties have been discussed. Also used in compilation of the ground-water map were the well data listed in table 17, the well logs shown in figure 35, data from field investigations of the geology, and the results of pumping tests.

The approximate contour lines on the bedrock surface shown on plate 1 are based chiefly on the logs of wells, supplemented by earth-resistivity measurements, seismic-refraction determinations, and numerous exposures of the consolidated rocks. The approximate thickness of the unconsolidated materials covering the bedrock in a specific area may be calculated by subtracting the bedrock altitude from the land surface altitude. The first rock unit to be encountered in drilling at a specific location can be determined from plates 2 and 3.

The water wells for which data are listed have been numbered consecutively by townships, beginning with no. 1 in each township. Numbers referring to oil and gas wells or earth-resistivity and seismic-refraction determinations (see pl. 1) have prefixes of G, R, and S, respectively.

The reported yields of many home wells and farm wells do not necessarily represent the maximum yields of the formation from which the water is obtained. The yields generally are based on bailer tests of short duration conducted by the driller. Also, domestic wells generally are not equipped with a well screen, the water being obtained through the open end of the casing.

In a temperate climate such as that of Ohio the geology is believed to be the principal factor controlling the sustained flow of streams. Those streams having the highest sustained flow are in areas underlain by extensive deposits of permeable sand and gravel. Streams with the lowest sustained flow are in areas underlain by impermeable till. Inasmuch as the sustained or base flow of a stream is almost entirely from ground-water sources, it indicates in a general way the water-yielding characteristics of the shallow ground-water bodies in the drainage basin. The principal streams in Licking County—South Fork Licking River, North Fork Licking River, Licking River, and Raccoon Creek—flow through regions composed of unconsolidated clay, sand, and gravel and consolidated shale, siltstone, and sandstone.

In its course a stream may be an effluent or gaining stream, an influent or losing stream, or an insulated stream that neither receives from nor discharges water into the underlying deposits. Gaging stations and periodic measurements made along the course of the stream record its varying flow and thus serve as a guide in understanding the geology and water-bearing properties of the region through which the stream has passed. For example, the Licking River was studied in detail by George W. White (Cross and Bernhagen, 1949, p. 19) to determine the relationship of the geology to the varying streamflow within the basin. Miscellaneous measurements at low water indicated different rates of increase in flow below the gaging station on the North Fork Licking River at Utica. The study of the glacial geology of the region provided an explanation for the streamflow characteristics. The North Fork Licking River and its tributaries above Utica flow through regions of ground moraine and end moraine composed largely of till. South of Utica the North Fork Licking River flows through a region of permeable valley-train deposits. An increase in flow at Vanatta was explained by the presence of an outwash deposit at a higher elevation lying upon the main valley train. The presence of this deposit had not previously been recognized.

Along an effluent stream, such as the North Fork Licking River, the water table or other piezometric surface stands at a higher altitude than the level of the stream. Water therefore flows downgradient from the saturated deposits to the stream. The pumping of ground water along the course of the stream could lower the water table in the aquifer to such an extent that ground-water gradients would be reversed, thereby inducing water to flow from the stream to the adjacent deposits. This method of inducing water to flow from the stream into the aquifer is used to obtain the largest supplies of ground water in the State of Ohio.

The areas designated on plate 1 as good sources of ground water are the valleys of North Fork Licking River, South Fork Licking River, and Raccoon Creek. The outwash sand and gravel in the valley of Raccoon Creek is about 100 feet thick, 75 feet of which is saturated. Wells drilled into the sand and gravel deposits are favorably situated to receive recharge from Raccoon Creek. As no pumping tests were conducted in these outwash materials, their maximum yields are not known. According to data collected during this and previous investigations, however, the coefficient of permeability of outwash sand and gravel in Ohio commonly ranges between 2,000 and 3,000 gpd per square foot. If we assume a coefficient of permeability of 2,000 for the outwash deposits in Raccoon valley and multiply it by 75 feet, the saturated thickness of the materials, the resulting coefficient of transmissibility is 150,000 gpd per foot. With these assumptions, using a formula discussed by Rorabaugh (1956, p. 156), the theoretical yield of one well (neglecting screen loss) in a line of wells recharged by a surface source can be calculated. Suppose, for example, we wish to know the yield of 1 well in a line of 3 wells spaced 500 feet apart and recharged by Raccoon Creek. The well, which has a diameter of 1 foot and a screen length of 30 feet, is 300 feet from Raccoon Creek. Using the formula given by Rorabaugh, we find that each well has a theoretical yield of 3.5 mgd. Three wells would therefore yield 10.5 mgd. However, in estimating the yield of outwash materials recharged by a surface source, other factors must be considered, such as the limiting infiltration rate through the bed of the river and the mean and minimum flow of the stream.

The infiltration rate through the bed of a river is at best an estimate. Suppose we consider the 2-mile stretch of river from Granville east to the Newark valley. If infiltration were effective over the entire width of the river, 40 feet, the infiltration rate would have to be 1,080,000 gpd per acre of stream bottom to satisfy the estimated yield of 10.5 mgd. Infiltration rates greater than 1 mgd per acre of stream bottom have been reported for dredged ditches at the Dayton municipal well field, but this rate is probably much too high when applied to the bed of Raccoon Creek. A more reasonable estimate of the rate of infiltration would be about 200,000 gpd per acre of stream bottom.

Wells that have high initial yields from the outwash sand and gravel in Raccoon valley may yield less under continued pumping because of the small minimum flow of Raccoon Creek and the limited width of the valley. The mean flow of Raccoon Creek is 93.2 cfs, or about 60 mgd. This discharge is more than enough to replenish the withdrawals of ground water from induced infiltration through the bed of Raccoon Creek. However, low-flow measurements made at Granville on August 9 and 10, 1944, and September 9, 1953, were 1.54 cfs and 0.79 cfs respectively. (See table 7.) During extended dry periods yields would have to be maintained primarily from storage in the aquifer. The valley of Raccoon Creek, being only about half a mile wide, does not provide a large ground-water reservoir; therefore, potential yields must be computed on the basis of prolonged periods of low streamflow.

We see, therefore, that in any infiltration study the transmissibility of the aquifer, the infiltration rate through the stream bed, the minimum flow of the stream, and the available storage in the aquifer must be considered in predicting the availablity of ground water. In addition other factors, such as the temperature of the surface stream, the sediment load of the stream, screen losses in the well, and the effect of partial penetration of the well, must all be considered.

Wells drilled in the valleys of the North and South Fork Licking Rivers generally encounter three separate layers of outwash sand and gravel. The first or upper layer occurs at the surface and has a maximum thickness of about 55 feet near the centers of the valleys. Pumping tests of wells drilled in this aquifer gave an average permeability of about 760 gpd per square foot. The second aquifer is about 40 feet thick and occurs at a depth of about 90 feet below the ground surface. This aquifer is overlain by 40 feet of relatively impermeable clay and consequently there is little opportunity for recharge by stream infiltration. Recharge to these buried deposits must be derived from water seeping through the overlaying clay and from the Cuyahoga formation which forms the walls of the valley. A pumping test of wells drilled into this second aquifer gave an average permeability of 1,700 gpd per square foot. The third aquifer in these valleys occurs at a depth of about 170 feet below the land surface. It is about 30 feet thick and is separated from the second layer of sand and gravel by 40 to 50 feet of impermeable clay. There is little opportunity for stream infiltration to this aquifer, consequently, recharge must be by seepage through the overlaying clays and possibly from the consolidated rocks which form the valley walls. A pumping test of wells tapping this aquifer indicated a permeability of about 2,400 gpd per square foot.

Good to fair ground-water areas (shown on plate 1) also occur in the valleys of the North Fork Licking River, South Fork Licking River, Raccoon Creek, and the Licking River. The deposits in these areas are thinner and less permeable than the outwash deposits in the good ground-water areas. In fact, in a few places in the good to fair ground-water areas, in the North Fork and South Fork Licking River valleys, the upper and lower of the three principal aquifers are absent.

Other buried valleys in Licking County also contain outwash sand and gravel, generally in the form of thin, narrow, and discontinuous lenses surrounded by finer grained and relatively impermeable silts and clays. These are designated fair sources of ground water on plate 1; yields to wells generally are limited by the thinness and small areal extent of the deposits.

The consolidated rocks in Licking County shown on plate 1 as fair sources of ground water yield ample supplies of water for home and farm use and, in some areas, may yield adequate supplies for limited industrial and municipal use.

The least productive ground-water areas in Licking County are underlain by thick deposits of glacial till. These are shown on plate 1 as poor sources of ground water. Many wells, especially in the western part of the county, are drilled entirely through the till, which in places is over 300 feet thick, to obtain water from the underlying bedrock. Though ample supplies of water for home and farm use are obtained in most instances, the cost of drilling such wells is high. Water supplies in such areas are commonly obtained from shallow dug wells, augmented by cisterns.

## BENNINGTON TOWNSHIP

The main streams in Bennington Township are North Fork, Otter Fork, and Lake Fork Licking River. Otter Fork and North Fork Licking River join in western Burlington Township and flow eastward to Utica. Lake Fork Licking River flows from Bennington Township and joins the main stem of North Fork Licking River south of Utica. No measurements were made on these streams in Bennington Township; consequently, their flow is not known. However, measurements made on the North Fork Licking River at Utica during periods of low flow indicate that the combined minimum flow of North Fork and Otter Fork Licking River is less than 1 cfs, and it is probable that the low flow of Lake Fork Licking River in Bennington Township is less than 0.5 cfs.

The most favorable area in Bennington Township for obtaining ground water underlies the North Fork Licking River and the Otter Fork Licking River. The deposits in this area are outwash sand and gravel of undetermined thickness, which are favorably situated to receive recharge from the streams. From a general knowledge of geologic and hydrologic conditions, it is estimated that yields up to 150 gpm may be obtained from these deposits.

Part of Bennington Township is underlain by a wide, deeply buried valley that extends from the southwest corner of the township to its eastern border. (See pl. 1.) This buried valley is more than 450 feet deep and is filled with sand, gravel, and till. The sand and gravel deposits are in thin, narrow, and discontinuous lenses interbedded in the till. Their areal extent cannot be defined accurately by the few available well data nor their potential yields estimated. The thickest and most extensive of the sand and gravel deposits, and consequently the largest yields, are probably at depths of about 300 feet.

Elsewhere in Bennington Township adequate supplies of water for farm and home use generally may be obtained from small sand and gravel beds in the thick till deposits. Only one well, No. 22, is known to be drilled into the underlying bedrock. The drilled wells in the township range in depth from 30 to 285 feet; the dug wells average 21 feet in depth.

## BOWLING GREEN TOWNSHIP

No large streams cross Bowling Green Township. The minimum flow of Valley Run, in the eastern part of the township, recorded about a half mile above its mouth on September 9, 1953, was 0.02 cfs. The other streams in the township are small tributaries to Jonathan Creek in Perry County.

All the wells inventoried in Bowling Green Township obtain water from the consolidated rocks of Mississippian age, which generally yield adequate supplies for farm and house use. The wells range in depth from 77 to 260 feet.

Along the southern edge of the township, east of Buckeye Lake, a buried valley is filled with over 200 feet of glacial deposits. These deposits in places may yield fairly large water supplies, possibly enough for small industrial or municipal demand. However, well 6 in the buried valley was drilled 224 feet to bedrock and the unconsolidated deposits did not yield enough water even for domestic use. Water was obtained from the underlying Cuyahoga formation.

In the eastern part of Bowling Green Township, thick deposits of glacial till underlie Valley Run; however, ground water is obtained from the consolidated rocks that underlie the thick deposits of till.

## BURLINGTON TOWNSHIP

The principal stream in Burlington Township is North Fork Licking River. This stream is joined by Otter Fork Licking River in the western part of the township. This reach of the stream has not been gaged but low-flow measurements made at Utica indicate that the minimum flow is probably between 1 and 2 cfs.

The largest supplies of ground-water in Burlington Township are available in the vicinity of Homer. Here outwash sand and gravel at least 55 feet thick immediately underlies the North Fork Licking River. Wells drilled into these sand and gravel deposits are favorably situated to receive recharge by infiltration from the stream. Yields of wells in this area, however, are limited by the depth of the aquifer, the fairly low permeability of the outwash materials, and the low mean flow of the North Fork Licking River.

A Teays-Stage buried valley extends from the northeast corner of Burlington Township southwestward beyond the Bennington Township line. The sand and gravel deposits in this buried valley offer fair possibilities for the development of ground-water supplies; however, the deposits are discontinuous and at considerable depth. Yields from wells in this area are unknown but may be expected to be less than yields of wells in the shallow sand and gravel aquifer at Homer.

In the eastern part of Burlington Township, outside the buried-valley area, water is obtained from the Cuyahoga formation. Yields of wells that tap the Cuyahoga average 5 to 15 gpm. In other parts of the township water is obtained from sand and gravel beds that occur locally in the till.

## EDEN TOWNSHIP

Rocky Fork and Long Run are the principal streams in Eden Township. The base flow of these streams is derived mainly from the numerous springs in the eastern part of the township. These springs commonly flow at rates of 5 to 15 gpm. Rocky Fork and Long Run join in northeast Mary Ann Township. Flows recorded above Lost Run in Mary Ann Township indicate that the combined minimum flow of Rocky Fork and Long Run is about 2 cfs.

Rocks of the Pennsylvanian and Mississippian systems are exposed in practically all parts of Eden Township. There are no thick sand and gravel deposits in the township and most ground water is obtained from the consolidated rocks, by drilled wells that range in depth from 32 to 196 feet.

Adequate supplies of water for home and farm use generally may be obtained from the thin glacial and alluvial deposits in the valleys of Rocky Fork, Long Run, and their tributaries. Large-diameter dug wells in these areas range in depth from 9 to 50 feet. Only one well, No. 28, is known to go dry in the summer.

## ETNA TOWNSHIP

The largest supplies of ground water in Etna Township are obtained from a sand and gravel aquifer that underlies the South Fork Licking River northwest of Kirkersville. The aquifer is as much as 100 feet thick and is favorably situated to receive recharge by infiltration from the river. Recharge is limited however, by the low flow of the South Fork Licking River, which was only about 0.34 cfs on September 9, 1953.

A deeply buried Teays-stage valley underlies the center of Etna Township between Wagram and Etna. The unconsolidated deposits that fill the valley are more than 400 feet thick, but no information is available on the character and water-bearing properties of these deposits below a depth of 292 feet. Consolidated rocks of the Cuyahoga formation, Sunbury shale, Berea sandstone, and Bedford shale crop out along the valley walls. Some of these beds undoubtedly provide some recharge to sand and gravel deposits in the valley. Wells drilled into the glacial deposits that fill the valley range in depth from 57 to 292 feet.

Along the western edge of Etna Township, east of the village of Etna, most drilled wells obtain water from the consolidated rocks that underlie the thick deposits of glacial drift. Wells in these areas yield 3 to 10 gpm, and range in depth from 45 to 173 feet. Two, wells 16 and 43, obtain water from the Berea sandstone. A pumping test was conducted on well 16 by the driller, who reported a drawdown of 20 feet after pumping the well for 14 hours at a rate of 3 gpm.

In the other areas in Etna Township water is obtained from thin and discontinuous sand and gravel beds in the till deposits. Wells in these areas generally yield less than 5 gpm. Well 3 was drilled 192 feet deep and failed to supply enough water for household use. Wells 17 and 18 (see pl. 1) are only 27 and 25 feet deep respectively. Well 17 was pumped by the driller for 3½ hours at the rate of 15 gpm and reportedly had a drawdown of only 6 feet at the end of that time. Well 18 was pumped by the driller for 3½ hours at 20 gpm with a drawdown of only 5½ feet.

## FALLSBURY TOWNSHIP

All the drilled wells inventoried in Fallsbury Township obtain water from consolidated rocks. They range from 25 to 145 feet in depth and yield up to 25 gpm.

Thin glacial and alluvial deposits occur in the valley of Wakatomika Creek and in Pleasant Valley south of Fallsburg. Shallow dug wells, 10 to 24 feet deep, in these deposits generally yield adequate supplies of water for house and farm needs. Larger yields are precluded by the small extent and thickness of the sands and gravels. No records are available on the minimum flow of Pleasant Valley Run, but it is probably less than 0.3 cfs. The low flow of Wakatomika Creek, measured at the Knox-Licking County line September 9, 1953, was 1.27 cfs.

## FRANKLIN TOWNSHIP

All the wells inventoried in Franklin Township obtain water from consolidated rocks of the Mississippian age. The wells range in depth from 44 to 129 feet. The largest yield reported is 28 gpm and the average is about 10 gpm. Thick glacial deposits occur in the stream valleys in Franklin Township, but these consist mostly of clay and are poor sources of ground water.

The major streams in Franklin Township are Swamp Run and Hog Run. No records are available on the flow of these streams, but it is probably slight. Both streams traverse areas underlain by relatively impermeable clay and there is no opportunity for stream infiltration.

## GRANVILLE TOWNSHIP

The largest supplies of ground water in Granville Township are obtained from sand and gravel deposits in the valley of Raccoon Creek. The sand and gravel aquifer is about 100 feet thick and is favorably situated to receive recharge from Raccoon Creek. The city of Granville pumps as much as 300,000 gpd of water from these deposits. Without conducting controlled pumping tests it is difficult to estimate the maximum amounts of water that could be pumped from these sand and gravel deposits, or what effect such pumping would have on ground-water levels in the area. Any such estimates must take into consideration the minimum flow of Raccoon Creek and the limited storage area of the valley. The valley is about half a mile wide. Low-flow measurements made at Granville August 9 and 10, 1944, and September 9, 1953 were 1.54 cfs and 0.79 cfs respectively.

Small supplies of ground water, possibly as much as 25 gpm, may be obtained from the outwash sand and gravel deposits immediately north of Granville. Wells drilled into these deposits have an average depth of 51 feet.

In the western part of Granville Township a buried valley, more than 200 feet deep, extends from Raccoon Creek north to the McKean Township line (see pl. 1). In the northern part of the valley, underlying Griffin Run, thin deposits of sand and gravel, which may yield up to 25 gpm of water, occur at the surface. Deeper deposits in the valley are mostly clay, but include also thin beds of sand and gravel. Wells drilled into the buried sand and gravel generally yield less than 5 gpm of water.

Also west of Granville is a small buried valley which extends from Raccoon Creek south into Union Township. The valley in places is filled with over 300 feet of glacial till. Small supplies of water are obtained from thin beds of sand and gravel within the till.

North and south of Raccoon Creek consolidated rocks of the Cuyahoga and Logan formations underlie a mantle of glacial drift. The drift is as much as 180 feet thick and is generally a very poor source of water; therefore, most ground-water supplies are obtained from the underlying bedrock.

## HANOVER TOWNSHIP

The Licking River flows through regions of outwash sand and gravel and consolidated sandstone in Hanover Township. The low flow of the river, measured at Toboso August 8 and 9, 1944, and September 9, 1953, was 62.7 and 51.8 cfs, respectively. In the western part of Hanover Township the river is underlain by poorly sorted sand and gravel. Water supplies adequate for small municipal or industrial use probably are available from these outwash materials.

A deeply buried Teays-stage valley extends along the northern edge of Hanover Township. (See pl. 1.) During Illinoian time outwash sand and gravel, up to 360 feet in thickness, was deposited in this valley. Wells drilled into the sand and gravel deposits in the vicinity of the Rocky Fork River should obtain ample supplies of water for small municipal or industrial uses. East of the Rocky Fork River, in areas above the altitude of 900 feet, the water in the sand and gravel deposits is at considerable depth below the land surface, and wells generally must be deeper than 200 feet to obtain enough water for home or farm use.

In the remainder of the township consolidated rocks of the Pennsylvanian and Mississippian systems are exposed at the surface. Wells drilled into these rocks range in depth from 27 to 215 feet and yield adequate amounts of water for home and farm use.

## HARRISON TOWNSHIP

The best ground-water areas in Harrison Township are along the Muddy Fork and the South Fork Licking Rivers. These areas are underlain by glacial outwash deposits of sand and gravel, which are as much as 100 feet thick and are favorably situated to receive recharge from the streams. However, the flow in these streams was too small to be measured on September 9, 1953. It is not possible to estimate the maximum amount of water available from these deposits without conducting pumping tests, but sustained yields will necessarily be limited by the small flow of the Muddy Fork and South Fork Licking Rivers.

Along the eastern edge of Harrison Township water supplies are obtained from the consolidated rocks of Mississippian age. These rocks occur beneath a mantle of glacial drift that ranges in thickness from about 5 feet at a point north of Kirkersville to more than 100 feet in the northeastern corner of the township.

In the remainder of the township water is obtained from thin and discontinuous sand and gravel beds in the till deposits. Wells drilled into these beds generally yield less than 5 gpm.

## HARTFORD TOWNSHIP

Otter Fork Licking River has its headwaters in the gacial till deposits near the village of Hartford. No measurements are available on the flow of streams in Hartford Township, but as till deposits contribute very little water to streamflow the sustained flow of Otter Fork Licking River undoubtedly is small.

The preglacial river that cut the deep, now buried valley underlying Bennington and Burlington Townships flowed across the southeastern corner of Hartford Township. A major tributary to this river also flowed across Hartford Township, passing just east of Hartford (see pl. 1). There are few available data from which to determine the character of the materials filling the valley, but presumably the upper 200 or 300 feet is mostly till. The village of Johnstown in nearby Monroe Township obtains its water supply from two wells drilled into the glacial drift that fills this valley.

In the northwest part of Hartford Township an adequate supply of water for home or farm use is obtained from the consolidated rocks of the Cuyahoga formation. Wells generally are drilled through 50 to 150 feet of glacial drift before they reach the bedrock surface.

In other areas of the township water is obtained from wells drilled into sand and gravel beds in the till deposits. Such wells range from 63 to 136 feet in depth and generally yield less than 5 gpm.

## HOPEWELL TOWNSHIP

Valley Run and its tributaries are the principal surface-water sources in Hopewell Township. The base flow of these streams is fairly small and is derived mainly from seeps and springs along the valley walls. In the northeast corner of the township Brushy Fork Creek flows over thin glacial deposits. These deposits are situated to receive recharge from the creek, but yields of wells probably would be small.

Adequate supplies of ground water for home and farm use generally are obtained from the consolidated Mississippian and Pennsylvanian rocks in Hopewell Township. These rocks are exposed at the surface in many places and wells drilled into them range in depth from 28 to 325 feet. A small buried valley, containing about 150 feet of till deposited by the Illinoian glacier, underlies Gratiot in the southeast corner of the township. The till contains thin and discontinuous lenses of water-bearing sand and gravel, but most wells in the area are drilled into the underlying bedrock.

## JERSEY TOWNSHIP

A deeply buried valley extends in a north-south direction beneath Jersey Township. The bedrock floor of this valley is about 500 feet below the general land surface. No wells in the area penetrate the entire thickness of glacial drift that lies above the valley floor, and it is not possible to estimate the maximum yields that may be obtained from the deposits. Well 49L, just east of Jersey, was drilled to a depth of 312 feet before an adequate supply of water for household use was obtained.

Deposits of coarse sand and gravel occur beneath the South Fork Licking River in Jersey Township. These deposits reach a maximum thickness of 40 feet, and are favorably situated to receive recharge from the river. The amount of water available for recharge, however, is limited by the small flow of the South Fork Licking River. Adequate water supplies for small municipal or industrial use may be obtained from the deposits.

Ground water is obtained in other areas from sand and gravel lenses in the glacial till. Only one well, No. 21, obtains water from the bedrocks. This well, reportedly 440 feet deep, taps the Berea sandstone.

## LIBERTY TOWNSHIP

The principal surface-water source in Liberty Township is Lobdell Creek which flows across the southwest corner of the township through regions of end moraine and thick ground moraine. Because the moraines are composed principally of till, very little ground water is contributed to the flow of the stream. Measurements made at the mouth of Lobdell Creek in St. Albans Township on September 9, 1953, indicated no flow in the creek.

No large supplies of ground water are available in Liberty Township. Adequate supplies of water for home and farm use, however, may be obtained from sand and gravel beds in the deposits of till that cover the area, and from the consolidated rocks that crop out beneath the till deposits. Wells drilled into the consolidated rocks range in depth from 43 to 357 feet and wells drilled into the till deposits range from 44 to 270 feet. Owing to the uncertainty of obtaining adequate supplies of water from the glacial deposits, and the expense of drilling through these thick deposits to the underlying bedrock, many property owners in the township have one or more shallow dug wells. These dug wells range in depth from 10 to 35 feet.

## LICKING TOWNSHIP

The South Fork Licking River flows through areas of thick ground moraine in Licking Township. The flow of the river is in part regulated by gates at Buckeye Lake. The low flows of the South Fork Licking River at Hebron on August 8 and 9, 1944, and September 9, 1953, were 1.83 and 3.66 cfs, respectively.

Adequate supplies of ground water for farm and domestic use generally are available in Licking Township, and supplies sufficient for small industrial or municipal requirements are available from the buried valley in the western part of the township (see pl. 1). This buried valley is filled with 350 feet of glacial drift. In many places the drift contains thick layers of fine sand, called quicksand by well drillers. These deposits of quicksand are saturated, but they are so fine-grained that they retard development. Drillers commonly drill through the sand to more favorable materials. The log of well 20 (fig. 35) shows over 100 feet of fine sand between the depths of 78 and 183 feet. This well is 303 feet deep and obtains water from the sandstones of the underlying Cuyahoga formation.

In the eastern part of Licking Township ground-water supplies are obtained from rocks of the Cuyahoga and Logan formations.

## LIMA TOWNSHIP

The most favorable area for ground water development in Lima Township is in the vicinity of Pataskala, where the village obtains its water supply from two wells drilled into the outwash sand and gravel. Wells 17L and 25 are 106 and 153 feet deep respectively, and are favorably situated to receive recharge from the South Fork Licking River. The amount of water available for recharge, however, is limited by the small flow of the river.

Thick glacial drift covers Lima Township. The drift ranges in thickness from about 30 feet in the area east of the South Fork Licking River, to more than 400 feet in the north-central part of the township. Wells drilled into the glacial deposits range in depth from 36 to 145 feet. Wells 13 and 15 were drilled through 170 and 158 feet of till, respectively, and obtain water from the underlying Cuyahoga formation.

A deep buried valley extends north and south beneath the center of the township (see pl. 1). The bedrock floor of this valley is more than 400 feet below the land surface. No information is available on the character or water-bearing properties of the unconsolidated deposits in this valley below a depth of 65 feet. Therefore, it is not possible to estimate the maximum yields that might be obtained from them.

## MADISON TOWNSHIP

The buried Deep-stage Newark valley extends in an east-west direction beneath the center of Madison Township (see pl. 1). The valley is filled with over 200 feet of glacial deposits that are favorably situated to receive recharge from the Licking River. Measurements made on the Licking River near Newark indicate that during periods of low flow ample recharge is available from the river. Flows recorded on August 9 and 10, 1944, and September 9, 1953, were 46.8 and 41.7 cfs respectively. The character of the glacial deposits underlying the river, however, differs from place to place, and well data are not sufficient to permit close estimates of their available yields. Wells 3 and 4 are each 112 feet deep and obtain water from sand and gravel of the glacial outwash in the buried valley. The wells reportedly flow in the spring, and in the summer they are pumped 7 hours a day at a combined rate of 350 gpm. Well 53, which also is in this buried valley, reportedly failed to obtain sufficient water from the valley-fill deposits and was drilled into the underlying bedrock. It is 210 feet deep and reportedly flowed when it was drilled.

Thick and extensive coalescing kames and kame terraces were deposited by the Illinoian glacier in Madison Township in the area immediately north of the Deep-Stage buried valley. These deposits are about half a mile wide and, in places, more than 300 feet thick. Wells drilled into them range in depth from 97 to 186 feet and have an average specific capacity of about 1½ gpm per foot of drawdown. No large supplies of ground water are obtained from the deposits however, and their maximum available yields are not known.

All the drilled wells in the upland areas obtain water from the consolidated rocks of Mississippian age. These wells range in depth from 64 to 255 feet, and yield adequate supplies of water for farm and household use.

## MARY ANN TOWNSHIP

The principal streams in Mary Ann Township are Lost Run and Rocky Fork Run. The courses of these streams are for the most part in a pre-Illinoian buried valley which extends diagonally from the northeast corner to the southwest corner of Mary Ann Township. The flow of Lost Run at its mouth on September 9, 1953, was 3.95 cfs, and the flow of Rocky Fork Run just above the mouth of Lost Run was 2.48 cfs.

The materials that fill the buried valley are favorably situated to receive recharge from Lost Run and Rocky Fork Run. However, there are few available data from which to ascertain the character of these deposits. Owing to the manner in which they were deposited, these valley-fill deposits evidently include beds of poorly sorted silt, sand, and gravel. Adequate supplies of water for small industrial and municipal use should be available from such deposits.

In other areas in the township water is obtained from the consolidated rocks of the Logan and Cuyahoga formations. Wells drilled into these rocks range in depth from 22 to 186 feet.

## MCKEAN TOWNSHIP

Fairly large ground-water supplies are available in McKean Township from outwash sand and gravel in the valleys of Dry Run and Clear Fork. These deposits are 50 to 100 feet thick and are favorably situated to receive recharge from the streams. Although no measurements were made, recharge to the outwash deposits presumably would be limited by the small sustained flows of Dry Run and Clear Fork.

In the northwestern and southwestern parts of McKean Township, water is obtained from thin, discontinuous sand and gravel lenses in the thick till deposits. Yields generally are less than 5 gpm.

In the remainder of the township water is obtained from the consolidated rocks of Mississippian age. Wells drilled into these rocks generally yield adequate supplies of water for home and farm use. An exception is well 1, which was drilled to a depth of 380 feet and reportedly was dry.

## MONROE TOWNSHIP

The largest stream in Monroe Township is Raccoon Creek. No measurements are available on the flow of this stream in Monroe Township, but at Alexandria, in St. Albans Township, the flow on September 9, 1953, was 0.78 cfs.

In the southeast corner of Monroe Township, Raccoon Creek flows through a region of outwash sand and gravel that is favorably situated to receive recharge from the creek. No information is available on the character of these outwash deposits, but they should yield adequate supplies for small industrial or municipal use.

Parts of Monroe Township are underlain by buried valleys of which scarcely a surface trace remains. The largest of these buried valleys extends from the northeast corner of the township south into Jersey Township. (See pl. 1.) The bedrock floor of this valley is more than 450 feet below the general land surface. The valley fill contains thin and discontinuous lenses of water-bearing sand and gravel, but well data are not sufficient to show their areal extent or to permit an accurate estimate of their maximum yields. The municipal water supply at Johnstown is obtained from two wells, 10L and 47, drilled 309 and 320 feet deep, respectively, in sand and gravel deposits. The wells are pumped alternately and yield an average of 80,000 gpd.

Along the eastern and western edges of Monroe Township water is obtained from the consolidated rocks of Mississippian age. Domestic wells drilled into these rocks have an average yield of 5 to 10 gpm.

Elsewhere in the township water is obtained from thin, discontinuous sand and gravel beds in thick till deposits. These till-covered areas are poor sources of water, and wells generally yield less than 5 gpm. Owing to the uncertainty of obtaining adequate water supplies in the till, and because of the expense of drilling through these thick deposits to the underlying bedrock, many property owners have one or more shallow dug wells.

## NEWARK TOWNSHIP

The three principal streams in Licking County—North Fork Licking River, South Fork Licking River, and Raccoon Creek—join at Newark and form the Licking River. The low flow of the Licking River near Newark on August 9 and 10, 1944, and September 9, 1953, were 46.8 and 41.7 cfs, respectively. The city of Newark, largest user of water in the county, obtains its supply from the North Fork Licking River.

In its course through Newark Township, the North Fork Licking River flows along the eastern edge of the Newark valley. The sand and gravel underlying the stream is favorably situated to receive recharge from the stream but at this location is only about 15 feet thick. The South Fork Licking River also flows along the eastern edge of the Newark valley. The sand and gravel underlying the stream in this area is only 10 feet thick or even less, and contains a great deal of silt. Raccoon Creek flows across the center of Newark Township. The sand and gravel underlying this stream in the center of the Newark valley are as much as 55 feet thick. However, these sand and gravel deposits contain a large amount of silt, and the flow of Raccoon Creek is relatively small.

The largest supplies of ground water in Licking County are obtained from the outwash sand and gravel that underlies nearly the whole of Newark Township. These outwash deposits, which range from silt to coarse gravel, occur chiefly in the buried Newark valley. The bedrock floor of this buried valley is in places more than 350 feet below the general land surface. Interbedded in the sand and gravel are layers and lenses of till, which represent advances and retreats of the glaciers.

Outwash deposits at the surface in the buried Newark valley are traversed by the North Fork Licking River, South Fork Licking River, and Raccoon Creek. These deposits are up to 55 feet thick near the center of the valley and thin to 15 feet or less near its edges. No large streams traverse the thicker deposits and consequently there is little opportunity for large amounts of stream infiltration. Recharge to the sand and gravel is derived principally from direct precipitation. Most domestic wells in the Newark valley obtain water from these shallow sands and gravels.

A second layer of water-bearing sands and gravels in the buried Newark valley occurs about 90 feet below the general land surface. These deposits are up to 40 feet in thickness and are overlain by about 50 feet of relatively impermeable till. Wells drilled into this aquifer may yield up to 500 gpm, the water occurring under artesian pressure. From the center of the buried valley eastward the outwash sands become much finer grained, and the fine sand makes the recovery of water difficult.

A third aquifer in the buried Newark valley is about 175 feet below the general land surface. The aquifer is composed of about 30 feet of outwash, ranging in size from silt to coarse gravel. In places where the outwash is relatively coarse, yields of as much as 500 gpm are available. Water occurs in the aquifer under artesian pressure.

The well data are not sufficient to show the character or water-bearing properties of the deposits in the Newark valley below a depth of about 210 feet. The few data available, however, indicate that deposits are mostly fine-grained sand and clay.

In a few areas in Newark Township water is obtained from the consolidated rocks of Mississippian age, which generally yield adequate supplies for home and farm use.

## NEWTON TOWNSHIP

As is shown on plate 1, the buried valley described in the preceding section on Newark Township extends also in a north-south direction beneath central Newton Township. Here this buried valley is about a mile wide and is filled with more than 300 feet of drift. The North Fork Licking River flows in a meandering course through the valley. The well data are not sufficient to define clearly the principal sand and gravel aquifers in the valley fill, but presumably the aquifers are similar to those in the buried valley in Newark Township. The most favorable area for stream infiltration is near the center of the valley where the North Fork Licking River crosses the thicker outwash deposits.

The largest single use of ground water in Newton Township is for washing sand and gravel quarried from the valley-fill deposits. Wells 62 and 63, each 50 feet deep, are used for this purpose. These wells are near Dry Run and are excellently situated to receive recharge from the stream. They are pumped 9 hours a day at a combined rate of 400 gpm. Domestic wells drilled into the shallow sand and gravel in the buried valley range from 39 to 79 feet in depth.

In valleys tributary to the North Fork Licking River glacial deposits average about 100 feet in thickness. These deposits are sand and gravel and should yield adequate supplies of ground water for smaller industrial or municipal use. Most domestic supplies of ground water in these areas are obtained from shallow dug or driven wells.

In many areas of Newton Township ground water is obtained from the consolidated rocks of Mississippian age. Wells in these areas generally yield adequate supplies of water for home and farm use.

## PERRY TOWNSHIP

A major tributary to the Deep Stage Newark River flowed southwest across Perry Township. The bedrock of the now buried valley ranges from about 100 feet below the general land surface in the northeastern corner of the township to more than 300 feet below the general land surface at the Hanover Township line. Most of the unconsolidated materials that fill the valley were deposited by melt water from the Illinoian glacier. These materials are predominantly fine silt and sand, which become coarser toward the southern end of the valley. Brushy Fork flows in a northeastward direction over the outwash deposits that fill the old tributary valley in Perry Township. The flow at the mouth of this creek on September 9, 1953, was 0.59 cfs. No large supplies of ground water are available from the silts and sands that underlie Brushy Fork, but wells should yield adequate amounts of water for small industrial or municipal use.

In the upland areas of Perry Township water is obtained from the consolidated Mississippian rocks. Wells drilled into these rocks generally yield supplies of water sufficient for home and farm use. Well 6 is 62 feet deep and was drilled 50 feet into the Cuyahoga formation. This well was test-pumped for 1 hour at a rate of 25 gpm with little drawdown.

## ST. ALBANS TOWNSHIP

The most productive aquifer in St. Albans Township is in the valley of Raccoon Creek which is underlain by 250 feet or more of sand, gravel, and till. The surface of the valley is covered with coarse sand and gravel, and the writer believes that fairly large quantities of ground water can be obtained from these deposits as wells drilled in the area would be favorably situated to receive recharge by infiltration from Raccoon Creek. The low flow of Raccoon Creek at Alexandria on September 9, 1953, was 0.78 cfs.

In other areas in the township, water is obtained from thin sand and gravel beds in the till and from the consolidated rocks of Mississippian age.

## UNION TOWNSHIP

The major sources of surface water in Union Township are South Fork Licking River and Beaver Run. No measurements were made of the flow of Beaver Run but it probably is small. The low flow of the South Fork Licking River near the center of Union Township on September 9, 1953, was 0.34 cfs. The glacial drift which underlies these streams in the township is fairly impermeable and there is no opportunity for stream infiltration.

Thick deposits of unconsolidated glacial drift fill deeply buried valleys which underlie the South Fork Licking River in the southern and eastern parts of Union Township. The bedrock floors of the buried valleys range from about 150 feet to more than 350 feet below the general land surface. The surface of these valleys is covered by fairly impermeable deposits of glacial till, lake silts, and recent river alluvium (see pl. 3). Beneath these deposits are alternating layers of sand and gravel, and clay. The sand and gravel yields adequate supplies of water for small industrial and municipal use. The town of Hebron obtains its water supply from two wells, Nos. 36 and 37, drilled into these deposits. They are 155 and 156 feet deep and are pumped at a combined rate of 65,000 to 70,000 gpd.

In other parts of Union Township ground water in adequate amounts is obtained from sand and gravel beds in thick till deposits and from the Mississippian rocks that underlie the till. An exception is well 6, drilled into the consolidated Cuyahoga formation, which was reportedly pumped dry by the driller.

## WASHINGTON TOWNSHIP

Deeply buried valleys underlie Lake Fork and North Fork Licking Rivers in Washington Township. The low flows of North Fork Licking River at Utica August 9 and 10, 1944, and September 9, 1953, were 1.46 and 4.92 cfs, respectively. The flow of Lake Fork Licking River is relatively small. The bedrock floors of these valleys underlying these streams average about 325 feet below the general land surface. The well data are not sufficient to show accurately the principal sand and gravel aquifers that occur in the buried valleys, nor to permit their potential yields to be estimated. The only known industrial groundwater pumpage in the township is from well 7, which is drilled into these sands and gravels. The well is 150 feet deep and is pumped at an average rate of 50,000 gpd. Drilled wells for farm and home use in the valleys range from 38 to 94 feet in depth.

Beneath the headwaters of Rocky Fork Run, in the eastern part of Washington Township, is a small buried valley filled with silt and clay. These materials generally are poor aquifers, and no wells are drilled into them.

In many areas in Washington Township water is obtained from consolidated rocks of Mississippian age. The Utica water supply is obtained from three wells drilled into these rocks. The wells are 148, 200, and 212 feet deep. Two of the wells are pumped at a combined rate of 100,000 gpd and the third well is kept in reserve.

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## TABLE 17

## RECORDS OF WELLS IN LICKING COUNTY, OHIO

**Explanation of terms and symbols:**

Well number ............. The number of the well shown on the map, plate 1. * An asterisk preceding the number indicates that a chemical analysis of the water in the well is given in table 15. The letter "L" following well number refers to log shown on figure 35. Numbers are listed by township.

Owner .................... The name of the land owner at the time of the well survey. The letter "T" after the name in the remarks column table 15 signifies that the person interviewed was a tenant at the time of the well survey.

Elevation of well .......... Determined approximately from topographic maps of the United States Geological Survey.

Depth to bedrock .......... Depth to the surface of the consolidated rocks. A plus sign (+) indicates that bedrock was not reached.

Depth of well ............. Depth reported by driller, owner or tenant.

Character of material ...... Geologic material in which water was obtained or in which well was terminated: G. Gravel; S, sand; Sh, shale; Ss, sandstone; Sss, siltstone; T, till or clay.

Geologic horizon ........... Refers to the geologic age of the water-bearing material; $M_b$, Mississippian system, Berea sandstone; $M_c$, Mississippian system, Cuyahoga formation; $M_L$, Mississippian system, Logan formation; P, Pennsylvanian system; Gla, glacial drift.

Water level ............... The depth to water in the well as measured at the time of the survey, or as reported by the driller, owner, or tenant.

Rate ...................... The rate, in gallons per minute, at which the well was pumped or bailed.

Drawndown ............... The amount of lowering of the water level in the well caused by the withdrawal of water at the rate indicated.

Type of well .............. Method used in constructing the well; Dr, drilled; Dv, driven.

Type of pump ............ Pump and power data: Dwe, deep well electric; Dwt, deep well turbine; H, hand; Swe, shallow well electric; Wind, wind driven.

Diameter of well .......... Approximate inside diameter of well casing.

Use ...................... D, domestic; DS, domestic and stock; Ind, industrial; Irr, irrigation; PS, public supply; S, stock.

Remarks .................. Temperature of the water at the time of the well survey.

Table 17.--Records of wells in Licking County, Ohio.

| Well number | Owner or Name | Elevation at well (feet above sea level) | Depth to bedrock (feet) | Depth of well (feet) | Principal water-bearing bed: Character of material | Principal water-bearing bed: Geologic horizon | Water level: Below land surface (feet) | Water level: Date | Yield: Rate (g.p.m.) | Yield: Drawdown (feet) | Type of well | Type of pump | Diameter of well (inches) | Use | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BENNINGTON TOWNSHIP | | | | | | | | | | | | | | | |
| 1L | Geo. Van Roden | 1092 | 148+ | 148 | g | Gla | 54.78 | 2- 6-52 | | | Dr | | 5 | | Well not used. |
| 2L | Geo. Van Roden | 1076 | 77+ | 77 | g | Gla | 18 | 9- 1-50 | | | Dr | Dwe | 5 | D | 53° F. |
| 3L | Charles Hatfield | 1121 | 148+ | 148 | s | Gla | 60 | 11-13-50 | | | Dr | Dwe | 4 | D | |
| 4L | J. K. Freshwater | 1100 | 177+ | 177 | s | Gla | 33 | 12-23-47 | | | Dr | Dwe | 4 | D | 54° F. |
| 5L | Ralph Parsons | 1163 | 248+ | 248 | s & g | Gla | 60 | 2- 7-52 | 5 | 100 | Dr | Dwe | 4 | D | Well pumped 100 hours by driller. |
| 6L | Howard Lynch | 1142 | 94+ | 94 | g | Gla | 50 | 10-12-51 | 5 | 15 | Dr | Dwe | 5 | D | Well pumped 1 hour by driller. |
| 7L | James Foster | 1061 | 102+ | 102 | g | Gla | 56 | 2- 7-52 | | | Dr | Dwe | 4 | D | |
| 8L | John Dowds | 1059 | 93+ | 93 | s & g | Gla | 40 | 2- 7-52 | 15 | | Dr | Dwe | 4 | D | |
| 9L | R. W. Kirpatrick | 1122 | 118+ | 118 | s | Gla | 72 | 10-30-51 | 6 | 4 | Dr | Dwe | 4 | D | |
| 10L | Mrs. Mikesell | 1135 | 141+ | 141 | g | Gla | 50 | 9-21-51 | | | Dr | | 4 | | Well not used. E.F. Kreager (T). |
| 11L | Lester Seville | 1076 | 30+ | 30 | s | Gla | 20 | 9-12-51 | | | Dr | Swe | 4 | D | |
| 12 | Earl Gleason | 1142 | 25+ | 25 | | Gla | 12.29 | 8- 4-52 | | | Dug | H | 36 | DS | 51° F. Well pumped dry. |
| 13 | Mrs. Davis | 1161 | 22+ | 22 | | Gla | 16.23 | 8- 4-52 | | | Dug | H | 36 | D | 52° F. Mr. Foust (T). |
| 14 | E. Dennis | 1161 | 22+ | 22 | | Gla | 14 | 8- 4-52 | | | Dug | H | 36 | D | 52° F. |
| 15 | Sesser | 1152 | 22+ | 22 | | Gla | 12.30 | 8- 4-52 | | | Dug | Swe | 36 | DS | 54° F. |
| 16 | E. Williams | 1155 | 110+ | 110 | | Gla | 60 | 8- 4-52 | | | Dr | Dwe | 4 | DS | Also has 2 dug wells. |
| 17 | J. Gillespie | 1161 | 20+ | 20 | | Gla | 6.49 | 8- 4-52 | | | Dug | H | 36 | D | 52° F. |
| 18 | W. Woodbury | 1122 | 25+ | 25 | | Gla | 17 | 8- 5-52 | | | Dug | H | 36 | D | 51° F. |
| 19 | Lee Ward | 1072 | 87+ | 87 | | Gla | 57 | 8- 5-52 | | | Dr | H | 8 | DS | 52° F. Also has a dug well. |
| 20 | E. Myers | 1102 | 17+ | 17 | | Gla | 9.50 | 8- 5-52 | | | Dug | Swe | 36 | DS | 54° F. |
| 21 | R. Tudor | 1122 | | 130 | | | 70 | 8- 5-52 | | | Dr | Dwe | 5 | DS | |
| 22 | J. R. Watson | 1052 | 80 | 86 | sss | $M_c$ | 20 | 8- 5-52 | | | Dr | H | 4 | D | 53° F. |
| 23 | H. Mahan | 1142 | | 58 | | | 42 | 8- 6-52 | | | Dr | Dwe | 5 | DS | 53° F. Also has a dug well. |
| 24 | H. Elliot | 1068 | 40+ | 40 | | Gla | 34 | 8- 6-52 | | | Dug | Swe | 36 | DS | 52° F. |
| 25 | R. Davis | 1108 | | 165 | | | 45 | 8- 6-52 | | | Dr | Dwe | 4 | DS | 53° F. |
| 26 | J. Gleason | 1168 | 285+ | 285 | | Gla | 83 | 7-24-52 | | | Dr | Dwe | 5 | DS | 53° F. Boulder encountered at 285 ft. |
| 27 | J. Gleason | 1163 | 18+ | 18 | | Gla | 10 | 7-24-52 | | | Dug | H | 36 | DS | 51° F. N. J. Johnson (T). |
| BOWLING GREEN TOWNSHIP | | | | | | | | | | | | | | | |
| 1L | Brownsville Comm. Ch. | 956 | | 175 | ss | $M_c$ | 75 | 2- 2-50 | | | Dr | Dwe | 5 | D | |
| 2L | State of Ohio | 1100 | 12 | 97 | ss | $M_L$ | 58 | 6- 9-42 | | | Dr | H | 5 | PS | Pump is broken. |
| 3L | E. J. Armbrust | 958 | 34 | 77 | sh | $M_L$ | 18 | 5-29-48 | 12 | 5 | Dr | Dwe | 5 | D | Well pumped 2 hours by driller. |
| *4L | Charles Grove | 963 | 20 | 88 | sh | $M_L$ | 20.7 | 5-20-48 | 10 | 20 | Dr | H | 5 | D | 51° F. Well pumped 3 hours by driller. |
| 5L | Lee Scheckosd | 922 | | 170 | ss | $M_c$ | 20 | 6-23-51 | | | Dr | Dwe | 5 | D | Well deepened from 120 ft. |
| 6L | Paul Boring | 882 | 224 | 225 | ss | $M_c$ | 2.51 | 6-17-52 | | | Dr | Swe | 5 | D | 54° F. Well sometimes flows. |
| 7L | Cecil Gutridge | 1033 | 27 | 79 | sss | $M_L$ | 23 | 6-19-52 | 3 | 15 | Dr | Dwe | 5 | S | 55° F. |
| 8L | Noel Swinehart | 930 | 2 | 145 | ss | $M_c$ | 6 | 6-19-52 | | | Dr | Swe | 6 | D | 54° F. |
| 9L | Merril Hoskinson | 980 | 18 | 260 | ss | $M_c$ | 140 | 2-28-52 | | | Dr | Dwe | 5 | D | 54° F. |
| 10 | Wm. N. Cooper | 950 | 17 | 200 | ss | $M_c$ | 90 | 6-19-53 | | | Dr | Dwe | | D | |
| BURLINGTON TOWNSHIP | | | | | | | | | | | | | | | |
| 1L | Geo. McNamara | 1186 | 40 | 227 | ss | $M_c$ | 1 | 3-19-48 | | | Dr | Dwe | 5 | D | |
| 2L | Ross Rice | 1018 | 165+ | 165 | s & g | Gla | 65 | 3- 5-49 | 5 | 65 | Dr | Dwe | 4 | D | |
| 3L | Calvin Layman | 1183 | 172+ | 172 | s | Gla | 102 | 11- 8-51 | | | Dr | Dwe | 4 | DS | Also has a well 100 ft. deep. |
| 4L | Don Mathew | 1085 | 10 | 115 | sss | $M_c$ | 55 | 7- 2-51 | | | Dr | | 4 | | |
| 5L | Reid Householder | 1005 | 48+ | 48 | s & g | Gla | 18.05 | 2- 6-52 | 25 | 1 | Dr | H | 4 | D | 53° F. Well pumped 4 hours by driller. |
| *6L | Russell Anderson | 1007 | 55+ | 55 | s & g | Gla | 20 | 4-19-49 | 12 | 1 | Dr | H | 4 | D | 52° F. Well pumped 6 hours by driller. |
| 7L | Russell Ross | 1000 | 53+ | 53 | s & g | Gla | 20 | 4-22-49 | 12 | 1 | Dr | H | 4 | D | 52° F. Well pumped 3 hours by driller. |
| 8L | C. A. Farley | 1058 | 88+ | 88 | s & g | Gla | 28.58 | 2- 6-52 | | | Dr | H | 5 | D | 52° F. Well pumped 1 hour by driller. |
| 9 | Maurice Ross | 1007 | 45+ | 45 | | Gla | 16.68 | 2- 6-52 | | | Dr | H | 4 | D | 53° F. |
| 10L | Kyle Parks | 1065 | 48 | 60 | sss | $M_c$ | 25 | 4-26-49 | 5 | 18 | Dr | H | 4 | D | Well pumped 2 hours by driller. Earl Patrick (T). |
| 11L | L. A. White | 1105 | 140+ | 140 | g | Gla | 75 | 5-10-50 | 5 | 20 | Dr | | 4 | | Well pumped 10 hours by driller. Well not used. |
| 12L | Ernest Gosnell | 1103 | 138+ | 138 | s & g | Gla | 75 | 7-20-49 | 10 | 15 | Dr | Dwe | 4 | D | Well pumped 8 hours by driller. |
| 13L | H. G. Dean | 995 | 182 | 222 | ss | $M_c$ | | | | | Dr | | 6 | | Well not used. |
| 14L | Leroy Cochran | 1050 | 45+ | 45 | g | Gla | 20 | 4-23-49 | 12 | 1 | Dr | Dwe | 4 | D | Well pumped 2 hours by driller. |
| 15 | R. E. McGurder | 1123 | | 96 | ss | $M_c$ | 46 | 8-13-52 | | | Dr | Dwe | 4 | DS | 58° F. |
| 16 | H. L. Keckley | 1095 | 20+ | 20 | | Gla | 10 | 8-13-52 | | | Dug | H | 36 | D | 53° F. Also has a dug well. |
| 17L | C. Orsborn | 1105 | 60 | 125 | ss | $M_c$ | | | | | Dr | Dwe | 4 | D | Well has been pumped dry. |
| 18 | E. Sillen | 1055 | 88+ | 88 | | Gla | 32 | 8- 5-52 | | | Dr | H | | D | 52° F. |
| 19 | W. H. Bell | 1077 | 20+ | 20 | | Gla | 13 | 8- 7-52 | | | Dug | H | 36 | D | 54° F. |
| 20 | G. Keckley | 1145 | | 65 | | $M_c$ | 30 | 8- 7-52 | | | Dr | Dwe | 3 | DS | 52° F. |
| 21 | G. Patton | 1025 | | 100 | | $M_c$ | 12 | 8- 7-52 | | | Dr | Swe | 6 | DS | 52° F. Also has a flowing well. |
| 22 | F. E. Robbins | 1007 | 85+ | 85 | | Gla | 9 | 8- 7-52 | | | Dr | Dwe | 4 | DS | 53° F. |
| 23 | H. L. McClintrick | 1043 | 40+ | 40 | | Gla | 18 | 8- 7-52 | | | Dr | Swe | | DS | 53° F. |
| 24 | J. B. Lecrone | 1100 | | 150 | | | | | | | Dr | H | | D | 55° F. |
| 25 | G. McDaniel | 1166 | 21+ | 21 | | Gla | 16 | 8- 8-52 | | | Dug | H | 36 | DS | Well pumps dry. |
| 26 | Edmond | 1017 | 70+ | 70 | | Gla | | 8- 8-52 | | | Dr | Swe | | DS | 53° F. Well flows in the winter. |
| 27 | R. Griffith | 1052 | | 48 | | $M_c$ | 23 | 8- 8-52 | | | Dr | Dwe | 5 | DS | H. McClure (T). |
| 28 | H. W. Cullison | 1150 | | 130 | | $M_c$ | 28 | 8- 8-52 | | | Dr | Dwe | 4 | DS | Five springs on farm. |
| 29 | Todd | 1035 | 17+ | 17 | | Gla | 12 | 8- 8-52 | | | Dug | Swe | 36 | DS | Also has a spring. |
| 30 | T. P. Edman | 985 | 35+ | 35 | | Gla | 1 | 8- 8-52 | | | Dr | H | 4 | DS | 52° F. Three other wells on farm. |
| 31 | F. Riley | 1090 | | 110 | | $M_c$ | 32 | 8- 8-52 | | | Dr | H | 5 | D | |
| 32 | S. L. Wagoner | 1063 | | 109 | | | 20 | 8- 8-52 | | | Dr | Dwe | 4 | S | 54° F. Also has a drilled well. |
| 33 | H. C. Dean | 991 | | 170 | | | 20 | 8-11-52 | | | Dr | Dwe | 4 | DS | 53° F. Also has a drilled well. |
| 34 | L. A. Christman | 1035 | | 100 | | | 42 | 8-11-52 | | | Dr | Dwe | 4 | DS | 52° F. Also has a drilled well. |

Table 17.--Records of wells in Licking County, Ohio

| Well number | Owner or Name | Elevation at well (feet above sea level) | Depth to bedrock (feet) | Depth of well (feet) | Principal water-bearing bed: Character of material | Principal water-bearing bed: Geologic horizon | Water level: Below land surface (feet) | Water level: Date | Yield: Rate (g.p.m.) | Yield: Drawdown (feet) | Type of well | Type of pump | Diameter of well (inches) | Use | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EDEN TOWNSHIP | | | | | | | | | | | | | | | |
| 1L | Purity School | 1165 | 15 | 190 | ss | $M_c$ | 16 | 3- 2-49 | | | Dr | Dwe | 5 | PS | |
| 2L | Ockley Hale | 997 | 0 | 97 | ss | $M_c$ | 45 | 6-15-50 | | | Dr | Dwe | 5 | D | |
| 3L | V. Sabo | 1020 | 5 | 75 | ss | $M_L$ | 25 | 12- 2-49 | | | Dr | Dwe | 5 | D | |
| 4L | Eden Church | 1140 | 15 | 130 | ss | $M_c$ | 88.26 | 11-27-51 | | | Dr | | 4 | | Well not used. |
| 5L | Camp Ohio Well | 965 | 24 | 126 | ss | $M_c$ | 9.59 | 11- 1-51 | | | Dr | | 8 | | Well not used. |
| 6L | Theodore Kemp | 965 | 10 | 48 | ss | $M_c$ | 15 | 6- 4-51 | | | Dr | | 4 | D | |
| 7 | N. H. Stephens | 1012 | | 33 | | | 18.71 | 11-15-51 | | | Dug | Swe | 36 | D | |
| 8 | R. E. Knight | 1123 | | 43 | | | 33.75 | 11-15-51 | | | Dug | Dwe | 36 | D | 52° F. |
| 9 | V. S. Glover | 1070 | | | | | | | | | Dr | Dwe | 5 | S | |
| 10 | Kramer | 990 | | 50 | | | | | | | Dr | H | 5 | D | 51° F. |
| 11 | Howard Evans | 1030 | | 19 | | | 3.35 | 11-20-51 | | | Dug | H | 36 | D | 53° F. |
| 12 | Wm. Collinge | 942 | | 50 | | | 8 | 11-20-51 | | | Dr | Dwe | 4 | S | |
| 13 | Wm. Collinge | 960 | | 50 | | | 8 | 11-20-51 | | | Dr | Dwe | 4 | D | |
| 14 | Edward Richcreek | 1043 | | | | | | | | | Dr | Dwe | | D | |
| 15 | F. D. Hawke | 983 | | | | | 20 | 11-20-51 | | | Dr | Swe | 4 | D | Jim Hawke (T). |
| 16 | F. D. Hawke | 965 | | 9 | s | Gla | 6.15 | 11-20-51 | | | Dug | Swe | 36 | D | |
| 17 | F. W. Wilkin | 1110 | | | | | | | | | Dr | Dwe | | D | |
| 18 | F. M. Hunt | 1117 | | 32 | | | 9.09 | 11-23-51 | | | Dr | H | 4 | S | |
| 19 | F. M. Hunt | 1114 | | | | | | | | | Dr | Dwe | 4 | D | |
| 20 | Harry Wilkin | 1135 | | 67 | sss | $M_L$ | 31.11 | 11-23-51 | | | Dr | Dwe | 4 | DS | |
| 21 | C. E. Smith | 1123 | | | | | | | | | Dr | Dwe | | D | |
| 22 | J. E. Kelly | 1162 | | | | | | | | | Dr | H | 5 | D | 51° F. |
| 23 | James Delancey | 995 | | 40 | | | 28.48 | 11-26-51 | | | Dug | Swe | 36 | D | |
| 24 | Cater | 1119 | | 85 | | $M_L$ | 50 | 11-27-51 | | | Dr | Dwe | 5 | D | |
| 25 | W. Thompson | 1104 | | 50 | | | 30.30 | 11-27-51 | | | Dug | H | 36 | DS | |
| 26L | Neil Wilkin | 1103 | 20 | 100 | ss | $M_c$ | 50 | 9- -49 | 12 | 2 | Dr | Dwe | 5 | D | Bailing test. |
| 27 | Nethers | 1163 | | | | | | | | | Dr | Dwe | | D | |
| 28 | Bill Wilson | 1160 | | 36 | | | 27.16 | 11-28-51 | | | Dug | Swe | 36 | D | Well goes dry in summer. |
| 29 | Bill Wilson | 1182 | | 13 | | | 9.78 | 11-28-51 | | | Dug | H | 36 | S | |
| 30 | C. Davis | 1147 | | | | | 42.39 | 11-29-51 | | | Dr | Dwe | 5 | D | 51° F. |
| 31L | Boy Scout Farm | 917 | 62 | 196 | ss | $M_c$ | 9.88 | 6-20-52 | | | Dr | | 8 | | Well not used. |
| ETNA TOWNSHIP | | | | | | | | | | | | | | | |
| *1L | W. R. McKinley | 1043 | 159+ | 159 | g | Gla | 56 | 7-30-50 | | | Dr | Dwe | 5 | D | 55° F. |
| 2 | Gerald C. Castle | 1041 | 120+ | 120 | s | Gla | | | | | Dr | | 5 | D | |
| 3L | L. S. Glassmyer | 1032 | 192+ | 192 | t | Gla | | | | | Dr | | 5 | | Dry hole. |
| 4L | W. J. Crow | 1032 | 115+ | 115 | g | Gla | | | | | Dr | Dwe | 5 | D | |
| 5L | W. H. Drauz | 1000 | 100 | 140 | ss | $M_c$ | 16 | 1- 4-50 | | | Dr | Dwe | 5 | D | |
| 6L | Glen Bard | 991 | 70 | 79 | ss | $M_c$ | 3.74 | 2- 7-52 | 3 | | Dr | Dwe | 5 | D | 52° F. |
| 7L | Harley Snook | 970 | 56+ | 56 | s & g | Gla | 8+ | 10-12-48 | | | Dr | | 5 | D | 52° F. Well flows. |
| 8L | Bob Newman | 983 | 64+ | 64 | s & g | Gla | 31.09 | 2- 7-52 | 6 | | Dr | | 6 | D | |
| 9 | C. H. Goings | 987 | 105+ | 105 | t | Gla | 12.55 | 2- 7-52 | | | Dr | H | 6 | | 51° F. Well not used. |
| 10 | L. D. Gambill | 978 | 64+ | 64 | s | Gla | 30 | 11-18-48 | | | Dr | | 6 | D | |
| 11L | Roy Millar | 1010 | 105+ | 105 | s & g | Gla | 40 | 10-12-50 | | | Dr | | 5 | D | |
| 12 | W. H. Haskett | 980 | 76+ | 76 | s & g | Gla | 27.73 | 2- 7-52 | | | Dr | H | 5 | D | 51° F. |
| 13L | Earl Uhrig | 1000 | 102 | 133 | ss | $M_c$ | 16 | 2- 3-50 | | | Dr | Dwe | 5 | D | |
| 14 | R. G. Uhrig | 1003 | 54 | 54 | sh | $M_c$ | 12 | 2- 7-52 | | | Dr | Dwe | 4 | D | |
| 15 | Herbert Uhrig | 1002 | 60 | 81 | sh | $M_c$ | 15 | 1- -50 | | | Dr | H | 5 | D | |
| 16L | Frank Myers | 973 | 148 | 173 | ss | $M_b$ | 50 | 5-17-50 | 3 | 20 | Dr | Dwe | 8 | D | Well pumped 14 hours by driller. |
| 17 | L. Catron | 1005 | 27+ | 27 | s & g | Gla | 20.50 | 8- 5-46 | 15 | 6 | Dr | H | 4 | D | Well pumped 3½ hours by driller. |
| 18 | John Edholm | 1009 | 25+ | 25 | s & g | Gla | 20 | 5-30-46 | 20 | 5½ | Dr | Swe | 4 | D | Well pumped 3 hours by driller. |
| 19 | Donald Herriott | 1022 | 96+ | 96 | s | Gla | 55 | 7-12-49 | | | Dr | | 4 | D | |
| 20 | Mrs. Ramsey | 968 | 34+ | 34 | s | Gla | 16.22 | 2-. 8-52 | | | Dr | H | 5 | D | 51° F. |
| 21 | Glen Whitmer | 1002 | 102+ | 102 | t | Gla | 50 | 8- 9-50 | | | Dr | Dwe | 5 | D | |
| 22L | R. J. McDaniel | 1013 | 92 | 116 | sh | $M_c$ | 38 | 10-24-49 | | | Dr | Dwe | 5 | D | |
| 23 | H. T. Warner | 1061 | 81+ | 81 | g | Gla | 50 | 5- 5-50 | 5 | 20 | Dr | Dwe | 4 | S | 52° F. Well pumped 6 hours by driller. |
| 24L | T. Mazelia | 1066 | 181+ | 181 | t | Gla | 30 | 12-23-49 | | | Dr | Dwe | 5 | D | |
| 25L | Mike Mudrick | 1050 | 93+ | 93 | s | Gla | 20 | 12-15-49 | 10 | 35 | Dr | | 5 | | Well covered. |
| 26 | McMurray Motel | 1046 | 180+ | 180 | s | Gla | 90 | 4-10-49 | | | Dr | Dwe | 5 | D | |
| 27 | Fred McMurray | 1046 | 80+ | 80 | s & g | Gla | 36 | 5-13-50 | | | Dr | | 5 | | Well covered. |
| 28 | R. S. Jones | 1048 | 135+ | 135 | s | Gla | | | | | Dr | | 4 | | |
| 29L | Ralph Hippely | 1053 | 227+ | 227 | s & g | Gla | 110 | 5-10-49 | 10 | 115 | Dr | Dwe | 5 | D | |
| 30 | H. W. Patton | 1063 | 125+ | 125 | g | Gla | 35 | 12- 1-49 | 6 | 60 | Dr | Dwe | 5 | D | |
| 31 | Chester Maurer | 1071 | 150+ | 150 | s & g | Gla | 30 | 7-15-48 | | | Dr | Dwe | 5 | DS | |
| 32L | Chester Maurer | 1071 | 241+ | 241 | s & g | Gla | 80.25 | 2- 8-52 | | | Dr | | 5 | | |
| 33 | Circle Inn | 1073 | 258+ | 258 | s & g | Gla | | | 10 | 20 | Dr | | 4 | | Well not used. |
| 34L | Emerson Lucas | 1054 | 292+ | 292 | g | Gla | 85 | 10- 1-51 | | | Dr | Dwe | 5 | D | 50° F. |
| 35 | Hugh Bender | 1061 | 72+ | 72 | t | Gla | | | | | Dr | | 5 | D | |
| 36 | Mr. Corbin | 942 | 78+ | 78 | g | Gla | 20 | 3- 1-48 | 6 | 38 | Dr | | 5 | | Well covered. |
| 37 | Joe Telekes | 1030 | 104+ | 104 | s | Gla | 50 | 7-14-50 | | | Dr | H | 5 | D | 52° F. |
| 38 | Charles Bland | 990 | 102+ | 102 | s & g | Gla | | | 12 | 35 | Dr | Dwe | 5 | D | |
| 39 | Henry Whitehead | 1032 | 140+ | 140 | s | Gla | 90 | 8-23-50 | | | Dr | Dwe | 5 | D | |
| 40L | W. M. Wright | 1020 | 90 | 122 | sh | $M_c$ | 60 | 10- 9-51 | | | Dr | Dwe | 5 | D | |
| 41L | Lawrence Pickering | 1022 | 65+ | 65 | g | Gla | 50 | 6-18-52 | | | Dr | Dwe | 4 | S | Well deepened to 125 ft. |
| 42L | Fred Hastilon | 950 | 30 | 45 | sh | $M_c$ | 13 | 2-29-52 | | | Dr | Dwe | 5 | D | |
| 43L | Lee French | 1021 | 232 | 235 | ss | $M_b$ | 1 | 6-18-52 | | | Dr | Dwe | 5 | D | |
| 44 | John Hooper | 1050 | 100+ | 100 | s & g | Gla | 16.41 | 6-18-52 | 8 | 26 | Dr | Dwe | 5 | D | 56° F. |
| 45 | Frank Seymour | 1030 | 104+ | 104 | s & g | Gla | 54.66 | 6-18-52 | 9 | 67 | Dr | | 5 | | Pump not installed. |
| 46L | Robert Henderson | 1062 | 57+ | 57 | s & g | Gla | 18 | 11-26-51 | 10 | 35 | Dr | | 5 | D | Well pumped 1 hour by driller. |
| 47L | A. B. Hup | 1010 | 202 | 262 | s & g | Gla | 56.10 | 6-19-52 | 7 | 72 | Dr | Dwe | 5 | | Well not used. |
| 48 | D. L. Evans | 1024 | 132+ | 132 | s & g | Gla | 85.70 | 6-19-52 | | | Dr | Dwe | 5 | D | 55° F. |
| 49L | D. L. Evans | 1020 | 152 | 152 | sh | $M_c$ | 74.77 | 6-19-52 | | | Dr | | 5 | | Well not used. |
| 50L | Mr. Arnold | 1002 | 225 | 240 | sh | $M_c$ | 59.09 | 6-24-52 | | | Dr | | 5 | | Well not used. |
| 51L | John H. Moore | 950 | 108+ | 108 | s & g | Gla | 56.60 | 6-24-52 | | | Dr | | 5 | DS | |

Table 17.--Records of wells in Licking County, Ohio

| Well number | Owner or Name | Elevation at well (feet above sea level) | Depth to bedrock (feet) | Depth of well (feet) | Principal water-bearing bed: Character of material | Principal water-bearing bed: Geologic horizon | Water level: Below land surface (feet) | Water level: Date | Yield: Rate (g.p.m.) | Yield: Drawdown (feet) | Type of well | Type of pump | Diameter of well (inches) | Use | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FALLSBURY TOWNSHIP | | | | | | | | | | | | | | | |
| 1 | S. W. Little | 855 | | 49 | | $M_c$ | 2 | 6-26-52 | | | Dr | Dwe | | DS | $52^{\circ}$ F. |
| 2L | Jay Frost | 1195 | 8 | 145 | ss | $M_L$ | 78 | 12- 9-48 | 25 | 1 | Dr | Dwe | 5 | D | Well pumped 1 hour by driller. |
| 3L | J. M. Beaty | 1155 | 6 | 85 | ss | $M_L$ | 25 | 8-31-51 | 2 | 20 | Dr | Dwe | 5 | D | $58^{\circ}$ F. Well pumped 20 hours by driller. |
| 4L | Charles Van Winkle | 838 | 20 | 40 | ss | $M_c$ | 6.82 | 6-27-52 | 24 | 8 | Dr | Swe | 5 | D | $52^{\circ}$ F. Well pumped ½ hour by driller. |
| 5L | Girl Scout Camp | 978 | 0 | 118 | ss | $M_c$ | 32.65 | 6-20-52 | | | Dr | | 8 | | Well not used. |
| 6 | Lester Clard | 1030 | | 17 | | | 10 | 6-25-52 | | | Dug | Swe | 36 | D | $58^{\circ}$ F. |
| 7 | E. J. Hankey | 980 | | 60 | | | 9.22 | 6-26-52 | | | Dr | H | 5 | S | $54^{\circ}$ F. |
| 8 | Dwight Moran | 833 | | 39 | | | 29.22 | 6-25-52 | | | Dr | Swe | | D | $55^{\circ}$ F. |
| 9 | Dwight Moran | 830 | | 40 | | | 26.22 | 6-25-52 | | | Dr | H | | S | $53^{\circ}$ F. |
| 10 | H. Watson | 830 | | 55 | ss | $M_c$ | 26 | 6-25-52 | | | Dr | Dwe | | D | $56^{\circ}$ F. |
| 11 | Mr. Gull | 815 | | 26 | | | 9.64 | 6-25-52 | | | Dr | H | | D | $52^{\circ}$ F. Jack Marvin (T). |
| 12 | Annabelle Babcock | 960 | | 90 | | | 45.57 | 6-25-52 | | | Dr | H | | D | Pump is broken. |
| 13 | Annabelle Babcock | 965 | | 28 | | | 21.92 | 6-25-52 | | | Dr | | | | Well not used. |
| 14 | W. J. Van Winkle | 1002 | | 25 | | | 24 | 6-25-52 | | | Dr | Swe | | D | |
| 15 | Frank Beckford | 1045 | | 44 | | | 11.20 | 6-25-52 | | | Dr | Swe | | D | |
| 16 | Ora Dennis | 824 | | 40 | | | 5.22 | 6-27-52 | | | Dr | H | | D | $52^{\circ}$ F. |
| 17 | Don Rine | 837 | | 24 | s | Gla | 6.42 | 6-27-52 | | | Dug | Swe | | DS | $53^{\circ}$ F. Also has two springs. |
| 18 | M. W. Supher | 850 | | 56 | | | 28 | 6-27-52 | | | Dr | Dwe | | DS | $52^{\circ}$ F. Also has a spring. |
| 19 | Russell Mizer | 875 | | 60 | | | 25.12 | 6-27-52 | | | Dr | H | | S | $53^{\circ}$ F. |
| 20 | Smith | 1155 | | 105 | sss | $M_L$ | 80 | 6-27-52 | | | Dr | H | | D | $52^{\circ}$ F. |
| 21 | Cullison | 1077 | | 36 | | | 20 | 6-27-52 | | | Dr | H | | D | $52^{\circ}$ F. |
| 22 | Earl Camp | 885 | | 10 | | | 8.28 | 6-27-52 | | | Dug | H | 36 | D | $54^{\circ}$ F. |
| FRANKLIN TOWNSHIP | | | | | | | | | | | | | | | |
| 1 | G. V. Huffman | 1025 | 25 | 47 | ss | $M_L$ | 25 | 10-14-49 | | | Dr | Dwe | 5 | D | |
| 2 | W. Clark | 1005 | 40 | 50 | ss | $M_L$ | | | | | Dr | Dwe | 5 | D | |
| 3L | F. W. Lugenbeal | 1063 | 5 | 110 | ss | $M_L$ | 43 | 4- 7-48 | 10 | 15 | Dr | Dwe | 5 | D | Well pumped 1 hour by driller. |
| 4 | Weakley | 1075 | 8 | 76 | sh | $M_L$ | 48 | 9- 1-48 | 10 | 25 | Dr | Dwe | 5 | D | |
| 5 | Walter Nadolson | 980 | 8 | 107 | sss | $M_c$ | 33 | 8-14-48 | 10 | 15 | Dr | Dwe | 5 | D | Well pumped 2 hours by driller. |
| 6 | Britton | 1000 | 12 | 86 | ss | $M_L$ | 42 | 10-24-51 | | | Dr | Dwe | 5 | D | $52^{\circ}$ F. |
| 7L | H. R. Bode | 920 | 22 | 73 | ss | $M_c$ | 24.17 | 9- 7-48 | 28 | 11 | Dr | Dwe | 5 | D | Well pumped ½ hour by driller. |
| 8L | St. Louis | 1010 | 95 | 118 | ss | $M_c$ | 38 | 5-27-48 | 8 | 5 | Dr | Dwe | 5 | DS | Well pumped 1½ hours by driller. |
| 9L | Arthur Kreager | 1040 | 40 | 50 | ss | $M_L$ | 33 | 5-18-50 | | | Dr | Dwe | 5 | S | $52^{\circ}$ F. |
| 10 | Orville W. Kreager | 1030 | 5 | 44 | ss | $M_L$ | | | | | Dr | Dwe | 5 | DS | $51^{\circ}$ F. Oscar Bixler (T). |
| 11L | Earl Kinser | 1095 | 32 | 110 | sh | $M_L$ | 23 | 3- -50 | 6 | 6 | Dr | Dwe | 5 | D | |
| 12L | John Schaller | 1000 | 87 | 127 | ss | $M_c$ | 46 | 8-23-48 | | | Dr | Dwe | 5 | D | |
| 13L | T. G. Robinson | 978 | 20 | 103 | ss | $M_c$ | 29.49 | 6-17-52 | | | Dr | H | 4 | | $53^{\circ}$ F. Well not used. |
| 14 | R. Inlow | 960 | | 122 | ss | $M_c$ | 72 | 8-15-52 | | | Dr | Dwe | 5 | DS | $53^{\circ}$ F. |
| 15L | Paul Poorman | 1110 | 129 | 129 | ss | $M_L$ | 31 | 6-23-52 | 10 | 1 | Dr | Dwe | 5 | D | $54^{\circ}$ F. Well pumped 1 hour by driller. |
| 16L | John Wiley | 990 | 12 | 78 | ss | $M_L$ | 32 | 6-23-52 | 15 | 5 | Dr | Dwe | 5 | D | $57^{\circ}$ F. Well pumped 1 hour by driller. |
| 17 | Homer Ogle | 990 | 15 | 57 | sss | $M_L$ | 17.69 | 6-24-52 | | | Dr | H | 4 | D | $54^{\circ}$ F. |
| GRANVILLE TOWNSHIP | | | | | | | | | | | | | | | |
| 1 | Irwin Davis | 902 | 43+ | 43 | g | Gla | 22.81 | 8- 9-48 | 35 | 1 | Dr | Swe | 5 | D | $54^{\circ}$ F. Well pumped ½ hour by driller. |
| 2 | Don Johnson | 905 | 53+ | 53 | g | Gla | 28 | 8-31-48 | 40 | 1 | Dr | Dwe | 5 | D | Well pumped ½ hour by driller. |
| *3L | J. V. Felumlee | 913 | 54' | 54 | g | Gla | 23.33 | 8- 4-48 | 35 | 1 | Dr | Dwe | 5 | D | $55^{\circ}$ F. Well pumped ½ hour by driller. |
| 4 | Harold Essman | 880 | 44+ | 44 | s & g | Gla | 25.50 | 4-17-48 | 13 | 1 | Dr | Swe | 5 | D | Well pumped ½ hour by driller. |
| 5 | C. E. McCracken | 890 | 53+ | 53 | g | Gla | 22.33 | 10- 6-50 | 28 | 2 | Dr | Dwe | 5 | D | Well pumped ½ hour by driller. |
| 6 | Henry Klotz | 927 | 42+ | 42 | g | Gla | 20.75 | 8-17-50 | | | Dr | Dwe | 5 | D | $54^{\circ}$ F. |
| 7L | H. E. Richardson | 922 | 125 | 135 | ss | $M_c$ | 20 | 3-24-49 | 9 | 70 | Dr | Dwe | 5 | D | Well pumped 1 hour by driller. |
| 8L | Richard Showman | 1047 | 20 | 68 | ss | $M_c$ | 47 | 5-26-48 | 30 | 17 | Dr | Dwe | 5 | D | Well pumped 1 hour by driller. |
| 9L | Fleck Miller | 1077 | 42 | 112 | ss | $M_c$ | 42 | 6- 2-48 | | | Dr | Dwe | 4 | D | |
| 10L | Bob Steele | 1038 | 151+ | 151 | g | Gla | 75 | 6-22-50 | 5 | 10 | Dr | Dwe | 5 | D | Well pumped 1 hour by driller. |
| 11 | Dean Tinker | 1060 | 7 | 120 | sh | $M_c$ | 69 | 2-14-52 | 8 | 9 | Dr | Dwe | 5 | D | |
| 12 | Okey Tracey | 1070 | 245 | 265 | ss | $M_c$ | 90 | 4- -48 | | | Dr | Dwe | 4 | D | |
| 13 | Paul Quisenberry | 938 | 43+ | 43 | s & g | Gla | 24 | 4-29-50 | | | Dr | Dwe | 5 | D | |
| 14L | City of Granville | 918 | 91+ | 91 | g | Gla | 16.50 | 2-28-40 | 328 | 5 | Dr | | 12 | PS | $52^{\circ}$ F. |
| 15 | City of Granville | 918 | 100+ | 100 | s & g | Gla | 20 | 8-29-42 | 400 | 14 | Dr | | 12 | PS | $52^{\circ}$ F. |
| 16L | Gerard de Piolene | 1126 | 35 | 128 | ss | $M_c$ | 41.83 | 7-18-50 | | | Dr | | 5 | | Well covered. |
| 17 | Gerard de Piolene | 1126 | 41 | 175 | ss | $M_c$ | 53.58 | 10-17-50 | 28 | 12 | Dr | Dwe | 5 | D | Well pumped 2 hours by driller. |
| 18 | Gerard de Piolene | 1120 | 20 | 92 | ss | $M_c$ | 27 | 3-30-48 | 28 | 1 | Dr | H | 5 | | Well pumped ½ hour by driller. Well not used. |
| 19 | Aileen D. Paul | 1114 | 2 | 243 | ss | $M_c$ | 98 | 7-31-47 | 5½ | 147 | Dr | Dwe | 5 | D | Well pumped dry in 1 hour by driller |
| 20 | Drexel Lantz | 1080 | | 96 | ss | $M_c$ | 29.50 | 10- 5-47 | 28 | 4 | Dr | Dwe | 5 | D | Well pumped ½ hour by driller. Well deepened from 69 ft. |
| 21L | Leonard Mason | 932 | 52+ | 52 | g | Gla | 23 | 8-14-48 | 42 | 1 | Dr | Dwe | 5 | D | Well pumped 1 hour by driller. |
| 22 | Harold Sunkle | 928 | 46+ | 46 | s & g | Gla | 15 | 8- 8-50 | 18 | 5 | Dr | Dwe | 5 | D | Well pumped 1 hour by driller. |
| 23 | C. E. Renner | 921 | 46+ | 46 | s & g | Gla | 15 | 2-15-52 | 18 | 5 | Dr | Swe | 5 | D | Well pumped 1 hour by driller. |
| 24L | Merlin M. Ekenberry | 1130 | 10 | 219 | ss | $M_c$ | 145 | 10-25-50 | 3 | 1 | Dr | | 5 | | Well not used. |
| 25 | Lyle Blaine | 990 | 46+ | 46 | s & g | Gla | 30 | 3-30-50 | 12 | 15 | Dr | Swe | 5 | D | |
| 26 | Karl Rees | 1003 | 52+ | 52 | s & g | Gla | 13 | 4- 3-48 | 10 | 6 | Dr | Swe | 5 | D | |
| 27L | Ward Hiles | 1007 | 43+ | 43 | s | Gla | 3 | 4-30-48 | 10 | 20 | Dr | Swe | 5 | D | Well pumped 2 hours by driller. |
| 28L | Lester Foster | 1100 | 45 | 83 | ss | $M_L$ | 45 | 3-27-50 | 20 | 10 | Dr | Dwe | 5 | D | |
| 29 | Maylon Hepp | 1167 | 6 | 211 | ss | $M_c$ | 81.50 | 10- 6-49 | 14 | 59 | Dr | Dwe | 5 | D | Well pumped 2 hours by driller. |
| 30L | Mel Lindsey | 1090 | 25 | 75 | ss | $M_c$ | 43 | 9- -48 | 15 | 10 | Dr | Dwe | 5 | D | Well pumped 2 hours by driller. |
| 31 | Tristram Coffin | 1100 | 12 | 202 | ss | $M_c$ | | 10- -50 | 3 | | Dr | Dwe | 5 | D | |
| 32 | Robert Seager | 1090 | 18 | 156 | ss | $M_c$ | | | | | Dr | Dwe | 5 | D | |

Table 17.--Records of wells in Licking County, Ohio

| Well number | Owner or Name | Elevation at well (feet above sea level) | Depth to bedrock (feet) | Depth of well (feet) | Principal water-bearing bed: Character of material | Principal water-bearing bed: Geologic horizon | Water level: Below land surface (feet) | Water level: Date | Yield: Rate (g.p.m.) | Yield: Drawdown (feet) | Type of well | Type of pump | Diameter of well (inches) | Use | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GRANVILLE TOWNSHIP (continued) | | | | | | | | | | | | | | | |
| 33L | E. A. Connell | 1061 | 50 | 81 | ss | $M_c$ | 38 | 12-10-49 | 28 | 10 | Dr | Dwe | 5 | D | Well pumped ½ hour by driller. Paul Haynes (T). |
| 34 | J. C. Hood | 1054 | 49+ | 49 | g | Gla | 20 | 8-20-48 | 18 | 5 | Dr | H | 4 | D | 52° F. Well pumped ½ hour by driller. |
| 35L | Henry Bomer | 1181 | 5 | 107 | ss | $M_L$ | | | 9 | 5 | Dr | Dwe | 5 | D | Well pumped 1 hour by driller. |
| 36L | Charles Wade | 1148 | 10 | 132 | ss | $M_c$ | 29 | 3-17-48 | 25 | 6 | Dr | Dwe | 5 | D | Well pumped ½ hour by driller. |
| 37 | George Young | 955 | 43+ | 43 | g | Gla | 18 | 1- 4-51 | 10 | 3 | Dr | Swe | 5 | D | Well pumped 1 hour by driller. |
| 38 | Earl Wright | 940 | 25 | 48 | ss | $M_c$ | 24 | 1-15-51 | 8 | 10 | Dr | Swe | 5 | D | Well pumped 1 hour by driller. |
| 39L | Al Hansen | 1037 | 112+ | 112 | g | Gla | 89.92 | 11-12-47 | 28 | 1 | Dr | Dwe | 5 | D | Well pumped 1 hour by driller. |
| 40 | G. W. Claggett | 1036 | 83+ | 83 | g | Gla | 22 | 8- 9-50 | 42 | 6 | Dr | Swe | 5 | S | Well pumped ½ hour by driller. |
| 41L | Harry Jester | 1063 | 122 | 138 | ss | $M_c$ | 67 | 9- 2-49 | 28 | 10 | Dr | Dwe | 5 | D | Well pumped 1 hour by driller. |
| 42L | James Clark | 1103 | 3 | 147 | ss | $M_c$ | | 2-19-52 | | | Dr | Dwe | 5 | D | |
| 43 | Paul Helm | 958 | 104+ | 104 | g | Gla | | 5- 1-51 | 42 | 4 | Dr | Dwe | 5 | D | Well pumped ½ hour by driller. |
| 44 | Conservation Club | 1004 | 35 | 78 | ss | $M_c$ | 40 | 11-29-51 | 12 | 15 | Dr | Dwe | 5 | D | Well pumped 1 hour by driller. |
| 45 | William Hartman | 1090 | 61+ | 61 | g | Gla | 36 | 2-20-51 | 42 | 1 | Dr | Dwe | 5 | D | Well pumped 1 hour by driller. |
| 46 | Carl Welsh | 1017 | 55+ | 55 | s & g | Gla | 25 | 11-29-51 | 12 | 10 | Dr | Dwe | 5 | D | Well pumped 1 hour by driller. |
| 47L | C. O. Slaughterbeck | 1185 | | 190 | sss | $M_c$ | 67 | 10-26-51 | 5 | 123 | Dr | Dwe | 5 | D | Well pumped dry in ½ hour by driller. |
| 48 | John Daley | 1133 | 157 | 188 | ss | $M_c$ | 31 | 7-12-51 | 8 | 44 | Dr | Dwe | 5 | D | |
| 49L | Paul Stinson | 1130 | 180 | 204 | ss | $M_c$ | 50 | 7- 6-51 | 8 | 72 | Dr | Dwe | 5 | D | |
| 50 | Walter Robb | 1110 | 18 | 341 | ss | $M_c$ | | 6-26-50 | | | Dr | Dwe | 5 | D | 53° F. |
| 51L | C. R. Baker | 878 | 42+ | 42 | g | Gla | 23.85 | 3-10-49 | 42 | 1 | Dr | Swe | 5 | D | Well pumped ½ hour by driller. |
| 52 | James Crouch | 906 | 31+ | 31 | s & g | Gla | 21 | 1-20-51 | 5 | 8 | Dr | Swe | 5 | D | |
| 53 | Carl Baker | 934 | | 115 | ss | $M_c$ | 30.69 | 6-17-52 | | | Dr | | 4 | | Well not used. |
| 54 | E. A. Connell | 1023 | 51 | 58 | ss | $M_c$ | 32 | 6-17-52 | | | Dr | Dwe | 5 | D | |
| 55L | Fred McPeck | 1030 | 12 | 127 | ss | $M_c$ | 76.02 | 6-17-52 | | | Dr | H | 4 | D | 54° F. |
| 56 | Bob Nutter | 1095 | 27 | 50 | ss | $M_c$ | 9.52 | 6-17-52 | 18 | 12 | Dr | Swe | 5 | D | 54° F. Well pumped 1 hour by driller. |
| 57L | Hull Nutter | 1082 | 35 | 75 | ss | $M_c$ | 50 | 6-17-52 | | | Dr | Dwe | 5 | D | |
| 58 | Franklin Griffiths | 885 | 45+ | 45 | g | Gla | 12 | 6-18-52 | | | Dr | Swe | 4 | D | |
| 59 | Charles R. Williams | 998 | 114+ | 114 | g | Gla | 50 | 6-18-52 | | | Dr | Dwe | 5 | D | 56° F. |
| 60 | A. P. Hess, Jr. | 1100 | 10 | 115 | ss | $M_c$ | | | | | Dr | Dwe | 5 | D | 52° F. |
| 61 | Elmer Smith | 943 | | 18 | | | 10 | 7-10-52 | | | Dr | Swe | | S | 52° F |
| HANOVER TOWNSHIP | | | | | | | | | | | | | | | |
| *1L | John Predmore | 795 | 8 | 38 | ss | $M_c$ | | | 5 | 5 | Dr | | 5 | D | 55° F. |
| 2 | Clark Walrath | 790 | 22 | 38 | ss | $M_c$ | 10 | 9-25-51 | 5 | 10 | Dr | H | 5 | D | 54° F. |
| 3 | C. W. Cayton | 793 | 20 | 37 | ss | $M_c$ | 15 | 1-21-50 | 3 | 18 | Dr | | 5 | D | |
| 4 | Marge Hessian | 804 | 20 | 45 | ss | $M_c$ | 28 | 1-18-50 | 5 | 6 | Dr | | 5 | D | |
| 5L | Bowerston Shale Co. | 900 | 12 | 137 | ss | $M_c$ | 35 | 11-20-45 | 10 | 1 | Dr | Dwe | 5 | Ind | Company pumps 500 to 800 gpd. |
| 6L | Elmer Moore | 790 | 22 | 38 | ss | $M_c$ | 25 | 3-24-40 | 36 | 10 | Dr | | 5 | D | Well pumped 1 hour by driller. |
| 7 | Carl Wills | 795 | 12 | 38 | ss | $M_c$ | | | | | Dr | Dwe | 4 | D | |
| 8L | William Osborn | 850 | 216+ | 216 | g | Gla | 40 | 4- 8-50 | 20 | 10 | Dr | Dwe | 5 | D | Well pumped ½ hour by driller. |
| 9L | Warren Mears | 822 | 144+ | 144 | s & g | Gla | 60 | 2-20-48 | 18 | 20 | Dr | | 5 | D | Well pumped 1 hour by driller. |
| 10 | Art Smith | 810 | 24 | 50 | ss | $M_c$ | 30 | 6- -50 | 4 | 12 | Dr | Dwe | 5 | D | Well pumped 6 hours by driller. |
| 11L | H. D. Drumm | 947 | 40 | 77 | ss | $M_c$ | 30 | 3-28-50 | 8 | 20 | Dr | Dwe | 5 | D | |
| 12 | Charles Flowers | 830 | 194 | 215 | ss | $M_c$ | 40 | 3-16-48 | 18 | 3 | Dr | | 4 | D | Well abandoned. |
| 13 | Roy Myers, Jr. | 858 | 20 | 56 | ss | $M_c$ | 56+ | 9-25-51 | | | Dr | H | 5 | | Well dry. |
| 14 | Ernest Wolfe | 863 | 30 | 57 | ss | $M_c$ | 22 | 3-30-50 | 3 | 35 | Dr | Dwe | 5 | D | Well pumps dry. |
| 15L | Mary Cummous | 797 | 38 | 56 | ss | $M_c$ | 19 | 10-24-50 | 5 | 5 | Dr | | 5 | D | James Ruffle (T). Well pumped 12 hours by driller. |
| 16 | R. W. Montgomery | 902 | 65+ | 65 | s | Gla | 12 | 9-29-48 | 6 | 4 | Dr | Dwe | 5 | D | |
| *17L | George Clark | 1093 | 3 | 60 | ss | $M_L$ | 28 | 10-20-49 | 2 | 20 | Dr | Dwe | 5 | D | 60° F. Well pumped 8 hours by driller. |
| 18 | L. E. Stickle | 1090 | 4 | 50 | ss | $M_L$ | 22 | 2-23-50 | 2 | 18 | Dr | | 5 | D | |
| 19L | Charles Neff | 1104 | 5 | 60 | ss | P | 18 | 5- 2-48 | 2 | 35 | Dr | | 5 | D | Well pumped 2 hours by driller. |
| 20 | C. W. Krier | 1030 | 4 | 175 | sss | $M_L$ | 28 | 11-12-49 | 2 | 24 | Dr | | 5 | D | Well pumped 12 hours by driller. |
| *21L | C. W. Prysi | 783 | 179+ | 179 | s & g | Gla | 20 | 2- 9-48 | 30 | 10 | Dr | Dwe | 5 | DS | Well pumped 2 hours by driller. J. A. Wills (T). |
| 22 | Larry J. Wolford | 878 | | 270 | | | | | | | Dr | Dwe | 5 | DS | |
| 23 | Mears | 800 | | 28 | ss | $M_c$ | 17 | 7- 3-52 | | | Dr | Swe | | DS | 56° F. |
| 24 | Satterfield | 800 | | 27 | ss | $M_c$ | 18 | 7- 3-52 | | | Dr | Swe | | D | |
| 25 | J. R. Williams | 808 | | 13 | | | 4.09 | 7- 3-52 | | | Dug | Swe | 36 | DS | 54° F. |
| 26L | K. Kreager | 818 | 15 | 65 | ss | $M_c$ | | | | | Dr | H | 5 | D | 52° F. |
| 27 | Brice Settles | 863 | | 22 | | | | | | | Dv | Swe | 1½ | DS | |
| 28 | Roy Hunkins | 903 | 45+ | 45 | s | Gla | 38 | 7- 3-52 | | | Dr | Dwe | 4 | DS | |
| 29 | Richard Swigert | 870 | | 28 | | | 7 | 7- 3-52 | | | Dug | H | 36 | DS | 54° F. |
| 30 | Nethers | 803 | | 23 | s | Gla | | | | | Dv | | | D | 54° F. |
| 31 | C. E. McFadden | 805 | | 60 | | | 35 | 7- 3-52 | | | Dug | Dwe | | D | 55° F. |
| 32 | Ralph Lake | 855 | 12+ | 12 | t | | 4.51 | 7- 7-52 | | | Dug | H | 36 | DS | 56° F. |
| 33 | D. Morrison | 987 | | 87 | | | 27.82 | 7- 7-52 | | | Dr | H | | DS | 53° F. |
| 34 | William Priest | 860 | | 54 | | | 28 | 7- 7-52 | | | Dr | H | | DS | 53° F. |
| 35 | Orville Lane | 1050 | | 75 | | | | | | | Dr | Dwe | 5 | DS | |
| 36 | Sam Richards | 880 | | | | | | | | | Dr | Dwe | | DS | 52° F. |
| 37 | G. W. Bradley | 923 | | 7 | | | 3.10 | 7- 7-52 | | | Dug | Swe | 36 | DS | 57° F. |
| 38 | A. Sforza | 847 | | 113 | | | 35 | 7- 7-52 | | | Dr | Dwe | 5 | D | 58° F. |
| 39 | Robert Francis | 760 | | 30 | | | 22 | 7- 7-52 | | | Dr | Swe | | D | |
| 40 | Nettie Evans | 820 | | 55 | | | 38.22 | 7- 7-52 | | | Dr | H | | D | Well not used. |
| 41L | L. Kerrig | 864 | 186+ | 186 | g | Gla | 52 | 12-18-51 | | | Dr | Dwe | 4 | D | 54° F. Raymond Arthur (T). |
| HARRISON TOWNSHIP | | | | | | | | | | | | | | | |
| 1 | C. B. Wilson | 1020 | 31+ | 31 | s & g | Gla | 5.49 | 2-13-52 | 10 | 12 | Dr | H | 5 | D | 52° F. Well pumped 8 hours by driller. |
| 2L | Kenneth Brooks | 1080 | 50+ | 50 | s & g | Gla | 20 | 2- 5-49 | | | Dr | Dwe | 4 | D | |
| *3L | Edward Dixon | 1004 | 20 | 75 | sh | $M_c$ | 20 | 10- 1-49 | 12 | 25 | Dr | Dwe | 5 | D | 51° F. |

Table 17.--Records of wells in Licking County, Ohio

| Well number | Owner or Name | Elevation at well (feet above sea level) | Depth to bedrock (feet) | Depth of well (feet) | Principal water-bearing bed: Character of material | Principal water-bearing bed: Geologic horizon | Water level: Below land surface (feet) | Water level: Date | Yield: Rate (g.p.m.) | Yield: Drawdown (feet) | Type of well | Type of pump | Diameter of well (inches) | Use | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HARRISON TOWNSHIP (continued) | | | | | | | | | | | | | | | |
| 4L | Ray Leyton | 1073 | 42+ | 42 | g | Gla | 25 | 11-17-50 | 10 | 2 | Dr | Swe | 4 | D | |
| 5 | N. N. Cramer | 1070 | 54 | 112 | sh | $M_c$ | 17 | 6-17-52 | | | Dr | Dwe | 4 | D | 55° F. |
| 6L | Mr. Leatherman | 1070 | 102 | 184 | ss | $M_c$ | 17.38 | 6-17-52 | | | Dr | H | 4 | D | 54° F. E. E. Clinch (T). |
| 7L | John Flodt | 1183 | 75 | 97 | ss | $M_c$ | 32 | 10-31-51 | | | Dr | Dwe | 4 | D | 54° F. |
| 8 | H. Runkle | 1222 | | 80 | | | 50 | 7- 9-52 | | | Dr | Dwe | 5 | D | S. Presley (T). |
| 9 | J. Warrington | 1181 | | 140 | | | 30 | 7-11-52 | | | Dr | Dwe | 5 | DS | |
| 10 | Wollard | 1210 | | 150 | | | 62 | 7-11-52 | | | Dr | Dwe | 5 | DS | 56° F. Also has a dug well. |
| 11 | J. E. Kirts | 1155 | | 276 | | | | | | | Dr | Dwe | 5 | DS | 54° F. |
| 12 | W. Parr | 1078 | | 51 | | | 9 | 7-11-52 | | | Dr | Dwe | 4 | D | 55° F. |
| 13 | James Lamp | 1021 | | 60 | | | 28 | 7-11-52 | | | Dr | Dwe | 5 | D | |
| 14 | Ralph Lennington | 1202 | | 30 | | | 18 | 7-11-52 | | | Dug | H | 36 | D | 52° F. |
| 15 | Rex Watson | 1224 | | 325 | | | 75 | 7-11-52 | | | Dr | Dwe | 4 | DS | 52° F. |
| 16 | M. McCullough | 1202 | | 28 | | | 6.76 | 7-11-52 | | | Dug | H | 36 | D | 51° F. |
| 17 | H. Runkle | 1202 | | 17 | | | 13.12 | 7-11-52 | | | Dug | Swe | 36 | D | H. Morgan (T). |
| 18 | C. S. Hubbard | 1182 | | 30 | | | 22.28 | 7-11-52 | | | Dug | H | 36 | D | |
| 19 | N. W. Nichols | 1182 | | 48 | | | 23.12 | 7-11-52 | | | Dr | Wind | 12 | DS | 52° F. |
| 20 | L. Bashor | 1163 | | 80 | | | 30 | 7-11-52 | | | Dr | Dwe | 5 | D | 53° F. |
| 21 | W. C. Myers | 1172 | | 285 | | | 30 | 7-11-52 | | | Dr | Dwe | 5 | DS | 53° F. |
| 22 | W. Wickliff | 1163 | | 215 | | | 35 | 7-14-52 | | | Dr | Dwe | 4 | DS | 52° F. |
| 23 | J. Ackerman | 1122 | | 17 | | | 5.50 | 7-14-52 | | | Dug | H | 36 | DS | 52° F. |
| 24 | Gale Stevens | 1103 | | 82 | | | 25 | 7-14-52 | | | Dr | Dwe | 4 | DS | 52° F. |
| 25 | John Welsh | 1123 | | 150 | | | 25 | 7-14-52 | | | Dr | Dwe | 5 | S | 56° F. |
| 26 | R. S. Eagle | 1097 | | 135 | | | 40 | 7-14-52 | | | Dr | Dwe | 4 | DS | |
| 27 | G. Deeds | 1142 | | 180 | | | 35 | 7-14-52 | | | Dr | Dwe | 5 | D | 56° F. Also has a dug well. |
| 28L | C. J. Bonham | 1163 | 90 | 100 | ss | $M_c$ | 5 | 7-14-52 | | | Dr | H | 4 | DS | 52° F. |
| 29L | H. Lee Emerson | 930 | 42+ | 42 | g | Gla | 19.69 | 2-13-52 | 12 | 20 | Dr | Swe | | | Well not used. |
| 30 | G. M. Welch | 927 | 52+ | 52 | s & g | Gla | 13 | 6- 6-49 | 6 | 16 | Dr | Dwe | 4 | D | |
| 31 | Edna Rostorfer | 932 | 38+ | 38 | s & g | Gla | 9.49 | 2-13-52 | | | Dr | Swe | 5 | D | |
| 32 | T. R. Coughenour | 930 | 70+ | 70 | s & g | Gla | 22 | 2-15-49 | 12 | 28 | Dr | Dwe | 5 | D | |
| 33 | Red Star Restaurant | 930 | 42+ | 42 | s & g | Gla | 16 | 7-16-48 | 6 | 21 | Dr | Swe | 5 | D | Well pumped 4 hours by driller. |
| 34 | Fred Ray | 922 | 39+ | 39 | s & g | Gla | 16 | 6-27-49 | 12 | 23 | Dr | Swe | 5 | D | 53° F. |
| 35 | Village of Kirkersville | 930 | 97+ | 97 | s & g | Gla | | 1- -49 | 12 | 21 | Dr | H | 5 | PS | 52° F. Well pumped 14 hours by driller. |
| 36L | State of Ohio | 972 | 123 | 170 | sss | $M_c$ | 4.68 | 7-24-52 | | | Dr | | 6 | | Test well. |
| HARTFORD TOWNSHIP | | | | | | | | | | | | | | | |
| 1L | Charles Martin | 1176 | 143 | 149 | ss | $M_c$ | 45 | 5-29-48 | 5 | 14 | Dr | Dwe | 5 | D | |
| 2L | Daniel Brentlinger | 1165 | 131 | 160 | ss | $M_c$ | 33 | 8- 3-48 | | | Dr | H | 4 | D | |
| 3 | Harold Banick | 1142 | 73+ | 73 | s | Gla | 20 | 11- 4-49 | 6 | 7 | Dr | Dwe | 4 | D | |
| 4 | Leland Crottinger | 1143 | 74+ | 74 | s | Gla | 20 | 2- 1-50 | 6 | 2 | Dr | Dwe | 4 | D | |
| 5 | J. E. Van Fossen | 1163 | 63+ | 63 | g | Gla | 32 | 2-12-52 | | | Dr | Dwe | 4 | D | Gordon Clayton (T). |
| 6L | K. A. Garee | 1107 | 186 | 210 | s | Gla | 30 | 3- 5-48 | 2½ | ½ | Dr | H | 4 | D | |
| 7 | J. R. Kirpatrick | 1150 | 99+ | 99 | s | Gla | 36 | 1- 4-52 | 6 | 5 | Dr | Dwe | 5 | D | |
| 8L | Adam Cox | 1142 | 136+ | 136 | s | Gla | 30 | 11-28-51 | 8 | 8 | Dr | Dwe | 4 | D | |
| 9 | D. Clem | 1167 | | 18 | | | 12 | 7-24-52 | | | Dug | Swe | 36 | DS | 56° F. Also has a drilled well and a bored well. |
| 10 | J. E. Van Fossen & Sons | 1182 | | 85 | | | 35 | 7-25-52 | | | Dr | Dwe | 6 | DS | 55° F. |
| 11 | W. H. Dixon | 1183 | | 14 | | | 9 | 7-25-52 | | | Dug | H | 36 | D | 53° F. Well goes dry. |
| 12 | A. Ross | 1168 | | 107 | | | 51 | 7-25-52 | | | Dr | Dwe | 4 | DS | 55° F. |
| 13 | Carl Jones | 1164 | | 22 | | | 16.80 | 7-25-52 | | | Dug | H | 36 | D | 52° F. Also has a drilled well. |
| 14 | H. C. Grube | 1162 | | 130 | | | 65 | 7-25-52 | | | Dr | Dwe | 4 | DS | 56° F. Also has a drilled well. |
| 15 | W. Hogue | 1163 | | 136 | ss | $M_c$ | 15 | 7-25-52 | | | Dr | Dwe | 4 | DS | Also has a dug well. |
| 16 | I. R. Hogue | 1161 | | 100 | | | 15 | 7-25-52 | | | Dr | Dwe | 4 | DS | 52° F. |
| 17L | Frank Perfect | 1178 | 190 | 208 | ss | $M_c$ | 30 | 7-25-52 | | | Dr | Dwe | 6 | DS | 53° F. Also has two dug wells. |
| 18L | R. Curry | 1143 | 50 | 115 | ss | $M_c$ | 70 | 7-25-52 | | | Dr | Dwe | 4 | DS | |
| 19 | R. Curry | 1140 | | 45 | | | 1 | 7-25-52 | | | Dr | Swe | 4 | DS | 57° F. E. Nichols (T). |
| 20 | T. H. Cramer | 1140 | | 73 | | | 25 | 7-27-52 | | | Dr | Dwe | 4 | DS | |
| 21 | Robert Tagg | 1143 | | 50 | | | 13 | 7-27-52 | | | Dr | Dwe | 6 | DS | 53° F. |
| 22 | A. Williams | 1115 | | 27 | | | 21.42 | 7-27-52 | | | Dug | | 36 | DS | 51° F. |
| 23 | Frank Ross | 1132 | | 20 | | | 14 | 7-27-52 | | | Dug | Swe | 36 | D | 51° F. |
| 24 | Earl Downing | 1133 | | 90 | | | 4 | 7-27-52 | | | Dr | Dwe | 4 | DS | 53° F. |
| 25 | Willison | 1121 | | 25 | | | 15 | 7-27-52 | | | Dr | Swe | 5 | DS | 52° F. E. Duagy (T). |
| 26 | Willison | 1142 | | 55 | | | 32 | 7-27-52 | | | Dr | Dwe | 6 | DS | |
| 27 | Irwin Rhodenback | 1162 | | 32 | | | 12.79 | 8- 4-52 | | | Dug | H | 36 | D | 51° F. Paul Rhodenback (T). |
| 28 | C. White | 1168 | | 77 | | | 30 | 8- 4-52 | | | Dr | Dwe | 5 | DS | 54° F. |
| 29 | F. H. Wells | 1171 | | 140 | | | 20 | 8- 4-52 | | | Dr | Dwe | 4 | DS | 52° F. |
| HOPEWELL TOWNSHIP | | | | | | | | | | | | | | | |
| 1L | Ross Brown | 940 | 112+ | 112 | g | Gla | 25 | 5-12-50 | | | Dr | Dwe | 5 | D | |
| 2L | L. G. Fink | 943 | 36 | 50 | sss | $M_L$ | 18 | 7-19-48 | | | Dr | Dwe | 5 | D | |
| 3L | William Bratton | 920 | 40 | 56 | sss | $M_L$ | 6 | 11-13-50 | 12 | 15 | Dr | Dwe | 5 | DS | 54° F. Well pumped 1 hour by driller. |
| 4 | C. H. Binckley | 1020 | | 28 | ss | P | 13 | 8-15-52 | | | Dr | H | 5 | DS | |
| 5 | V. Binckley | 998 | | 30 | ss | P | | | | | Dr | H | 4 | D | 54° F. |
| 6L | Fanesville | 983 | 156 | 175 | sss | $M_L$ | 60 | 3- 4-52 | | | Dr | Dwe | 5 | D | |
| 7 | George Porter | 980 | 150 | 325 | ss | $M_c$ | 120 | 6-19-52 | | | Dr | Dwe | 5 | D | 57° F. |
| 8L | Vernon Iden | 950 | 115 | 135 | sss | $M_L$ | 30 | 6-19-52 | | | Dr | Dwe | 5 | D | 56° F. |
| 9 | Mr. Augletti | 1085 | | 300 | ss | | | | | | Dr | H | 6 | D | 52° F. J. Pierce (T). |
| 10 | E. Nethers | 895 | | 44 | ss | $M_c$ | 27 | 8-13-52 | | | Dr | H | 4 | D | 54° F. |
| JERSEY TOWNSHIP | | | | | | | | | | | | | | | |
| 1L | Ralph Corwin | 1107 | 39+ | 39 | g | Gla | 20 | 9-25-51 | | | Dr | Swe | 5 | D | |
| 2L | H. A. McDonald | 1121 | 97+ | 97 | g | Gla | 35 | 12-11-50 | | | Dr | Dwe | 5 | D | |

Table 17.--Records of wells in Licking County, Ohio

| Well number | Owner or Name | Elevation at well (feet above sea level) | Depth to bedrock (feet) | Depth of well (feet) | Principal water-bearing bed: Character of material | Principal water-bearing bed: Geologic horizon | Water level: Below land surface (feet) | Water level: Date | Yield: Rate (g.p.m.) | Yield: Drawdown (feet) | Type of well | Type of pump | Diameter of well (inches) | Use | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JERSEY TOWNSHIP (continued) | | | | | | | | | | | | | | | |
| 3L | K. O. Eby | 1126 | 48+ | 48 | s & g | Gla | 12 | 4-15-47 | 7 | 6 | Dr | Dwe | 4 | D | Well pumped 6 hours by driller. |
| 4L | R. J. Snider | 1120 | 170 | 175 | s | Gla | 49 | 5-22-51 | | | Dr | Dwe | 5 | D | |
| 5L | C. G. McDonald | 1160 | 92+ | 92 | t | Gla | | | | | Dr | | 4 | | Dry hole. |
| 6L | G. T. Lanman | 1127 | 106+ | 106 | s & g | Gla | 56 | 5-23-50 | | | Dr | Dwe | 5 | D | |
| 7L | Charles Cady | 1181 | 269+ | 269 | s & g | Gla | 124 | 5- 7-51 | 6 | 130 | Dr | Dwe | 5 | D | |
| 8L | F. O. Wood | 1136 | 80+ | 80 | g | Gla | 16 | 6-20-51 | 4 | 48 | Dr | Dwe | 4 | D | |
| 9L | Clarence Jordan | 1144 | 64+ | 64 | s | Gla | 28 | 5-17-51 | 8 | 44 | Dr | Dwe | 4 | D | |
| 10L | Peter M. Anderson | 1118 | 115+ | 115 | s | Gla | 20 | 10-12-51 | 6 | 46 | Dr | Dwe | 5 | D | |
| 11L | Emerson Smith | 1210 | 76+ | 76 | g | Gla | 38 | 12- 2-51 | | | Dr | Dwe | 5 | D | |
| 12L | Carl Johnston | 1065 | 146+ | 146 | s | Gla | 55 | 6-17-52 | 9 | 2 | Dr | Dwe | 5 | D | 53° F. |
| 13 | R. Richards | 1181 | | 40 | | | 12.92 | 7- 8-52 | | | Dug | H | 36 | D | 55° F. |
| 14 | Phalen | 1225 | | 33 | | | 15 | 7-14-52 | | | Dug | H | 36 | D | 51 F. |
| 15 | W. Quick | 1227 | | 40 | | | 20 | 7-14-52 | | | Dug | Swe | 36 | DS | Well goes dry. |
| 16 | R. and F. Wolcott | 1221 | | 16 | | | 9.76 | 7-14-52 | | | Dug | H | 36 | D | 52° F. |
| 17 | Clarence Hite | 1200 | | 90 | | | .05 | 7-14-52 | | | Dr | Dwe | 4 | D | 52° F. Robert Bookman (T). Also has a drilled well. |
| 18 | Sam Dean | 1163 | | 11 | | | 4.30 | 7-14-52 | | | Dug | Swe | 36 | DS | |
| 19 | Frank Whitehead | 1207 | | 15 | | | 14.32 | 7-15-52 | | | Dug | H | 36 | D | |
| 20 | L. Lapke | 1202 | | 120 | | | 70 | 7-15-52 | | | Dr | Dwe | 5 | D | 54° F. |
| 21 | B. B. Burton | 1230 | | 440 | ss | $M_b$ | 148 | 7-15-52 | | | Dr | Dwe | 6 | D | 56° F. |
| 22 | W. B. Kent | 1191 | | 26 | | | 21 | 7-15-52 | | | Dug | Swe | 36 | D | |
| 23 | F. Neal | 1162 | | 40 | | | 30 | 7-15-52 | | | Dug | Dwe | 36 | D | 52° F. Also has an unused drilled well. |
| 24 | E. Thompson | 1142 | | 18 | | | 8 | 7-15-52 | | | Dug | Swe | 36 | D | 52° F. |
| 25 | George Smith | 1105 | | 40 | | | 30 | 7-15-52 | | | Dug | Swe | 36 | DS | |
| 26 | George Smith | 1110 | | 120 | | | 40 | 7-15-52 | | | Dr | Dwe | 8 | S | 52° F. |
| 27 | George Smith | 1130 | | 167 | | | 72 | 7-15-52 | | | Dr | Dwe | 4 | DS | 53° F. |
| 28 | R. Shaffer | 1176 | | 54 | | | 20 | 7-14-52 | | | Dr | Dwe | 4 | D | |
| 29 | S. J. Hendren | 1137 | | 40 | | | 34 | 7-15-52 | | | Dr | Swe | 4 | DS | |
| 30 | D. C. Walston | 1122 | | 20 | | | 16.24 | 7-15-52 | | | Dug | H | 36 | D | 52° F. |
| 31 | L. E. Frederick | 1123 | | 139 | | | 69 | 7-15-52 | | | Dr | Dwe | 5 | DS | |
| 32 | R. Stewart | 1092 | | 169 | | | 35 | 7-15-52 | | | Dr | Dwe | 5 | DS | 56° F. |
| 33 | E. Michael | 1161 | | 30 | | | 24 | 7-15-52 | | | Dr | Swe | 4 | D | |
| 34 | W. Koontz | 1242 | | 16 | | | 8.68 | 7-16-52 | | | Dug | H | 36 | S | 54° F. |
| 35 | N. Diehl | 1201 | | 293 | | | 60 | 7-16-52 | | | Dr | Dwe | 4 | DS | 52° F. |
| 36 | Charles Cook | 1171 | | 19 | | | 8.28 | 7-16-52 | | | Dug | H | 36 | D | 53° F. |
| 37 | G. Jones | 1163 | | 15 | | | 9.26 | 7-16-52 | | | Dug | H | 36 | DS | 54° F. |
| 38 | Mr. Smith | 1143 | | 20 | | | 6.76 | 7-16-52 | | | Dug | H | 36 | D | 54° F. A. Miller (T). |
| 39 | Carl Ochs | 1128 | | 26 | | | 24 | 7-16-52 | | | Dug | H | 36 | DS | 54° F. Also has a driven well. |
| 40 | G. Monroe | 1142 | | 68 | | | 32 | 7-16-52 | | | Dr | Dwe | 4 | S | Also has 5 other wells. |
| 41 | Lola Dague | 1168 | | 65 | | | 37 | 7-16-52 | | | Dr | Dwe | 5 | DS | 54° F. |
| 42 | C. W. Walther | 1164 | | 21 | | | 9.49 | 7-16-52 | | | Dug | H | 36 | D | 53° F. |
| 43 | H. Bush | 1155 | | 130 | | | 52 | 7-16-52 | | | Dr | Dwe | 4 | DS | 53° F. |
| 44 | N. Kirts | 1142 | | 40 | | | 28 | 7-16-52 | | | Dug | H | 36 | D | 53° F. |
| 45 | F. B. Bevelhymer | 1131 | | 17 | | | 3.92 | 7-16-52 | | | Dug | H | 36 | S | 57° F. |
| 46 | Reid Miller | 1189 | | 10 | | | 4 | 7-16-52 | | | Dug | H | 36 | D | 56° F. |
| 47 | J. Sacks | 1202 | | 38 | | | 28 | 7-16-52 | | | Dr | Swe | 4 | DS | 54° F. |
| 48 | C. S. Rannebarger | 1197 | | 28 | | | 14.22 | 7-16-52 | | | Dug | Swe | 36 | D | |
| 49L | Robert Taylor | 1164 | 312+ | 312 | s | Gla | 112 | 10- -53 | | | Dr | Dwe | 5 | D | |
| LIBERTY TOWNSHIP | | | | | | | | | | | | | | | |
| 1L | T. V. Stiers | 1165 | 155+ | 155 | g | Gla | 45 | 5-11-50 | | | Dr | Dwe | 4 | D | 52° F. |
| 2L | W. W. Deitzel | 1273 | 153+ | 153 | g | Gla | 75 | 5- 2-49 | 10 | 40 | Dr | Dwe | 5 | D | Well pumped 2 hours by driller. |
| 3L | P. L. Winger | 1257 | 53+ | 53 | s | Gla | 29 | 11- 1-49 | 8 | 7 | Dr | Dwe | 4 | S | C. G. Clay (T). Well pumped 10 hours by driller. |
| 4L | Homer Conard | 1307 | 270+ | 270 | g | Gla | 170 | 6-14-50 | 4 | 100 | Dr | Dwe | 5 | D | Well pumps dry in 2 hours. |
| 5 | Nina Jennings | 1145 | 153+ | 153 | g | Gla | 67.54 | 2- 8-52 | | | Dr | Dwe | 4 | D | Well deepened to 225 feet. |
| 6L | A. L. Barber | 1243 | 157 | 206 | ss | $M_c$ | 93 | 3- 1-48 | 14 | 15 | Dr | Dwe | 4 | D | Well pumped 5 hours by driller. |
| 7L | N. R. Needels | 1122 | 35 | 43 | sh | $M_c$ | 28.15 | | 12 | 1 | Dr | Dwe | 6 | D | Well pumped 2 hours by driller. |
| 8L | C. L. Riffe | 1103 | 78+ | 78 | s & g | Gla | 48 | 8-22-49 | 12 | 1 | Dr | Dwe | 4 | D | Well pumped 2 hours by driller. |
| 9L | Dwight Adams | 1194 | 110 | 156 | sh | $M_c$ | 35 | 6-21-48 | 10 | 1 | Dr | Dwe | 5 | D | Well pumped 15 hours by driller. |
| 10L | Sherm Byers | 1142 | 121 | 145 | ss | $M_c$ | 35 | 3-22-51 | 6 | 20 | Dr | Dwe | 4 | D | |
| 11L | Dave Thompson | 1302 | 205+ | 205 | s & g | Gla | 120 | 8-10-48 | | | Dr | Dwe | 5 | D | W. Smith (T). Well pumped 1 hour by driller. |
| 12L | E. E. Collins | 1122 | 218 | 240 | sss | $M_c$ | | | | | Dr | Dwe | 5 | D | N. F. Thompson (T). |
| 13L | Charles Cornell | 1073 | 147 | 202 | ss | $M_c$ | 23 | 9- 5-50 | 8 | 88 | Dr | | 4 | | Well not used. Well pumped 3 hours by driller. |
| 14 | Edwin Stout | 1102 | 62 | 73 | g | Gla | 15 | 12-11-50 | | | Dr | Dwe | 4 | D | L. E. Lafferty (T). |
| 15 | Melvin Downing | 1121 | 67+ | 67 | s | Gla | 27 | 11-15-51 | 9 | 5 | Dr | Dwe | 5 | D | |
| 16 | Russell Moore | 1084 | | 280 | | | 40 | 7- 8-52 | | | Dr | Dwe | 5 | D | 53° F. |
| 17 | Robert Crist | 1147 | | 335 | | | 58.71 | 7-22-52 | | | Dr | Dwe | 5 | DS | 53° F. |
| 18 | Fred Smith | 1165 | | 85 | | | 20 | 7-22-52 | | | Dr | Dwe | 5 | DS | Also has a dug well. |
| 19 | G. Wynne | 1105 | | 25 | | | 21.51 | 7-22-52 | | | Dug | H | 36 | DS | 52° F. |
| 20 | H. T. Smith | 1110 | | 18 | | | 17.5 | 7-22-52 | | | Dug | Swe | 36 | D | 52° F. Well goes dry in summer. |
| 21 | Oscar Foster | 1121 | | 17 | | | 9.29 | 7-22-52 | | | Dug | H | 36 | D | 54° F. |
| 22 | H. McMillen | 1120 | | 44 | | | 20 | 7-22-52 | | | Dr | H | 4 | D | 53° F. |
| 23 | Fred Saxton | 1130 | | 40 | | | 36 | 7-22-52 | | | Dr | H | 8 | D | 49° F. |
| 24 | R. Harrison | 1145 | | 21 | | | 14.31 | 7-22-52 | | | Dr | H | 6 | D | 53° F. |
| 25 | Ellis Roberts | 1176 | | 150 | | | 45 | 7-22-52 | | | Dr | Dwe | 4 | DS | 52° F. |
| 26 | J. H. Blackburn | 1145 | | 35 | | | | | | | Dug | H | 36 | D | 52° F. |
| 27L | R. Bishop | 1147 | 80 | 110 | ss | $M_c$ | 50 | 7-22-52 | | | Dr | Dwe | 5 | D | Also has a dug well and a spring. |
| 28 | H. Garrabrant | 1242 | | 225 | | | 43 | 7-22-52 | | | Dr | Dwe | 4 | DS | O. R. Scott (T). |
| 29 | A. J. Scott | 1244 | | 135 | sss | $M_c$ | 45 | 7-23-52 | | | Dr | Dwe | 4 | DS | 53° F. |
| 30 | H. W. Kincaid | 1221 | | 72 | | | 37 | 7-23-52 | | | Dr | Dwe | 5 | D | 53° F. |
| 31 | A. E. Rose | 1251 | | 325 | | | 125 | 7-23-52 | | | Dr | Dwe | 4 | DS | 52° F. |
| 32 | J. Wyth | 1168 | | 23 | | | 12.12 | 7-23-52 | | | Dug | H | 36 | DS | 53° F. C. R. Swick (T). |
| 33 | J. Werts | 1249 | | 357 | | | 125 | 7-23-52 | | | Dr | H | 4 | DS | 52° F. |

Table 17.--Records of wells in Licking County, Ohio

| Well number | Owner or Name | Elevation at well (feet above sea level) | Depth to bedrock (feet) | Depth of well (feet) | Principal water-bearing bed: Character of material | Principal water-bearing bed: Geologic horizon | Water level: Below land surface (feet) | Water level: Date | Yield: Rate (g.p.m.) | Yield: Drawdown (feet) | Type of well | Type of pump | Diameter of well (inches) | Use | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LIBERTY TOWNSHIP (continued) | | | | | | | | | | | | | | | |
| 34L | J. Goldsberry | 1282 | 165 | 265 | sss | $M_c$ | 70 | 7-23-52 | | | Dr | Dwe | 5 | DS | $52^{\circ}$ F. |
| 35 | G. S. Drake | 1323 | | 25 | | | 19.61 | 7-23-52 | | | Dug | Swe | 36 | D | $52^{\circ}$ F. |
| 36 | H. Casson | 1260 | | 22 | | | 17 | 7-23-52 | | | Dug | Swe | 36 | DS | $53^{\circ}$ F. |
| 37 | R. Freas | 1162 | | 10 | | | 8.20 | 7-23-52 | | | Dug | H | 36 | D | $53^{\circ}$ F. E. Wickieser (T). |
| 38L | Roy Green | 1263 | 100 | 160 | sss | $M_c$ | 60 | 7-23-52 | | | Dr | Dwe | 5 | DS | $50^{\circ}$ F. |
| 39 | W. C. Adams | 1203 | | 12 | | | 6 | 7-23-52 | | | Dug | H | 36 | DS | $52^{\circ}$ F. W. S. Disbennett (T). |
| 40 | L. Atherton | 1224 | | 14 | | | 6.71 | 7-24-52 | | | Dug | Swe | 36 | D | $53^{\circ}$ F. |
| 41 | R. Montgomery | 1223 | | 15 | | | 10.21 | 7-24-52 | | | Dr | H | 8 | DS | $53^{\circ}$ F. J. Kitzmiller (T). |
| 42 | C. Ridgeway | 1183 | | 17 | | | 11.60 | 7-24-52 | | | Dug | Swe | 36 | DS | Also has 2 other wells. |
| 43 | T. E. Johnson | 1182 | | 26 | | | 23.42 | 7-24-52 | | | Dug | H | 36 | DS | $53^{\circ}$ F. Also has another well. |
| 44 | C. Parsons | 1181 | | 52 | | | 28 | 7-24-52 | | | Dr | Dwe | 4 | DS | $54^{\circ}$ F. |
| 45 | L. F. Berkley | 1182 | | 30 | | | 25.18 | 7-24-52 | | | Dr | Swe | 6 | DS | |
| 46 | L. Bachar | 1317 | | 30 | | | 28 | 8- 6-52 | | | Dug | H | 36 | S | Pumped dry every day. |
| LICKING TOWNSHIP | | | | | | | | | | | | | | | |
| 1L | Milt Bowman | 881 | 43+ | 43 | g | Gla | 35 | 6-28-48 | 40 | 4 | Dr | Swe | 6 | D | Well pumped ½ hour by driller. |
| 2L | Sam Steele | 1000 | 40 | 73 | ss | $M_L$ | 54 | 11-29-48 | 20 | 1 | Dr | Dwe | 5 | D | Well pumped 1 hour by driller. |
| 3 | K. L. Stagges | 979 | 60 | 87 | ss | $M_c$ | 56 | 10-18-48 | 20 | 3 | Dr | Dwe | 5 | D | Well pumped 2 hours by driller. |
| 4L | William Dolberg | 1036 | 4 | 108 | ss | $M_L$ | 35 | 10-24-51 | | | Dr | Dwe | 5 | D | |
| 5L | Kenneth Smith | 866 | 200+ | 200 | g | Gla | 150 | 7-30-49 | 25 | 25 | Dr | Dwe | 5 | D | |
| 6L | Ralph Turner | 962 | 93 | 100 | ss | $M_c$ | | | | | Dr | Dwe | 5 | D | |
| 7 | Cary Cullison | 980 | 20 | 110 | ss | $M_c$ | 82 | 6-12-51 | 10 | 5 | Dr | Dwe | 5 | D | Well pumped 1 hour by driller. |
| 8 | Harold Smith | 1055 | 40 | 135 | ss | $M_L$ | 35 | 7-13-50 | | | Dr | Dwe | 5 | D | |
| 9L | Paul Dove | 1070 | 33 | 110 | ss | $M_L$ | 35 | 4- 2-51 | 10 | 10 | Dr | Dwe | 5 | D | Well pumped 1 hour by driller. |
| 10L | Robert Baker | 957 | 100+ | 100 | g | Gla | | | 28 | 30 | Dr | | 5 | D | Well flows. |
| 11L | Jean Davis | 898 | 103 | 135 | ss | $M_c$ | | | | | Dr | | 5 | | |
| 12L | James Slayter | 926 | 90+ | 90 | s | Gla | 15.61 | 2-25-52 | | | Dr | Dwe | 4 | D | |
| 13 | Jean Davis | 907 | 134 | 225 | ss | $M_c$ | | 2-26-52 | | | Dr | | 5 | DS | Well flows. |
| 14 | Jean Davis | 903 | 203 | 301 | ss | $M_c$ | | | | | Dr | | 5 | | Well plugged. Charles Arnold (T). |
| 15 | Jean Davis | 921 | 189 | 228 | ss | $M_c$ | | | | | Dr | | | | Charles Arnold (T). Well plugged. |
| 16 | Bob Statler | 1015 | 25 | 59 | sss | $M_L$ | | | | | Dr | Dwe | 5 | D | $51^{\circ}$ F. |
| 17L | Ernest Fulk | 1012 | 30 | 69 | ss | $M_L$ | 29 | 4-18-50 | | | Dr | H | 5 | D | $52^{\circ}$ F. |
| *18L | J. E. House | 963 | 173 | 219 | ss | $M_c$ | 71 | 4-17-44 | | | Dr | Dwe | 4 | DS | $53^{\circ}$ F. |
| 19 | J. E. House | 965 | 54+ | 54 | | | 26 | 5- 9-44 | | | Dr | H | 4 | S | $52^{\circ}$ F. |
| 20L | Ross Smith | 905 | 297 | 303 | ss | $M_c$ | 1 | 3-22-51 | 5 | 150 | Dr | Dwe | | DS | Well pumped 12 hours by driller. |
| 21 | Frank Christ | 1043 | 24 | 108 | ss | $M_L$ | 22 | 7- 8-49 | 3 | 12 | Dr | Dwe | 4 | D | Well pumped 1 hour by driller. |
| 22 | W. R. Peterman | 897 | 135 | 175 | | | 7.13 | 2-19-52 | 10 | 1 | Dr | Dwe | 4 | D | $52^{\circ}$ F. |
| 23 | Paul Armbrust Assoc. | 898 | 63 | 67 | ss | $M_c$ | 56.67 | 9-12-47 | | | Dr | | 5 | D | |
| 24L | A. W. Bebout | 895 | 110 | 145 | ss | $M_c$ | 12 | 9-16-45 | 9 | 1 | Dr | Dwe | 4 | D | |
| 25 | R. R. Ingold | 900 | 140+ | 140 | g | Gla | 5 | 2-19-52 | 3 | 15 | Dr | | 4 | | |
| 26L | W. E. Warden | 895 | 163+ | 163 | g | Gla | 4 | 6- -47 | | | Dr | | 4 | D | |
| 27 | A. E. Davis estate | 903 | 109+ | 109 | s & g | Gla | 8 | 9- 3-47 | 15 | 3 | Dr | H | 4 | D | $45^{\circ}$ F. Well pumped 4 hours by driller. Floyd Schockley (T). |
| 28L | E. E. Hamm | 960 | 25 | 85 | sss | $M_c$ | 25 | 10- 8-46 | 10 | 1 | Dr | | 5 | D | |
| 29L | E. J. Kroll Sr. | 900 | 45+ | 45 | g | Gla | 34 | 9- 8-47 | 21 | 2 | Dr | | 4 | D | Well pumped 1 hour by driller. |
| 30 | M. B. Roberts | 900 | 44 | 80 | ss | $M_c$ | 25 | 10- 2-46 | | | Dr | Dwe | 4 | D | $52^{\circ}$ F. |
| 31 | Charles Eckard | 993 | 20 | 100 | ss | $M_c$ | 60 | 8-28-50 | 5 | 3 | Dr | Dwe | 5 | D | |
| 32 | William Adams | 910 | 38+ | 38 | g | Gla | 25.5 | 6-19-52 | | | Dr | Swe | 5 | D | $60^{\circ}$ F. |
| LIMA TOWNSHIP | | | | | | | | | | | | | | | |
| 1L | Brode Frame | 1060 | 90+ | 90 | s & g | Gla | 26 | 4-14-49 | | | Dr | Dwe | 5 | D | |
| 2L | H. E. Stouffer | 1051 | 140+ | 140 | s & g | Gla | 50 | 6-20-49 | | | Dr | H | 5 | D | $52^{\circ}$ F. |
| 3 | Carl Albery | 1082 | 109+ | 109 | s | Gla | 60 | 11- 5-49 | | | Dr | Dwe | 4 | D | |
| 4 | H. A. Young | 1047 | 71+ | 71 | s & g | Gla | 12 | 7- -46 | 10 | 24 | Dr | H | 4 | D | Well pumped 5 hours by driller. |
| 5L | Trafford Talmadge Farm | 1061 | 90+ | 90 | t | Gla | 48 | 8-22-42 | | | Dr | Dwe | 4 | D | |
| 6 | Lester K. Snook | 1081 | 102+ | 102 | s & g | Gla | 39 | 10-28-48 | | | Dr | Dwe | 5 | D | |
| 7 | Merle Souder | 1008 | 70+ | 70 | s & g | Gla | 3 | 7-13-49 | | | Dr | Dwe | 5 | D | $51^{\circ}$ F. |
| 8 | Ralph Butler | 1081 | 119+ | 119 | s | Gla | 27.60 | 10- 5-48 | 14 | 5 | Dr | Dwe | 4 | D | Well pumped 2 hours by driller. |
| 9 | J. W. Blauser | 1081 | 70+ | 70 | s | Gla | 23 | 6-19-50 | 4 | 27 | Dr | Dwe | 4 | D | |
| 10L | Shelva Short | 1065 | 145+ | 145 | s | Gla | 100 | 6- 7-50 | 6 | 10 | Dr | Dwe | 4 | D | |
| 11 | Robert Turner | 1080 | 143+ | 143 | g | Gla | 68 | 2-17-50 | | | Dr | Dwe | 4 | D | |
| 12 | Walter Campbell | 1058 | 139+ | 139 | s & g | Gla | 60 | 3-26-48 | 12 | 60 | Dr | Dwe | 5 | D | |
| 13L | Arthur Todd | 1074 | 170 | 185 | sss | $M_c$ | 70 | 8-20-51 | | | Dr | Dwe | 5 | D | |
| 14 | Clyde Layton | 1076 | 123+ | 123 | s & g | Gla | 40 | 8- 1-51 | | | Dr | Dwe | 5 | D | |
| 15L | Charles Chissner | 1088 | 158 | 170 | ss | $M_c$ | | | | | Dr | Dwe | 5 | D | |
| 16 | Edger Morris | 1080 | 66+ | 66 | s | Gla | | | | | Dr | Dwe | 5 | D | |
| 17L | Village of Pataskala | 995 | 106+ | 106 | s & g | Gla | 2 | 7-10-48 | | | Dr | | 10 | PS | |
| 18L | I. R. Oldham | 1064 | 77+ | 77 | g | Gla | 12 | 6- 3-50 | | | Dr | H | 5 | D | $52^{\circ}$ F. John Runyan (T). |
| 19 | Harry Twinning | 1022 | 36+ | 36 | s & g | Gla | 3.20 | 2-21-52 | | | Dr | Swe | 5 | D | $53^{\circ}$ F. |
| 20 | Melvin Foor | 1021 | 50+ | 50 | s & g | Gla | | 2-21-52 | 12 | 23 | Dr | Swe | 5 | D | Well flows. |
| 21L | Clyde Frost | 1021 | 62+ | 62 | s & g | Gla | 2 | 5-15-51 | | | Dr | Dwe | 4 | D | |
| 22 | Barbara Goyak | 1030 | 102+ | 102 | s & g | Gla | 5 | 10- 6-50 | | | Dr | H | 5 | D | Wayne Rush (T). Water has an odor. |
| 23L | Irwin Gieseck | 1042 | 130+ | 130 | s & g | Gla | 23 | 4- 2-51 | 12 | 80 | Dr | Dwe | 5 | D | |
| 24 | Emmett Wiley | 1035 | 107+ | 107 | s & g | Gla | 17.71 | 6-25-52 | | | Dr | H | 4 | D | $54^{\circ}$ F. |
| 25 | Village of Pataskala | 995 | 153+ | 153 | s & g | Gla | | | 25 | | Dr | Dwt | 10 | PS | |
| MADISON TOWNSHIP | | | | | | | | | | | | | | | |
| 1L | Alex Turner Co. | 810 | 64+ | 64 | s & g | Gla | 10 | 8-22-47 | 6 | 3 | Dr | | 6½ | | Well not used. Well pumped 1½ hours by driller. |
| *2L | Paul Bryson | 808 | 160+ | 160 | s & g | Gla | 12 | 7-22-50 | 20 | 3 | Dr | Dwe | 5 | D | Well pumped 1 hour by driller. |
| 3L | Weiant Gardens | 793 | 112+ | 112 | s & g | Gla | 2 | 9-25-51 | | | Dr | Dwe | 16 | Irr | $57^{\circ}$ F. Well flows in springtime. |
| 4 | Weiant Gardens | 793 | 112 | 112 | s & g | Gla | 2 | 9-25-51 | | | Dr | Dwe | 6 | Irr | Well flows in springtime. |
| 5 | D. L. Drumm | 810 | 36+ | 36 | g | Gla | 10 | 11-29=49 | 10 | 3 | Dr | | 4 | D | Well pumped ½ hour by driller. |

Table 17.--Records of wells in Licking County, Ohio

| Well number | Owner or Name | Elevation at well (feet above sea level) | Depth to bedrock (feet) | Depth of well (feet) | Principal water-bearing bed: Character of material | Principal water-bearing bed: Geologic horizon | Water level: Below land surface (feet) | Water level: Date | Yield: Rate (g.p.m.) | Yield: Drawdown (feet) | Type of well | Type of pump | Diameter of well (inches) | Use | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MADISON TOWNSHIP (continued) | | | | | | | | | | | | | | | |
| 6 | Orville Simpson | 812 | 187+ | 187 | s | Gla | 24 | 11-17-49 | 15 | 8 | Dr | Dwe | 4 | D | Well pumped 3 hours by driller. |
| 7 | Louis Phillippi | 830 | 160+ | 160 | s & g | Gla | 32 | 9-22-49 | 28 | 10 | Dr | Dwe | 5 | D | Well pumped 1 hour by driller. |
| 8 | Maharge | 822 | 130+ | 130 | g | Gla | | | | | Dr | Dwe | 4 | D | |
| 9 | J. F. Watson | 825 | 178+ | 178 | s & g | Gla | 32 | 7- 8-48 | | | Dr | Dwe | 4 | D | |
| 10L | Eugene Chaney | 881 | 97+ | 97 | g | Gla | 27 | 5-30-50 | 10 | 15 | Dr | Dwe | 4 | D | Well pumped 8 hours by driller. |
| 11 | Harold Carroll | 995 | 70 | 112 | ss | $M_c$ | 16 | 6-26-48 | | | Dr | Dwe | 4 | D | |
| 12 | V. W. McVey | 1043 | 41 | 90 | ss | $M_L$ | 34 | 5-17-48 | 20 | 20 | Dr | Dwe | 5 | D | Well pumped 2 hours by driller. |
| 13L | V. W. McVey | 1030 | 25 | 64 | ss | $M_L$ | 8 | 9-18-50 | 18 | 10 | Dr | Dwe | 5 | D | Well pumped 1 hour by driller. |
| 14 | V. W. McVey | 1045 | 30 | 92 | ss | $M_L$ | 40 | 9-18-50 | 12 | 10 | Dr | Dwe | 5 | D | Well pumped 1 hour by driller. |
| 15 | Jacob Hockney | 838 | 135 | 135 | g | Gla | 35 | 5- 8-51 | 18 | 15 | Dr | H | 5 | D | Well pumped 1 hour by driller. |
| 16L | John Burris | 823 | 145 | 145 | s & g | Gla | 30.96 | 11- 2-51 | 18 | 15 | Dr | H | 5 | D | 52° F. Well pumped 1 hour by driller. |
| 17L | Dale Wolford | 810 | 216+ | 216 | s | Gla | 16 | 8-25-51 | 12 | 200 | Dr | Dwe | 5 | D | Well pumped dry by driller in 2 hours. |
| 18L | W. L. Frey | 875 | 160+ | 160 | g | Gla | 63 | 9- 8-50 | 12 | 5 | Dr | Dwe | 5 | D | Well pumped 1 hour by driller. |
| 19L | William Warner | 920 | 3 | 94 | ss | $M_c$ | 17 | 3- 8-51 | 12 | 5 | Dr | | 5 | D | Well pumped 1 hour by driller. |
| 20L | George McCoy | 1063 | 5 | 77 | ss | $M_L$ | 13 | 5-18-50 | 3 | 5 | Dr | | 5 | D | Well pumped 6 hours by driller. |
| 21 | J. S. Fink | 830 | | 34 | | | | | | | Dv | | 1½ | D | |
| 22 | J. S. Fink | 830 | | 308 | ss | $M_c$ | 39.48 | 11- 5-51 | | | Dr | | 8 | | Abandoned oil and gas well. |
| 23 | Harold Lees | 840 | | 165 | | | | | | | Dr | Dwe | 5 | D | |
| 24 | Harold Lees | 840 | | 30 | | | | | | | Dv | H | 1½ | | 53° F. Well not used. |
| 25 | Mary Haluczik | 903 | | 54 | | | | | | | Dr | Dwe | 5 | D | |
| 26 | Arthur Nieburger | 947 | | 24 | | | 20.66 | 11- 5-51 | | | Dug | Swe | 36 | D | |
| 27 | Mitchell | 953 | | | | | | | | | Dr | H | 5 | D | 53° F. |
| 28 | Edward Bogent | 978 | | 25 | | | 9.59 | 11- 6-51 | | | Dug | H | 36 | D | |
| 29 | Paul McDowell | 912 | | 18 | | | 10 | 11- 7-51 | | | Dv | H | 1½ | D | 55° F. |
| 30 | Ben Tyrer | 931 | | 11 | | | 6.91 | 11- 7-51 | | | Dug | H | 36 | D | |
| 31 | Arthur Jones | 957 | | 11 | | | 6.69 | 11- 7-51 | | | Dug | Swe | 36 | D | Ray Kirkpatrick (T). |
| 32 | Lawrence Jones | 940 | | 150 | | | 45 | 11- 7-51 | | | Dr | Dwe | 6 | D | |
| 33 | Levi Montgomery | 858 | | 21 | | | 10.69 | 11- 7-51 | | | Dug | H | 24 | D | |
| 34 | C. A. Darkes | 922 | | | | | | | | | Dr | H | | D | 52° F. |
| 35 | Fred Davis | 877 | | 25 | | | | | | | Dv | Swe | 1½ | D | |
| 36 | R. E. Dunn | 1013 | | 161 | | | | | | | Dr | Dwe | 5 | D | |
| 37 | C. S. Gleckler | 1017 | | 36 | | | 23.71 | 11-13-51 | | | Dug | H | 36 | DS | 52° F. |
| 38 | Warman | 1078 | | 137 | | | | | | | Dr | Dwe | 5 | D | |
| 39 | W. A. Davidson | 1006 | | 127 | | | | | | | Dr | Dwe | 5 | D | |
| 40 | R. Ayers | 981 | | 117 | | | | | | | Dr | Dwe | 5 | D | |
| 41 | Darnes | 947 | | 115 | | | | | | | Dr | Dwe | 4 | D | |
| 42 | W. Redman | 928 | | 106 | | | | | | | Dr | H | 5 | D | 53° F. |
| 43 | D. B. Holtz | 943 | | 23 | | | 13.90 | 11-13-51 | | | Dug | H | 36 | D | |
| 44 | H. A. Thompson | 920 | | 95 | | | 57 | 11-13-51 | | | Dr | Dwe | 6 | DS | |
| 45 | F. S. Baker | 835 | | 15 | | | 11.75 | 11-13-51 | | | Dug | Swe | 36 | D | 53° F. |
| 46 | Crawford | 843 | | 100+ | | | | | | | Dr | H | 6 | D | 52° F. Loughman (T). |
| 47 | John Niebarger Jr. | 813 | | 120 | | | | | | | Dr | Dwe | 6 | D | |
| 48 | C. W. Niebarger | 855 | | 120 | | | 54.32 | 11-14-51 | | | Dr | H | 4 | | Well not used. |
| 49 | Wollard | 842 | | 100 | | | 24.07 | 11-14-51 | | | Dr | | 5 | | Well not used. |
| 50 | Robert Bounds | 890 | | 182 | | | 24.49 | 11-14-51 | | | Dr | H | 4 | DS | 53° F. |
| 51 | Jo Walters | 895 | | 32 | | | | | | | Dv | H | 1½ | D | 50° F. |
| 52 | Marie Hickey | 795 | | 30 | | | 21.50 | 11-15-51 | | | Dug | Swe | 36 | S | 54° F. |
| 53L | Madison School House | 792 | 206 | 210 | ss | $M_c$ | | 12- 6-51 | | | Dr | Dwt | 8 | PS | Well flows. |
| 54L | George Lovell | 810 | 170+ | 170 | s & g | Gla | 12 | 12- 4-50 | 18 | 10 | Dr | Dwe | 5 | D | Well pumped 1 hour by driller. |
| 55L | Bero Brothers | 847 | 190+ | 190 | g | Gla | 40 | 6-23-52 | | | Dr | Dwe | 5 | Ind | |
| 56L | Warren Darnes | 890 | 42 | 255 | ss | $M_c$ | 102 | 6-23-52 | | | Dr | H | 4 | D | 53° F. |
| 57L | Newark Telephone Co. | 803 | 56+ | 56 | g | Gla | 18 | 6-23-52 | | | Dr | Dwe | 4 | D | 60° F. |
| 58L | Carl E. Tate | 1052 | 42 | 97 | ss | $M_c$ | 62.50 | 6-23-52 | | | Dr | | 4 | | Well not used. |
| MARY ANN TOWNSHIP | | | | | | | | | | | | | | | |
| 1 | Grange Hall | 879 | | 32 | g | Gla | 4.93 | 10-23-51 | | | Dr | H | 5 | D | 53° F. |
| 2L | Nethers | 900 | 126 | 152 | ss | $M_c$ | | | | | Dr | | 5 | D | |
| 3 | Homer Roe | 920 | | 81 | | | 42.24 | 10-23-51 | | | Dr | H | 5 | D | 51° F. |
| 4L | Jack Nolon | 1000 | 5 | 170 | ss | $M_c$ | 37 | 10- -49 | | | Dr | Dwe | 5 | | 52° F. |
| 5L | Mary Ann School | 874 | 103+ | 103 | g | Gla | 18 | 4- 5-49 | 21 | 18 | Dr | Dwe | 5 | PS | |
| 6L | Russel Goble | 1043 | 22 | 88 | ss | $M_L$ | 39.33 | 12- 2-48 | 5 | | Dr | | 4 | D | Well pumped dry in ½ hour by driller. |
| 7 | Swinehart | 985 | 28 | 52 | ss | $M_L$ | 14.80 | 11-24-48 | 12 | 1 | Dr | Dwe | 4 | D | Well pumped ½ hour by driller. |
| 8 | D. A. Benner | 980 | | 129 | | | 50 | 10-25-51 | | | Dr | Dwe | 5 | D | |
| 9 | Minnie Rice | 998 | | | | | | | | | Dr | Dwe | | D | |
| 10 | Frank Jones | 920 | | | | | | | | | Dv | Swe | 1½ | D | 55° F. |
| 11 | Franklin Wilkin | 898 | | 22 | | | 19 | 10-25-51 | | | Dv | Swe | 1½ | D | |
| 12 | K. I. Priest | 896 | | | | | 29 | 10-25-51 | | | Dv | Swe | 1½ | DS | |
| 13 | Lon Banks | 900 | | 62 | | | | | | | Dr | H | 5 | DS | 53° F. |
| 14 | Stanton Wilson | 916 | | 65 | | | | | | | Dr | H | 5 | D | |
| 15 | Wm. Stricker | 857 | | 19 | | | | | | | Dv | Swe | 1½ | D | |
| 16 | H. C. Marmie | 858 | | 33 | | | | | | | Dv | H | 1½ | D | 52° F. |
| 17 | Paul Miller | 857 | | | | | | | | | Dr | H | 6 | D | 53° F. |
| 18 | G. Hazelett | 917 | | | | | 9.03 | 10-29-51 | | | Dr | H | 4 | | Well not used. |
| 19 | Harold Richard | 925 | | 50 | | | | | | | Dr | Dwe | 5 | DS | |
| 20 | Cora Hoyt | 900 | | 15 | | | 12.02 | 10-29-51 | | | Dug | H | 36 | D | |
| 21 | Homer Warthen | 885 | 55 | 65 | ss | $M_c$ | 2.95 | 6-20-52 | | | Dr | Dwe | 5 | D | 54° F. |
| 22 | William Bevard | 1055 | | 92 | | | 42.86 | 10-30-51 | | | Dr | H | 4 | DS | 52° F. |
| 23 | Bishop | 973 | | | | | | | | | Dr | Dwe | | D | |
| 24 | Bertha Pound | 982 | | | | | | | | | Dr | Dwe | | D | Wayne Jones (T). |
| 25 | Bertha Pound | 963 | | 30 | | | | | | | Dv | Swe | 1½ | D | |
| 26 | Jones | 863 | | 8 | | | 1.86 | 10-30-51 | | | Dug | | 48 | | 51° F. Well not used. |
| 27 | B. Moore | 892 | | 22 | | | 5 | 10-30-51 | | | Dv | Swe | 1½ | D | |
| 28 | Walter Balo | 1028 | | 35 | | | 25.29 | 10-30-51 | | | Dug | H | 36 | D | |
| 29 | John Levingston | 1045 | | 37 | | | 24.94 | 10-30-51 | | | Dug | H | 48 | D | 52° F. |
| 30 | Kenneth Yost | 893 | | 68 | | | | | | | Dr | Dwe | | D | Well flows in spring. |

Table 17.--Records of wells in Licking County, Ohio

| Well number | Owner or Name | Elevation at well (feet above sea level) | Depth to bedrock (feet) | Depth of well (feet) | Principal water-bearing bed | | Water level | | Yield | | Type of well | Type of pump | Diameter of well (inches) | Use | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Character of material | Geologic horizon | Below land surface (feet) | Date | Rate (g.p.m.) | Drawdown (feet) | | | | | |
| MARY ANN TOWNSHIP (continued) | | | | | | | | | | | | | | | |
| 31 | Leroy Robinson | 1162 | | 113 | | | 73.68 | 10-31-51 | | | Dr | H | 5 | D | $55^{\circ}$ F. |
| 32 | Donald Romine | 837 | | 19 | | | 18 | 10-31-51 | | | Dv | Swe | 1¼ | D | $53^{\circ}$ F. |
| 33 | Bob Levingston | 850 | | 100 | | | 18 | 10-31-51 | | | Dr | Dwe | 6 | D | |
| 34 | Tom Levingston | 827 | | 22 | | | 10 | 10-31-51 | | | Dr | Dwe | 6 | D | |
| 35 | Daley Goat Farm | 835 | 22 | 22+ | ss | $M_c$ | | | | | Dr | | | DS | $53^{\circ}$ F. Well flows in winter. |
| 36L | D. W. Pound | 1115 | 9 | 186 | ss | $M_c$ | 69 | 6-20-52 | 10 | 50 | Dr | Dwe | 5 | D | $56^{\circ}$ F. Well pumped 1 hour by driller. |
| 37 | H. R. Broseus | 1127 | | 97 | | | | | | | Dr | H | 5 | D | $52^{\circ}$ F. |
| MCKEAN TOWNSHIP | | | | | | | | | | | | | | | |
| 1L | Kilgore Explosive Mfg. | 988 | 5 | 380 | sh | $M_c$ | | | | | Dr | | 6 | | Dry hole. |
| 2L | Kilgore Explosive Mfg. | 950 | 63+ | 63 | g | Gla | 58.67 | 5-13-40 | 200 | 2 | Dr | Dwt | 10 | Ind | Well pumped 1 hour by driller. Plant closed. |
| 3L | Forest Ashcraft | 976 | 58+ | 58 | g | Gla | 45 | 7-20-50 | 42 | 2 | Dr | Dwe | 5 | D | Well pumped 1 hour by driller. |
| 4L | J. R. Rauch | 1007 | 25 | 44 | ss | $M_c$ | 22 | 4-30-51 | 12 | 10 | Dr | | 5 | D | Well pumped 1 hour by driller. |
| 5L | D. Wyth | 1175 | 70+ | 70 | s & g | Gla | 45 | 7-24-48 | 10 | 25 | Dr | Dwe | 5 | D | S. L. Victor (T). Well pumped 3 hour by driller. |
| 6L | F. Varner | 1023 | 94 | 131 | ss | $M_c$ | 32 | 11- 7-48 | | | Dr | Dwe | 5 | D | |
| 7L | Frederick Smith | 1205 | 8 | 186 | ss | $M_c$ | 62 | 3-30-50 | 6 | 6 | Dr | Dwe | 5 | D | |
| 8L | Russel Hoar | 1138 | 48+ | 48 | g | Gla | 30 | 1-17-49 | 20 | 10 | Dr | Dwe | 6 | D | Well pumped 1 hour by driller. |
| 9L | John Gibbid | 1061 | 111+ | 111 | g | Gla | 60.33 | 6-16-48 | | | Dr | Dwe | 5 | D | |
| 10L | Bob Welsh | 1132 | 23 | 135 | ss | $M_c$ | 35 | 5- 8-50 | 5 | 25 | Dr | Dwe | 5 | D | Well pumped 1 hour by driller. |
| 11L | F. M. Ryan | 1210 | 30 | 132 | ss | $M_c$ | 28 | 7-28-50 | | | Dr | Dwe | 5 | D | |
| 12L | G. J. Thomas | 1039 | 20 | 86 | ss | $M_c$ | 24 | 6-18-52 | | | Dr | Dwe | 4 | D | $54^{\circ}$ F. |
| 13L | Minnie Hupp | 1145 | 20 | 92 | ss | $M_c$ | 59.58 | 6-20-52 | | | Dr | Dwe | 5 | D | $54^{\circ}$ F. |
| 14L | George Rhodenbush | 997 | 50+ | 50 | g | Gla | 43.50 | 6-20-52 | | | Dr | Dwe | 5 | D | |
| 15L | G. K. Nash | 1250 | 30 | 122 | ss | $M_L$ | 100 | 6-20-52 | | | Dr | Dwe | 5 | D | $55^{\circ}$ F. |
| 16L | Frank Powell | 1283 | 200 | 261 | ss | $M_c$ | 103 | 6-20-52 | | | Dr | Dwe | 4 | D | $51^{\circ}$ F. |
| 17L | Charles Roberts | 1093 | 132+ | 132 | g | Gla | 43.15 | 6-20-52 | | | Dr | H | 5 | D | $54^{\circ}$ F. |
| 18 | R. A. Conter | 1039 | | 35 | | | 7.90 | 8-13-52 | | | Dr | Swe | 5 | DS | $53^{\circ}$ F. |
| 19 | R. Kreager | 1121 | | 160 | | | 90 | 8-13-52 | | | Dr | Dwe | 5 | DS | |
| 20 | H. Harris | 1220 | | 140 | | | 100 | 8-13-52 | | | Dr | Dwe | 4 | DS | $52^{\circ}$ F. |
| 21 | C. B. Freas | 1162 | | 150 | | | 50 | 8-12-52 | | | Dr | Swe | 5 | D | $54^{\circ}$ F. |
| 22 | C. Sasser | 1202 | | 180+ | | | 80 | 8-13-52 | | | Dr | Dwe | 4 | DS | $53^{\circ}$ F. |
| 23 | W. Lantz | 1045 | | 75 | | | 50 | 8-14-52 | | | Dr | Dwe | 4 | DS | $52^{\circ}$ F. |
| 24 | A. Stickle | 1240 | | 93 | | | 34 | 8-14-52 | | | Dr | Dwe | 4 | D | $53^{\circ}$ F. Also has a dug well and a spring. |
| 25 | W. D. Smith | 1281 | | 125 | | | 52 | 8-13-52 | | | Dr | Dwe | 5 | D | |
| 26 | J. A. Black | 1057 | | 33 | | | 7 | 8-14-52 | | | Dr | Swe | 5 | DS | $53^{\circ}$ F. Also has two springs. |
| 27 | R. Billman | 975 | | 85 | | | 15 | 8-14-52 | | | Dr | Dwe | 5 | DS | $52^{\circ}$ F. |
| 28 | M. Hankinson | 1146 | | 22 | | | 17 | 8-14-52 | | | Dug | H | 36 | DS | $52^{\circ}$ F. |
| 29 | Schaffer | 1040 | | 52 | | | 35 | 8-14-52 | | | Dr | Dwe | 4 | D | |
| 30 | W. A. McDaniel | 1063 | | 24 | | | | | | | Dr | Swe | 5 | DS | $55^{\circ}$ F. |
| 31 | R. Keckley | 1183 | 30 | 136 | ss | $M_c$ | 36 | 8-13-52 | | | Dr | Dwe | 4 | DS | $51^{\circ}$ F. |
| 32 | R. Rhodeback | 1083 | | 22 | | | 15 | 8-12-52 | | | Dug | Swe | 36 | DS | $53^{\circ}$ F. Also has a spring. |
| 33 | C. M. Neldon | 1163 | | 20 | | | 13.20 | 8-12-52 | | | Dug | H | 36 | DS | $53^{\circ}$ F. |
| 34 | A. R. Boyd | 1224 | | 100 | | | 60 | 8-12-52 | | | Dr | Dwe | 5 | DS | $52^{\circ}$ F. Also has a spring. |
| 35 | W. A. Cooper | 1135 | 12 | 102 | ss | $M_c$ | 38 | 8-12-52 | | | Dr | Dwe | 5 | | $54^{\circ}$ F. |
| 36 | T. W. Dodrill | 1127 | | 175 | | | 2 | 8-12-52 | | | Dr | Dwe | 4 | DS | |
| 37 | Atherton | 1304 | | 200 | | | 60 | 8-12-52 | | | Dr | Dwe | 4 | DS | $53^{\circ}$ F. |
| 38 | Dodsworth | 1162 | | 10 | | | 6 | 8-12-52 | | | Dug | Swe | 36 | DS | $54^{\circ}$ F. |
| 39 | W. Stevens | 1087 | | 44 | | | 18 | 8-12-52 | | | Dr | Dwe | 4 | DS | |
| 40 | O. Neighbarger | 1105 | | 97 | | | 30 | 8-13-52 | | | Dr | H | 4 | D | $53^{\circ}$ F. |
| 41 | C. M. Rhodebush | 1018 | | 61 | | | 22 | 8-11-52 | | | Dr | H | 5 | | $52^{\circ}$ F. |
| 42 | E. Noble | 1028 | | 80 | | | | | | | Dr | H | 5 | DS | $54^{\circ}$ F. |
| 43 | Mr. Robinson | 1042 | | 18 | | | 12 | 8-11-52 | | | Dug | H | | DS | $52^{\circ}$ F. R. Bruce (T). |
| 44 | J. S. Grahm | 1117 | | 150 | | | 15 | 8-11-52 | | | Dr | Dwe | 5 | DS | $50^{\circ}$ F. |
| 45 | J. Poste | 1003 | | 41 | | | 20.80 | 8- 6-52 | | | Dr | H | 4 | DS | $53^{\circ}$ F. Also has three springs. |
| 46 | J. Poste | 1017 | | 56 | | | 27.21 | 8- 7-52 | | | Dr | H | 5 | DS | $53^{\circ}$ F. F. Grubaugh (T). |
| 47 | Severe | 1039 | | 112 | | | 5 | 8- 7-52 | | | Dr | H | 5 | S | $52^{\circ}$ F. Also has a spring. |
| 48 | E. Ledbetter | 1193 | | 200 | | | | | | | Dr | Dwe | 4 | D | $53^{\circ}$ F. |
| 49 | S. L. Runnels | 1222 | | 24 | | | 15.10 | 7-23-52 | | | Dug | H | 36 | DS | $54^{\circ}$ F. |
| MONROE TOWNSHIP | | | | | | | | | | | | | | | |
| *1L | Noah Blamer | 1122 | 130 | 132 | ss | $M_c$ | 22 | 2-21-49 | 10 | 8 | Dr | Dwe | 5 | S | Well pumped 24 hours by driller |
| 2L | R. E. Smith | 1121 | 72+ | 72 | g | Gla | 15 | 7- 2-48 | 10 | 5 | Dr | Dwe | 5 | D | |
| 3L | K. E. Woltz | 1143 | 164 | 200 | ss | $M_c$ | 65 | 1-10-48 | 10 | 1 | Dr | Dwe | 4 | D | $53^{\circ}$ F. |
| 4L | Don. R. Perkins | 1162 | 110+ | 110 | g | Gla | 35 | 11- 8-48 | 5 | 40 | Dr | Dwe | 4 | S | |
| 5L | J. M. Deitrich | 1141 | 188+ | 188 | g | Gla | 90 | 1-19-48 | 5 | 30 | Dr | Dwe | 4 | D | |
| 6L | Floyd Carlock | 1116 | 145 | 202 | ss | $M_c$ | 62 | 6- 4-48 | 6 | ½ | Dr | Dwe | 4 | D | $55^{\circ}$ F. |
| 7L | Herman Wright | 1142 | 268+ | 268 | s | Gla | 65 | 6-22-48 | 6 | ½ | Dr | Dwe | 4 | D | |
| 8L | Lester Piper | 1149 | 187 | 210 | ss | $M_c$ | 28 | 1-18-50 | 10 | 6 | Dr | Dwe | 4 | | Albert Piper (T). |
| 9L | Dwight Smith | 1132 | 104 | 243 | sh | $M_c$ | 48 | 12-30-49 | 7 | 70 | Dr | Dwe | 5 | D | Well pumped 1 hour by driller. |
| 10L | Village of Johnstown | 1163 | 309+ | 309 | g | Gla | 100 | 5- 5-44 | | | Dr | Dwt | 8 | PS | $52^{\circ}$ F. |
| 11L | R. F. Ross | 1126 | 154+ | 154 | g | Gla | 49 | 2-10-49 | 5 | ½ | Dr | Dwe | 4 | D | H. C. Harrison (T). |
| 12 | R. D. Shea | 1160 | 409+ | 409 | g | Gla | | | | | Dr | | | | Well not used. |
| 13L | Howey Barcus | 1143 | 218+ | 218 | g | Gla | 40 | 9-16-51 | | | Dr | Dwe | 5 | | |
| 14 | Toy Sheets | 1142 | 99+ | 99 | s | Gla | 48 | 10-31-51 | 10 | 1 | Dr | Dwe | 4 | D | |
| 15 | F. J. Nesser | 1122 | | 187 | | | 57 | 7-17-52 | | | Dr | Dwe | 4 | DS | $50^{\circ}$ F. |
| 16 | J. R. Swich Bros. | 1144 | | 20 | | | 2 | 7-17-52 | | | Dug | H | 36 | D | $53^{\circ}$ F. |
| 17 | Hendrick | 1145 | | 100 | | | 41.50 | 7-17-52 | | | Dr | H | 4 | D | $55^{\circ}$ F. |
| 18 | E. Searofs | 1112 | | 36 | | | 22 | 7-17-52 | | | Dug | Swe | 36 | DS | |
| 19 | C. L. Clark | 1123 | | 22 | | | 13.22 | 7-17-52 | | | Dug | H | 36 | DS | $52^{\circ}$ F. |
| 20 | C. L. Phalen | 1103 | | 25 | | | 18.72 | 7-17-52 | | | Dug | H | 36 | S | $50^{\circ}$ F. |
| 21 | L. W. Rice | 1141 | | 185 | | | 80 | 7-17-52 | | | Dr | Dwe | 5 | DS | |

Table 17.--Records of wells in Licking County, Ohio

| Well number | Owner or Name | Elevation at well (feet above sea level) | Depth to bedrock (feet) | Depth of well (feet) | Principal water-bearing bed: Character of material | Principal water-bearing bed: Geologic horizon | Water level: Below land surface (feet) | Water level: Date | Yield: Rate (g.p.m.) | Yield: Drawdown (feet) | Type of well | Type of pump | Diameter of well (inches) | Use | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MONROE TOWNSHIP (continued) | | | | | | | | | | | | | | | |
| 22 | J. Wright | 1103 | | 130 | | | 64 | 7-18-52 | | | Dr | Dwe | 4 | S | |
| 23 | O. E. Noble | 1078 | | 29 | | | | | | | Dr | Swe | 4 | DS | $49^{\circ}$ F. |
| 24 | Newton Conard | 1104 | | 160 | | | 60 | 7-18-52 | | | Dr | Dwe | 4 | DS | $54^{\circ}$ F. |
| 25 | Floyd Parkinson | 1133 | | 20 | | | 8.30 | 7-18-52 | | | Dug | Swe | 36 | DS | |
| 26 | C. Heskett | 1141 | | 29 | | | 9.27 | 7-18-52 | | | Dug | H | 36 | D | $52^{\circ}$ F. |
| 27 | E. E. Skeens | 1131 | | 25 | | | 9.22 | 7-19-52 | | | Dug | Swe | 36 | DS | $53^{\circ}$ F. |
| 28 | J. S. Brockman | 1109 | | 38 | | | 17.51 | 7-19-52 | | | Dr | Swe | 4 | D | $52^{\circ}$ F. |
| 29 | E. Hisey | 1135 | | 19 | | | 12 | 7-19-52 | | | Dug | H | 36 | DS | $52^{\circ}$ F. |
| 30 | H. F. Parr | 1120 | | 114 | | | 9 | 7-17-52 | | | Dr | Dwe | 4 | DS | $54^{\circ}$ F. |
| 31 | I. Weaver | 1121 | | 20 | | | 18 | 7-18-52 | | | Dug | H | 36 | DS | $55^{\circ}$ F. Well goes dry in summer. |
| 32 | Kirby Barrick | 1141 | | 28 | | | 16 | 7-18-52 | | | Dug | Swe | 36 | S | |
| 33 | Dugan | 1100 | | | | | | | | | Dug | H | 36 | D | $54^{\circ}$ F. |
| 34 | J. Butsko | 1116 | | 98 | | | 22.81 | 7-18-52 | | | Dr | Dwe | 4 | DS | |
| 35 | A. Ashbrook | 1154 | | 90 | | | 30 | 7-21-52 | | | Dr | Dwe | 4 | DS | $51^{\circ}$ F. |
| 36 | H. J. Snider | 1144 | | 40 | | | 18 | 7-21-52 | | | Dr | H | 6 | DS | $52^{\circ}$ F. |
| 37 | G. A. Humphrey | 1175 | | 26 | | | 18.92 | 7-21-52 | | | Dug | Swe | 36 | DS | $52^{\circ}$ F. |
| 38 | Vern Davis | 1175 | | 26 | | | 19.73 | 7-21-52 | | | Dug | H | 36 | D | $52^{\circ}$ F. |
| 39 | N. Stagg | 1158 | | 17 | | | 13 | 7-21-52 | | | Dug | H | 36 | DS | $53^{\circ}$ F. |
| 40 | Van Fossen | 1162 | | 19 | | | 14.50 | 7-21-52 | | | Dug | Swe | 36 | DS | $53^{\circ}$ F. Clark (T). |
| 41 | R. J. McInturf | 1184 | | 183 | | | 90 | 7-21-52 | | | Dr | Dwe | 4 | DS | $52^{\circ}$ F. Also has a dug well. |
| 42 | W. Bowen | 1141 | | 18 | | | 15 | 7-21-52 | | | Dug | H | 36 | D | $51^{\circ}$ F. Also has a spring. |
| 43 | Mr. Miller | 1147 | | 70 | | | 32 | 7-21-52 | | | Dr | Dwe | 4 | DS | $56^{\circ}$ F. Joe Hubbard (T). |
| 44 | W. Davis | 1121 | | 45 | | | 27 | 7-21-52 | | | Dug | Dwe | 40 | DS | $54^{\circ}$ F. |
| 45 | Mr. Eichert | 1164 | | 21 | | | 16.50 | 7-21-52 | | | Dug | Swe | 36 | DS | $54^{\circ}$ F. Orndorf (T). |
| 46 | Mr. E. E. Collins | 1154 | | 20 | | | 14.90 | 7-21-52 | | | Dug | Swe | 36 | D | $53^{\circ}$ F. R. Ross (T). |
| NEWARK TOWNSHIP | | | | | | | | | | | | | | | |
| 1 | Lloyd Ford | 873 | 65+ | 65 | s | Gla | 21 | 8-18-50 | 12 | 10 | Dr | Dwe | 5 | D | Well pumped 1 hour by driller. |
| 2 | State Highway Dept. | 870 | 8 | 75 | sh | $M_c$ | 16.87 | 9-24-51 | | | Dr | H | 5 | PS | $54^{\circ}$ F. |
| 3L | G. L. Kemmitzer | 855 | 54+ | 54 | g | Gla | 41 | 7-10-50 | 42 | 2 | Dr | Dwe | 5 | D | Well pumped 1 hour by driller. |
| 4 | Wilbur Cochran | 853 | 41+ | 41 | g | Gla | 23.16 | 1-17-49 | 2 | 1 | Dr | Swe | 4 | | Well pumped 1 hour by driller. |
| 5 | Mound Builder C. Club | 895 | 32+ | 32 | g | Gla | 17.50 | 11-13-50 | | | Dr | H | 4 | | $54^{\circ}$ F. |
| 6L | Tuberculosis Hospital | 900 | 70 | 122 | ss | $M_c$ | 26 | 12-28-47 | | | Dr | Dwe | 5 | S | $52^{\circ}$ F. |
| 7L | Bernard Sullivan | 970 | 110 | 120 | sh | $M_c$ | 46 | 9-26-48 | 6 | 20 | Dr | Dwe | 5 | D | Well pumped 3 hours by driller. |
| 8 | Price | 925 | | 126 | | | | | | | Dr | Dwe | 5 | D | $57^{\circ}$ F. |
| 9 | Orr Gist | 925 | | 132 | | | 20 | 10- 2-51 | | | Dr | Dwe | 4 | D | |
| 10 | James Rizzo | 865 | 44+ | 44 | g | Gla | 12 | 4-26-48 | 15 | 12 | Dr | Swe | 5 | D | Well pumped 2 hours by driller. |
| 11 | B. C. Keller | 893 | | 67 | | | | | | | Dr | Dwe | 4 | DS | Well pumped 1 hour by driller. |
| 12 | Mary & Elizabeth Owens | 878 | 78+ | 78 | g | Gla | 30.84 | 9-26-47 | 14 | 1 | Dr | Dwe | 4 | D | Well pumped 1 hour by driller. |
| 13L | Ferris-Owens Potato Farm | 858 | 98+ | 98 | s & g | Gla | 8 | 2-17-50 | 600 | 10 | Dr | Dwt | 10 | Irr | $56^{\circ}$ F. Rate of pumpage for 18 hours. |
| 14 | David Dingledge | 885 | 92+ | 92 | s & g | Gla | 35 | 10-20-49 | 28 | 3 | Dr | Dwe | 5 | DS | Well pumped 1 hour by driller. |
| 15 | John Kane | 874 | 51+ | 51 | g | Gla | 20.58 | 12-15-49 | 15 | 1 | Dr | Dwe | 4 | D | Well pumped ½ hour by driller. |
| 16 | Eugene Cunningham | 874 | 47+ | 47 | g | Gla | 21 | 6- 2-49 | 15 | 1 | Dr | Dwe | 4 | D | Well pumped 1 hour by driller. |
| 17 | Ora Warner | 874 | 45+ | 45 | g | Gla | 19.84 | 8-24-49 | 15 | 1 | Dr | Swe | 4 | D | Well pumped ½ hour by driller. |
| 18L | Chumsy Hess | 874 | 79+ | 79 | g | Gla | 30.50 | 4- 4-49 | | | Dr | Dwe | 5 | D | |
| 19L | C. O. Slotterbeck | 893 | 35+ | 35 | g | Gla | 15 | 10- 3-51 | | | Dr | Swe | 5 | D | |
| 20 | L. R. Stebelton | 965 | 32+ | 32 | s & g | Gla | 24 | 10- 3-51 | | | Dr | Swe | | D | |
| 21 | Herman Sigler | 886 | 40+ | 40 | s & g | Gla | | | | | Dv | H | 1½ | D | $54^{\circ}$ F. |
| 22 | North Park Dairy | 876 | | 90 | | | | | | | Dr | Dwe | 5 | S | |
| 23L | City of Newark | 842 | 123 | 134 | sh | $M_c$ | | | | | Dr | | 5 | | Test well. Covered. |
| 24 | City of Newark | 842 | 104+ | 104 | t | Gla | | | | | Dr | | 5 | | Test well. Covered. |
| 25L | Wayne Dankemer | 957 | 235+ | 235 | t | Gla | 120 | 8- -49 | 6 | 90 | Dr | Dwe | 5 | D | Well not used. |
| 26 | Crone | 960 | | 191 | | | 65.61 | 10- 4-51 | | | Dr | | 5 | | Well not used. |
| 27 | Wayne Dankemer | 925 | | 48 | | | | | | | Dr | Dwe | 5 | D | |
| 28 | Lewis E. Bailey | 910 | | 40 | | | | | | | Dr | Swe | 5 | D | |
| 29 | J. M. Miller | 878 | 95+ | 95 | g | Gla | | 6- 7-50 | | | Dr | Dwe | 5 | D | |
| 30 | Mr Johnson | 898 | | | | | | | | | Dug | Swe | 36 | D | D. L. Wince (T). |
| 31 | Perry White | 895 | | 200 | | | | | | | Dr | Dwe | 5 | D | $56^{\circ}$ F. |
| 32 | Macklin | 1007 | 21 | | | | 16.78 | 10- 5-51 | | | Dug | Swe | 22 | DS | |
| 33 | Macklin | 1006 | | 80 | | | 70.67 | 10- 5-51 | | | Dr | | 4 | | Well not used. |
| 34 | U.S.A.F. Supply Depot | 895 | 131+ | 131 | s & g | Gla | | | 350 | | Dr | Dwt | 26 | Ind | Pumped 3½ hours to fill 250,000-gal. storage tank. |
| 35 | C. E. Street | 1041 | | 70 | | | | | | | Dr | Dwe | 4 | D | |
| 36 | James Hughes | 1000 | | 88 | | | | | | | Dr | Dwe | 4 | D | |
| 37 | U.S.A.F. Supply Depot | 895 | 146+ | 146 | s & g | Gla | | | 500 | | Dr | Dwt | 26 | Ind | Pumped 3½ hours to fill 250,000-gal. storage tank. |
| 38 | Paul Smith | 940 | | 115 | | | | | | | Dr | Dwe | 5 | D | |
| 39L | U.S.A.F. Supply Depot | 895 | 167+ | 167 | s & g | Gla | | | 350 | | Dr | Dwt | 26 | Ind. | Pumped 3½ hours to fill 250,000-gal. storage tank. |
| 40 | Jesse Baugtman | 941 | 100 | 138 | sh | $M_c$ | 67 | 7-25-48 | 15 | 20 | Dr | Dwe | 5 | D | |
| 41 | B. Gauman | 950 | 110 | 115 | ss | $M_c$ | 45 | 8-24-50 | 12 | 20 | Dr | Dwe | 5 | D | Well pumped 1 hour by driller. |
| 42 | John A. Jones | 895 | 32+ | 32 | s & g | Gla | 16.33 | 11- 6-47 | 20 | 1 | Dr | Swe | 5 | D | Well pumped ½ hour by driller. |
| 43 | A. M. Young | 870 | | 85 | | | | | | | Dr | Dwe | 5 | D | |
| 44 | Francis B. Pope | 860 | 47+ | 47 | s & g | Gla | 7.87 | 10- 9-51 | 1 | 9 | Dr | H | 4 | D | $55^{\circ}$ F. Well pumped 1 hour by driller. |
| 45 | LeSavoy Industries | 862 | 68+ | 68 | s & g | Gla | 21.11 | 10- 9-51 | 600 | 26 | Dr | Dwt | 26 | Ind | Well not used. |
| 46 | LeSavoy Industries | 862 | 66+ | 66 | s & g | Gla | 20.10 | 10- 9-51 | | | Dr | Dwt | 26 | Ind | Well not used. |
| *47L | Rockwell Spring & Axle Co | 876 | 226+ | 206 | s & g | Gla | 49.69 | 10-21-53 | 100 | 3.24 | Dr | | 6 | | $54^{\circ}$ F. Well pumped 20 hours by driller. |
| 48 | Newark Sand & Gravel Co. | 876 | 37+ | 37 | g | Gla | 8.5 | 8-11-50 | 110 | 4 | Dr | | 8 | Ind | Well pumped 2 hours by driller. |
| 49 | Newark Sand & Gravel Co. | 858 | 54+ | 54 | s | Gla | 5.50 | 10- 9-51 | 125 | 25 | Dr | | 8 | Ind | Well pumped 3 hours by driller. |
| 50L | Westinghouse | 818 | 127+ | 127 | s | Gla | | | | | Dr | | 12 | | Test well. Well covered. |
| 51 | Tectum Corp. | 820 | 148+ | 148 | g | Gla | 17.80 | 10- 9-51 | 20 | 10 | Dr | | 6 | | Well not used. |
| 52L | Tectum Corp. | 820 | 158+ | 158 | g | Gla | 17 | 7- 5-50 | 350 | 20 | Dr | Dwt | 10 | Ind | Well pumped 4 hours by driller. |
| 53 | Newark Ice & Coal Co. | 820 | 244+ | 244 | s & g | Gla | 28 | 4-12-48 | | | Dr | Dwt | 8 | Ind | |
| 54 | John Lanning | 878 | 30+ | 30 | s & g | Gla | 11 | 3-30-50 | 15 | 5 | Dr | | | | |

Table 17.--Records of wells in Licking County, Ohio

| Well number | Owner or Name | Elevation at well (feet above sea level) | Depth to bedrock (feet) | Depth of well (feet) | Principal water-bearing bed: Character of material | Principal water-bearing bed: Geologic horizon | Water level: Below land surface (feet) | Water level: Date | Yield: Rate (g.p.m.) | Yield: Drawdown (feet) | Type of well | Type of pump | Diameter of well (inches) | Use | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NEWARK TOWNSHIP (continued) | | | | | | | | | | | | | | | |
| 55L | Ralph Gebbart | 862 | 52+ | 52 | g | Gla | 24 | 7- 5-50 | 12 | 16 | Dr | Dwe | 5 | | 54° F. Well pumped 3 hours by driller |
| 56 | Ralph Gebbart | 864 | 52+ | 52 | g | Gla | 26 | 10- 9-51 | | | Dr | | 5 | | |
| 57 | Owens-Corning Fiberglass Corp. | 815 | 112+ | 112 | s & g | Gla | 16 | 9- 4-46 | 250 | 34 | Dr | Dwt | 18 | Ind | 55° F. |
| 58 | Owens-Corning Fiberglass Corp. | 815 | 141 | 142 | g | Gla | 8 | 9-20-47 | 250 | 34 | Dr | | 18 | Ind | |
| 59 | Heisey Glass Co. | 846 | 166 | 169 | ss | $M_c$ | 48.13 | 10-10-51 | | | Dr | | 10 | Ind | |
| 60L | Borden Dairy | 825 | 280+ | 280 | s & g | Gla | 23 | 8-19-47 | 350 | 2 | Dr | Dwt | 8 | Ind | 54° F. |
| 61 | Ludwig and Kibey | 841 | 50+ | 50 | s & g | Gla | 24 | 6-26-48 | 15 | 6 | Dr | Dwe | 5 | D | Well pumped 2 hours by driller. |
| 62 | Gallagher Drug Store | 830 | 158+ | 158 | g | Gla | | | 27 | 1 | Dr | Dwe | 5 | | |
| 63L | Vanatta | 900 | 178+ | 178 | g | Gla | 102 | 8- 4-48 | | | Dr | Dwe | 4 | D | |
| 64 | Howard Nichols | 805 | | 29 | | | 19 | 11- 9-51 | | | Dv | H | 1½ | D | 55° F. |
| 65L | R. Stewart | 887 | 75+ | 75 | g | Gla | 25 | 5- 7-51 | 12 | 10 | Dr | Dwe | 5 | D | Well pumped 1 hour by driller. |
| 66 | Vern Hollar | 922 | 45+ | 45 | g | Gla | 21 | 4-21-48 | 4 | | Dr | H | 5 | D | Well pumped dry in 1 hour by driller. |
| 67 | Foster Holcombe | 870 | 47+ | 47 | g | Gla | 22 | 11-10-50 | | | Dr | | 5 | D | |
| 68 | Parker Wolfe | 862 | 70 | 85 | sh | $M_c$ | 58 | 1- 4-51 | 12 | 20 | Dr | Dwe | 5 | D | Well pumped 1 hour by driller. |
| 69 | H. Baker | 865 | 48+ | 48 | g | Gla | 25 | 3- 4-52 | 12 | 3 | Dr | Dwe | 5 | DS | L. J. Westbrook (T). Well pumped 2 hours by driller. |
| 70 | Wilfred Everett | 853 | 63+ | 63 | g | Gla | 12 | 3- 2-52 | 12 | 10 | Dr | Dwe | 5 | D | Well pumped 1 hour by driller. |
| 71L | Warren Myers | 950 | 42 | 94 | ss | $M_c$ | 30 | 7-22-50 | | | Dr | Swe | 5 | D | |
| 72 | J. L. Nichols | 818 | 146+ | 146 | g | Gla | 8 | 3- 3-52 | 18 | 12 | Dr | Dwe | 5 | D | |
| 73 | R. J. Holman | 930 | 58+ | 58 | g | Gla | 42 | 12-27-47 | 10 | 1 | Dr | Dwe | 5 | D | Well pumped ½ hour by driller. |
| 74 | G. Erhard | 864 | 54+ | 54 | g | Gla | 30 | 4-24-51 | | | Dr | Dwe | 4 | D | 54° F. |
| 75L | Rock Geer | 816 | 108+ | 108 | g | Gla | | | | | Dr | Dwe | 4 | D | 58° F. |
| 76 | Charles Day | 817 | 100+ | 100 | g | Gla | 82.15 | 6-23-52 | | | Dr | H | 5 | D | |
| 77 | H. F. Gregg | 970 | 70 | 76 | ss | $M_c$ | 22 | 6-23-52 | | | Dr | Dwe | 5 | D | 58° F. |
| 78L | Rockwell Spring and Axle Co. | 843 | 56+ | 56 | g | Gla | 23.51 | 6-24-52 | | | Dr | | 6 | Ind | 52° F. Observation well during aquifer hydraulics test. |
| *79L | Rockwell Spring and Axle Co. | 833 | 50+ | 50 | g | Gla | 5.95 | 6-24-52 | | | Dr | | 6 | Ind | 52° F. Observation well during aquifer hydraulics test. |
| 80L | Rockwell Spring and Axle Co. | 843 | 55+ | 55 | g | Gla | 22.76 | 6-24-52 | | | Dr | | 6 | Ind | 52° F. Observation well during aquifer hydraulics test. |
| 81L | Newark Telephone Co. | 835 | 140+ | 140 | s & g | Gla | 17 | 10-17-53 | 50 | 25 | Dr | | 6 | PS | Well pumped 2 hours by driller. |
| 82 | Vanatta Sand and Gravel Co. | 845 | 52+ | 52 | g | Gla | 24.34 | 6-24-52 | 500 | 21 | Dr | Dwt | 10 | Ind | Well pumped ½ hour by driller. |
| 83 | R. C. Helle | 873 | 56+ | 56 | g | Gla | 25.82 | 6-24-52 | | | Dr | H | 5 | | 52° F. |
| 84 | Claire Ritchey | 855 | 55+ | 55 | g | Gla | 9 | 6-25-52 | | | Dr | Dwe | 5 | D | 50° F. |
| 85 | Edward Nelson | 841 | 42+ | 42 | s | Gla | 27 | 7-20-49 | 10 | 10 | Dr | | 5 | D | Well pumped 1 hour by driller. |
| 86 | Roy Shields | 860 | 22+ | 22 | g | Gla | 9 | 12- 9-48 | 6 | | Dr | | 4 | D | Well pumped dry in 1 hour by driller. |
| 87 | Pure Oil Co. | 884 | 180+ | 180 | s & g | Gla | 50 | 9- 3-42 | | | Dr | | | Ind | Well abandoned. |
| 88 | Pure Oil Co. | 884 | 131+ | 131 | g | Gla | 38 | 8-21-42 | | | Dr | | 26 | | Well abandoned. |
| 89L | Pure Oil Co. | 884 | 203 | 253 | g | Gla | 75 | 9- 3-42 | | | Dr | | 6 | | Test well. |
| 90L | Pure Oil Co. | 884 | 133+ | 133 | g | Gla | 35 | 9- 3-42 | | | Dr | | 6 | | State observation well. |
| 91 | Pure Oil Co. | 884 | 178+ | 178 | g | Gla | 35 | 9- 3-42 | | | Dr | | 6 | | Test well. |
| 92 | Pure Oil Co. | 884 | 185+ | 185 | s & g | Gla | 35 | 3- 7-49 | | | Dr | | 16 | | Test well. |
| 93L | Pure Oil Co. | 884 | 128+ | 128 | g | Gla | 38 | 8-21-42 | | | Dr | | 26 | | Observation well during aquifer hydraulics test. |
| 94L | Pure Oil Co. | 884 | 138+ | 138 | s & g | Gla | | 4-26-54 | 210 | | Dr | | | | 54° F. Well pumped 47½ hours during test. |
| 95 | Pure Oil Co. | 892 | 33+ | 33 | g | Gla | 4.91 | | | | Dr | | 6 | | |
| 96 | Pure Oil Co. | 892 | 41+ | 41 | s & g | Gla | 5.75 | | | | Dr | | 6 | | |
| *97L | Pure Oil Co. | 892 | 38+ | 38 | s & g | Gla | 5.08 | | | | Dr | | 6 | | |
| 98 | Pure Oil Co. | 892 | 41+ | 41 | s & g | Gla | | | | | Dr | | 6 | | |
| 99 | Pure Oil Co. | 892 | 30+ | 30 | g | Gla | | | | | Dr | | 6 | | |
| 100 | Pure Oil Co. | 892 | 39+ | 39 | g | Gla | | | | | Dr | | 6 | | |
| 101 | Pure Oil Co. | 892 | 29+ | 29 | s | Gla | | | | | Dr | | 6 | | |
| 102L | Pure Oil Co. | 892 | 38+ | 38 | s | Gla | | | | | Dr | | 6 | | |
| 103 | Pure Oil Co. | 892 | 179 | 179 | | | | | | | Dr | | 4 | | Test well. Covered. |
| 104 | Pure Oil Co. | 890 | 195 | 195 | | | | | | | Dr | | | | Test well. Covered. |
| 105 | Pure Oil Co. | 890 | 207 | 207 | | | | | | | Dr | | 4 | | Test well. Covered. |
| 106 | Pure Oil Co. | 890 | 140+ | 140 | | | | | | | Dr | | 4 | | Test well. Covered. |
| 107L | State of Ohio | 892 | 40+ | 23 | g | Gla | | | | | Dr | | 6 | | State observation well. Casing pulled back to 23 ft. |
| 108 | Kaiser Aluminum Co. | 890 | 140+ | 140 | s & g | Gla | | | | | Dr | | | | |
| 109 | Kaiser Aluminum Co. | 890 | 118+ | 118 | g | Gla | | | | | Dr | | | | |
| 110L | Kaiser Aluminum Co. | 890 | 132+ | 132 | s & g | Gla | | | | | Dr | | | | Recorder installed on well during aquifer hydraulics test at Heath Refinery. |
| 111 | Kaiser Aluminum Co. | 890 | 132+ | 132 | s & g | Gla | | | | | Dr | | | | |
| 112 | Kaiser Aluminum Co. | 890 | 141+ | 141 | s & g | Gla | | | | | Dr | | | | |
| 113 | Kaiser Aluminum Co. | 890 | 143+ | 143 | s & g | Gla | | | | | Dr | | | | |
| 114 | Kaiser Aluminum Co. | 890 | 210+ | 210 | s & g | Gla | | | | | Dr | | | | Test well. |
| 115 | Kaiser Aluminum Co. | 890 | 195+ | 195 | s & g | Gla | | | | | Dr | | | | Test well. |
| 116L | Kaiser Aluminum Co. | 890 | 254+ | 254 | s & g | Gla | | | | | Dr | | | | Test well. |
| 117 | Kaiser Aluminum Co. | 890 | 132+ | 132 | g | Gla | | | | | Dr | | | | Test well. |
| *118L | Rockwell Spring and Axle Co. | 843 | 53+ | 53 | g | Gla | | | | | Dr | Dwt | 6 | Ind | 52° F. Well pumped 47½ hours during test. |
| 119 | Rockwell Spring and Axle Co. | 843 | 47+ | 47 | g | Gla | | | | | Dr | | 6 | Ind | |
| 120 | State of Ohio | 848 | 65+ | 65 | g | Gla | | | | | Dr | | 8 | | State observation well. |

Table 17.--Records of wells in Licking County

| Well number | Owner or Name | Elevation at well (feet above sea level) | Depth to bedrock (feet) | Depth of well (feet) | Principal water-bearing bed: Character of material | Principal water-bearing bed: Geologic horizon | Water level: Below land surface (feet) | Water level: Date | Yield: Rate (g.p.m.) | Yield: Drawdown (feet) | Type of well | Type of pump | Diameter of well (inches) | Use | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NEWTON TOWNSHIP | | | | | | | | | | | | | | | |
| 1L | Paul Dillon | 900 | 68+ | 68 | g | Gla | 23.78 | 10-11-47 | 28 | 1 | Dr | Dwe | 5 | D | Well pumped ½ hour by driller. |
| 2L | N. C. Bennett | 904 | 63+ | 63 | g | Gla | 41.08 | 9-21-51 | 30 | 4 | Dr | | 5 | D | 52° F. Well pumped 1 hour by driller. |
| 3 | Clarence Stevens | 902 | 46+ | 46 | s & g | Gla | 24 | 12- 1-48 | 10 | 2 | Dr | Swe | 5 | D | Well pumped 2 hours by driller. |
| 4L | Robert Patton | 945 | 33 | 50 | ss | $M_c$ | 22.66 | 11- 2-49 | 28 | 4 | Dr | Dwe | 5 | S | Well pumped ½ hour by driller. |
| 5 | Orville Cross | 916 | 78+ | 78 | g | Gla | 31 | 10-28-47 | 28 | 6 | Dr | Dwe | 5 | D | Well pumped ½ hour by driller. |
| 6L | Richard Anderson | 916 | 72+ | 72 | g | Gla | 46 | 7- 5-50 | 12 | 5 | Dr | Dwe | 5 | D | Well pumped ½ hour by driller. |
| 7 | William Thompson | 912 | 63+ | 63 | s & g | Gla | | | 10 | 2 | Dr | | 5 | D | Well pumped 2 hours by driller. |
| 8 | Fred Glousinger | 911 | 68+ | 68 | s & g | Gla | 30 | 8-28-50 | 10 | 10 | Dr | Dwe | 5 | D | Well pumped 1 hour by driller. |
| 9 | Owen Kinney | 917 | 72+ | 72 | g | Gla | 35 | 6-23-50 | 10 | 10 | Dr | Dwe | 5 | D | Well pumped 1 hour by driller. |
| 10L | Robert Tiebout | 910 | 32 | 79 | ss | $M_c$ | 16.78 | 9-21-51 | 15 | | Dr | H | 5½ | D | 55° F. Well pumped dry by driller. |
| 11L | L. C. Black | 970 | 59+ | 59 | g | Gla | | | | | Dr | Dwe | 4 | D | |
| 12L | H. Warthen | 912 | 51+ | 51 | g | Gla | 20 | 5- 8-48 | 20 | 3 | Dr | Dwe | 5 | D | Well pumped 1 hour by driller. |
| 13 | Forest Griffith | 912 | 57+ | 57 | s & g | Gla | 32 | 5-31-50 | | | Dr | Dwe | 5 | D | |
| 14 | Frank Ranch | 918 | 44+ | 44 | g | Gla | 12 | 7- 5-50 | 20 | 6 | Dr | Swe | 5 | D | Well pumped 2 hours by driller. |
| 15 | E. J. Gaudett | 914 | | 24 | | | 12 | 10-10-51 | | | Dv | H | 3 | S | 56° F. |
| 16 | H. Hughes | 878 | 39+ | 39 | g | Gla | 22 | 5- 4-48 | 10 | 3 | Dr | Swe | 5 | D | Well pumped 1 hour by driller. |
| 17L | Jess Livingston | 912 | 79+ | 79 | g | Gla | 47 | 10-10-51 | | | Dr | Dwe | 5 | D | |
| 18 | Harry Bickle | 912 | | 63 | | | | | | | Dr | Dwe | 4 | D | |
| 19 | R. Cass | 903 | 61+ | 61 | g | Gla | 22 | 2-18-50 | 10 | 1 | Dr | Dwe | 5 | D | |
| 20 | Homer Jenkins | 1000 | | | | | | | | | Dr | Swe | 5 | D | |
| 21 | John Cornwell | 980 | | 35 | | | 20 | 10-11-51 | | | Dv | H | 1¼ | D | 53° F. |
| 22 | Ben Shirley | 922 | | 35 | | | | | | | Dv | H | 2 | D | 53° F. |
| 23 | L. O. Long | 900 | | 53 | | | | | | | Dr | H | 6 | D | |
| 24 | R. H. Hughes | 975 | | 78 | | | 44.07 | 10-11-51 | | | Dr | | | D | |
| 25 | R. H. Hughes | 965 | | 18 | | | 16.88 | 10-11-51 | | | Dug | H | | S | |
| 26 | Robert J. Hughes | 1013 | | | | | | | | | Dr | Dwe | 5 | S | 53° F. |
| 27 | G. C. Carthen | 1023 | | 100 | | | | | | | Dr | Dwe | 3 | DS | 52° F. |
| 28 | Roy Wilson | 1070 | | 135 | | | | | | | Dr | Dwe | 5 | DS | |
| 29 | J. H. Hartman | 982 | | 45 | | | 32 | 10-11-51 | | | Dv | Swe | 1¼ | DS | |
| 30 | Page Carr | 985 | | 25 | | | 19 | 10-11-51 | | | Dug | Swe | 36 | D | |
| 31 | Mr. Hoskinson | 930 | | 80 | | | | | | | Dr | Dwe | 5 | D | Paul Bailey (T). |
| 32 | Homer Van Wey | 1037 | | | | | | | | | Dr | Dwe | 5 | DS | |
| 33 | Howard McGinnis | 890 | | | | | | | | | Dr | Dwe | 5 | D | |
| 34 | Alex Miller | 1038 | | | | | | | | | Dr | Dwe | 5 | D | 52° F. |
| 35 | C. B. Wilson | 1027 | | 110 | | | | | | | Dr | Dwe | 5 | D | 52° F. |
| 36 | Harry Pound | 1010 | | 118 | | | | | | | Dr | Dwe | 6 | D | |
| 37 | Addie Pound | 1002 | | 102 | | | | | | | Dr | Dwe | 5 | DS | |
| 38 | Manny Lynn | 1010 | | 58 | | | | | | | Dr | | 5 | D | Leo Nethers (T). |
| 39 | Ford Lane | 1080 | 20 | 98 | ss | $M_c$ | 34 | 9-14-48 | 28 | 12 | Dr | Dwe | 5 | D | Well pumped 1½ hours by driller. |
| 40 | Fred Sheet | 1075 | | 91 | | | 62 | 10-15-51 | | | Dr | Dwe | 4 | D | 53° F. |
| 41 | C. D. Morrow | 1007 | | 90 | | | 20 | 10-15-51 | | | Dr | Dwe | 5 | D | |
| 42L | Earl Marple | 1003 | 5 | 100 | ss | $M_c$ | 12 | 10-15-51 | | | Dr | Dwe | 4 | D | |
| 43 | Bell | 907 | | 18 | | | | | | | Dv | Swe | 2 | DS | 53° F. |
| 44 | John Claypool | 900 | | 23 | | | | | | | Dv | Swe | 2 | D | 56° F. |
| 45 | B. H. Lingafelter | 897 | | 42 | | | | | | | Dv | Swe | 2 | D | 53° F. |
| 46 | Fraiser | 897 | | | | | | | | | Dr | Dwe | 6 | DS | 55° F. |
| 47 | Larry Love | 895 | | | | | | | | | Dr | Dwe | 6 | D | 54° F. |
| 48 | Mr. Fraiser | 897 | | | | | | | | | Dv | Swe | 2 | DS | 54° F. Fred Peters (T). |
| 49 | Osburn | 993 | | 18 | | | 12.93 | 10-16-51 | | | Dug | H | 36 | DS | 57° F. |
| 50 | Frank Stewart | 962 | | 38 | | | | 10-17-51 | | | Dv | | | DS | 52° F. Well flows. |
| 51 | William Samuelson | 1007 | | 115 | | | | | | | Dr | Dwe | 3 | DS | 52° F. |
| 52 | Mr. Samuelson | 1000 | | 37 | | | 19.60 | 10-17-51 | | | Dug | H | 36 | DS | 55° F. Don Chapman (T). |
| 53 | James Dorsey | 980 | | 59 | | | 40.36 | 10-17-51 | | | Dr | H | 4 | D | |
| 54 | Harry Eshelman | 1070 | | 106 | | | | | | | Dr | Dwe | 5 | D | |
| 55 | Harry Eshelman | 1070 | | 129 | | | | | | | Dr | Dwe | 5 | S | 53° F. |
| 56 | P. R. Giblin | 982 | | | | | | | | | Dr | Dwe | | D | 53° F. |
| 57 | F. C. Jenkins | 1000 | | 80 | | | | | | | Dr | Dwe | 6 | DS | 53° F. |
| 58 | O. E. Wright | 868 | | 39 | | | 12 | 10-18-51 | | | Dv | Swe | 1¼ | D | |
| 59 | C. S. McKinney | 875 | | 38 | | | 14 | 10-18-51 | | | Dv | Dwe | 1¼ | DS | |
| 60 | W. T. Cochran | 905 | | | | | | | | | Dr | Dwe | 6 | DS | 52° F. |
| 61 | Vanatta Gravel Co. | 874 | 39+ | 39 | g | Gla | 3.50 | 10-18-51 | | | Dr | Dwt | 10 | Ind | Well measured while being pumped. |
| 62 | Dry Creek Gravel Co. | 860 | 50+ | 50 | g | Gla | | | | | Dr | Dwt | 6 | Ind | 47° F. |
| 63 | Dry Creek Gravel Co. | 860 | 50+ | 50 | g | Gla | | | | | Dr | Dwt | 6 | Ind | 47° F. |
| 64L | Myers & Son | 925 | 55+ | 55 | g | Gla | 16.84 | 5-28-49 | 16 | 1 | Dr | H | 4 | DS | Well pumped ½ hour by driller. |
| 65L | Jim Reynolds | 878 | 44+ | 44 | g | Gla | 20 | 2- 1-51 | 12 | 5 | Dr | | 5 | D | Well pumped 1 hour by driller. |
| 66 | W. H. Warthen | 1098 | | | | | 75.61 | 11- 1-51 | | | Dr | | 5 | DS | |
| 67L | Fowler | 875 | 44+ | 44 | g | Gla | 15.84 | 2-13-52 | | | Dr | Swe | 5 | D | |
| PERRY TOWNSHIP | | | | | | | | | | | | | | | |
| 1L | C. M. McCown | 1067 | 4 | 270 | ss | $M_c$ | 176.60 | 12-11-51 | 20 | 15 | Dr | | 5 | | Well not used. Well pumped 1 hour by driller |
| 2L | J. L. C. Barrick | 800 | 21+ | 21 | g | Gla | 8 | 9-28-51 | 15 | 8 | Dr | Swe | 4 | D | Well pumped 1 hour by driller. |
| 3L | Ernst McKee | 815 | 16 | 41 | ss | $M_c$ | 12 | 9-28-51 | 15 | 10 | Dr | Swe | 4 | D | Well pumped 1 hour by driller. |
| 4L | C. B. Walcutt | 817 | 25 | 38 | ss | $M_c$ | 15 | 8-27-51 | | | Dr | Swe | 5 | D | |
| 5L | Emery Hitchcock | 834 | 3 | 91 | ss | $M_c$ | 40 | 5-29-50 | 20 | 36 | Dr | Dwe | 5 | D | Well pumped ½ hour by driller. |
| 6L | Howard Siddle | 808 | 50 | 62 | ss | $M_c$ | 20 | 9- 8-48 | 25 | 1 | Dr | Dwe | 5 | DS | Well pumped 1 hour by driller. |
| 7L | Richard Nagle | 895 | 8 | 28 | ss | $M_c$ | 10 | 11- 1-50 | 5 | 2 | Dr | H | 5 | D | 51° F. Well pumped 3 hours by driller. |
| 8 | Thomas S. Moran | 810 | | 85 | | | 12.22 | 6-25-52 | | | Dr | H | 5 | | 53° F. |
| 9 | O. P. Lindewood | 840 | | 65 | | | | | | | Dr | Dwe | 5 | D | 53° F. |
| 10 | Frampton | 838 | | 85 | | | | | | | Dr | Dwe | 5 | S | 53° F. |
| 11 | E. Wright | 845 | | 22 | | | 4 | 7- 1-52 | | | Dug | H | 36 | D | 56° F. |
| 12 | George Wright | 900 | | 56 | | | 12 | 7- 1-52 | | | Dr | Dwe | 5 | DS | |
| 13 | Homer Baughman | 825 | | 32 | | | 9.26 | 7- 1-52 | | | Dr | H | 5 | D | |
| 14 | James Cush | 840 | | 33 | | | | | | | Dv | Swe | 1¼ | D | |
| 15 | E. T. Young | 817 | | 120 | | | | | | | Dr | Dwe | 5 | D | 54° F. |

Table 17.--Records of wells in Licking County, Ohio

| Well number | Owner or Name | Elevation of well (feet above sea level) | Depth to bedrock (feet) | Depth of well (feet) | Principal water-bearing bed: Character of material | Principal water-bearing bed: Geologic horizon | Water level: Below land surface (feet) | Water level: Date | Yield: Rate (g.p.m.) | Yield: Drawdown (feet) | Type of well | Type of pump | Diameter of well (inches) | Use | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PERRY TOWNSHIP (continued) | | | | | | | | | | | | | | | |
| 16 | McGown | 964 | | 400 | | | | | | | Dr | Dwe | 6 | D | 58° F. |
| 17 | W. E. Osborn | 883 | | 16 | | | 6 | 7- 2-52 | | | Dug | Swe | 36 | D | 52° F. |
| 18 | R. F. Rector | 885 | | 32 | | | 19.85 | 7- 2-52 | | | Dug | H | 36 | DS | 51° F. |
| 19 | M. McKnight | 880 | | 210 | | | 40 | 7- 2-52 | | | Dr | Dwe | 6 | DS | 53° F. |
| ST. ALBANS TOWNSHIP | | | | | | | | | | | | | | | |
| 1 | Ed Battie | 970 | 36+ | 36 | g | Gla | 24 | 5- 8-50 | | | Dr | Swe | 4 | D | Charles Roborcomb (T). |
| 2L | Keller | 955 | 75+ | 75 | s & g | Gla | 32 | 3-20-48 | 12 | 2 | Dr | Dwe | 5 | D | Well pumped 2 hours by driller. |
| 3 | Baptist Church | 982 | 59+ | 59 | g | Gla | 37 | 3-21-48 | | | Dr | Dwe | 4 | PS | |
| *4L | Ohio Central Tel. Co. | 975 | 44+ | 44 | g | Gla | 35 | 7- 1-48 | 5 | 1 | Dr | Dwe | 4 | D | |
| *5L | Fred Hammond | 973 | 121+ | 121 | s | Gla | 30 | 8-14-48 | 6 | 23 | Dr | Dwe | 4 | D | |
| 6L | C. T. Sahr | 1235 | 135 | 160 | ss | $M_c$ | 46.85 | 2- 7-52 | | | Dr | H | 5 | D | 52° F. |
| 7L | John Tritt | 993 | 56+ | 56 | s | Gla | 44 | 9-20-50 | 5 | 1 | Dr | Swe | 4 | D | |
| 8L | D. E. Derringer | 1032 | 44+ | 44 | s | Gla | 24 | 8-25-51 | 6 | 3 | Dr | Swe | 4 | D | |
| 9L | Don Berger | 1145 | 60 | 122 | ss | $M_c$ | 23.87 | 6-17-52 | | | Dr | Dwe | 4 | D | |
| 10 | Eva Monroe | 945 | 47+ | 47 | s | Gla | 21.15 | 6-18-52 | 10 | 2 | Dr | H | 4 | D | Clark Williams (T). |
| 11L | George Emblem | 1036 | 58+ | 58 | t | Gla | 13 | 6-18-52 | | | Dr | Dwe | 4 | D | 57° F. |
| 12 | Bryan Wood | 1043 | | 32 | | | 28.92 | 7- 8-52 | | | Dug | H | 36 | D | 53° F. |
| 13 | D. Derringer | 1023 | | 40 | | | | | | | Dug | Swe | 36 | D | 53° F. P. N. Snashell (T). |
| 14 | E. Mount | 1042 | | 135 | | | 75 | 7- 8-52 | | | Dr | Dwe | 5 | DS | 52° F. |
| 15 | Paul Garrabrant | 1122 | | 10 | | | 6.34 | 7- 8-52 | | | Dug | H | 36 | DS | 57° F. |
| 16 | Walter Castle | 1047 | | 130 | | | 80 | 7- 8-52 | | | Dr | Dwe | 4 | DS | 52° F. |
| 17 | Fred Miller | 965 | | 26 | | | 8.91 | 7- 8-52 | | | Dr | Swe | 4 | DS | 52° F. |
| 18 | J. Anderson | 1041 | | 20 | | | 14 | 7- 8-52 | | | Dr | H | 5 | D | |
| 19 | Lucy C. Smith | 997 | | 113 | | | 30 | 7- 8-52 | | | Dr | Dwe | 4 | D | |
| 20 | S. H. Chidester | 983 | | 108 | | | 28 | 7- 9-52 | | | Dr | H | 4 | D | 53° F. |
| 21 | Howard Fowler | 1070 | | 40 | | | 15 | 7- 9-52 | | | Dug | H | 36 | DS | 52° F. |
| 22 | Paul Conway | 1122 | | 25 | | | 12.46 | 7- 9-52 | | | Dug | H | 36 | DS | 53° F. |
| 23 | George Dodson | 1062 | | 200 | | | 160 | 7- 9-52 | | | Dr | Dwe | 5 | S | |
| 24 | C. B. Comisford | 1118 | | 21 | | | 17.42 | 7- 9-52 | | | Dug | H | 36 | DS | 53° F. |
| 25 | D. H. Hammond | 1108 | | 28 | | | 22 | 7- 9-52 | | | Dug | H | 36 | D | 50° F. |
| 26 | Clarence Tharp | 960 | | 35 | | | | | | | Dv | H | 1½ | D | 51° F. |
| 27 | C. A. Stewart | 1030 | | 60 | | | 55.28 | 7- 9-52 | | | Dug | Dwe | 40 | D | |
| 28 | Lewis Price | 1022 | | 96 | | | 81 | 7- 9-52 | | | Dr | Dwe | 4 | DS | W. S. Wright (T). |
| 29 | A. Osborn | 1203 | | 210 | | | 40 | 7- 9-52 | | | Dr | Dwe | 4 | S | 52° F. |
| 30 | O. C. McGomery | 1161 | | 30 | | | 17 | 7- 9-52 | | | Dug | Swe | 36 | DS | Levi Hayes (T). |
| 31 | Carl Board | 1162 | | 180 | | | | | | | Dr | H | 4 | D | 54° F. |
| 32 | Tarrier Farms | 1143 | | 80 | | | | | | | Dr | Dwe | 4 | DS | |
| 33 | Roth Bros. | 1128 | | 240 | | | 60 | 7-10-52 | | | Dr | Dwe | 4 | DS | |
| 34 | Arthur Keckley | 1160 | | 72 | | | 20 | 7-10-52 | | | Dr | Dwe | 6 | DS | 54° F. |
| 35 | Louderbach | 1120 | | 165 | | | | | | | Dr | Dwe | 4 | DS | 52° F. |
| 36 | Elmer Williams | 1060 | | 105 | | | 36.12 | 7-10-52 | | | Dr | Dwe | 5 | D | 55° F. |
| 37 | H. Nichols | 1067 | | 30 | | | 22 | 7-10-52 | | | Dug | H | 36 | DS | 52° F. |
| 38 | J. Phillis | 1107 | | 20 | | | 14.91 | 7-10-52 | | | Dug | Swe | 36 | DS | 54° F. |
| 39 | Ed. Trout | 1142 | | 71 | | | 30 | 7-10-52 | | | Dr | Dwe | 4 | D | 51° F. |
| 40 | Ralph Amore | 1160 | | 147 | | | 67 | 7-10-52 | | | Dr | Dwe | 4 | DS | 52° F. |
| 41 | Mr. Lynn | 1222 | | 14 | | | 6.72 | 7-10-52 | | | Dug | Swe | 36 | | W. Blosser (T). Well not used. |
| 42 | M. M. Mowry | 1106 | | 32 | | | 8 | 7-10-52 | | | Dug | Swe | 36 | DS | 51° F. |
| 43 | J. F. McClain | 1038 | | 65 | | | 30 | 7-22-52 | | | Dr | Dwe | 4 | DS | 53° F. |
| 44 | A. S. McKenzie | 1121 | | 167 | | | 27 | 7- 8-52 | | | Dr | Dwe | 4 | DS | 52° F. |
| UNION TOWNSHIP | | | | | | | | | | | | | | | |
| 1L | Aaron Dunway | 970 | 15 | 115 | sh | $M_c$ | 65 | 4-21-48 | 5 | 25 | Dr | Dwe | 5 | D | Well pumped 2 hours by driller. |
| 2L | Raymond Weekeley | 947 | 53+ | 53 | g | Gla | | | | | Dr | Dwe | 4 | D | |
| 3L | Karl Foster | 1038 | 29 | 57 | ss | $M_c$ | 22.50 | 1-30-50 | 28 | 2 | Dr | Dwe | 5 | S | Well pumped ½ hour by driller. |
| 4L | S. C. Colburn | 1118 | 120 | 160 | ss | $M_c$ | 52 | 3-16-50 | | | Dr | Dwe | 5 | D | |
| 5L | Licking County Home | 1005 | 176+ | 176 | s & g | Gla | 28 | 7- 5-50 | 12 | 30 | Dr | Dwe | 5 | PS | Well pumped 3 hours by driller. |
| 6L | Dick Sunkle | 1020 | 76 | 185 | ss | $M_c$ | 102 | 10- -50 | | | Dr | Dwe | 4 | D | Well pumped dry by driller. |
| 7L | G. B. Balser | 1100 | 104 | 136 | ss | $M_c$ | 36 | 6-15-48 | 16 | 9 | Dr | Dwe | 5 | D | |
| *8L | Emma Leatherman | 905 | 257+ | 257 | s & g | Gla | 62 | 7- 1-48 | 2 | 30 | Dr | Dwe | 4 | D | 53° F. Guy Miller (T). Well pumped 6 hours by driller. |
| 9 | H. G. Cotterman | 882 | 49+ | 49 | s & g | Gla | 30 | 10-10-49 | | | Dr | Dwe | 5 | D | Raymond Waples (T). |
| 10 | Bennett | 880 | 34+ | 34 | g | Gla | 26.33 | 9- 9-49 | 24 | 4 | Dr | Swe | 4 | D | |
| 11 | Arlow Parsons | 883 | 37+ | 37 | s & g | Gla | 12 | 3-12-48 | | | Dr | Swe | 5 | D | |
| 12 | Donley's Tavern | 884 | 104+ | 104 | g | Gla | | | | | Dr | Dwe | 4 | PS | |
| 13L | Dent Darling | 878 | 133+ | 133 | s & g | Gla | 99 | 6-12-49 | 15 | 5 | Dr | | 4 | S | Well pumped 2 hours by driller. |
| 14 | Frank Framer | 883 | 108+ | 108 | s | Gla | 76 | 4-11-49 | 10 | 16 | Dr | Dwe | 4 | D | Well pumped 1 hour by driller. |
| 15 | Louis Hessinger | 890 | 83+ | 83 | s & g | Gla | 10 | 9- 3-49 | 4 | 3 | Dr | Dwe | 4 | D | |
| 16 | Irene Frost | 893 | 95+ | 95 | s & g | Gla | 17 | 1-11-49 | | | Dr | Dwe | 5 | D | |
| 17 | Stanley Shaw | 893 | 136+ | 136 | g | Gla | 111 | 7-14-49 | | | Dr | Dwe | 5 | D | R. C. Willard (T). |
| 18 | Harold Byers | 897 | 99+ | 99 | g | Gla | 59.33 | 5-12-48 | | | Dr | Dwe | 5 | D | |
| 19 | J. E. DeMoss | 890 | 164+ | 164 | s & g | Gla | | | 6 | 10 | Dr | Dwe | 5 | D | |
| 20L | O. T. England | 883 | 185+ | 185 | g | Gla | 31 | 2-21-52 | | | Dr | Dwe | 5 | DS | |
| 21L | Tom Park | 1021 | 120+ | 120 | g | Gla | 31 | 7-25-49 | 12 | 54 | Dr | Dwe | 5 | D | |
| 22L | P. M. Gotschall | 905 | 65 | 75 | sh | $M_c$ | 12 | 6-30-51 | 3 | 40 | Dr | Dwe | 5 | D | Well pumped 1 hour by driller. |
| 23L | Dale Porter | 1010 | 35 | 70 | sh | $M_c$ | 50 | 6-20-51 | 12 | 10 | Dr | Dwe | 5 | S | Well pumped 1 hour by driller. |
| 24L | S. Engle | 995 | 28 | 80 | ss | $M_c$ | 1 | 9- 1-49 | | | Dr | | 4 | D | |
| 25L | Robert G. Wehrs | 918 | 21 | 23 | s & g | Gla | 14 | 10- 6-50 | 8 | 1 | Dr | Swe | 5 | D | Well pumped 1 hour by driller. |
| 26L | Robert G. Wehrs | 970 | 10 | 70 | sh | $M_c$ | 45 | 10-10-50 | 6 | 30 | Dr | Dwe | 5 | S | Well pumped 1 hour by driller. |
| 27L | Ralph Hanck | 922 | 90 | 110 | ss | $M_c$ | 19 | 5- -48 | 4 | 1 | Dr | Dwe | 5 | D | |
| 28L | J. L. Kearns | 890 | 175+ | 175 | s & g | Gla | 22 | 7-25-45 | | | Dr | H | 4 | D | 52° F. |
| 29 | Donald George | 883 | 44+ | 44 | g | Gla | 6.12 | 6-25-52 | 6 | 5 | Dr | H | 4 | D | 51° F. Well pumped 10 hours by driller. |
| 30 | Walter Grissinger | 890 | 127+ | 127 | g | Gla | 20.32 | 2-25-52 | 15 | 25 | Dr | | 5 | | Well pumped 1 hour by driller. |
| *31L | Lee Smith | 910 | 56+ | 56 | s & g | Gla | 13 | 10-29-49 | 12 | 17 | Dr | Dwe | 5 | D | 52° F. |

Table 17.--Records of wells in Licking County, Ohio

| Well number | Owner or Name | Elevation at well (feet above sea level) | Depth to bedrock (feet) | Depth of well (feet) | Principal water-bearing bed | | Water level | | Yield | | Type of well | Type of pump | Diameter of well (inches) | Use | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Character of material | Geologic horizon | Below land surface (feet) | Date | Rate (g.p.m.) | Drawdown (feet) | | | | | |
| UNION TOWNSHIP (continued) | | | | | | | | | | | | | | | |
| 32 | Goldie Hayes | 895 | 102+ | 102 | g | Gla | 77 | 4-25-49 | 23 | 3 | Dr | Dwe | 4 | D | Well pumped 1 hour by driller. |
| 33L | J. D. Canter | 901 | 204+ | 204 | s | Gla | | | | | Dr | Dwe | 4 | D | |
| 34 | Stotts Renter | 882 | 85+ | 85 | g | Gla | 36 | 10-26-51 | | | Dr | Dwe | 4 | D | $53^{\circ}$ F. |
| 35 | Russell Miller | 888 | 55+ | 55 | s & g | Gla | 17 | 12- 2-48 | 8 | 6 | Dr | Dwe | 5 | D | Well pumped 1 hour by driller. |
| 36 | Village of Hebron | | 155+ | 155 | g | Gla | | | | | Dr | Dwt | 8 | PS | Rated capacity 175 gpm. |
| 37 | Village of Hebron | | 156+ | 156 | g | Gla | | | | | Dr | Dwt | 8 | PS | Rated capacity of 180 gpm. |
| WASHINGTON TOWNSHIP | | | | | | | | | | | | | | | |
| *1L | State of Ohio | 940 | 94+ | 94 | g | Gla | 10 | 9-26-51 | | | Dr | H | 6 | PS | $54^{\circ}$ F. |
| 2 | Robert Linton | 963 | 38+ | 38 | g | Gla | 20 | 10-12-47 | 24 | 15 | Dr | Swe | 5 | D | Well pumped 1 hour by driller. |
| 3 | Leo Harmon | 961 | 45+ | 45 | g | Gla | 20 | 4- 8-49 | 20 | 1 | Dr | | 4 | D | Well pumped 5 hours by driller. |
| 4L | John Mills | 1005 | 74+ | 74 | s & g | Gla | 8 | 4- 1-49 | 2 | 4 | Dr | H | 4 | DS | $55^{\circ}$ F. Well pumped 6 hours by driller. |
| 5 | Wendell McCoy | 945 | 60+ | 60 | s | Gla | 30 | 8-28-51 | 20 | 1 | Dr | Dwe | 5 | D | Well pumped 4 hours by driller. |
| 6 | Paul Niceley | 955 | 73+ | 73 | g | Gla | 43 | 9-22-51 | | | Dr | Dwe | 4 | D | |
| 7L | Miller Company | 971 | 150+ | 150 | g | Gla | 35 | 7- -46 | | | Dr | Dwt | 10 | Ind | Well pumps 50,000 gpd. |
| 8L | Sidney Bell | 1153 | 20 | 151 | ss | $M_c$ | 111 | 3-19-51 | 5 | 1 | Dr | Dwe | 4 | D | |
| 9L | Village of Utica | 1125 | 15 | 200 | ss | $M_c$ | | | | | Dr | Dwt | 10 | PS | Well pumps 200 gpm 5 hours a day. |
| 10L | Ed. Bucanan | 1087 | 110 | 125 | ss | $M_c$ | 55 | 7- 2-51 | | | Dr | Dwe | 4 | D | |
| 11L | Clyde Smallwood | 1155 | 17 | 80 | ss | $M_L$ | 21 | 3-31-50 | 10 | 9 | Dr | Dwe | 5 | D | |
| 12L | J. Lauderbaugh | 1130 | 6 | 195 | ss | $M_c$ | 95 | 7- 2-51 | | | Dr | H | 4 | D | $53^{\circ}$ F. |
| 13L | Mel Blackburn | 1057 | 41 | 79 | ss | $M_c$ | 27 | 4-30-48 | | | Dr | H | 3 | D | $53^{\circ}$ F. |
| 14 | G. S. Hunt | 1096 | | | | | | | | | Dr | Dwe | 5 | D | |
| 15 | Allen Nethers | 1080 | | 40 | | | 31.90 | 11-28-51 | | | Dr | H | 4 | DS | $51^{\circ}$ F. |
| 16 | C. O. Coons | 1055 | | 800 | | | | | | | Dr | | 12 | S | Well flows 30 gpm continually. |
| 17 | B. F. Smith | 1050 | | 21 | | | 7.58 | 11-28-51 | | | Dug | Swe | 36 | D | Clay Levingston (T). |
| 18 | Weiss | 1035 | | 180 | | | 27 | 11-28-51 | | | Dr | H | 4 | D | $51^{\circ}$ F. |
| 19 | L. Clippinger | 1010 | | | | | 14.52 | 11-29-51 | | | Dr | | 4 | D | |
| 20 | Old Church | 1098 | | 20 | t | Gla | | 11-29-51 | | | Dug | | 36 | | Well is dry. |
| 21 | Charles Bricker | 1042 | | 16 | | | 13.59 | 11-29-51 | | | Dug | Swe | 36 | D | |
| 22 | A. T. Hunter | 1095 | | 43 | | | 32.58 | 11-29-51 | | | Dug | H | 36 | D | $50^{\circ}$ F. |
| 23 | Will Jones | 1142 | | 136 | | | 65 | 11-29-51 | | | Dr | Dwe | 5 | D | |
| 24 | Grange Hall | 1095 | | | | | 35.13 | 11-29-51 | | | Dr | H | 5 | PS | $51^{\circ}$ F. |
| 25 | Paul Stout | 1070 | | 19 | | | 4.14 | 11-29-51 | | | Dug | H | 36 | DS | $52^{\circ}$ F. |
| 26 | Ben Drumm | 960 | | | | | | | | | Dr | Dwe | 5 | D | $51^{\circ}$ F. |
| 27 | Dean McClelland | 976 | | 9 | | | 4.67 | 11-30-51 | | | Dug | H | 36 | D | $50^{\circ}$ F. |
| 28 | Fred Nick | 1100 | | 18 | | | 15.83 | 11-30-51 | | | Dug | Swe | 36 | D | |
| 29 | J. E. Myers | 1097 | | 180 | | | 63 | 11-30-51 | | | Dr | H | 5 | D | $51^{\circ}$ F. |
| 30 | Dean McClelland | 1085 | | 117 | ss | $M_c$ | 85.96 | 11-30-51 | | | Dr | Dwe | 4 | DS | |
| 31 | Frank Fishbaugh | 1100 | | 74 | | | 33 | 12- 4-51 | | | Dr | Dwe | 4 | D | $51^{\circ}$ F. |
| 32 | Frank Fishbaugh | 1107 | | 55 | | | 30.79 | 12- 4-51 | | | Dr | H | 4 | S | $53^{\circ}$ F. |
| 33 | O. C. Cooksey | 1124 | | 41 | | | 38.28 | 12- 5-51 | | | Dug | H | 30 | D | $51^{\circ}$ F. |
| 34 | L. Smith | 1143 | 16 | 150 | ss | $M_c$ | 100 | 12- 5-51 | | | Dr | Dwe | 4 | D | |
| 35 | Virgil Bell | 1109 | 16 | 86 | ss | $M_L$ | 70 | 12- 5-51 | | | Dr | H | 4 | D | |
| 36 | F. J. Savery | 1124 | | 10 | | | 2 | 12- 5-51 | | | Dug | H | 30 | D | |
| 37 | Mr. Hess | 1052 | | 22 | | | 16.28 | 12- 5-51 | | | Dug | H | 36 | D | $51^{\circ}$ F. Mechling (T). |
| 38 | John Orah | 1060 | | 83 | | | 53 | 12- 5-51 | | | Dr | Dwe | 5 | D | |
| 39 | Cless Bell | 947 | | 42 | | | 35.50 | 12- 6-51 | | | Dr | Swe | 4 | DS | |
| 40 | Reynolds Fruit Farm | 1182 | | | | | | | | | Dr | Dwe | 5 | D | |
| 41 | Carl Downey | 946 | | | | | | | | | Dr | Dwe | 5 | DS | |
| 42 | E. E. Van Winkle | 983 | | | | | | | | | Dr | Swe | 5 | DS | |
| 43 | Earl Glaeckler | 1165 | | | | | | | | | Dr | Dwe | 5 | D | |
| 44 | Hobbs | 1095 | | 15 | | | 4.42 | 12-10-51 | | | Dug | H | 30 | D | $50^{\circ}$ F. |
| 45 | Coad Homestead | 938 | | 18 | | | | | | | Dv | | 1¼ | DS | |
| 46 | Coad | 963 | | | | | | | | | Dr | Dwe | 5 | D | |

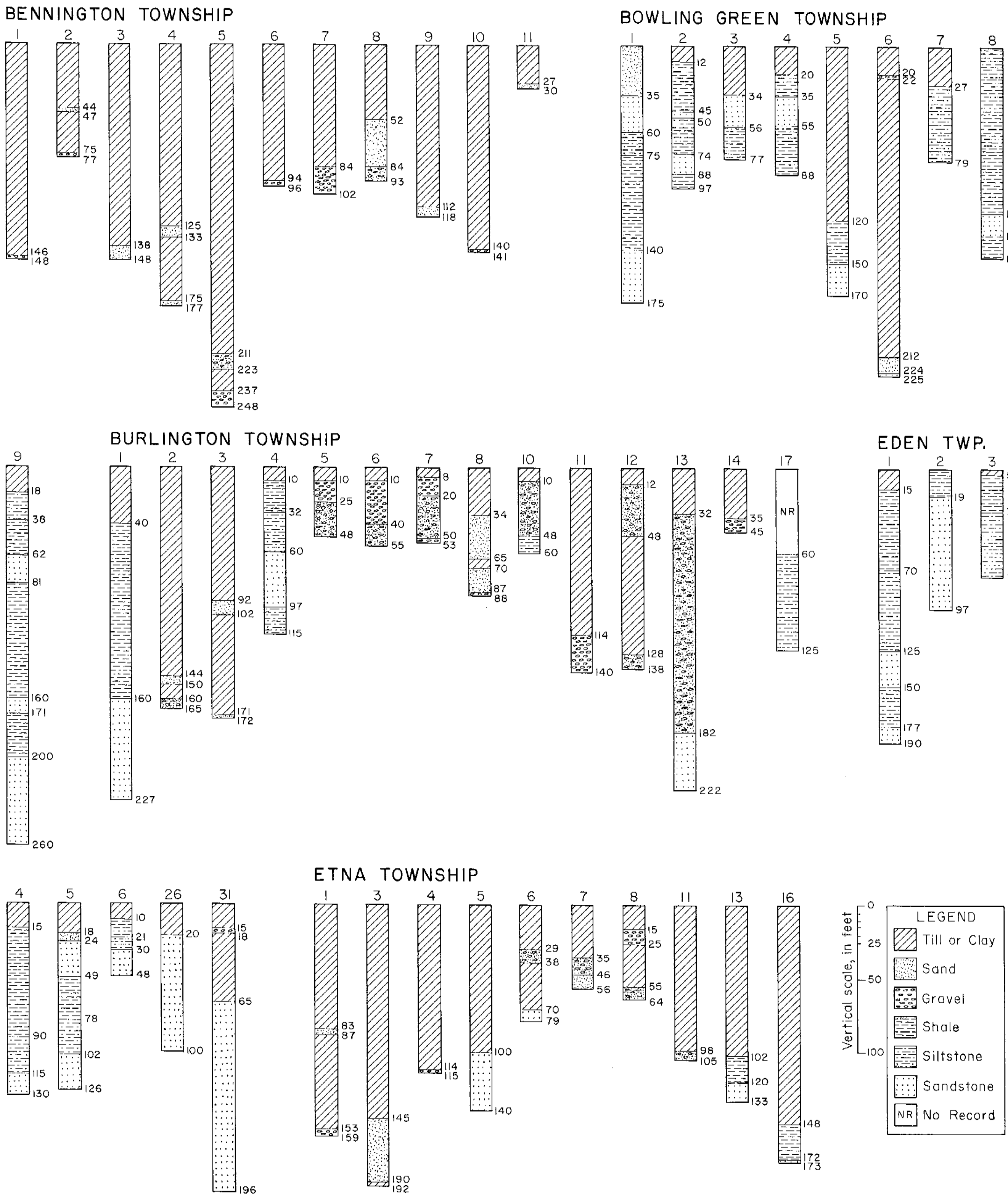



Figure 35. Logs of wells in Licking County, Ohio.
Well numbers refer to locations shown on plate I and in table 17.

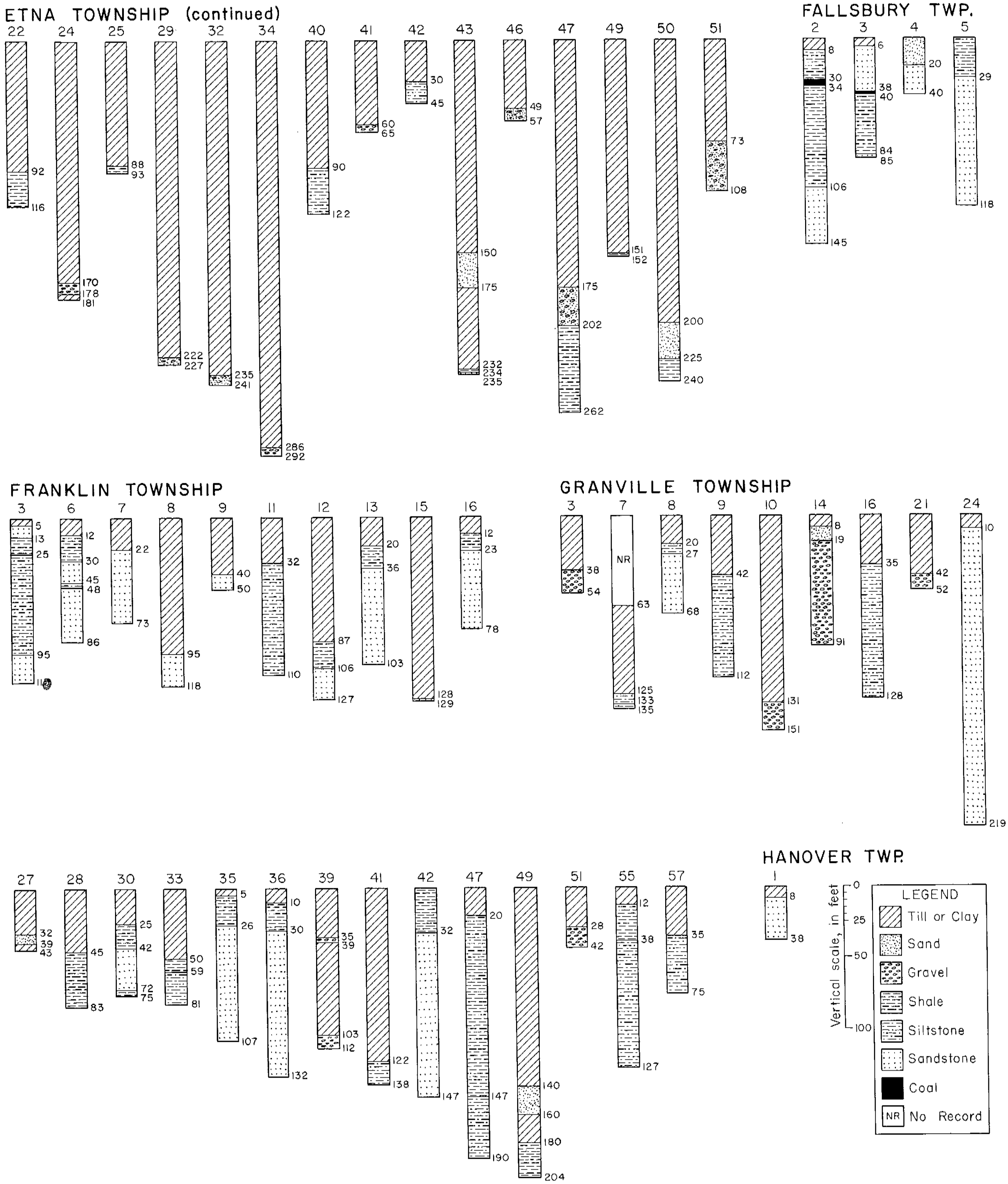



Figure 35. (continued)

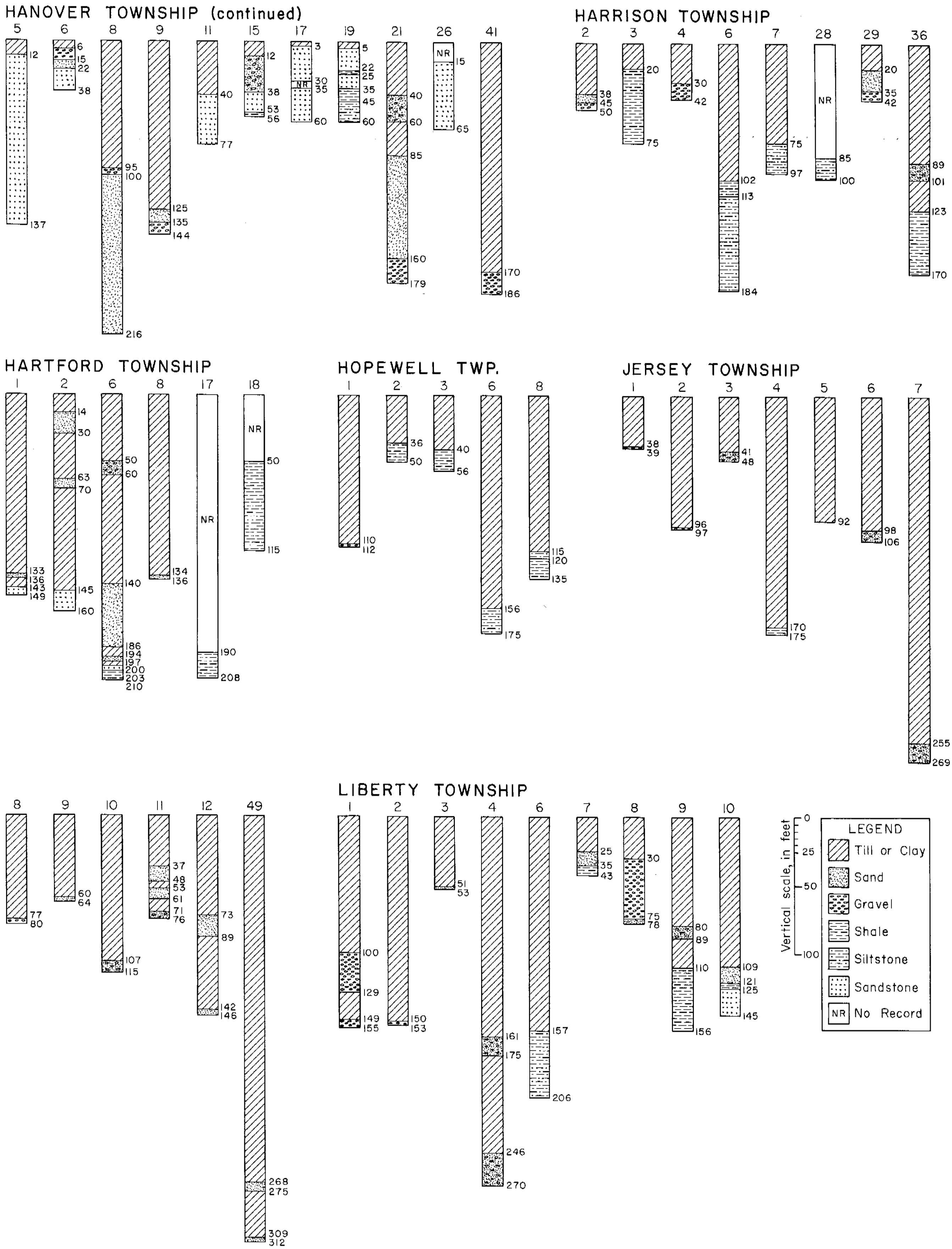



Figure 35. (continued)

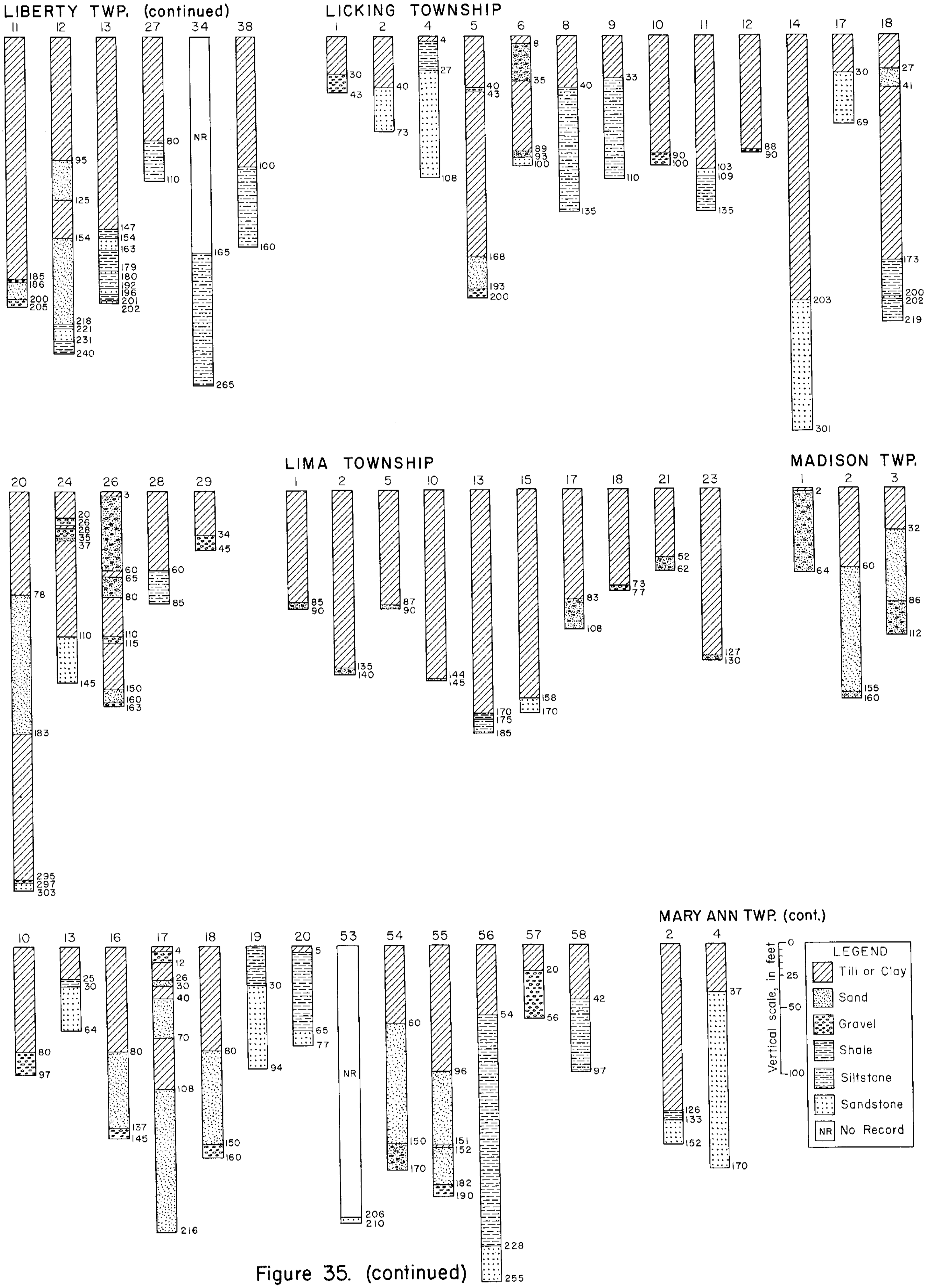



Figure 35. (continued)

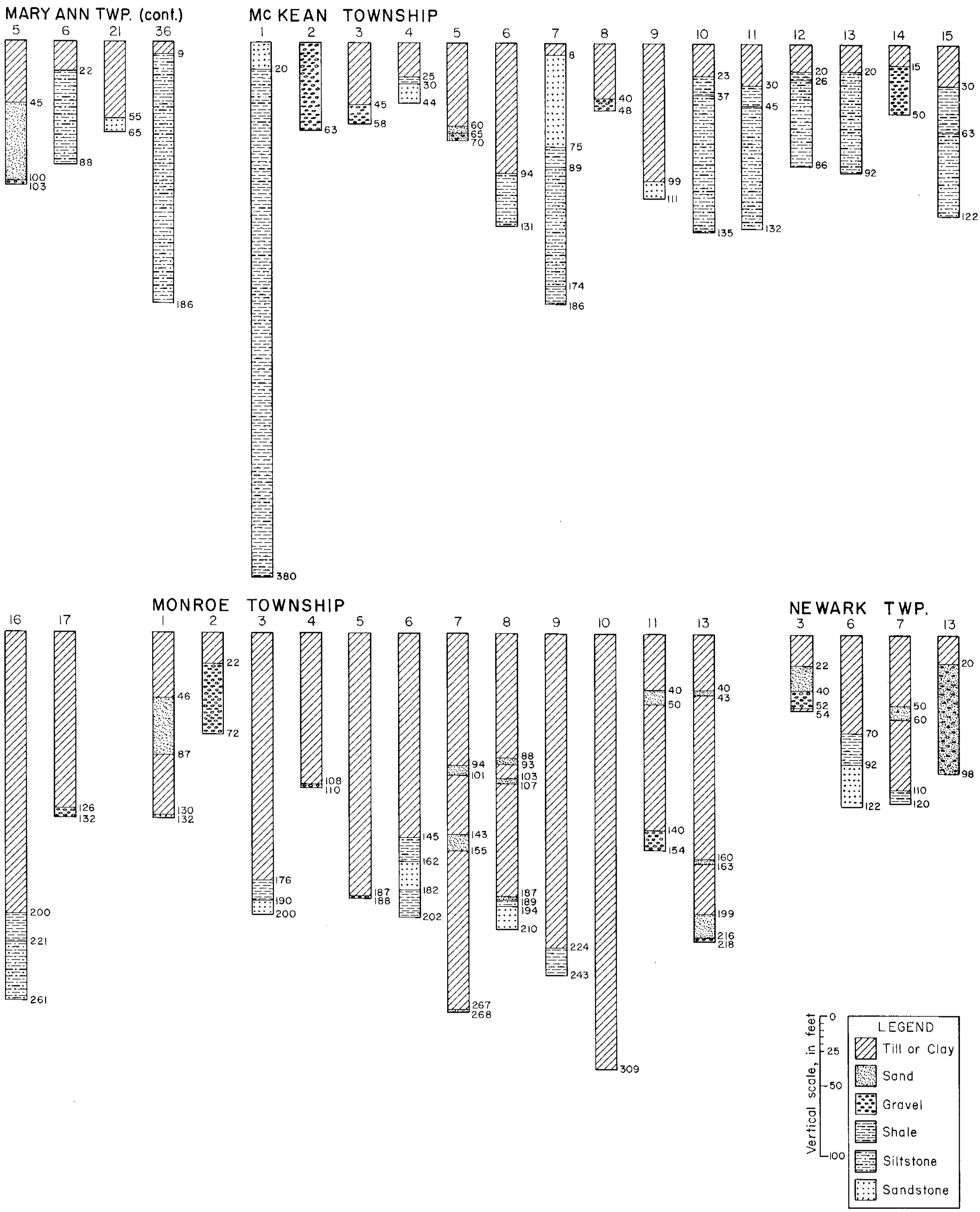



Figure 35. (continued)

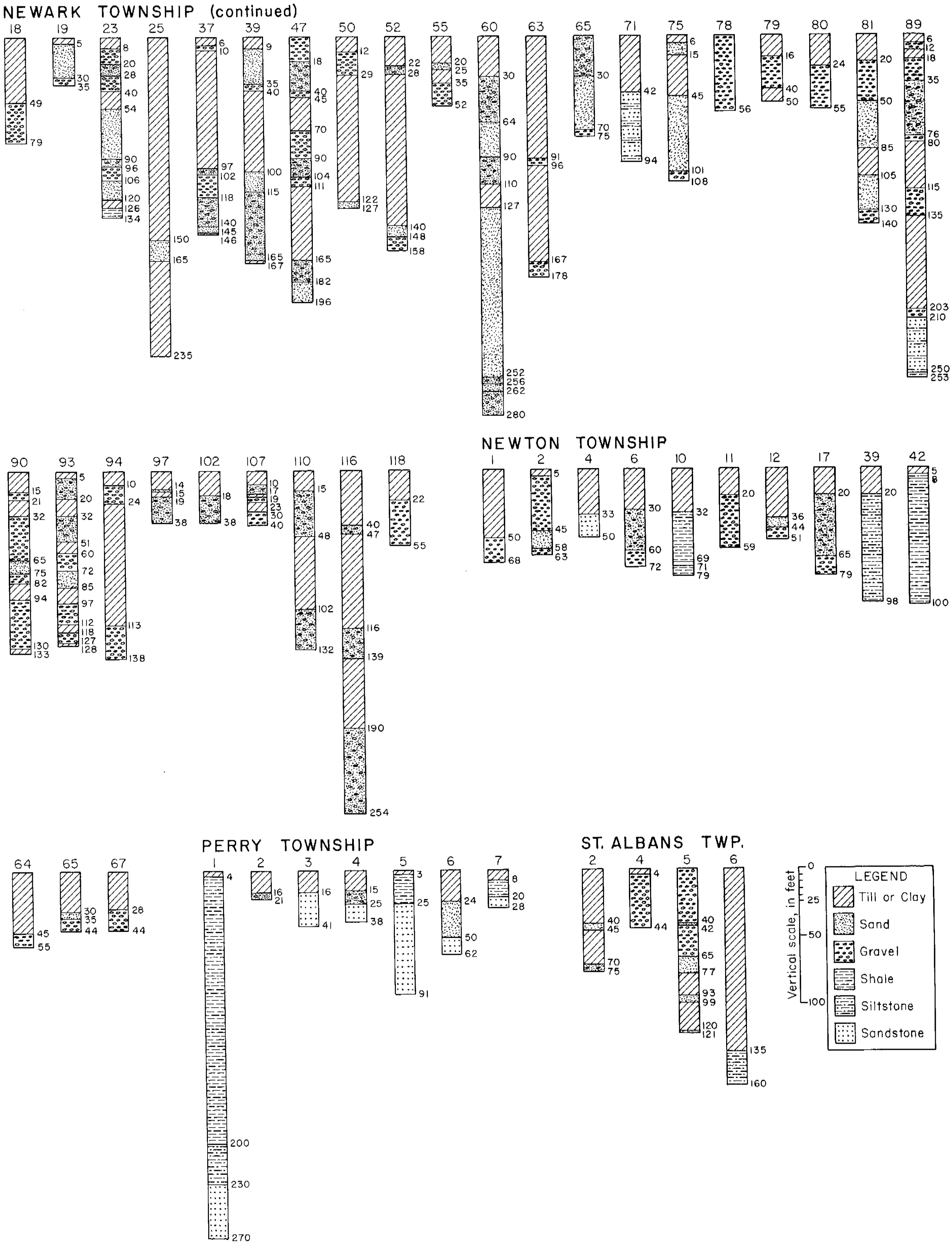



Figure 35. (continued)

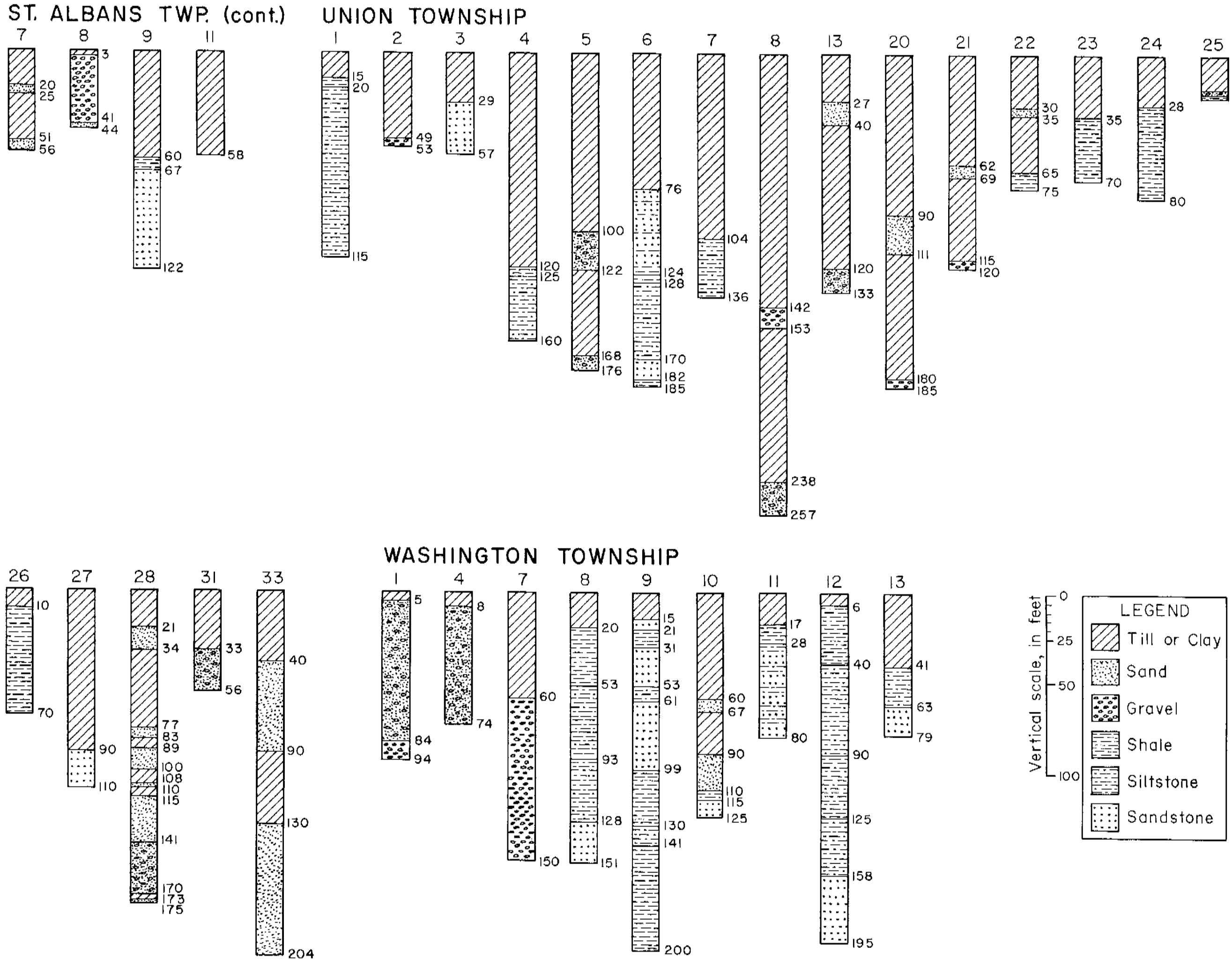
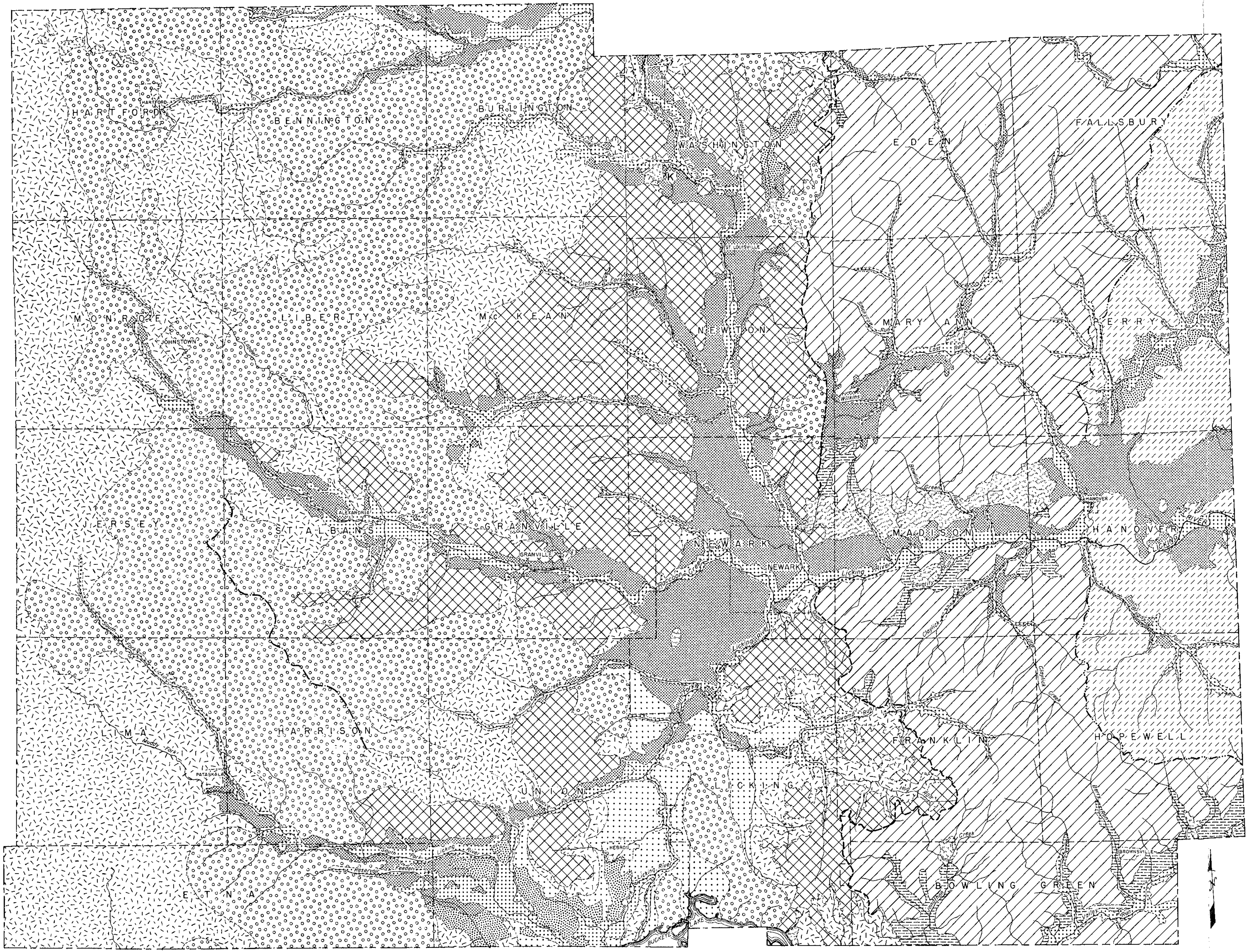



Figure 35. (continued)

# MAP OF THE ALLUVIAL AND GLACIAL DEPOSITS OF LICKING COUNTY, OHIO WITH DESCRIPTION OF THEIR WATER-BEARING PROPERTIES

GEOLOGY BY GEORGE D. DOVE

SCALE IN MILES 0 1 2 3 4 5




## EXPLANATION

ALLUVIAL DEPOSITS

Silts and sands deposited by the present rivers on their flood plains. These deposits are thin and generally not very permeable. Most wells penetrate these deposits and obtain water from the underlying formation.

LAKE DEPOSITS

Clay, silt, and fine sand deposited when drift from the Wisconsin and Illinoian glaciers blocked normal stream drainage. Generally poor source of ground water except in areas where underlain by coarse sands and gravels.

VALLEY-TRAIN DEPOSITS

Outwash deposits of sand and gravel laid down in the valleys by flooding melt waters from the glaciers. These deposits yield the largest supplies of ground water in the county.

KAMES AND KAME-TERRACE DEPOSITS

Sand and gravel deposited as hills and ridges at the edges of the glacier. Ground-water supplies in these deposits are extremely variable.

GROUND-MORAINE DEPOSITS (WISCONSIN) OVERLYING SAND AND GRAVEL

Till overlying extensive outwash deposits. Water generally occurs under artesian pressure in these areas. Water supplies adequate for small municipal or industrial needs.

THICK GROUND-MORAINE DEPOSITS (WISCONSIN)

Till generally more than 20 feet thick and containing buried sand or gravel lenses in some places. Yields to wells are small in these areas, but adequate supplies of water for home or farm use may be obtained from the included sand or gravel layers.

THIN GROUND-MORAINE DEPOSITS (WISCONSIN)

Till generally less than 20 feet thick although water supplies from the ground moraine are generally obtained from shallow dug wells, most water supplies in these areas are obtained from the underlying bedrock formations, which are generally exposed in many places.

END-MORAINE DEPOSITS (WISCONSIN)

Thick till deposited as hills and ridges of the edges of the glaciers. In places it contains thin and discontinuous sand and gravel lenses. Generally adequate supplies of water for home and farm use may be obtained from these lenses.

THICK GROUND-MORAINE DEPOSITS (ILLINOIAN)

Till deposits generally more than 20 feet thick. Ground water in these areas generally obtained from the underlying bedrock formations.

THIN GROUND-MORAINE DEPOSITS (ILLINOIAN)

Till deposits generally less than 20 feet thick. Absent in most places in eastern Licking County, and only erratics, pebbles foreign to the local bedrock, are found.

UNGLACIATED

K

KETTLE HOLE

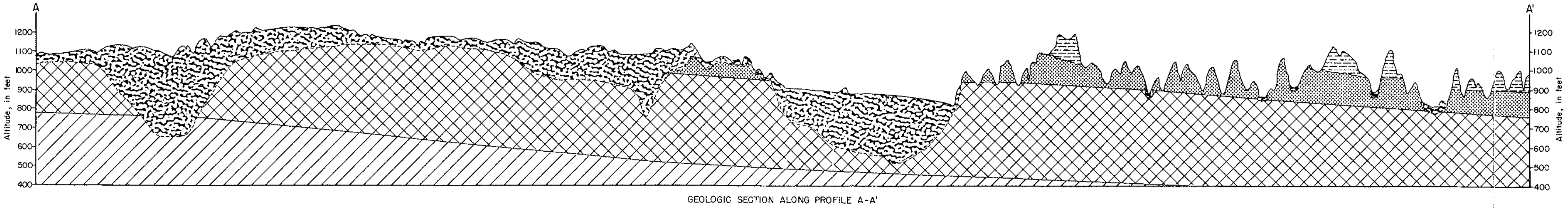
LATE WISCONSIN (CAREY?) GLACIAL BOUNDARY

EARLY WISCONSIN (TAZEWELL ?) GLACIAL BOUNDARY [1]

ILLINOIAN GLACIAL BOUNDARY [1]

[1] In part after G.W. WHITE

PLATE 2


GEOLOGIC SECTION ALONG PROFILE A-A'

# MAP OF THE CONSOLIDATED ROCKS OF LICKING COUNTY, OHIO

## WITH DESCRIPTION OF THEIR WATER-BEARING PROPERTIES AND SHOWING APPROXIMATE CONTOURS ON THE BEDROCK SURFACE

GEOLOGY BY GEORGE D. DOVE

SCALE IN MILES

0 1 2 3 4 5

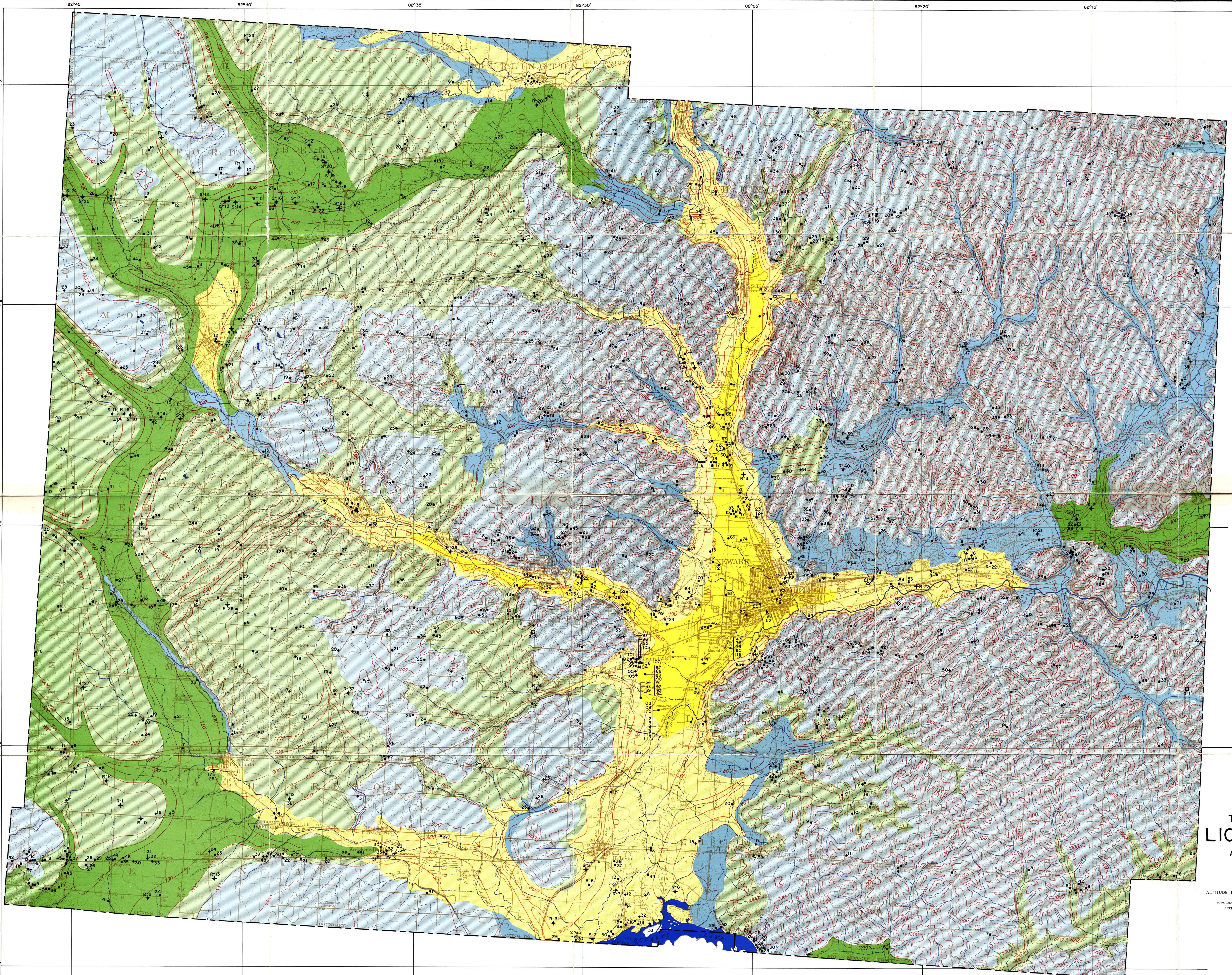
BEDROCK CONTOUR INTERVAL 200 FEET, DATUM MEAN SEA LEVEL

## EXPLANATION

| SYSTEM | FORMATION | MEMBER |
|---|---|---|
| PENNSYLVANIAN | Allegheny Pottsville | Vanport limestone to Harrison. Sandstone, shale, coal, clay, limestone, flint, and conglomerates. Small supplies of water for stock and domestic purposes are obtained from a few wells drilled into the Pennsylvanian sediments in eastern Licking County. |
| MISSISSIPPIAN | Logan | Vinton, Allensville, Byer, Berne. Conglomerate, sandstone, siltstone and shale. Moderate quantities of water are obtained from these rocks in the uplands in the central and eastern parts of Licking County. |
| | Cuyahoga | Black Hand, Raccoon shale. Conglomerate, sandstone, siltstone and shale. The Cuyahoga formation is the most productive of the consolidated rock aquifers in Licking County. Yields to wells range from 5 to more than 100 gpm. |
| | Sunbury shale | Shale. Not a source of ground water in Licking County. |
| | Berea sandstone | Sandstone. Ample supplies of ground water for domestic needs. |
| | Bedford shale | Shale. No wells inventoried in Licking County obtain water from the Bedford shale. |

Unconsolidated Glacial Deposits (Shown only on cross section). The description and water-bearing properties of these deposits are given on plate 2.

PLATE 3.



## EXPLANATION

### GOOD SOURCE OF GROUND WATER

Outwash deposits of sand and gravel in the principal valleys. These permeable deposits in the valley of Raccoon Creek are open to recharge from stream infiltration. Valley train deposits in the valleys of North Fork Licking River and South Fork Licking River are separated by layers of silt or clay into three aquifers. The most productive aquifers are about 90 and 170 feet beneath the ground surface, and recharge is from vertical leakage through the overlying confining beds and the permeable sandstones that form the valley walls.

### GOOD TO FAIR SOURCE OF GROUND WATER

Sand and gravel deposits of variable character. Yields generally are limited to about 100 to 200 gallons a minute owing either to low permeability, thinness of the aquifer, or its unfavorable location with respect to the valley walls.

### FAIR SOURCE OF GROUND WATER

Generally thin deposits of sand and gravel of small areal extent. Yields range generally from 50 to 100 gallons a minute.

Consolidated rocks. Coarse-grained sandstones of the Cuyahoga formation may yield 50 to 100 gallons of water a minute; yields generally range from 10 to 20 gallons a minute. In eastern Licking County the Logan formation, which overlies the Cuyahoga formation, yields 10 to 15 gallons a minute. In the northeastern part of the county a few wells obtain water from sandstones of Pennsylvanian age. These sandstones, which generally are thin and of small areal extent, yield about 5 gallons a minute.

### FAIR TO POOR SOURCE OF GROUND WATER

Sand and gravel deposits which may yield from 5 to 100 gallons a minute. In Western Licking County the deposits are covered by 200 feet or more of till. In the eastern part of the county the sand and gravel deposits are in the upland areas and the water table is at relatively great depths.

### POOR SOURCE OF GROUND WATER

Thick deposits of relatively impermeable glacial till. Water is obtained from interbedded sand and gravel lenses, which generally yield less than 5 gallons a minute. In some areas the sand and gravel lenses are absent and water is obtained from the underlying consolidated rocks.

WATER WELL

GAS WELL

RESISTIVITY MEASUREMENT LOCATION

SEISMIC MEASUREMENT LOCATION

MAP SHOWING

# THE GROUND-WATER RESOURCES IN LICKING COUNTY, OHIO AND THE APPROXIMATE CONTOURS ON THE BEDROCK SURFACE

BY GEORGE D. DOVE

ALTITUDE IN FEET ABOVE SEA LEVEL

BEDROCK CONTOUR INTERVAL 100 FEET

TOPOGRAPHY FROM THE U. S. GEOLOGICAL SURVEY TOPOGRAPHIC MAPS OF THE EAST COLUMBUS, FRAZEYSBURG, FREDERICKTOWN, GAMBIER, GRANVILLE, MARENGO, NEWARK, THORNVILLE, THURSTON, WESTERVILLE, AND ZANESVILLE QUADRANGLES. CONTOUR INTERVAL 10 AND 20 FEET.

SCALE IN MILES

0 1 2 3 4

PUBLISHED BY
STATE OF OHIO
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WATER
1960
BULLETIN 36 PLATE I