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GEOLOGICAL SURVEY DIVISION
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# GROUND-WATER HYDROLOGY AND GLACIAL GEOLOGY OF THE KALAMAZOO AREA, MICHIGAN

By

Morris Deutsch, K. E. Vanlier, and P. R. Giroux

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## ABSTRACT

The Kalamazoo report area includes about 150 square miles of Kalamazoo County, Mich. The area is principally one of industry and commerce, although agriculture also is of considerable importance. It has a moderate and humid climate and lies within the Lake Michigan "snow belt". Precipitation averages about 35 inches per year. Snowfall averages about 55 inches.

The surface features of the area were formed during and since the glacial epoch and are classified as outwash plain, morainal highlands, and glaciated channels or drainageways. The area is formed largely on the remnants of an extensive outwash plain, which is breached by the Kalamazoo River in the northeastern part and is dissected elsewhere by several small tributaries to the river. Most of the land drained by these tributaries lies within the report area. A small portion of the southern part drains to the St. Joseph River.

The Coldwater shale, which underlies the glacial deposits throughout the area, and the deeper bedrock formations are not tapped for water by wells and they have little or no potential for future development.

Deposits of glacial drift, which are the source of water to all the wells in the area, have considerable potential for future development. These deposits range in thickness from about 40 feet along the Kalamazoo River to 350 feet where valleys were eroded in the bedrock surface. Permeable outwash and channel deposits are the sources of water for wells of large capacity. The moraines are formed dominantly by till of lower permeability which generally yields small supplies of water, but included sand and gravel beds of higher permeability yield larger supplies locally.

The aquifers of the Kalamazoo area are recharged by infiltration of rainfall and snowmelt and by infiltration of surface waters induced by pumping of wells near the surface sources. Water pumped from most of the municipal well fields is replenished in part by such induced infiltration. Many of the industrial wells along the Kalamazoo River and Portage Creek are recharged in part from these streams. Locally, however, recharge from the streams is impeded, as their bottoms have become partly sealed by silt and solid waste matter.

Water levels fluctuate with seasonal and annual changes in precipitation and in response to pumping. Pumpage by the city of Kalamazoo increased from about 300 million gallons in 1880 to 4.6 billion gallons in 1957. Despite the fact that billions of gallons are pumped annually from well fields in the Axtell Creek area, water levels in this vicinity have declined only a few feet, as the discharge from the fields is approximately compensated by recharge from precipitation and surface water. Pumpage of ground water by industry in 1948 was estimated at about 14 billion gallons, but the use of ground water for industrial purposes has since declined.

Aquifer tests indicate that the coefficient of transmissibility of aquifers in the area ranges from as little as 18,000 to as high as 300,000 gpd (gallons per day) per foot, and that ground water occurs under water-table and artesian conditions.

The ground water is of the calcium magnesium bicarbonate type. It is generally hard to very hard and commonly contains objectionable amounts of iron. Locally, the water contains appreciable amounts of sulfate. Study of the chemical analyses of waters from the area show that all of the tributaries to the Kalamazoo River are fed primarily by ground-water discharge.

# INTRODUCTION

The investigation upon which this report is based was started in 1946 by the U. S. Geological Survey in cooperation with the Geological Survey Division of the Michigan Department of Conservation and the city of Kalamazoo. It forms a part of the statewide cooperative investigation of the availability and quality of ground-water resources to meet municipal, domestic, agricultural, and industrial needs. The work in the Kalamazoo area, in addition to the usual collection and compilation of data pertaining to the source, occurrence, availability, chemical quality, and use of ground water, included a series of aquifer tests, and also a program of test drilling, financed by the city of Kalamazoo, to determine the thickness and extent of the fresh-water aquifers underlying the city and contiguous areas. Using the information concerning the geology and hydrology of the area obtained during the study, and new techniques of well development, maintenance, and induced recharge, the city's Utilities Department has since expanded its well and pumping facilities and has developed one of the largest ground-water supply systems in Michigan.

The present report is designed to make the data collected during the investigation and interpretations therefrom readily available to the public. The section of the text entitled "Recharge", which is concerned largely with induced recharge of water from surface streams to the aquifers, may be of considerable interest and potential value to industry and to other cities in Michigan and elsewhere having similar geologic and hydrologic settings. In addition, data collected in the interval since the study was completed, and an evaluation of the effects of the increased use of ground water during the past 10 years, are included herein.

Cooperative ground-water investigations by the U. S. Geological Survey in Michigan are directed jointly by P. E. LaMoreaux, Chief of the Survey's Ground Water Branch, Washington, D. C., and W. L. Daoust, State Geologist, Michigan Department of Conservation, Lansing, Mich., and are under the direct supervision of Morris Deutsch, District Geologist, who succeeded J. G. Ferris of the Federal Survey.

## Historical Sketch of Municipal Ground-Water Developments

In 1843 the village of Kalamazoo adopted an ordinance covering the establishment of a public water-supply and fire-protection system (Kalamazoo City Utilities, 1954). In 1851, water surplus to the needs of the Michigan Central Railroad was made available to the village for a public supply. Later, Arcadia Creek was used as a source of supply for the village. The first waterworks plant was built in 1869 (Leverett, 1906a) and a large well 22 feet in diameter was dug to a depth of 32 feet. In 1872 a second source of supply was installed, consisting of a dug well 20 feet in diameter, 30 feet deep, and surrounded by 13 tubular wells 6 inches in diameter and ranging in depth from 80 to 120 feet. The 6-inch wells flowed 2 or 3 feet above the land surface, but the flow was discharged to the dug well below the surface. These facilities were installed at the site of the present Central Pumping Station on Burdick Street.

In 1914 the Schippers Station (No. 5) at the intersection of Schippers Lane and Lincoln Avenue (now East Michigan Ave.) was added to the system. A station (No. 3) was installed on Balch Street in 1917, another (No. 4) on Maple Street in 1924, and a third (No. 2) on Born Court the following year.

In 1932 Station "B", adjacent to the Central Pumping Station, and Station "C" on Stockbridge Avenue were built to replace the old shallow dug wells as sources of supply. Station "D" was added in 1941 and Stations C-1 and C-2 in 1945. Water from these stations is pumped at low pressure to the nearby Central Pumping Station, where it is repumped into the distribution system.

The Crosstown Station along Axtell Creek (No. 7) was added to the system in 1944. Another station (No. 8) was installed on the south side of East Kilgore Road in Portage Township in 1949. This marked the first time that Kalamazoo had obtained a water supply from facilities beyond the city limits. A second station (No. 9) in Portage Township, on West Kilgore Road, was put into operation in 1955.

To keep pace with the rapid areal growth of the city in recent years, new well stations have been installed near Kendall Avenue (No. 11), U. S. Highway 12 (No. 12), East Kilgore Road along Davis Creek (No. 13), and at Spring Valley (No. 14). Stations 15, 16, and 17 are well fields formerly operated by Millwood Community, which was annexed to the city in 1957. Construction of Stations 18 and 19 was started by the city of Kalamazoo in 1957. Figures 14 and 15 show the approximate locations of the municipal well fields.

Beyond the area served by the city, most residences obtain water supplies from privately owned wells. In at least one case, however, a newer suburban housing development is served by a public-supply system installed by the developer, and deeded to Portage Township for operation and maintenance.

## Previous Investigations

The reports of a number of investigations of the geology and water resources of Michigan made since 1895 include data or maps pertaining to the Kalamazoo area. Various phases of the geology of the Southern Peninsula were described by Lane (1895), Leverett (1912, 1917), and Leverett and Taylor (1915). Martin (1955) compiled a map of the surface formations of the Southern Peninsula of Michigan, and reported informally on the glacial history of Kalamazoo County (1957).

Reports of investigations of the water resources of the Southern Peninsula which contain data on the Kalamazoo area were made by Lane (1899) and Leverett (1906a, b). J. G. Ferris of the Geological Survey in 1949 investigated the ground-water hydrology and the relations of the level of the Kalamazoo River to ground-water supplies available to users along the reach of the river in and near the city of Kalamazoo, and much of the information from his unpublished study is included in this report.

## Well-Numbering System

The well-numbering system used in this report indicates the location of the wells within the rectangular subdivisions of the public lands, with reference to the Michigan meridian and base line. The first two segments of a well number designate the township and range; the third segment designates both the section and the serial number assigned to each well within the section. Thus, well 1S 12W 25-1 is well number 1 in sec. 25, T. 1 S., R. 12 W. (Alamo Township). Hence, it is necessary to plot only serial numbers on maps showing sections, as the complete number of the well is evident by its location. The locations of most wells described in this report are given to the nearest 10-acre tract within the section (table 1). Numbers formerly assigned to wells for which information has previously been published are also included in table 1.

## Acknowledgments

Special thanks are given to the numerous government and industrial officials, well drillers, contractors, engineering firms, businesses, and private individuals who provided assistance and pertinent information which made whis report possible. Lack of space prohibits a complete listing of contributors of information for this study. Major contributions of data, however, were made by the following persons or organizations.

Messrs. Albert Sabo, Manager, A. De Does, hydraulic engineer, Paul Sabo, well driller, and Richard Wetmore, Water Superintendent, all of the Kalamazoo Utilities Department; the Layne-Northern Drilling Co.; Mr. A. E. Woolam, Kalamazoo representative of the Ohio Drilling Co.; the C. S. Raymer Drilling Co.; Messrs. Walker H. Sisson, Engineering Division, Upjohn Co.; Charles M. Waddle and Dwight Lemon, Kalamazoo Vegetable Parchment Co.; and J. C. Newman, well driller; and officials of the Sutherland Paper Co., Allied Paper Co., Hawthorne Paper Co., Bryant Paper Co. (now St. Regis Paper Co.), Kalamazoo Paper Co.; and Raymond Concrete Pile Co.

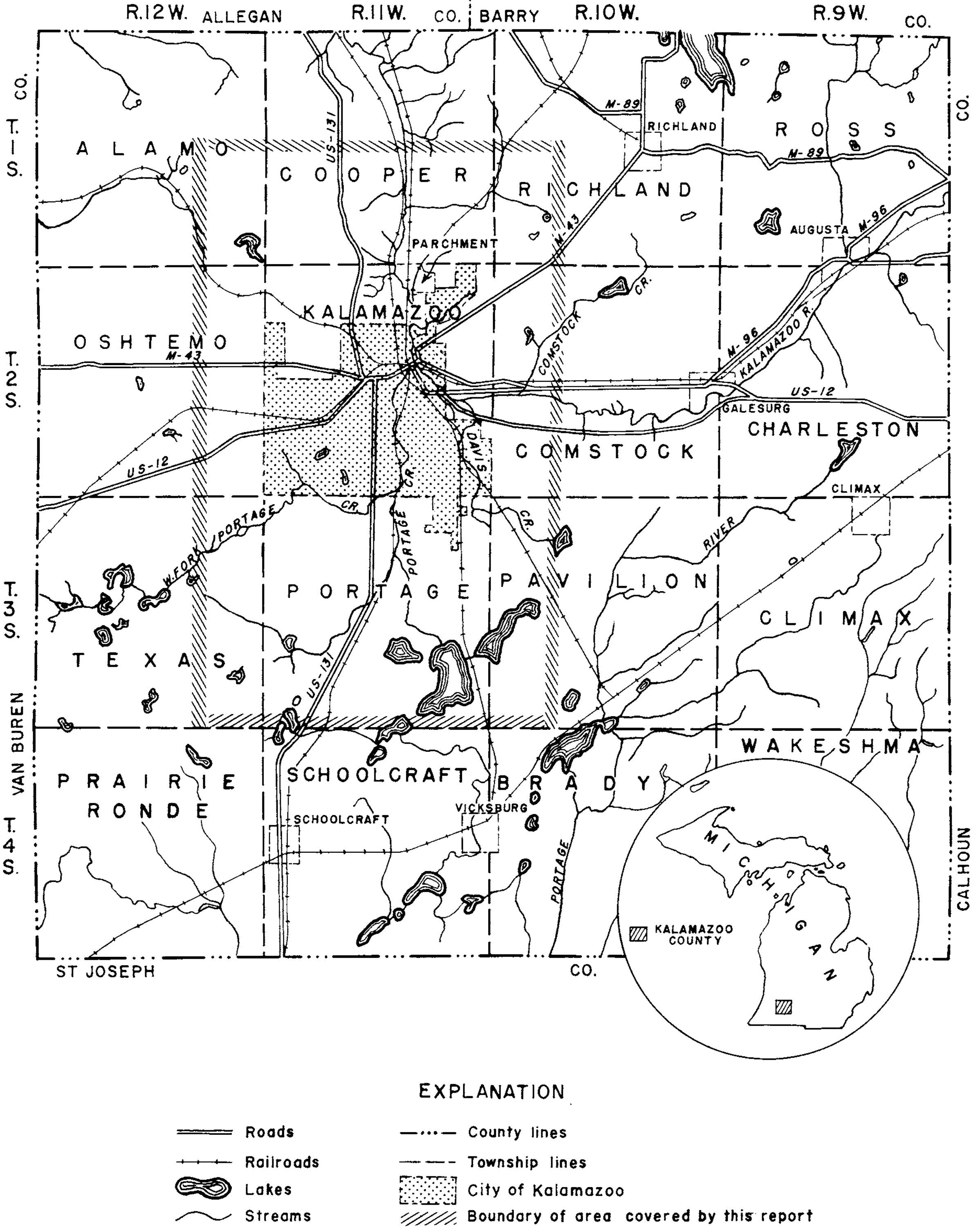



Figure 1. Index map showing location of the Kalamazoo area, Michigan.

# GEOGRAPHY

## Location and Extent of the Kalamazoo Area

The area covered by this report is rectangle consisting of about 150 square miles in Kalamazoo County, which is in the southwestern part of the Southern Peninsula of Michigan (fig. 1). The area includes the cities of Kalamazoo and Parchment, all of Kalamazoo and Portage Townships plus contiguous parts of Alamo, Cooper, Richland, Oshtemo, Comstock, Texas, and Pavilion Townships, and the villages of Oshtemo, Comstock, and Portage (fig. 2).

Kalamazoo and Parchment in the north-central part of the report area include most of the land formerly occupied by Kalamazoo Township (T. 2 S., R. 11 W.). The Kalamazoo River flows into the area at Comstock, turns sharply north at Kalamazoo, and flows out of the area at Cooper.

## Population and Economic Development

The population of the city of Kalamazoo according to the 1950 census was 57,704, and that of the Kalamazoo metropolitan area (all of Kalamazoo County) was 126,707. Parchment at that time had a population of 1,179. According to the latest estimate of the Michigan Health Department, the population of Kalamazoo had grown to 75,020 by 1957, and the county's population to 153,410. The W. E. Upjohn Institute for Community Research has estimated that the population of the county will grow to 208,000 by 1970 and to 234,000 by 1975 (Taylor, 1956). During the interval from 1920 to 1950 the population of the city of Kalamazoo increased

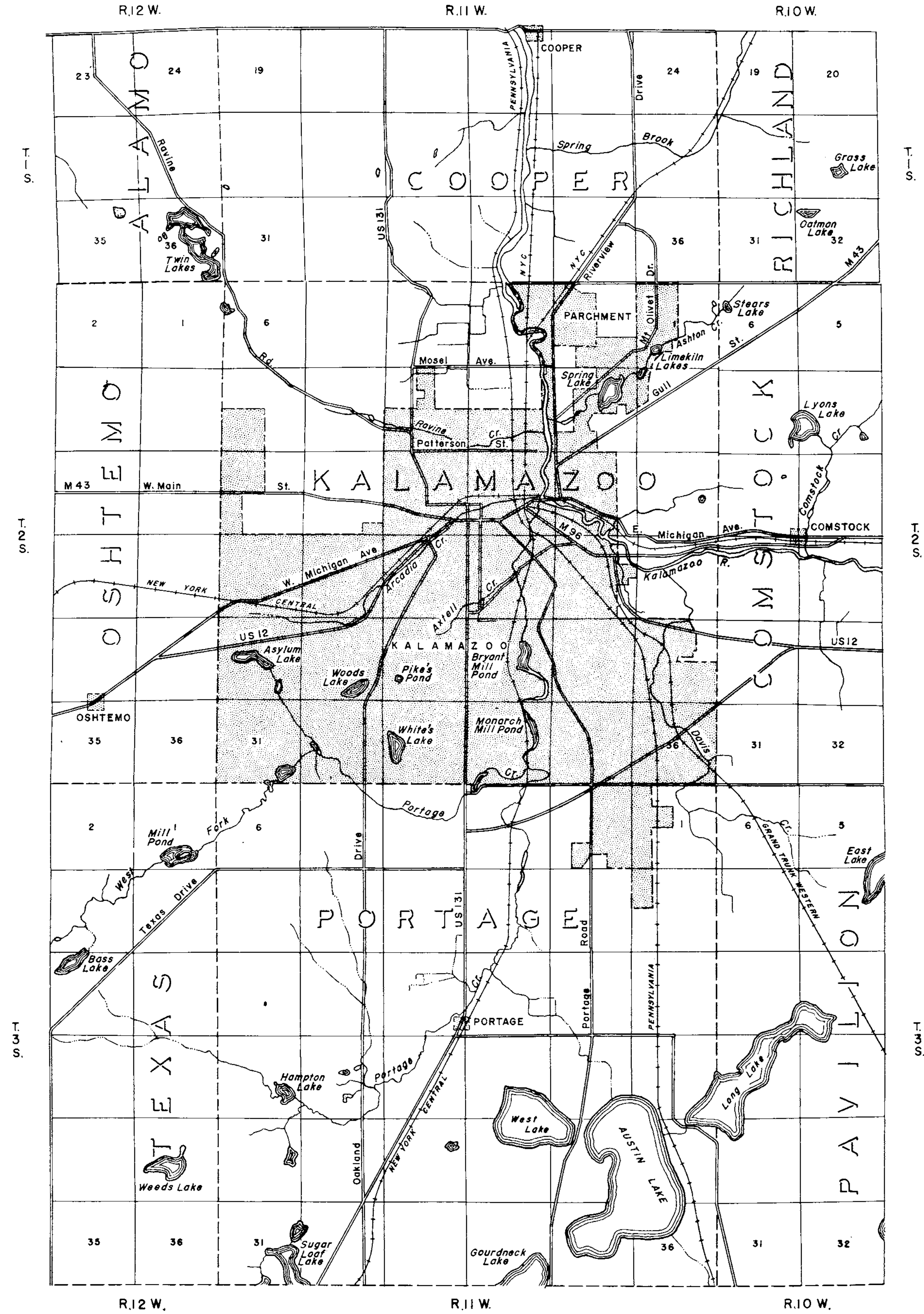



Figure 2. Location map of the Kalamazoo area.

by about 10,000, while that of Kalamazoo Township increased from about 5,000 to 28,000. Since 1950, however, the city's population and areal extent have increased through annexation of much of the township.

Kalamazoo is connected to other cities by U. S. Highways 12 and 131 and State Highways M-43, 89, and 96. It is served by the Grand Trunk Western, New York Central, and Pennsylvania Railroads, by 7 bus-lines and 32 Michigan or interstate truck lines, and by Lake Central and North Central Airlines.

The industry of the area is very diversified and in 1953 employed more than 24,000 persons. Among the most important products manufactured are paper and allied products, pharmaceuticals, chemicals, transportation equipment, various types of machinery, and fabricated metal products (Bennett and Jordan, 1950). Mineral industries in the county produce sand and gravel, marl, and a small amount of petroleum.

The agricultural land in the region around Kalamazoo yields a variety of specialized and general farm products. Celery and blueberries are the principal agricultural exports. The county is also one of the Nation's leading producers of cherries and grapes.

## Physiography and Relief

The Kalamazoo area lies in a region glaciated by a succession of at least four major continental ice sheets. The main topographic features of the area were formed during the recession of the last of the ice sheets. The physiographic features of the area may be classified into three major types: dissected outwash plain, morainal highlands, and glaciated channels or drainageways (fig. 5).

Most of the area is composed of the remnants of an extensive outwash plain which is breached by the Kalamazoo River and is dissected by several small tributaries to the river. This plain is not readily recognized as such because of the great amount of erosion that has occurred in glacial and postglacial time. Some of the uplands in the outwash plain have flat surfaces, and it is apparent locally that these flat-topped highlands are part of this plain. Remnants of the outwash plain lie at altitudes as much as 960 feet above sea level.

The most readily distinguished physiographic feature is the Outer Kalamazoo moraine, which crosses the northwestern part of the report area. A segment of the Inner Kalamazoo moraine is present in the extreme northwestern part of the report area, in Alamo Township. The moraines have a characteristic "knob-and-kettle" topography in contrast to the flat surface of the undissected remnants of the outwash plain. Some of the knobs reach altitudes greater than 1,000 feet, although in some areas the morainal deposits are lower than adjacent outwash deposits. Several small hills of morainal origin and some rolling till plains occur in the southeastern part of the report area. These features, which are of small areal extent and hydrologic significance, have only slightly different topographic expression from the surrounding outwash plain.

Broad bottom lands along the Kalamazoo River mark the drainageways or channels of the river during the glacial epoch, when its flow greatly exceeded that of the modern river. The bottom lands are formed on sand and gravel deposited in the channel of the glacial river. These lands are at elevations of less than 800 feet and are 80 to 100 feet below remnants of the adjacent outwash plain. The level of the Kalamazoo River, which is incised into these bottom lands for its entire reach within the report area, declines from about 760 feet above mean sea level at Comstock to about 740 feet at Cooper.

## Drainage and Streamflow

With the exception of a small portion of the southern part, which lies in the St. Joseph River drainage basin (fig. 10), the area covered by this report lies within the drainage basin of the Kalamazoo River. Above Comstock, the river drains an area of 1,010 square miles (Wells and others, 1958). The mean flow of the river at the Comstock gaging station for the period 1932-57 was 851 cfs (cubic feet per second). The minimum annual flow of the river recorded by this station was 577 cfs in 1934; however, records of similar streams indicate that the mean annual flow of the Kalamazoo in 1931 was about 400 cfs.

The altitude of the zero datum on the U. S. Geological Survey gage at Comstock is 759.12 feet above mean sea level. The Corps of Engineers (1958) designates a stage of 763.62 feet as critical flood stage. This stage is equivalent to a discharge of 3,100 cfs. According to the Michigan Water Resources Commission (1957), the river at the Kalamazoo Board of Water and Light gage in downtown Kalamazoo will overflow its banks at an altitude of 758.8 feet. Since 1946, flows in excess of 3,100 cfs have been observed 10 times, a maximum discharge of 6,910 cfs having been recorded during the flood of April 1947.

Several creeks are tributary to the Kalamazoo River within the report area. The largest of these is Portage Creek, which during the period 1947-57 had a mean flow of 57.5 cfs at the gaging station located on the boundary between secs. 22 and 27, T. 2 S., R. 11 W. Above this station, the creek drains an area of 48 square miles. The West Fork of Portage Creek flows into the main creek above the gaging station, but the confluence of Axtell Creek with the main creek is below the station. Comstock, Davis, Schippers, and Arcadia Creeks and Spring Brook are the largest of other tributaries to the Kalamazoo River within the report area. Flow of water in a few of the tributaries ceases intermittently because of the heavy pumping of ground water in nearby well fields.

## Climate

Weather data for the Kalamazoo area show that the highest temperature ever recorded was 109°F, on July 13, 1936, and the lowest was -25°F, on February 10, 1885. Temperatures reach the 100°F mark in about 1 summer out of 3. Days on which temperatures reach 90°F, or above, average 25 per year. At the other extreme, temperatures fall to zero or below on an average of 4 times during the winter. The average dates of the last freezing temperature in the spring and the first in the fall are May 9 and October 9. Lake Michigan greatly affects the weather at Kalamazoo, as the prevailing westerly winds are warmed in the winter and cooled in the summer while passing over the lake.

The average annual precipitation in the area is about 35 inches (fig. 3). Precipitation received during the growing season (April-September) averages 57 percent of the annual total. The rainfall is heaviest in May, which has an average of about 3.8 inches. The driest month of the year is February, in which the average is about 2 inches.

Snowfall averages about 55 inches, and 7 months of the average year have measurable amounts. January has the most snow, averaging 14.3 inches. Kalamazoo is on the eastern edge of the so-called snow belt, which is induced by moisture and warmth picked up by the prevailing westerlies while crossing Lake Michigan. Consequently, the average annual snowfall at Kalamazoo is 10 to 15 inches greater than in the central and eastern sections of southern Michigan.

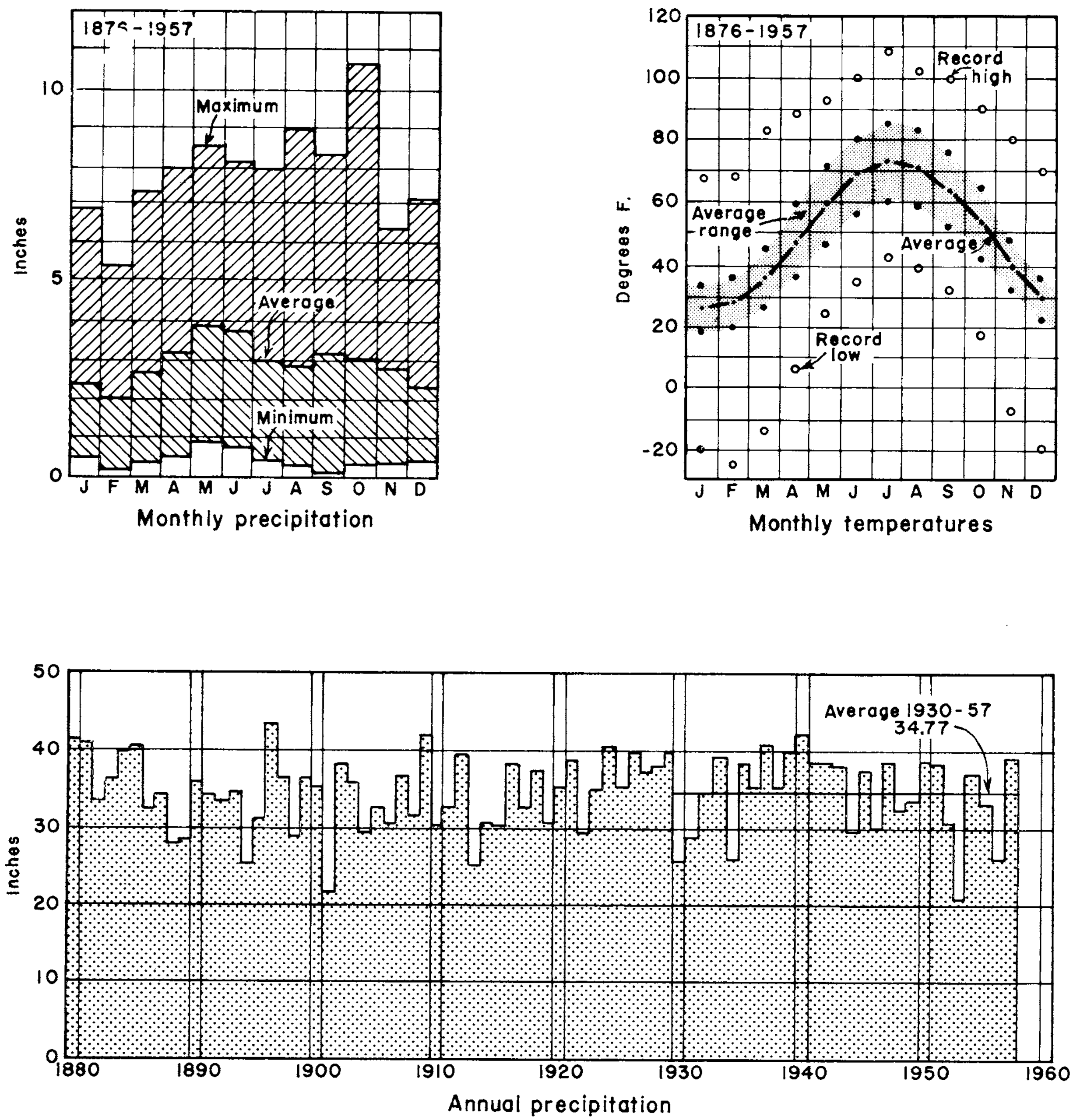



Figure 3. Precipitation and temperature records at Kalamazoo.

# GEOLOGY

## Summary of Geologic History

The bedrock formations that underlie the Kalamazoo area were formed by the consolidation of sediments deposited in seas which covered most of Michigan during the Paleozoic era. More than 10,000 feet of Paleozoic sedimentary rocks are present in the center of the Michigan basin.

The long interval of geologic time from the close of the Paleozoic era to the beginning of glaciation was primarily one of erosion. During this period, the land surface in and around the Kalamazoo area was reduced to relatively low relief. The major streams flowed from the southeast to the northwest (fig. 4), the direction of flow being controlled by the structure of the bedrock formations, which in this area strike northwest. (Strike is the direction of a horizontal line in the plane of the inclined strata and is perpendicular to the dip.) These streams are believed to have been actively downcutting into the sedimentary rocks at the start of the glacial epoch.

The period in the geologic history of the Kalamazoo area most significant to ground water is the Pleistocene or glacial epoch. In the Pleistocene epoch, ice migrated into the Great Lakes region from the north. The glaciers carried great amounts of rock materials picked up from the surface over which the ice passed. These materials, which were deposited as the ice sheets melted away, make up the only important fresh-water aquifers in the Kalamazoo area.

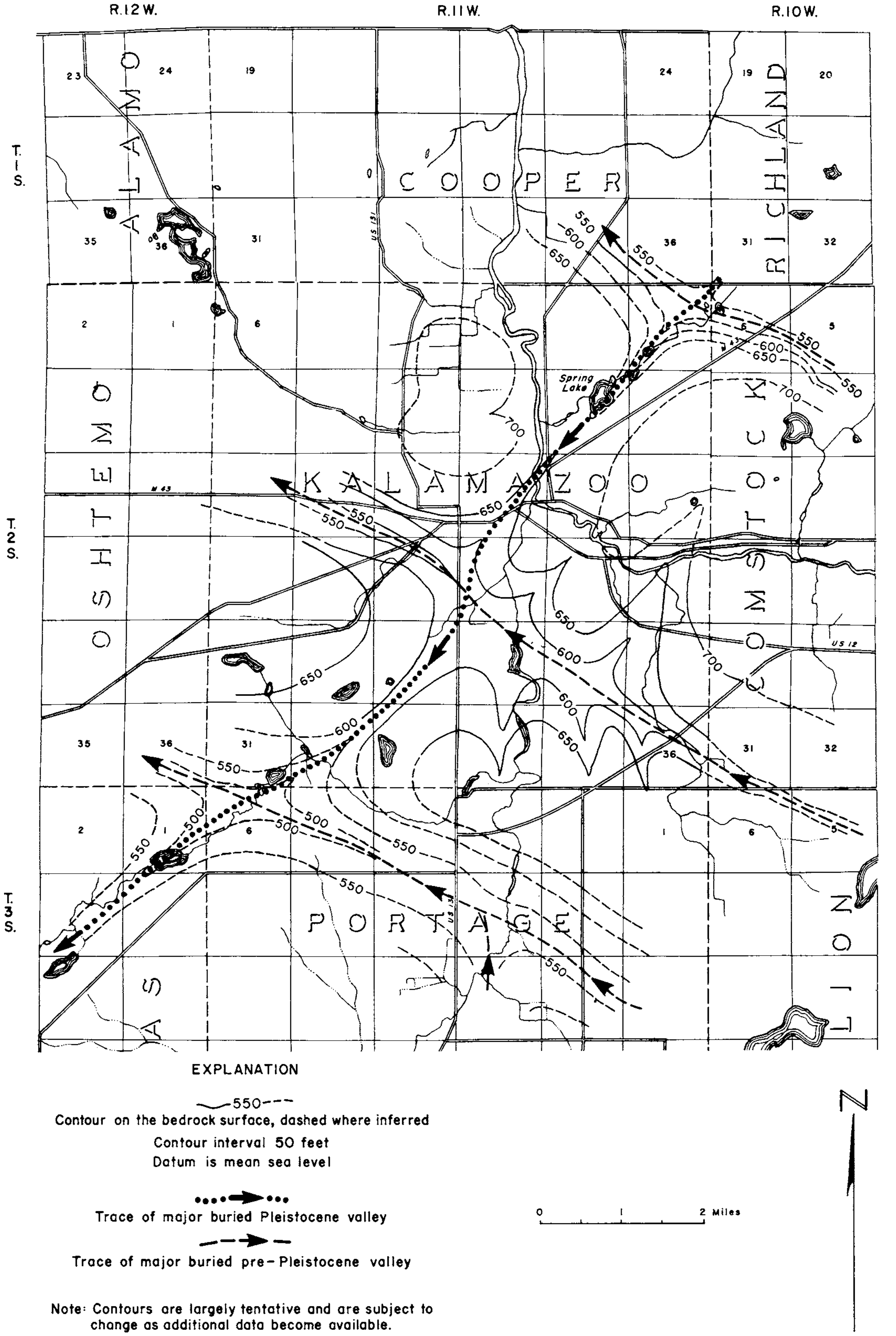



Figure 4. Map showing generalized contours on the surface of the Coldwater shale in part of the Kalamazoo area.

During Wisconsin time Kalamazoo County was first covered, at least in part, by a lobe of ice emanating from the Saginaw Bay area. Areas in the southeastern part of the county contain glacial deposits associated with the Saginaw lobe. The rest of the county, including the area covered by this report, was later covered by ice of the Lake Michigan lobe, which advanced from the Lake Michigan basin to the northwest. The movement of ice into the area from the Lake Michigan basin probably followed in part along the valleys in the pre-Pleistocene bedrock surface.

The ice front became stabilized at intervals along several fronts, and subsequent retreats of the fronts caused by melting left two moraines in the eastern part of the county. The ice front then retreated to a new position, marked by the Outer Kalamazoo moraine, which extends from northeastern Cooper Township through Texas Township. Melt water streams, which flowed from the ice standing on the Outer Kalamazoo moraine, spread outwash deposits of sand and gravel in front of the moraine. The melt water streams flowed eastward from the moraine into the glacial Kalamazoo River which at that time drained to the south.

Blocks of ice became detached from the melting glacier through the center of the county and were buried by sand and gravel outwash. Pits, formed when the ice remnants melted, now contain most of the lakes in Kalamazoo County. Melt water draining from the glaciers ponded against the ice front and formed glacial Lake Kalamazoo, which covered parts of the present Kalamazoo, Cooper, Comstock, Pavilion, and Portage Townships (Martin, 1957). Most of the sediments deposited in this lake were subsequently removed during downcutting of the Kalamazoo Valley.

The ice front then retreated a short distance to a position marked by the Inner Kalamazoo moraine. Melt waters from the ice at this front deposited outwash between the Inner and Outer Kalamazoo moraines. The melt waters drained to the east through several gaps in the Outer Kalamazoo moraine, one of which is in the vicinity of Crooked Lake in the central part of Texas Township.

After the ice retreated from the county, the Kalamazoo River abandoned its southern outlet and flowed northward to a lower outlet in southeastern Allegan County. Melt waters from the Saginaw lobe and the waters of Lake Kalamazoo also drained through this new valley to the vicinity of Otsego in Allegan County, where they emptied into the Gun River, a southward-flowing tributary of the St. Joseph River. The Kalamazoo River at that time cut 80 to 100 feet into the former outwash and lake plains, removed large quantities of sediment, and greatly widened the old valleys.

After the close of the Pleistocene epoch the volume of water discharged through the Kalamazoo River valley was greatly reduced, and hence the present-day Kalamazoo River occupies only a very small portion of the valley of the ancestral river.

## Bedrock Structure

The Paleozoic sediments of the Michigan basin were deposited in nearly horizontal layers, but gradual subsidence and compaction of the beds, which was contemporaneous with deposition and greatest in the center of the basin, produced a bowl-shaped structure. The formations crop out in roughly concentric bands, the youngest beds being at the surface in the central part of the structure and the oldest at the surface around the perimeter. The Kalamazoo area is in the southwestern part of the basin, where the Coldwater shale of Mississippian age forms the bedrock surface. This formation is 500 feet or more thick in the Kalamazoo area, dips generally northeastward toward the center of the basin, and strikes northwest. The Marshall formation, which directly overlies the Coldwater shale in the central part of the basin, extends into the northeast corner of Kalamazoo County; but elsewhere in the county, including the area covered by this report, it has been eroded away. Rocks older than the Coldwater shale crop out in the extreme southwest corner of the State and in northwestern Indiana.

## Bedrock Topography

The bedrock topography as shown on figure 4 has been inferred from the records of water wells that reach bedrock and oil wells and oil test wells in and adjacent to the Kalamazoo area. As shown by Terwilliger (1958), the southwestern part of Michigan in preglacial time was drained through valleys that trended northwestward, generally parallel to the strike of the underlying bedrock formations. At least three major bedrock valleys of preglacial origin are believed to cross the report area. Data from wells indicate that another valley, probably of Pleistocene age, transects the three older valleys. This Pleistocene channel probably was cut when the advancing glaciers blocked the normal northwestward flow of the streams. Sediments filling these valleys compose the thickest deposits of glacial drift in the Kalamazoo area. Wells in the Axtell Creek area (fig. 15) tap thick, permeable drift deposits at the intersection of a major pre-Pleistocene valley and the Pleistocene valley.

Generally, the basal part of the glacial-drift mantle is composed of dark-blue clay, most of which was derived from the Coldwater shale and redeposited by glacial ice. The shale is similar lithologically to the glacial-clay deposits, and it is difficult for drillers to distinguish between them in wells. Thus, the contact between the glacial drift and the Coldwater shale has not been accurately delineated in the logs of many wells. It appears that test drilling, which would more accurately define the bedrock valleys, would aid in the location of ground-water sources similar to that supplying the Axtell Creek area fields.

# GROUND WATER

A rock formation, part of a formation, or group of formations that yields water in usable quantities is called an "aquifer". The imaginary surface consisting of all points to which water will rise in wells tapping an aquifer is called the "piezometric surface". Aquifers are classified as water-table or artesian. In a water-table aquifer, ground water is unconfined; its surface within the aquifer is termed the "water table" and may be considered the piezometric surface of that aquifer. The zone of saturation is that part of the formation in which openings are filled with water under hydrostatic pressure. In an artesian aquifer, ground water is confined under pressure between relatively impermeable strata (strata through which water does not move readily). Under natural conditions, the water in a well that is finished in an artesian aquifer and tightly cased through the overlying confining bed will rise above the bottom of that bed, and therefore the piezometric surface is above the top of the aquifer. An artesian aquifer is full of water at all times, even when water is being removed from it. In topographically low areas wells tapping artesian aquifers may flow at the surface.

The capacity of a material to transmit water under pressure is called "permeability". The ability of an aquifer to yield water, however, relates not only to its permeability but also to its extent and thickness and to the amount of recharge available to it. The permeability of the glacial drift, which is the chief aquifer in the Kalamazoo area, is determined by the character (size and shape) of the open spaces between the drift particles. The character of the open spaces depends primarily on the mode of deposition of the various types of drift.

The coefficient of permeability (P) expressed in meinzers, is the rate of flow of water in gallons per day through a cross-sectional area of 1 square foot under a hydraulic gradient of 100 percent at a temperature of 60°F. The hydraulic characteristics of an aquifer are commonly expressed in terms of the coefficients of transmissibility and storage. The coefficient of transmissibility (T) is defined as the number of gallons of water per day, at the prevailing temperature, that will move through a vertical strip of the aquifer 1 foot wide and of a height equal to the thickness of the aquifer, under a hydraulic gradient of 100 percent, or 1 foot per foot. The transmissibility of an aquifer equals the average field coefficient of permeability (the coefficient measured at the prevailing temperature rather than at 60°F) times the thickness of the aquifer. The coefficient of storage (S) of an aquifer is defined as the volume of water the aquifer releases from or takes into storage per unit surface area per unit change in the component of head normal to that surface. The hydraulic characteristics of the glacial-drift aquifers in various parts of the Kalamazoo area are described below in the section entitled "Aquifer Tests".

The yield or the specific capacity of a well is a function of the efficiency of the well, the transmissibility and areal extent of the aquifer, and the availability of recharge. Specific capacity is defined as the yield per unit of drawdown and is usually expressed as the yield, in gallons per minute, for each foot of drawdown in water level caused by pumping of the well. Table 3 lists the specific capacities of a number of wells in the Kalamazoo area.

## Ground Water in Consolidated Rocks

The glacial drift in the Kalamazoo area is underlain by a thick sequence of shale, limestone, dolomite, sandstone, and other consolidated sedimentary rocks. The total thickness of the consolidated sediments has not been determined. None of these rock formations are known to supply fresh water to wells in the Kalamazoo area.

The Coldwater shale of Mississippian age, which is the uppermost bedrock formation under the Kalamazoo area, is composed primarily of dark-blue and relatively impermeable shale. Locally it contains layers of sandstone which may be water-bearing. The presence of two layers of water-bearing sandstone, one of which is 15 feet thick, is reported in the log of well 2S 11W 11-9 (table 2), but sandstone has not been reported in logs of other water wells in the area.

## Ground Water in Glacial Drift

Deposits of unconsolidated glacial drift constitute the only important fresh-water aquifers in the Kalamazoo area. The general term "glacial drift" embraces all types of sediments deposited during the glacial epoch by ice, melt-water streams, glacial lakes, and wind.

The glacial drift, which covers the entire Kalamazoo area, consists primarily of morainal, outwash, and channel deposits (fig. 5). The morainal deposits consist of till and were deposited directly from the glacial ice, water playing a minimum part in deposition. Outwash deposits are formed of materials deposited by melt-water streams issuing from the glacial ice. The channel deposits are similar in origin to the

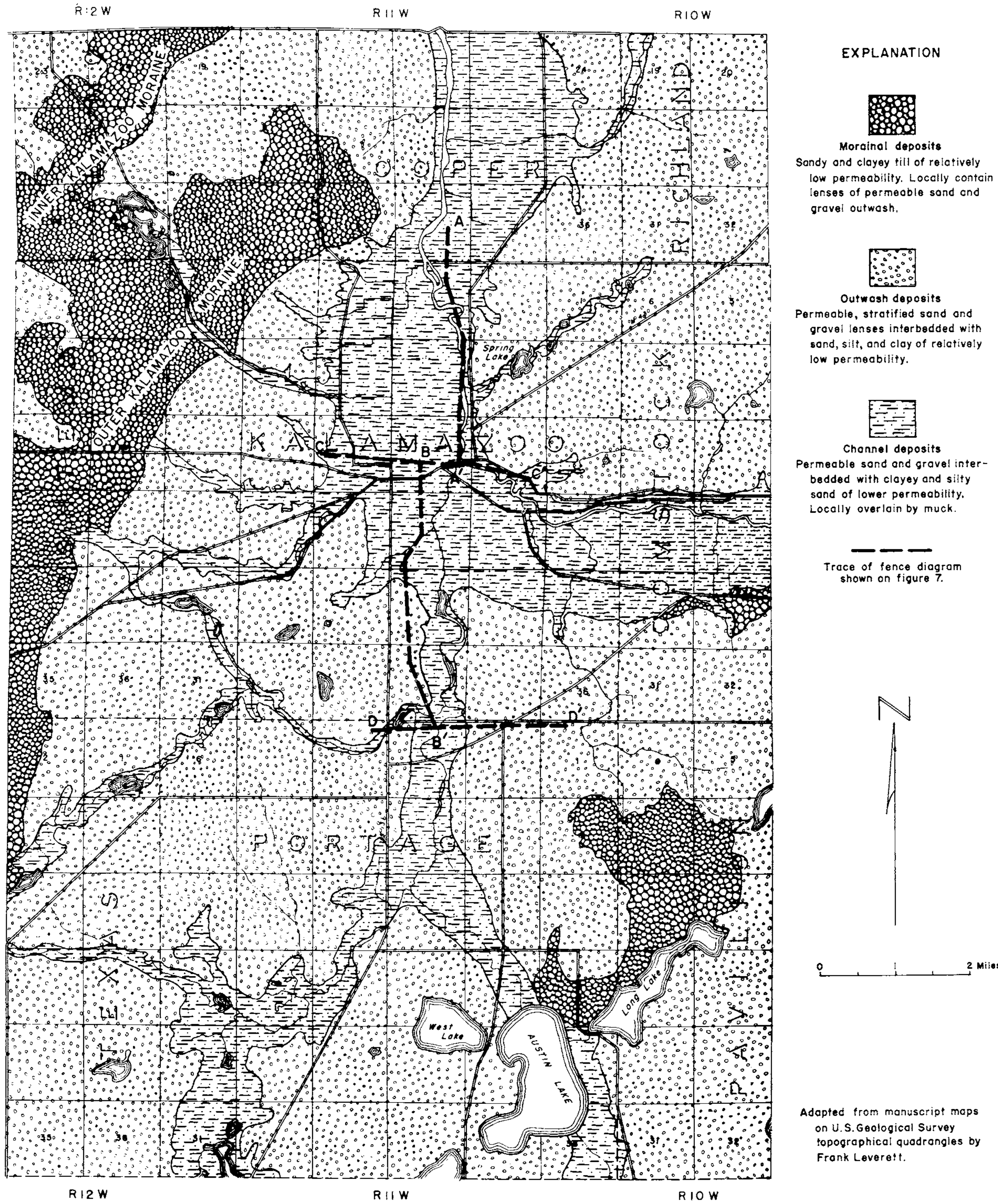



Figure 5. Surface geology of the Kalamazoo area.

outwash deposits, except that in late glacial and postglacial time the waters of the Kalamazoo River system extensively eroded and reworked these deposits and subsequently covered them with finer grained sediments. Layers of silt and clay deposited in glacial lakes and lenses of windblown sand also are present in the drift, but they are not present over significant areas of the surface and therefore are not shown on figure 5.

Figure 5 shows the nature of the glacial materials at or near the land surface and can be used as a general aid in prospecting for ground-water supplies. The aquifers best capable of supplying wells of high capacity are in areas mapped as outwash or channel deposits where the glacial drift is thick or where permeable beds of sand and gravel are hydraulically connected with surface streams or lakes.

Figure 6 shows the general thickness of the glacial drift in part of the area covered by this report. The drift ranges in thickness from about 50 feet at places along the Kalamazoo River to more than 300 feet where it fills the pre-Pleistocene valleys in the bedrock surface. Sufficient data were not available for construction of a drift-thickness (isopachous) map for the entire report area. Figure 7 shows schematically the thickness and general composition of the glacial drift along several cross sections through the city of Kalamazoo, from the north well field of the Kalamazoo Vegetable Parchment Co. to the north edge of Portage Township.

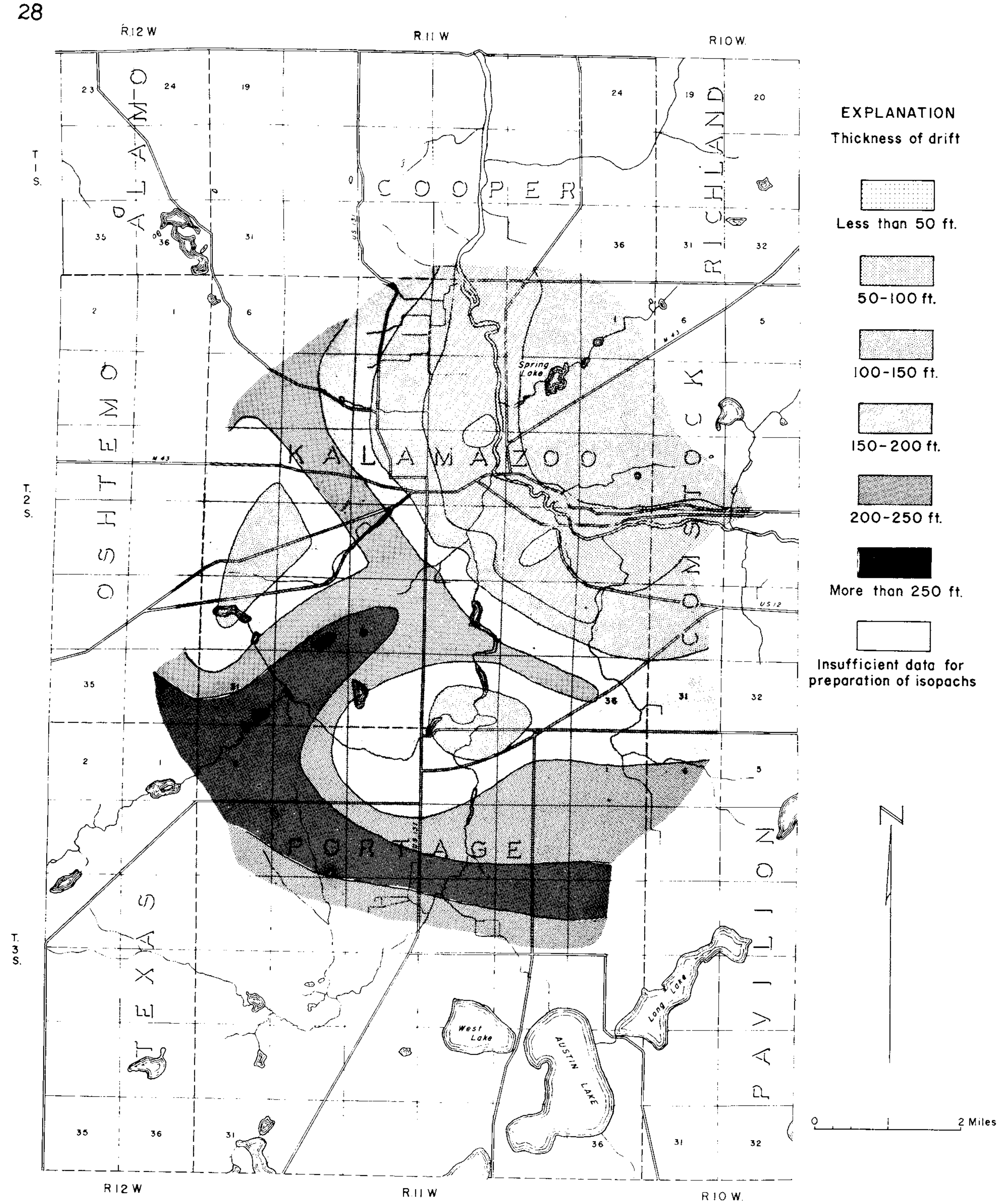



Figure 6. Generalized isopach map showing thickness of the glacial drift in part of the Kalamazoo area.

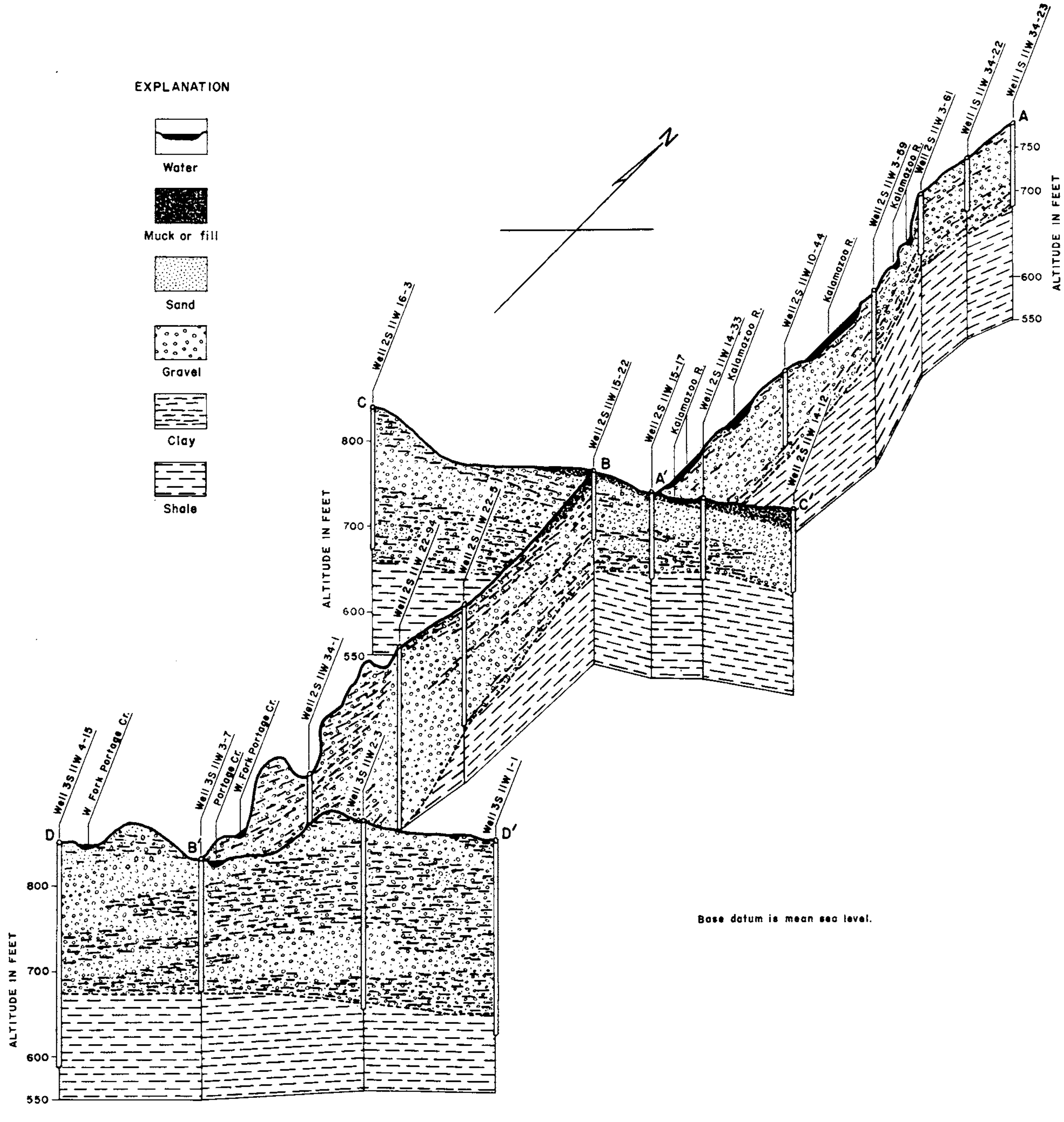



Figure 7. Schematic fence diagram of sections through the glacial drift along lines shown on figure 5.

## Morainal Deposits

The Outer and Inner Kalamazoo moraines are ridges of glacial till deposited along relatively static fronts of the Lake Michigan lobe of the Wisconsin glacier. The morainal tills generally are an unstratified and poorly sorted mixture of rock debris consisting of particles that range in size from clay to boulders. The tills of the Outer and Inner Kalamazoo moraines within the report area are generally sandy but contain sufficient amounts of clay and silt to reduce the permeability.

The morainal deposits generally will yield water adequate for domestic needs. Locally, however, they include beds of permeable sand or gravel outwash which will yield moderate to large supplies of water. Test hole 2S 11W 6-1, drilled to a depth of 167 feet (table 1), yielded 400 gpm. The source of most of this water is a bed of coarse gravel and boulders at a depth of 134 to 147 feet. The till above and below this bed is presumed to be of low permeability and to have contributed little to the yield of the well. The productivity of this well demonstrates the feasibility of obtaining water, at least locally, from permeable zones in the deposits of the Outer Kalamazoo moraine. Data are lacking, however, concerning the distribution, extent, and thickness of permeable materials that may be buried by or interbedded in the morainal tills.

Till was deposited also as ground moraine during retreat of the ice front in a period of rapid melting. The surface formed by such deposition is a rolling plain of low relief, and is referred to as a "till plain". Till plains are present in western Pavilion Township and extend into eastern Portage Township (fig. 5). The water-yielding characteristics of the ground-moraine deposits are not known, but supplies adequate for domestic use are pumped from shallow driven wells in this area. Data are not available as to whether these surficial till deposits are underlain by permeable sand and gravel outwash deposits.

The bedrock surface in most of the Kalamazoo area is mantled directly by basal till composed predominantly of blue clay, although stream-deposited sand and gravel may lie on the shale surface along the bottoms of preglacial valleys. The basal till was derived largely from the Coldwater shale, over which the ice advanced, and hence is similar to the shale in hydrologic and lithologic characteristics. These till deposits are not a source of ground water.

## Outwash Deposits

The outwash deposits in the Kalamazoo area are composed of relatively well sorted and stratified sand and gravel deposits, but some of the outwash is rather poorly sorted and difficult to distinguish from adjacent till. The sand and gravel outwash deposits are interbedded with numerous lenses of clay, silt, and fine sand.

The variation in grain size of the outwash particles is indicated in table 4, which lists the effective openings of screens used in different wells in the Kalamazoo area. The successful use of slotted casings in several wells indicates that much of the outwash is composed largely of coarse-grained material. Many lenses of highly permeable outwash are present at varying depths within the report area as indicated by the many depths of screen or slot settings, and a single well commonly penetrates several good water-bearing zones. Many of these lenses are thin and discontinuous and hence, even in the rather restricted area of a well field, it is difficult to correlate individual lenses of permeable outwash material between wells. In some areas the outwash consists primarily of fine-grained sediments of relatively low permeability.

Outwash deposits compose the most important water-bearing zones within the glacial-drift aquifers of the Kalamazoo area. The aggregate thickness of these deposits, which are at the surface in much of the area (fig. 5), is as much as 300 feet where they have filled the pre-Pleistocene valleys in the bedrock surface. Wells 2S 11W 28-1 and 2S 10W 5-3 penetrated 294 and 330 feet of glacial drift, respectively, most of which is composed of layers of sand and gravel outwash.

Many wells tapping the outwash deposits have specific capacities of 25 gpm, or more, per foot of drawdown (table 3). The major well fields operated by the city of Kalamazoo, including those in the Axtell and Portage Creek areas which tap these deposits, have yielded large quantities of water throughout the years (see "Pumpage, Municipal" below). The outwash deposits are the source of water to most of the large capacity public-supply wells in and near Kalamazoo, but in some areas they may not be a source of large or even moderate supplies.

## Channel Deposits

The material mapped as channel deposits on figure 5 consists mainly of well-sorted sand and gravel beds which are similar in composition and hydrologic characteristics to the outwash deposits. The channel deposits, however, are of more recent origin than the outwash deposits, and locally they are interbedded with lake-deposited silt and clay and are mantled by silt deposits of the modern Kalamazoo River. In some areas the channel deposits are mantled also by muck. The channel deposits are differentiated from the adjacent outwash deposits primarily by their lower topographic position.

The channel deposits are present in the drainageways developed after the Kalamazoo River changed its course from the south to a lower outlet at the north, in Allegan County. This change resulted in downcutting of the outwash plain by 80 to 100 feet. Hence the channel deposits represent outwash that was reworked by the Kalamazoo River and its tributaries plus additional sediments deposited in the new drainageways.

The sand and gravel channel deposits along the Kalamazoo River range in thickness from about 50 to more than 100 feet. The log of well 2S 11W 24-3 at the National Gypsum Co. reports shale at a depth of 38 feet, but logs of other nearby wells report clay or hardpan at that depth (table 2).

The channel deposits are very important aquifers in the Kalamazoo area, inasmuch as they are tapped for water supply by the various paper companies located along the Kalamazoo River. The sand and gravel beds included within the channel deposits are rather permeable and have yielded large quantities of ground water for many years, despite the fact that their aggregate thickness is much less than that of the outwash deposits. These beds are connected hydraulically to the Kalamazoo River, which serves as a source of recharge to the streamside aquifers and thus maintains relatively stable water levels (see "Recharge" below).

## Recharge

The initial source of all fresh ground water in the Kalamazoo area is precipitation, which averages about 35 inches annually (fig. 3). The percentage of precipitation that ultimately percolates to the various aquifers has not been determined, but there is no doubt that a large percentage of the annual precipitation over the area is evaporated, is transpired by vegetation, or runs off directly to surface streams.

Areas where unsaturated permeable materials are at or near the surface are favorable for infiltration of precipitation to the underlying aquifers. Precipitation on already-saturated sediments or on areas underlain by materials of relatively low permeability, such as clayey till or lake deposits, will not result in appreciable recharge. Much of the surface runoff is available for recharge to the ground-water reservoirs through induced infiltration to well fields in the area.

Under normal conditions in the Kalamazoo area, ground water discharges to the Kalamazoo River and its tributaries, which are hence classified as effluent streams. Where the streams are incised into permeable materials in the aquifer, water flows from the stream into the aquifer if the water level in the aquifer is lowered to a depth beneath the stream surface by pumping or any other influence. That reach of the stream is then classified as influent and is a source of recharge to the aquifer potentially equal to the flow of the stream. Pumping of wells in such an area will induce migration of water from the stream toward the wells.

Water levels in wells along or near the Kalamazoo River are influenced by changes in stage (gage height) of the river (fig. 8) in such a way as to demonstrate that the river and aquifer are connected hydraulically. The water level in observation well 2S 11W 10-11, which is about 300 feet from the Kalamazoo River, rose about 14 feet in response to precipitation that caused a 7-foot rise in stage of the river in March and April 1947. The water level in well 2S 11W 26-3, about 3,700 feet from the river, rose about 4 feet during the same period. A rise or fall in river stage ultimately results in corresponding changes of water level in the aquifer, although there is a lag in time before the entire effect is felt. The amount of rise in water levels in these wells which can be attributed directly to rise in river stage, and not to direct recharge from precipitation, however, cannot be determined on the basis of presently available data.

Most of the well fields of the city of Kalamazoo are adjacent to creeks tributary to the Kalamazoo River. The City Utilities Department is engaged in a continuing program of inducing recharge to some of the municipal well-field aquifers from these streams by construction of recharge ponds, lakes, and channels, and by streambed improvement. The

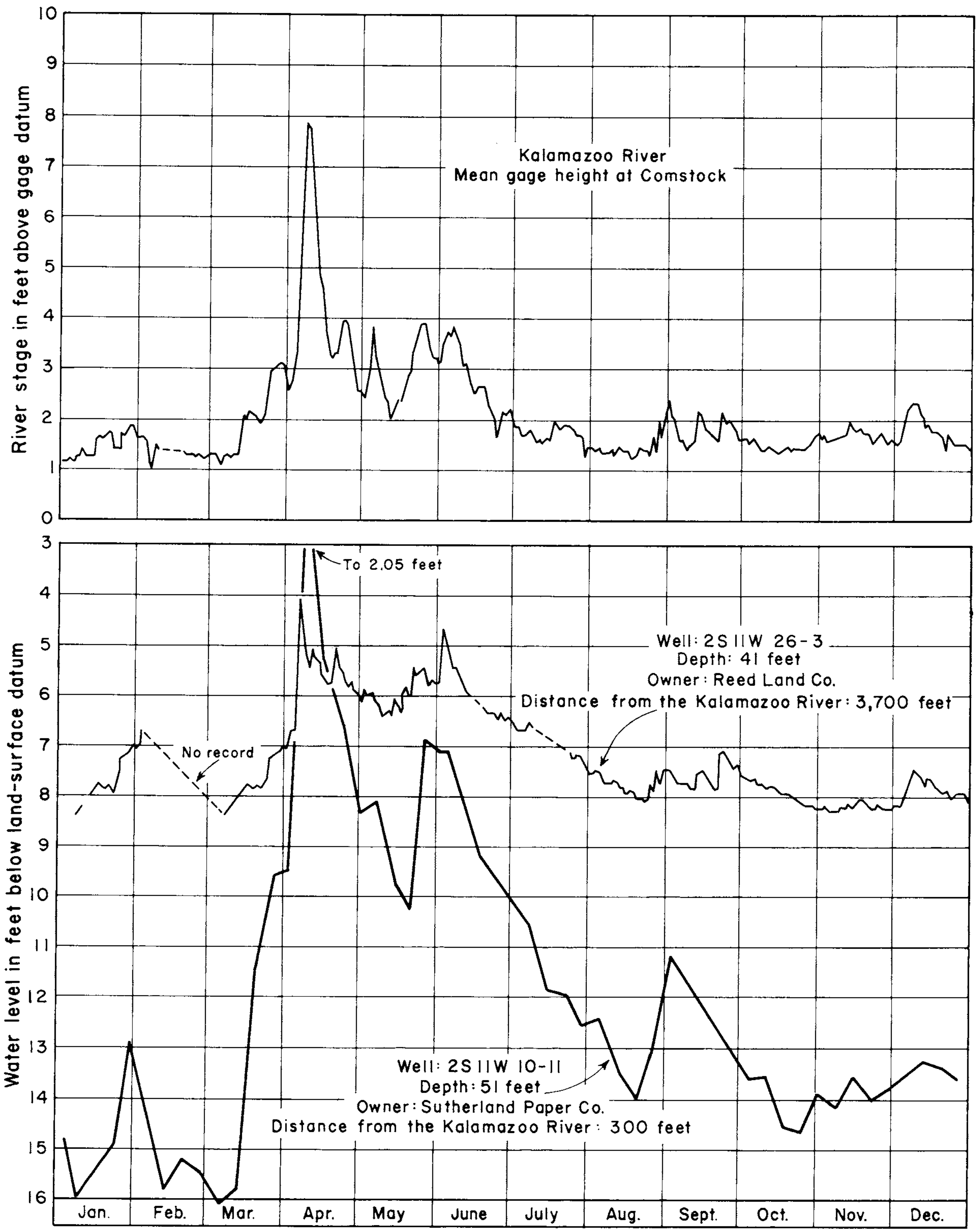



Figure 8. Graphs showing the relation between the mean gage height of the Kalamazoo River and water levels in wells 2S 11W 10-11 and 26-3 during 1947.

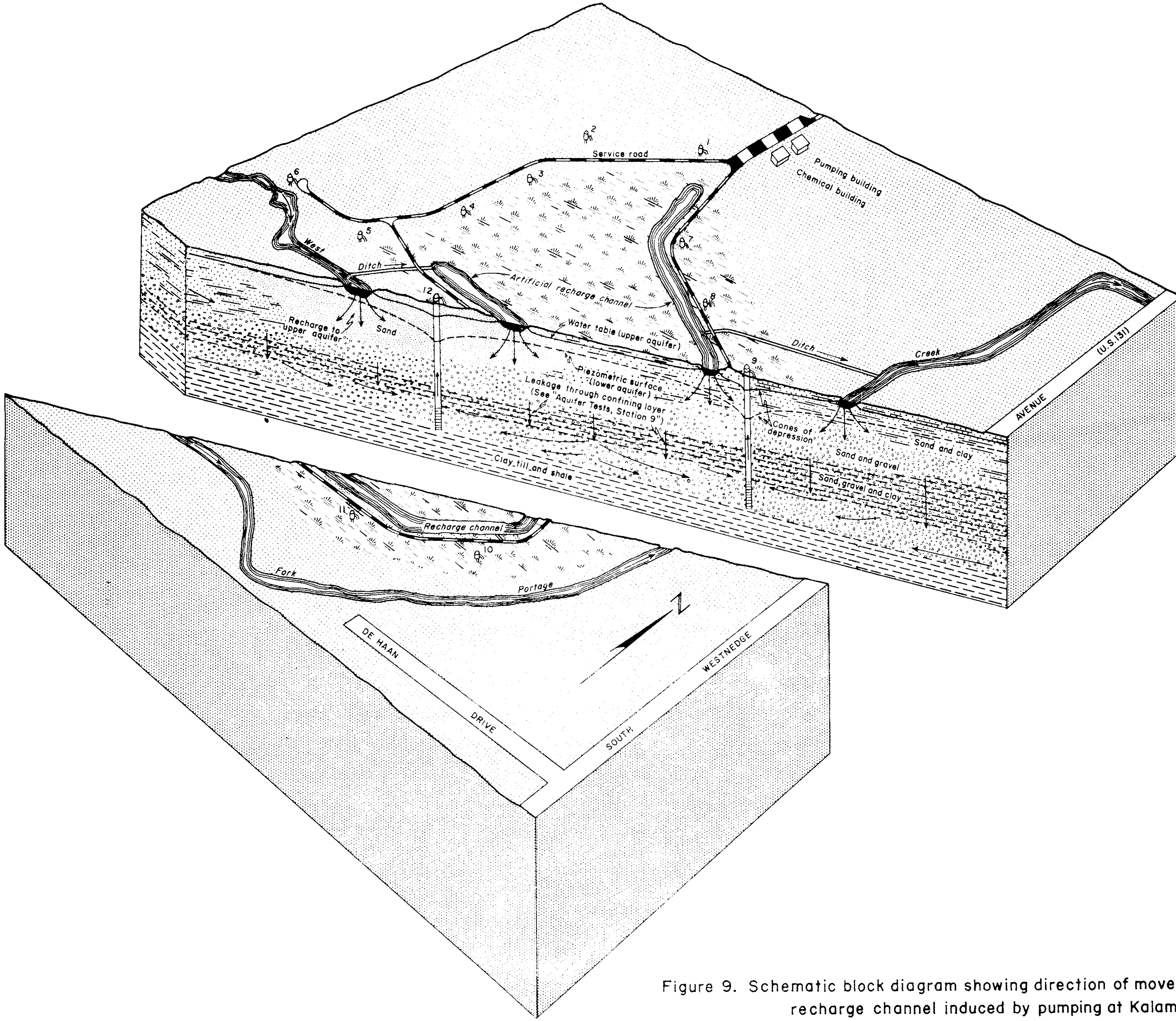
recharge operations increase the yield of the well fields because surface storage capacity (available recharge) is increased, and hydraulic connection with the aquifers is created or improved. Growth of cones of depression and lowering of water levels are practically halted as recharge in quantities equal to pumpage moves into the aquifers under increased hydraulic gradients. The quantity of surface water that can be recharged to the aquifer varies directly with the transmissibility of the aquifer, the permeability and area of the bottom of the surface source, the hydraulic gradient, and, of course, with the amount of surface water available.

For example, Axtell Creek has been deepened and widened to create three large ponds in the area of the important complex of well fields shown on figure 15. Silt and organic materials are periodically removed from the bottoms of these ponds and adjacent reaches of the creek so that optimum infiltration capacity can be maintained. Despite the fact that billions of gallons of water are pumped annually from numerous high-capacity wells in this area the relatively small drawdown of the ground-water level (fig. 18) is marked evidence of the success of this project. The amount of water pumped from the area is governed by the quantity of recharge available from precipitation and by the water carried into the area by Axtell Creek. The effects of pumping on Axtell Creek are illustrated by base flow measurements of the creek made on November 20, 1947 at the Maple Street bridge near Station 4 (drainage area, 0.77 square miles) and near the confluence of Axtell and Portage Creeks (drainage area, 1.47 square miles). The data showed an actual loss in flow from 0.876 to 0.650 cfs in this reach (Paulsen, 1950, p. 286). In terms of yield per square mile of drainage area, the flow at the mouth was only 39 percent of that at the Maple

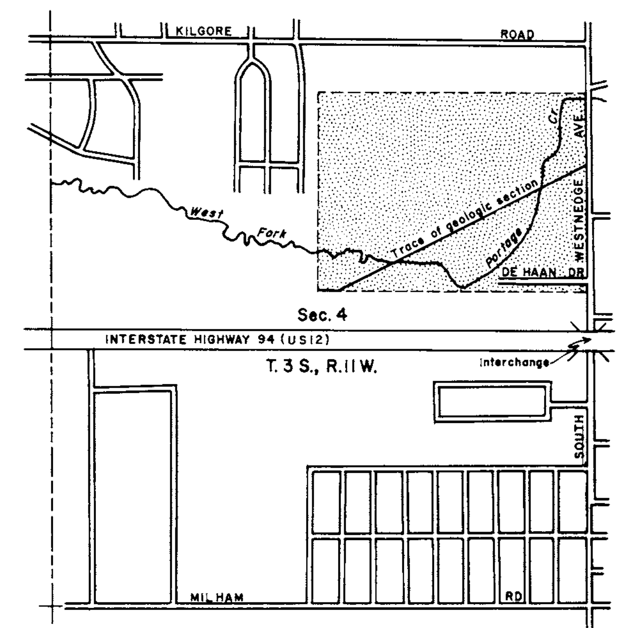
Street bridge. During many days in the summer, little or no water from Axtell Creek discharges to Portage Creek. The city endeavors to limit pumping to amounts equal to the available recharge, so as to avoid dewatering of the upper portion of the aquifer, which would cause increased pumping lifts.

A similar program is being carried out at the West Kilgore Road well field (Station 9). Here, a recharge channel has been dredged within the field. Part of the flow of the West Fork of Portage Creek is diverted to the recharge channel via a ditch and culvert. The waters in the creek and the channel are available for induced recharge to the aquifer by pumping. Figure 9 illustrates the principles involved in this case of induced infiltration and the general direction of movement of water from the stream and recharge channel through the aquifer and into the well. It does not, however, show movement of water to the well from sources other than the stream and recharge channel, such as precipitation on the area and on adjacent uplands.

The new Spring Valley well field (Station 14, fig. 14) constructed by the City Utilities Department has demonstrated supplemental benefits that can be derived from sound hydrologic research when combined with integrated urban planning. To provide water for the rapidly expanding population in the northeastern part of the city, a new well field was constructed in the vicinity of a series of small lakes, the so-called Limekiln Lakes in secs. 1, 11, and 12, T. 2 N., R. 11 W. The outwash materials in this area are only moderately permeable, because they contain a relatively large percentage of fine sand and silt. The Parks and Utilities Departments collaborated in dredging and expanding the lowest




Note: Entire area is in sec. 4, T. 3 S., R. 11 W. (Portage Township); hence, well numbers shown are 3S 11W 4-1, etc. See tables 1 and 2 for selected records and logs.




Index map showing location of area of block diagram.

Figure 9. Schematic block diagram showing direction of movement of water from creek and recharge channel induced by pumping at Kalamazoo station 9.

of the small lakes, providing a large source of recharge to the aquifer. The large area of recharge compensates for the moderate permeability of the aquifer. An elevated storage tank was constructed so that this facility could be used independently to provide water in the area without the necessity of importing water from distant pumping stations located at considerably lower altitudes. A scenic park was developed around the new lake, which was renamed Spring Lake (fig. 2).

The Upjohn Co., which pumps 5 to 9 million gallons of ground water daily, constructed two artificial-recharge ponds of 10,000 and 40,000 square feet, into which clean, but warm, process water is pumped (Sisson, 1955). Enough chloride is added to maintain a residual to prevent bacterial growth. A natural pond covering 90 acres also is used for recharging. Sisson calculated that the artificial ponds recharge 9 percent, and the natural pond 16 percent, of the well water pumped by the company.

Figure 8 demonstrates that hydraulic connection exists between the Kalamazoo River and the channel deposits that make up the aquifers along the reach of the river through the Kalamazoo area. The river thus provides recharge to the aquifer, which is tapped by numerous high-capacity industrial wells. Potentially, the river is a source of recharge greatly in excess of foreseeable industrial demands. However, recharge to the streamside well fields is impeded by the partial sealing of the river bottom by natural sedimentation and by settling of solids from industrial effluents. Measures designed to promote recharge from the river are necessary to utilize more fully the water-resource potential along the Kalamazoo River. Efforts made by several industries to scrape or remove impermeable materials from the river bottom in order to increase the recharge locally have met with varying degrees of success. Measures are also being taken by the industrial concerns in the area to reduce the volume of solids discharged to the river.

## Movement and Discharge

The movement of water underground is similar to that of surface streams, as the water moves by gravity from high levels to low levels in response to differences in hydraulic head. Ground water, however, moves slowly through the drift aquifers, because of the resistance to flow in the small openings through which it passes. Sisson (1955) calculated that water recharged to the aquifer in sec. 14, T. 3 S., R. 11 W., traveled at a velocity of 1 3/4 feet per day. Velocities of ground-water movement vary considerably, however, and may range from a few feet per year to as much as several feet per day. Water may travel considerable distances in the ground, from areas of recharge at the surface to areas downgradient where it may be pumped from wells, or may, under natural conditions, once more reach the surface and join the flow of streams, appear as a seep or spring, enter a lake, or escape directly to the atmosphere by evaporation or transpiration.

In the Kalamazoo area, except for the southern parts of Texas, Portage, and Pavilion Townships, which lie in the drainage basin of the St. Joseph River, the general direction of ground-water movement is toward the Kalamazoo River. Figure 10 shows the general configuration of the ground-water surface and the direction of flow in the Kalamazoo area. Movement of ground water is in the direction of the hydraulic gradient at right angles to the contours. The hydraulic gradient conforms generally

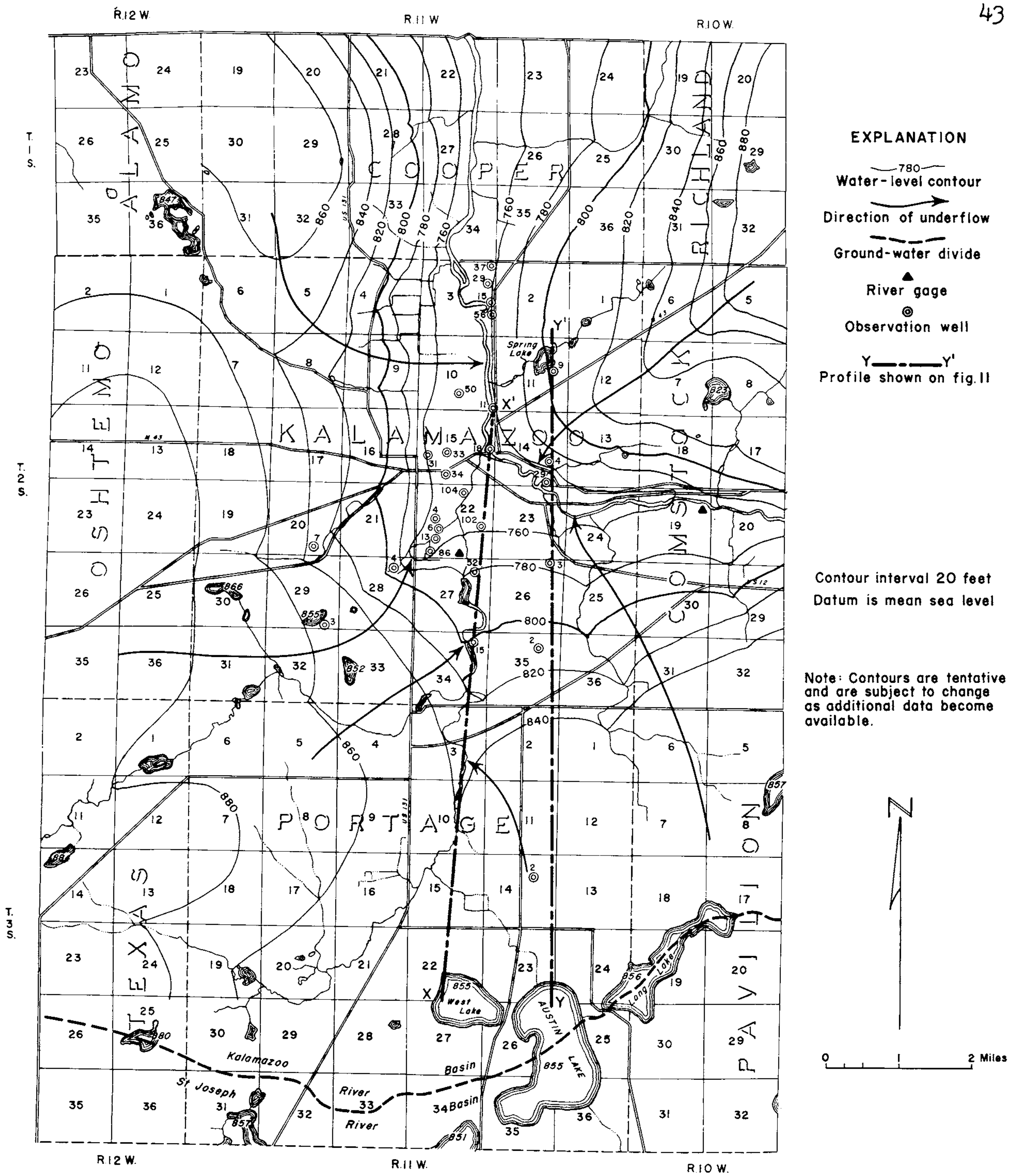



Figure 10. Generalized hydrologic map of the Kalamazoo area showing direction of ground-water movement.

to the topographic gradient. It should be clearly understood that the contours shown on figure 10 are generalized, as the actual pattern of flow in any aquifer is complex. In addition, the contours are interpolated from all available hydrologic data and represent a combination of the configurations of the water tables and piezometric surfaces in numerous water-bearing lenses within the glacial drift. Where two or more water-bearing zones in a given area are under different artesian pressures, water will percolate or "leak" from the aquifer having the higher head to the one having lower head.

Along the flank of the Outer Kalamazoo moraine, on the west side of Kalamazoo, the piexometric surface is above the land surface, indicating that the water in the underlying aquifers is under sufficient artesian pressure to flow.

Figure 10 is insufficiently detailed to show depressions in the piezometric surface caused by pumping in numerous well fields in the area. Figure 11, however, shows the effects of pumping on the water-level profiles along two north-south sections. Section X-X' shows that ground water flows northward to the Kalamazoo River from Austin Lake, which is on the ground-water divide between the Kalamazoo and St. Joseph River drainage basins. The section roughly parallels Portage Creek, and the ground-water level is a few feet above the level of Portage Creek in Portage and southern Kalamazoo Townships. In this area, except for the cone of depression created by well 3S 11W 14-40 and other wells of the Upjohn Co., the stream is effluent, as ground water is discharged to it. Where the aquifer is heavily pumped in the city of Kalamazoo, the water level is below the level of the stream, and

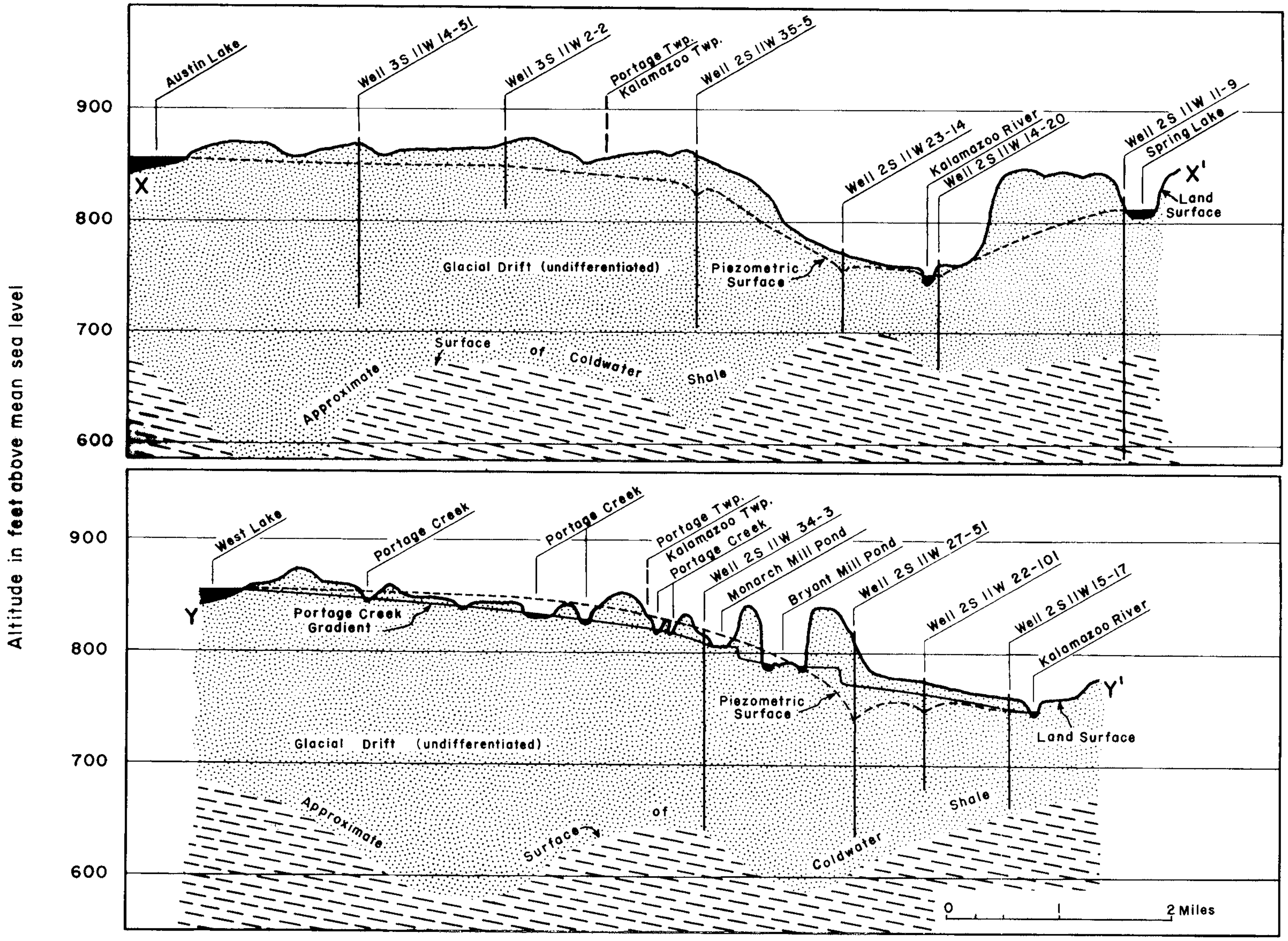



Figure 11. Profiles of the piezometric surface, Portage Creek, and the surface of the Coldwater shale along lines shown on figure 10.

in this reach the stream is influent, recharging the aquifer. The level of Portage Creek does not coincide with the land-surface profile shown on the section, inasmuch as the creek is about 1 to 1 1/2 miles west of the line of the section. This section also illustrates the recharge potential of the Kalamazoo River for aquifers that adjoin the river.

Section Y-Y' on figure 11 more closely parallels Portage Creek but crosses the creek several times. Where the water-level profile is above the land surface, wells drilled into the artesian aquifers will flow. Wells at the East Kilgore station (Station 8), which is located along side of Portage Creek in the north part of sec. 3, T. 3 S., R. 11 W., flow when they are not being pumped. Flows from artesian aquifers in the Kalamazoo area are generally small, and pumping is required to satisfy demands for most purposes. Along most of the reach of Portage Creek in the city of Kalamazoo, pumping has lowered ground-water levels, changing the creek to an influent stream.

Figure 10 shows also that the general movement of ground water in the Kalamazoo area is in the direction of flow of the various tributary streams, although the movement is deflected toward the tributaries where they drain the aquifers. Where municipal and industrial pumping operations have created cones of depression that intersect surface-water bodies, the direction of movement of ground water, and water recharged from the surface, is diverted toward the wells.

Under natural conditions, most of the discharge of ground water is to the Kalamazoo River and its tributaries. Although it is known that some of the surface-water runoff is intercepted by pumping of ground water, the quantity intercepted from most of the streams cannot be determined on the basis of presently available data. It is known, however, that during periods of heavy pumping all the flow of Schippers Creek, and much of that of Axtell Creek, is recharged to the ground. Most of the water pumped from wells is ultimately returned to the surface streams through sewers and drains. Also, some ground water is discharged directly to the atmosphere by evapotranspiration.

## Pumpage

### Municipal

Annual pumpage by the city of Kalamazoo from 1880 through 1957 is shown on figure 12. During this 78-year period, a total of about 118 billion gallons was withdrawn from the glacial-drift aquifers underlying the city and contiguous areas. Total pumpage in 1880 was about 300 million gallons, or about one-fifteenth of the municipal pumpage in 1957. By 1890, pumpage had increased to 790 million gallons, but subsequently, annual pumpage gradually declined until 1902, when only 400 million gallons was pumped. Most of this decline may be attributed to the gradual installation of water meters beginning in 1894 (Norman, 1949).

Annual pumpage increased to a new high of about 2.2 billion gallons in 1930, but declined during the following five years to 1.5 billion gallons in 1935. The decline in pumping can be attributed to the economic depression of that period. By the end of World War II the city of Kalamazoo was pumping about 3.2 billion gallons a year. The volume of pumping increased in the postwar years, but fell off in the early 1950's. This decline undoubtedly was due to above-average precipitation in 1950 and 1951, which tended to reduce water demands for

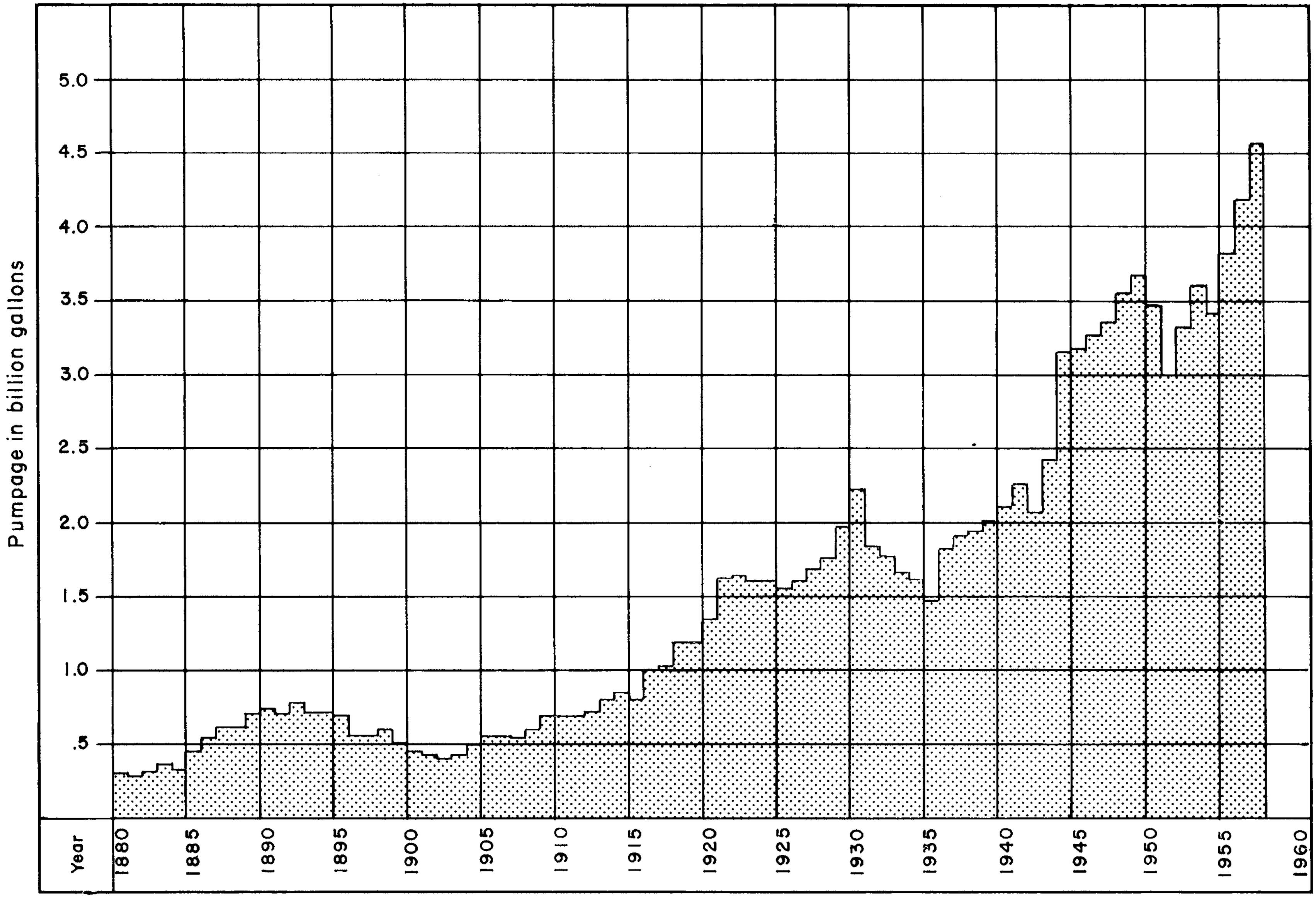



Figure 12. Annual pumpage by the city of Kalamazoo, 1880-1957.

lawn watering and certain other uses, and pumping from several of the smaller stations was temporarily discontinued. Deficient precipitation during the subsequent years was a principal cause of sharp increases in pumping, which reached a record high of about 4.6 billion gallons in 1957.

Prior to the close of World War II almost all the municipal water was pumped from stations along Axtell Creek near the Central Pumping Station, referred to herein as the Axtell Creek area. During this period, only Stations 4 and 5 supplemented the supply obtained from the Axtell Creek area.

After World War II, however, the city began a program of well-field construction in peripheral areas both inside and beyond the city limits. During the period 1946-57 pumpage of ground water from stations other than those located in the Axtell Creek area ranged from about 40 million gallons per year in 1951 to about 1.27 billion gallons in 1957. The pumpage from the various Kalamazoo city well fields for the period 1946-57 is given on figure 13. Figure 14 shows the approximate distribution and magnitude of pumpage from the Axtell Creek area stations and all other municipal well fields in 1957. The stations are at about the centers of the circular pumpage diagrams. Figure 15 shows the approximate location of pumping stations within the Axtell Creek area and the pumpage by each in 1957.

The city of Kalamazoo furnishes water to various industries, commercial firms, and institutions, as well as to the general public. The Kalamazoo State Hospital maintains its own well field and pumping facilities. Portage Township maintains a public supply at the Southfield Subdivision. Elsewhere, beyond the city of Kalamazoo's distri-

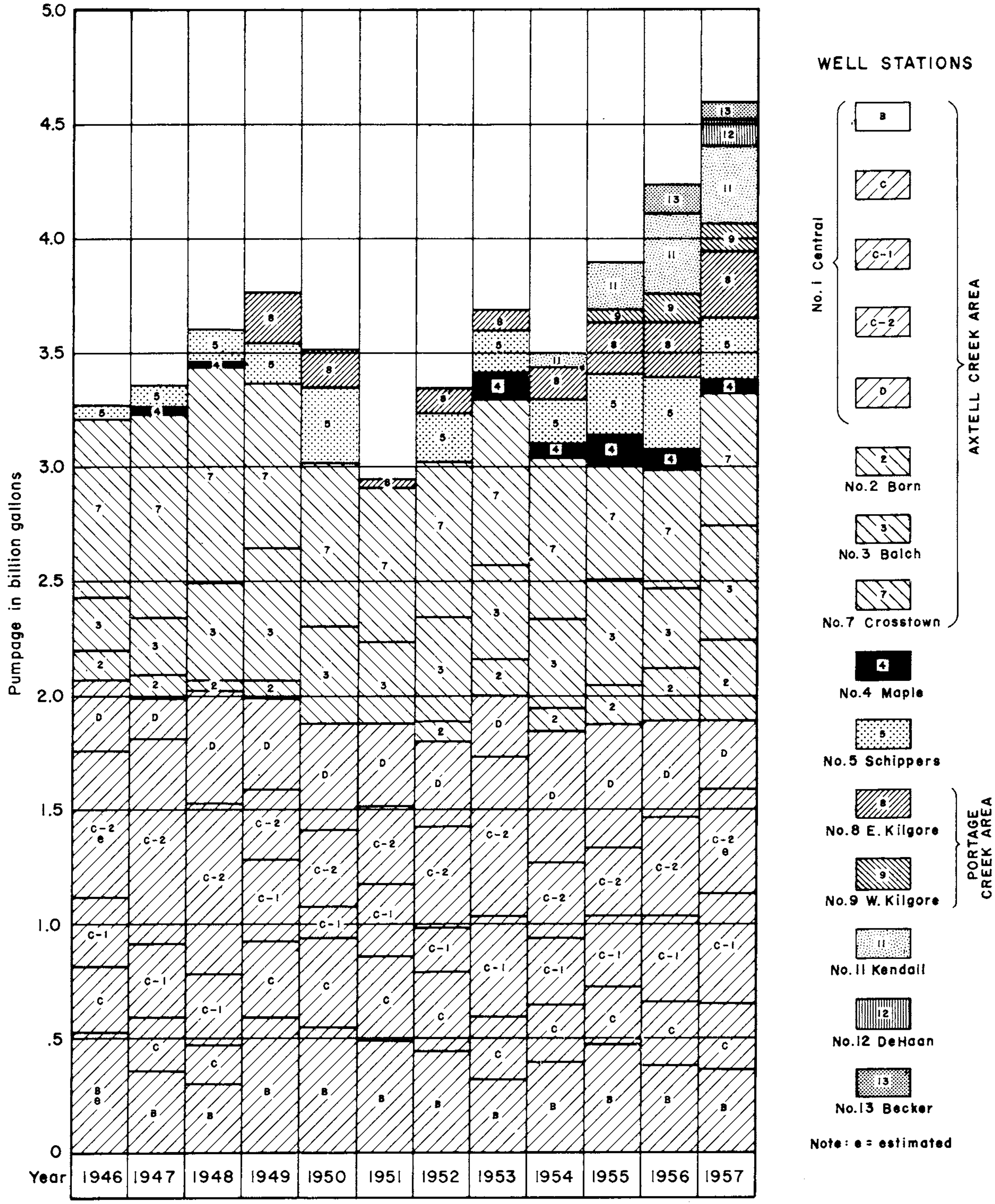



Figure 13. Annual municipal pumpage by stations, 1946-57.

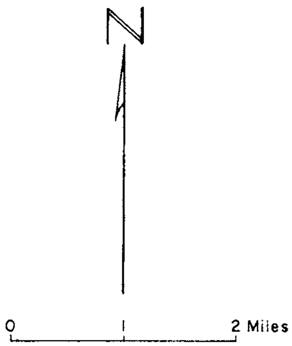
bution facilities, public and domestic water needs are supplied by individual wells or well fields.

### Industrial

A canvass of the larger industrial water users in and near Kalamazoo was made in 1948 in order to estimate the volume of ground water pumped from nonmunicipal wells. Detailed records of pumpage were not available, but it was estimated that the withdrawal of ground water for industrial use in 1948 was about 14 billion gallons. No data on industrial pumpage have been collected since 1948. It is believed, however, that industrial pumping of ground water has declined slightly, and that industrial use of surface water has increased. The paper manufacturers, most of whom are located along the Kalamazoo River and Portage Creek, account for most of the pumpage of ground water for industrial use. The Kalamazoo Vegetable Parchment Co. supplies the city of Parchment with water, in addition to supplying its own needs. The Upjohn Co. in Portage Township, which pumps 5 to 9 million gallons daily, is the only other industrial concern that uses large quantities of ground water; numerous other industrial and commercial firms in the area pump much smaller quantities of ground water for various uses.

## Water Levels

Water levels fluctuate in response to climatic and other natural influences and to pumping and other manmade changes in the hydrologic regimen. Giroux (1958) has analyzed fluctuations of




**EXPLANATION**

| | STATION | TOTAL PUMPAGE (million gallons) |
|---|---|---|
| | Axtell Creek Area (see figure 15) | 3302 |
| 4. | Maple | 56 |
| 5. | Schippers | 266 |
| 8. | East Kilgore | 288 |
| 9. | West Kilgore | 124 |
| 11. | Kendall | 335 |
| 12. | De Haan | 110 |
| 13. | Becker | 76 |

o
Station not pumped during 1957

Note: Stations 1,2,3, and 7 are included in the Axtell Creek Area

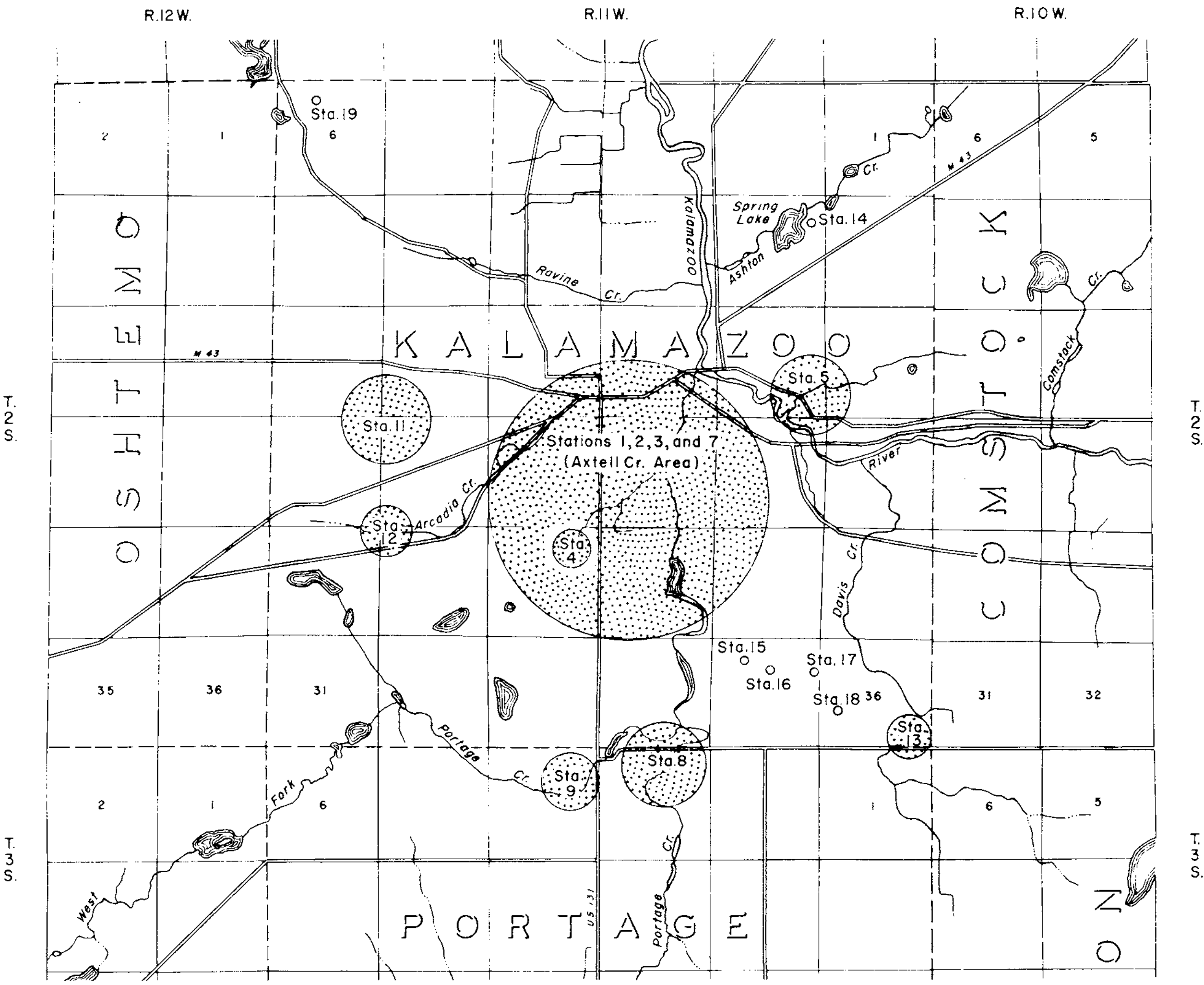



Figure 14. Distribution and magnitude of municipal ground-water pumpage by the city of Kalamazoo, 1957.

EXPLANATION

| STATION | TOTAL PUMPAGE (million gallons) |
|---|---|
| 1. Central | |
| B | 354 |
| C | 256 |
| C-1 | 446 |
| C-2 | 560 |
| D | 257 |
| 2. Born Ct. | 349 |
| 3. Balch St. | 495 |
| 7. Crosstown | 585 |

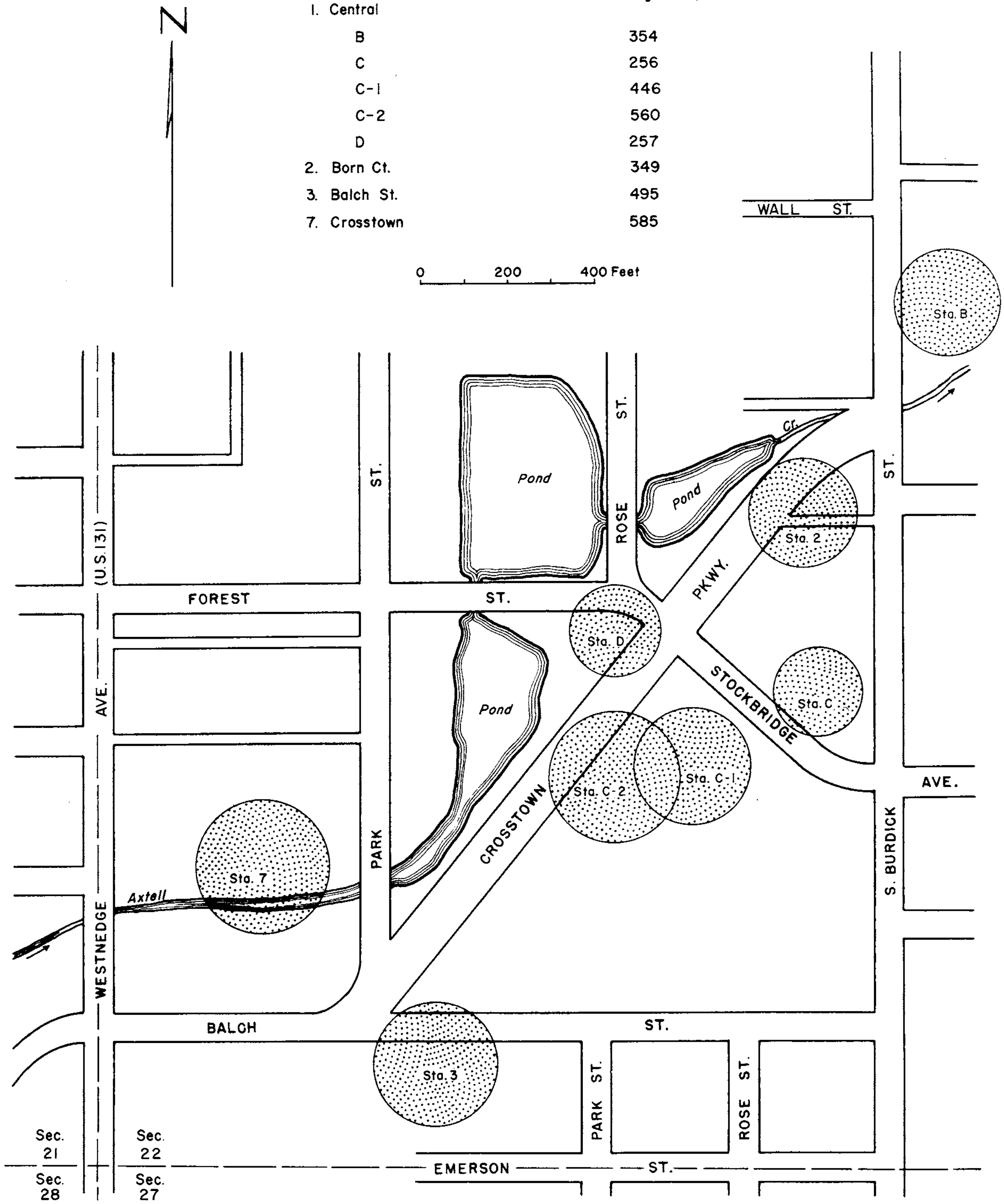



Figure 15. Distribution and magnitude of municipal ground-water pumpage in the Axtell Creek area, 1957.

of ground-water level in the Kalamazoo area for the year 1957 and has tabulated the range in fluctuation in 15 observation wells in which measurements were made during the period 1946-57. Tabulations of many water-level measurements made in the Kalamazoo area since 1939 are contained in the annual series of U. S. Geological water-supply papers entitled "Water Levels and Artesian Pressures in Observation Wells in the United States" (for 1956 and subsequent years, "Ground-Water Levels in the United States"). The length of the published record for each well and the number of the water-supply paper for each year are shown on figure 16.

## Natural Influences

Ground-water levels in the area fluctuate with seasonal changes in the rate of natural recharge to and discharge from the ground-water reservoirs. During the spring, water levels normally rise in response to the infiltration of rain and melting snow. Warmer temperatures that prevail during the growing season result in an increase in evapotranspiration and a reduction in the opportunity for recharge. Thus, unless total precipitation is abnormally high during the growing season, water levels decline. In the fall, when cold weather ends the growing season, precipitation may result in rises of water level after depleted soil moisture is restored. However, the usual summer decline in stage may continue if precipitation in the fall is deficient or if an early general freeze impedes infiltration. Recharge to the ground-water reservoir in the winter

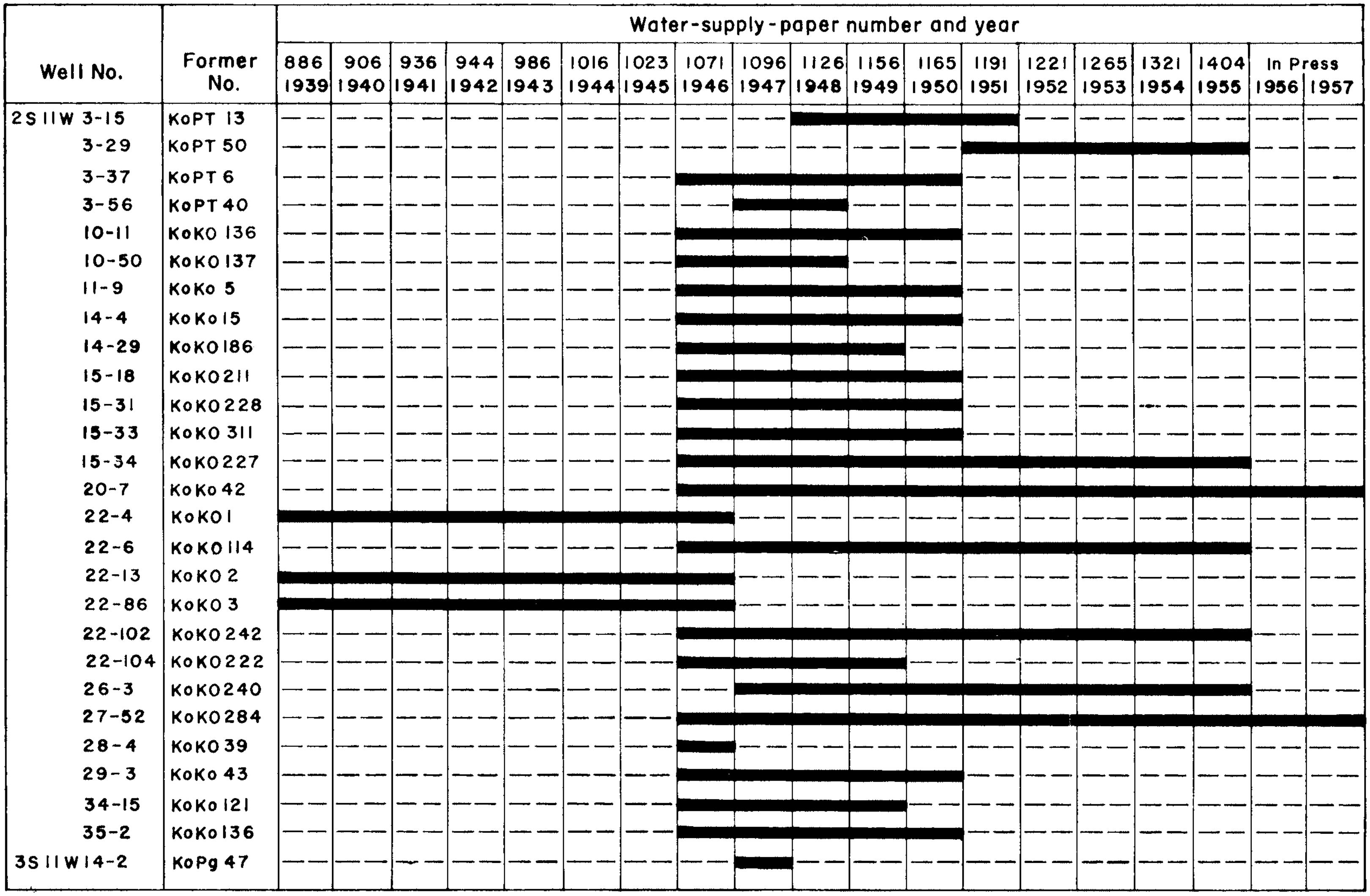



Figure 16. Chart showing length of water-level records for observation wells in the Kalamazoo area published in U.S. Geological Survey water-supply papers, 1939-57.

is reduced if most of the precipitation is in the form of snow and subfreezing temperatures persist.

Fluctuations of water levels, primarily in response to natural influences, are illustrated by the hydrographs of wells 2S 11W 20-7, 26-3, and 29-3 (fig. 17). The hydrographs show that the water levels in these wells in and near the city of Kalamazoo have remained relatively steady, barring seasonal fluctuations, during the period 1946-57. The water levels in these wells were somewhat higher during the period 1946-52 than in 1953-57. The relatively high water levels which were observed in 1950, 1951, and the early part of 1952 resulted from above average precipitation during that period. The lower levels during the latter period of record resulted from deficiencies of precipitation during the second half of 1952, and in 1953, 1955, and 1956 (figs. 3 and 18). Precipitation continued to be deficient until the fall of 1957, and the water level fell to a record low in well 20-7 at the Western Michigan University golf course, and to a near-record low in well 29-3 at Wood's Lake. Subsequently, levels rose in response to more than 11 inches of precipitation during the last quarter of 1957.

## Pumping Influences

Generally, ground water is a renewable natural resource because it is intermittently or continually being replaced directly or indirectly by precipitation. If an aquifer is to be developed by means of wells so that a long-term yield can be obtained, then

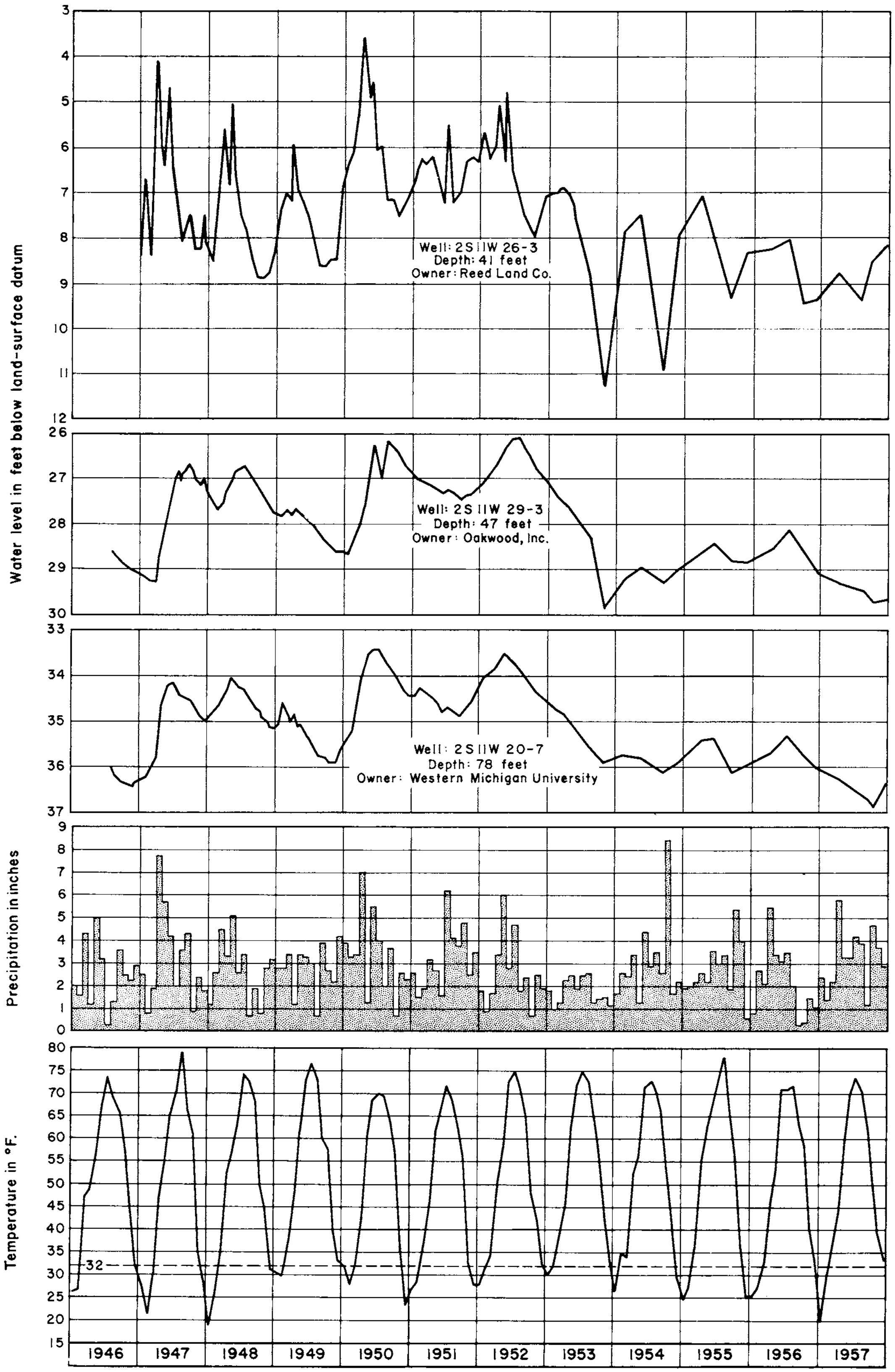



Figure 17. Hydrographs of observation wells, monthly totals of precipitation, and monthly mean temperatures at Kalamazoo, 1946-57.

the average rate of recharge must balance the rate of discharge. An approximate dynamic equilibrium between recharge and discharge exists in any aquifer in its natural state (before it is tapped by wells). When water is withdrawn from an aquifer by a well, a temporary change in the total discharge from the aquifer results. The pumping of the well causes a cone-shaped depression in the piezometric surface around the well. With continued discharge, the cone of depression expands until the resultant lowering of water level causes a decrease in discharge from the aquifer or an increase in recharge to the aquifer, or a combination of the two, which tends to restore the aquifer to a state of equilibrium. If the discharge from a well or group of wells exceeds the total available recharge, the water level will continue to decline so long as the discharge continues. Where a number of wells are pumped, a composite cone of depression is formed, which may extend over a large area. Water levels in other wells within this cone of depression also are lowered, even if the wells are not pumped.

A lowering of the water level, therefore, is a necessary result of the development of an aquifer. Historical data (Leverett, 1906a) reveal that artesian pressures in the aquifer in the vicinity of the Central Pumping Station at Burdick Street were sufficient to cause water to flow above the land surface. The development of the aquifer at this station has lowered the piezometric surface below the land surface. The graphs on figure 18 indicate that recharge by normal precipitation and by induced infiltration from surface sources is adequate to support pumpage of about 3 to 3.5 billion

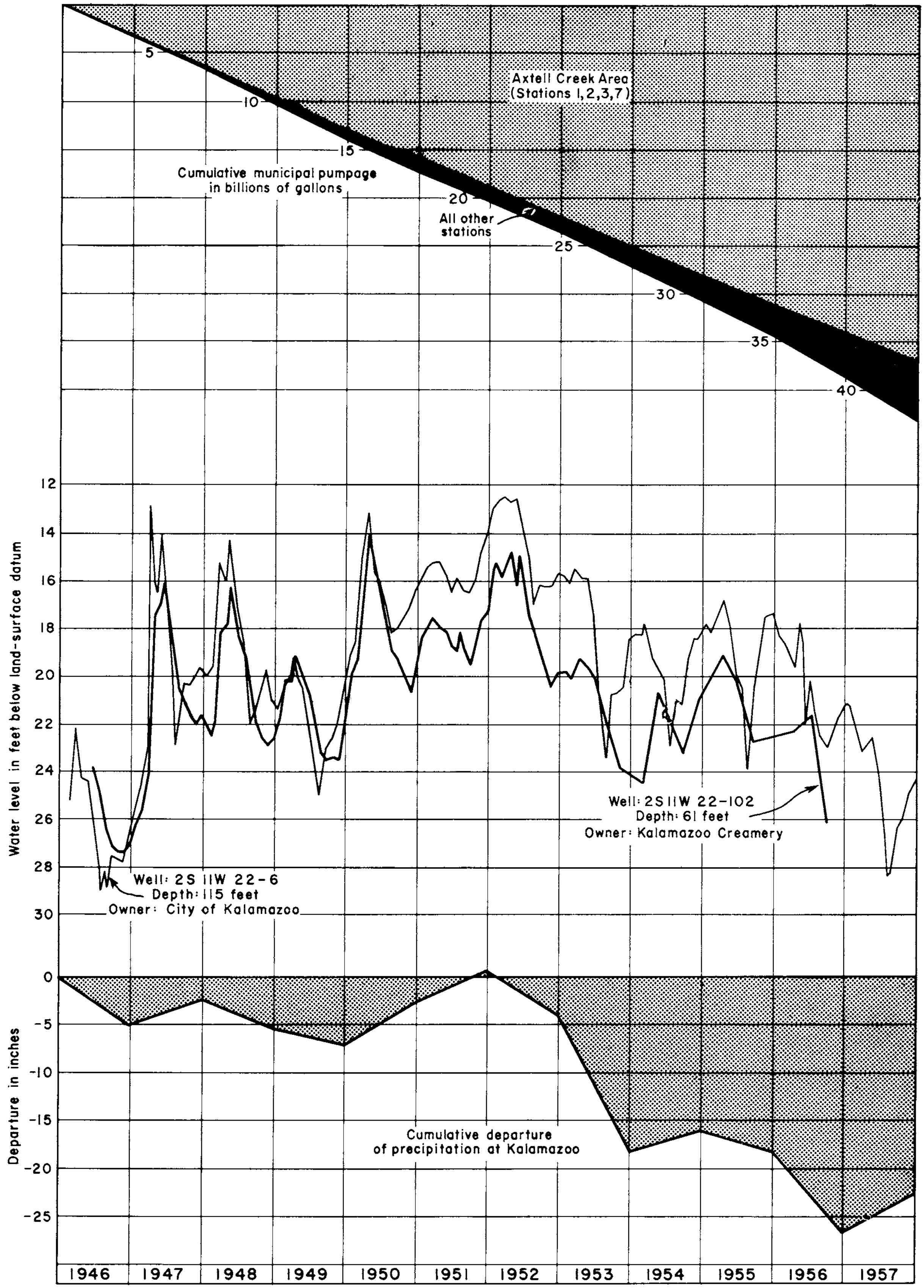



Figure 18. Cumulative municipal pumpage, hydrographs of wells 2S 11W 22-6 and 22-102, and cumulative departure of precipitation, 1946-57.

gallons annually without a further appreciable lowering of the water level. The declining trend in water levels from 1952 to 1957 apparently resulted from deficiencies of precipitation during this period, as pumping in the area has remained relatively constant (fig. 13). It is probable that normal precipitation for a period of several years, a slight decrease in pumpage, or a slight increase in artificially induced recharge would halt the declining trend in water levels. It is apparent from the data shown on figures 12, 13, and 18 that the glacial-drift aquifer in this area is a very productive source of water, inasmuch as billions of gallons of ground water have been pumped in this vicinity for the past 90 years, with relatively little drawdown of water levels.

Wells 2S 11W 15-18, 15-31, 15-33, and 15-34 (fig. 19) are in the business district of Kalamazoo, and they all tap the channel deposits along the Kalamazoo River. The glacial drift in this area ranges in thickness from about 75 to 150 feet (fig. 6, table 2). Water levels in these wells fluctuate in response to pumping and to seasonal climatic changes which influence the rate of recharge to the aquifer.

The total range in water-level fluctuations in these wells is comparatively small, and the lowest level recorded was about 27 feet below the land surface, in well 2S 11W 15-34. In 1953, however, the frequency of measurements in the wells was reduced from monthly to quarterly, and the range in fluctuations recorded since then is probably not as great as the actual range. Water levels in wells in this area generally will not decline to stages below that of the Kalamazoo River except in localized cones of depression caused by pumping.

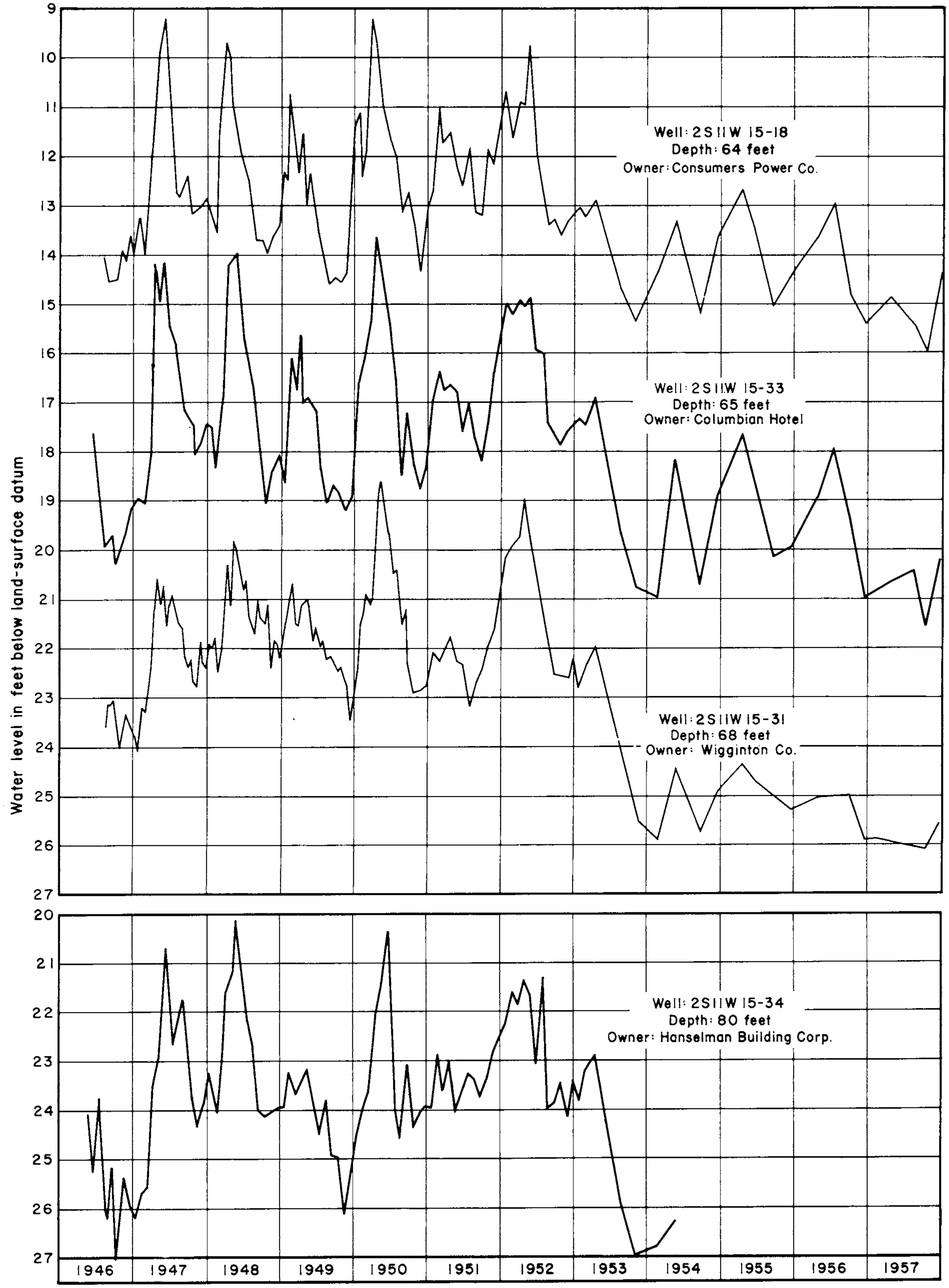



**Figure 19. Hydrographs of observation wells in the Kalamazoo business district, 1946-57.**

Ground water is naturally discharged to the Kalamazoo River as the ground-water level is generally above river stage. Arcadia Creek, Portage Creek, and the Kalamazoo River are potential sources of recharge, but they do not replenish the aquifer in the downtown area, as recharge from precipitation and underflow is adequate to meet present demands. A number of wells in the business district recharge the aquifer with disposed air-conditioning water.

Figure 20 shows hydrographs of observation wells located in industrial well fields where nearby surface streams are a potential source of recharge by induced infiltration. The hydrographs of the wells at the Kalamazoo Vegetable Parchment Co. plant at Parchment show a maximum range in water-level fluctuations of about 6 feet. Hydrographs of wells 2S 11W 3-56, 3-15, and 3-29 are combined to cover the period 1947-56 and are reduced to a common datum in feet above sea level. The fact that water levels in these wells do not decline below river stage in a heavily pumped aquifer indicates that the river becomes a source of recharge when the cone of depression caused by pumping intersects it.

The water level in observation well 2S 11W 10-11, at the Sutherland Paper Co. plant on the north side of Kalamazoo, ranged from 2 to 20 feet below the land surface. The cone of depression around the pumped wells in this field extends to the Kalamazoo River, and thus the river is a source of recharge. Heavy pumping in this field causes drawdowns of water level which in some wells are to stages below the screens (see tables 3 and 4). The relatively large pumping drawdowns in wells in this field, some of which are very

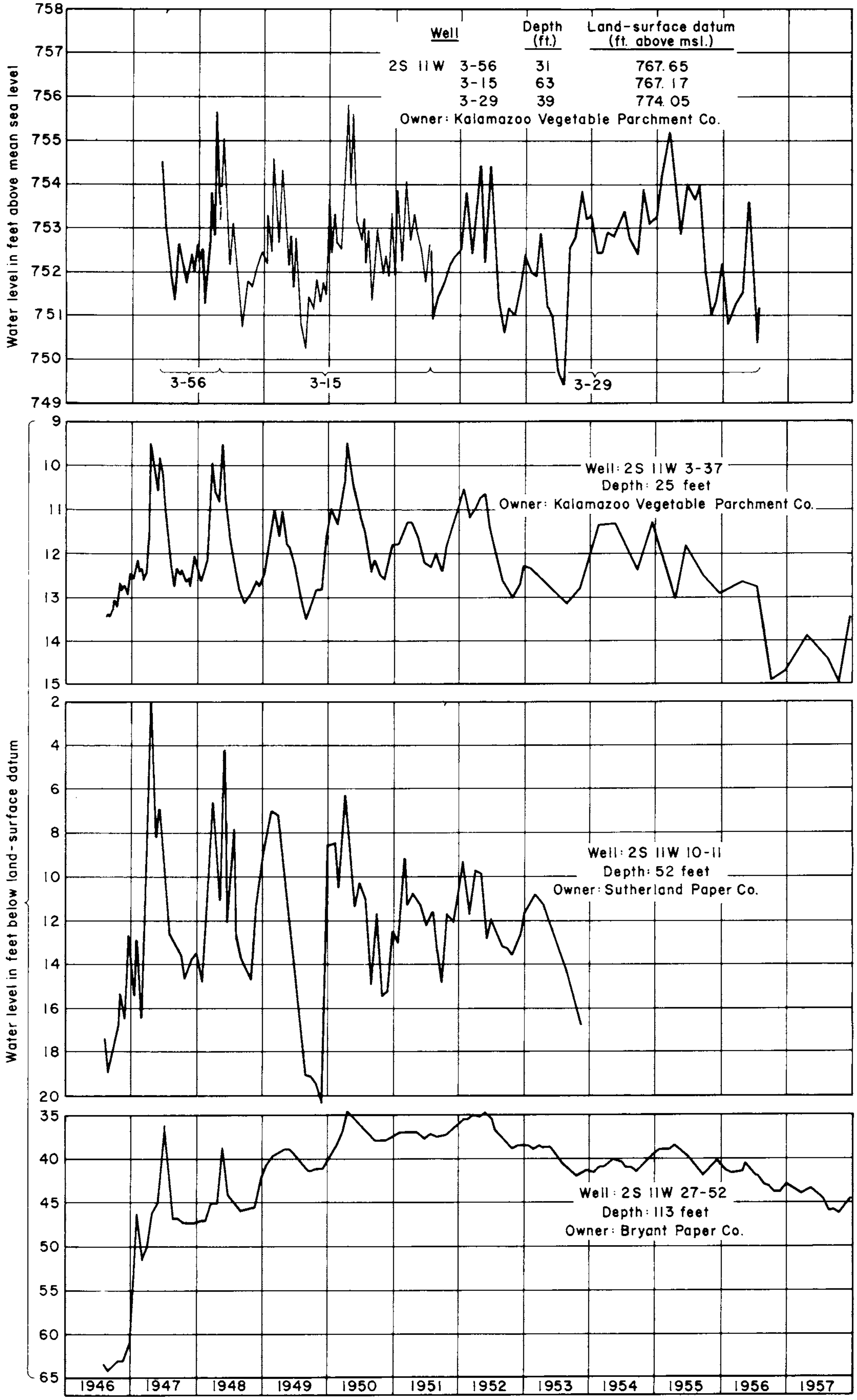



Figure 20. Hydrographs of observation wells in industrial well fields adjacent to the Kalamazoo River or Portage Creek, 1946-57.

close to the edge of the Kalamazoo River, to levels substantially below the river stage indicate that sedimentation and precipitation of solids from industrial effluents have substantially reduced recharge to the aquifer along this reach of the river.

Water levels in observation well 2S 11W 27-52, alongside Portage Creek in the well field of the Bryant Paper Co. (now St. Regis Paper Co.), have ranged for the most part between 35 and 50 feet below the land surface, or about at the level of Portage Creek. The low water levels recorded in 1946 probably were caused by heavy pumping during and immediately after World War II.

## Aquifer Tests

The most effective method for determining the amount of water that can be obtained from an aquifer is by analysis of records of water levels and pumpage. Such data, which are presented above, were supplemented by a number of aquifer (pumping) tests made during the period 1944-57 to determine the hydraulic characteristics of the channel and outwash deposits in the area.

By methods devised by Theis (1935) and others, the coefficients of transmissibility (T) and storage ( S) of an aquifer can be determined. Aquifer tests usually consist of pumping one well at a given rate and measuring the resultant change in water levels in nearby observation wells. The observed changes are then compared with the type curve of Theis' non-equilibrium equation.

The Theis equation, which may be used to predict water-level changes from anticipated pumping rates, is as follows:

$$T = \frac{114.6 \; Q \; W(u)}{s}$$

Where

T = coefficient of transmissibility, in gallons per day per foot

Q = rate of pumping, in gallons per minute

s = drawdown or recovery of water level, in feet

W(u) = well function of u

or

$$W(u) = \int_{u}^{\infty} \frac{e^{-u}}{u} \, du$$

and

$$u = \frac{1.87 \, r^2 \, S}{T \; t}$$

r = distance from pumped well, in feet

t = time since pumping started or stopped, in days

S = coefficient of storage

The formula is based on the assumption that the aquifer is infinite in extent, that it is homogeneous and isotropic (transmits water in all directions with equal facility), that its coefficients of transmissibility and storage are constant, that water is under artesian conditions, and that the water is released from storage instantaneously with the decline in head. The assumptions on which the formula is based must be met, or appropriate adjustments must be made in the formula. The presence of boundaries of the aquifer, leakage through the confining beds, and lowering of the water level below the upper confining bed are among the conditions that nullify the basic assumptions of the formula and therefore require adjustment.

The aquifers in the Kalamazoo area depart considerably from the ideal aquifer of the Theis equation. They are limited in areal extent, vary in permeability both vertically and horizontally, locally are hydraulically connected to surface waters which form recharge boundaries, and generally leak considerable water through the confining layers. Thus, the coefficients of transmissibility and storage can only be approximated from the tests conducted in the area. Whether surface water recharges the aquifer when a well is pumped may commonly be determined by use of a method devised by Ferris (1948). In the Kalamazoo area, however, use of this method is complicated by the fact that the aquifers are generally recharged indirectly through leaky confining layers (fig. 9).

## Sutherland Paper Co. (July 16, 1944)

A test was made in the Sutherland Paper Co. well field along the Kalamazoo River in sec. 10, T. 2 S., R. 11 W. The aquifer at this site is composed of about 60 feet of sand and gravel, but it includes layers of clay and sandy clay. The surface of the Coldwater shale at this site ranges from about 55 to 90 feet below the land surface.

Well 2S 11W 10-46, which is screened from 57 to 82 feet (table 4) was pumped at a rate of 232 gpm for several days. The pump was then stopped and the recovery of water levels was measured in 12 observation wells.

Analysis of the test data indicates that T is in the range of 18,000 to 24,000 gpd per foot. The aquifer is under semiartesian conditions, in that there is a wide range in vertical permeability in the aquifer. The test indicates that the Kalamazoo River is a source of recharge. Movement of water from the river to the screened portion of the aquifer is impeded, however, by several clay lenses within the drift section. Although more recent test data for this site are not available, yields reportedly have declined since the date of the test, presumably because of diminishing recharge from the Kalamazoo River.

Station C-1 (February 12, 1947)

The aquifer at Station C-1, near Axtell Creek, is composed of about 160 feet of sand and gravel and a few layers of silt. Well 2S 11W 22-51 (C-1-4), which is screened from 154 to 174 feet, was pumped for this test at a rate of 350 gpm. Drawdown of water levels was measured in three observation wells.

The aquifer at this site shows semiartesian conditions as a result of wide variations in vertical permeability. The test indicates that the aquifer is recharged by Axtell Creek. The coefficient of transmissibility cannot be determined precisely from the test data, but a figure in excess of 100,000 gpd per foot is indicated.

## Station 3 (February 28, 1947)

The aquifer at Station 3 consists of more than 200 feet of sand and gravel (see log of well 2S 11W 22-94, table 2). Station 3 is in the Axtell Creek area (fig. 15).

Well 2S 11W 22-91 was pumped at a rate of 400 gpm. The drawdown of water levels was measured in five observation wells.

The coefficient of transmissibility of the aquifer at this site as calculated from the test is about 300,000 gpd per foot and the coefficient of storage about 0.17. A coefficient of storage of this magnitude is typical of water-table conditions. Axtell Creek is probably a source of recharge to the aquifer, although the test was not long enough to provide data adequate to prove this.

## Upjohn Co. (June 24, 1947)

The glacial drift at the Upjohn Co. test site is about 300 feet thick, and the upper part of the drift section consists of layers of sand and gravel. The pumped well of this test (3S 11W 14-1) is 120 feet deep and screened from 85 to 95 feet and from 100 to 115 feet. The well was pumped at a rate of 280 gpm for 24 hours. Water levels in 1 deep well that was screened at the same depths and in 8 shallow wells that penetrated a short distance below the water table were measured during the test. The greatest drawdown in any of the observation wells was recorded in the deep well, which is farther from the pumped well than any of the eight shallow wells. The test revealed that the aquifer is under semiartesian conditions, in that there is a great difference in vertical permeability. The indicated transmissibility of the part of the aquifer tapped by the pumped well is 65,000 gpd per foot. However, the transmissibility of the entire aquifer probably is considerably greater.

### Station 8 (July 23, 1948)

The wells at Station 8 tap about 50 feet of sand and gravel which is overlain by about 75 feet of clayey drift (table 2, logs 3S 11W 3-2, 3-7, 3-8, and 3-10.) About 20 feet of permeable sand and gravel channel deposits lie at the surface but are not used as a source of supply. The wells at this station are drilled along a line adjacent to Portage Creek, which trends roughly north-south.

The pumped well of the test (3S 11W 3-3) was flowing at a rate of 300 gpm prior to the start of pumping. During the test the well was pumped at a rate of 650 gpm, and the drawdown was measured in nine observation wells. The transmissibility was calculated as 42,000 gpd per foot. The fact that the wells at this station flow when they are not being pumped, and that a typically artesian coefficient of storage of $2.4 \times 10^{-4}$ was determined by the test, demonstrates that the clayey drift in this area forms an efficient confining layer.

### Station 9 (October 14, 1949)

The wells at Station 9 penetrate about 160 feet of glacial drift consisting of layers of sandy and gravelly clay and about 100 feet of permeable sand and gravel. The West Fork of Portage Creek flows through the station. The pumped well of this test (3S 11W 4-3) and the other production wells at this station are completed in about 40 feet of sand and gravel which is present from about 120 to 160 feet. This aquifer is overlain by materials that contain a considerable amount of clay and silt and form a very leaky artesian cap (fig. 9).

The pumped well yielded 300 gpm during the test. The drawdown was measured in four observation wells, and recovery was measured after pumping was stopped.

The transmissibility at this site was calculated as 110,000 gpd per foot. The aquifer is semiartesian, as the upper zone is of lower permeability but does not form an efficient confining layer. The test proved that the West Fork of Portage Creek is a source of recharge to the aquifer. The relatively high transmissibility of the aquifer and the availability of abundant recharge combine to make this site a productive source of ground water.

### Kalamazoo Vegetable Parchment Co. (June 26, 1950)

The aquifer at the test site consists of a layer of coarse-gravel channel deposits at a depth of 23 to 48 feet. A layer of clayey material 7 feet thick forms an artesian cap over the aquifer. The aquifer is underlain by about 35 feet of clay till, which mantles the Coldwater shale.

The pumped well (1S 11W 34-7) yielded 470 gpm. Water levels in 12 observation wells were measured during the test. The transmissibility was determined to be about 230,000 gpd per foot. Divided by 25, the thickness of the aquifer in feet, this gives an average permeability of 9,200 gpd per square foot, the highest determined in the report area. The coefficient of storage is $2.7 \times 10^{-4}$, which indicates that the layer of clay above the aquifer forms an efficient artesian cap.

The data from the test show that the Kalamazoo River, which is about 300 feet southwest of the pumped well, is a source of recharge to the aquifer. This is demonstrated also by the fact that water-level fluctuations in the aquifer closely correlate with fluctuations in river stage. The test data and correlation of river stage and ground-water level indicate that the artesian cap is breached along the river.

Cahill Farms, Inc. (October 21, 1957)

The aquifer that underlies the site of the Southland Subdivision, in Portage Township, is composed primarily of medium and coarse sand and some fine gravel. Well 3S 11W 9-2, which is screened from 139 to 185 feet, was pumped at a rate of 770 gpm, and one observation well was measured during the test. The aquifer is semiartesian, in that a layer of sandy clay between depths of 32 to 43 feet (table 2) forms a very leaky artesian cap over the part of the aquifer in which the well is screened. The coefficient of transmissibility of the part of the aquifer tapped by the well is about 130,000 gpd per foot. The part of the aquifer above 32 feet also contributes water to the well through vertical leakage. The effects of the vertical leakage were clearly illustrated during the test, when the water level in the observation well rose in response to rainfall.

# CHEMICAL QUALITY OF THE WATER

Water percolating through soil and rocks dissolves some of the material with which it comes in contact. The amount and character of the dissolved mineral matter in ground water depend on the chemical and physical composition of the rocks through which the water moves, the duration of the contact, and other factors such as temperature, pressure, and amount of mixing, if any, with highly mineralized connate water (water entrapped at the time the sediment was deposited).

Water in the glacial drift is predominantly of the calcium magnesium bicarbonate type. The calcium, magnesium, and bicarbonate ions are derived largely from particles of limestone and sandstone which are major constituents of the glacial drift. Some of the water pumped from the drift, however, is of the calcium sulfate type. The Coldwater shale and the basal till, which was derived mainly from the shale, are the principal sources of the calcium sulfate in the water of the Kalamazoo area.

Concentrations of sulfate are commonly greatest in water from wells completed in sand and gravel that are in contact with shale or basal till. The lowering of water levels by pumping tends to induce upward migration of the calcium sulfate water into the glacial-drift aquifers. In Holland, Mich., where drift aquifers overlying the Coldwater shale were used as a source of supply, the concentration of sulfate in water from the municipal well fields increased with decline in water levels (Deutsch and others, 1959). Well 2S 11W 10-40, drilled to a depth of 50 feet, is completed a few feet above the basal till and shale and yielded water containing 225 ppm of sulfate (table 5). The highest sulfate concentration observed was in a sample taken from well 2S 11W 25-9, which also is completed in the drift near the surface of the Coldwater shale. It is believed that both the samples were taken at times when water levels were lowered by pumping. The Michigan Department of Health (1948) classifies water containing 250 ppm or more of sulfate as objectionable. Most of the ground water in the area, however, contains only relatively minor amounts of sulfate.

Nearly all the ground water in the Kalamazoo area is hard or very hard. Hardness is caused almost entirely by calcium and magnesium in the water. The hardness of ground-water samples collected in the area ranged from 185 ppm in well 2S 11W 32-1 to 580 ppm in well 2S 11W 10-40. Water is classified with respect to hardness by the Michigan Department of Health as follows:

| Class | Hardness (parts per million) |
|---|---|
| Very soft | Less than 50 |
| Soft | 50-100 |
| Moderately hard | 100-200 |
| Hard | 200-300 |
| Very hard | More than 300 |

(Hardness may be computed also in grains per gallon. One grain per gallon equals 17.1 ppm.)

The presence of appreciable quantities of iron in the form of bog ore was noted in the Kalamazoo area as early as 1840 (Douglass, 1928). Iron in the glacial drift and the bog ore are sources of objectionable quantities of iron present in ground water in parts of the Kalamazoo area. The iron content ranges from 0 to 7.5 ppm. Iron content exceeding about 0.2 will cause staining, and more than 0.3 ppm of iron, or iron and manganese together is considered objectionable in this regard (Michigan Department of Health, 1948). The city of Kalamazoo adds a sequestering agent to water high in iron content in order to prevent precipitation and staining.

The chemical quality of surface water in the area shows a definite relation to the quality of ground water yielded by wells near these streams (fig. 21). The similarity in chemical composition of surface- and ground-water samples indicates that the streams are fed largely by effluent seepage. Austin Lake, which is on the ground-water divide between the St. Joseph and Kalamazoo River drainage basins, is fed mainly by precipitation and is lower in mineral content than the ground-water-fed streams. The surface water of the area is generally somewhat lower in mineral content than the ground water. Additional information is needed regarding the effects of surface-water recharge on the quality of ground water.

Ground-water temperatures range from about 50° to 58°F. This rather wide range reflects the influence of surface water recharged to the aquifers from nearby sources. The temperature of water from wells distant from surface sources commonly varies only 1° or 2°F throughout the year.

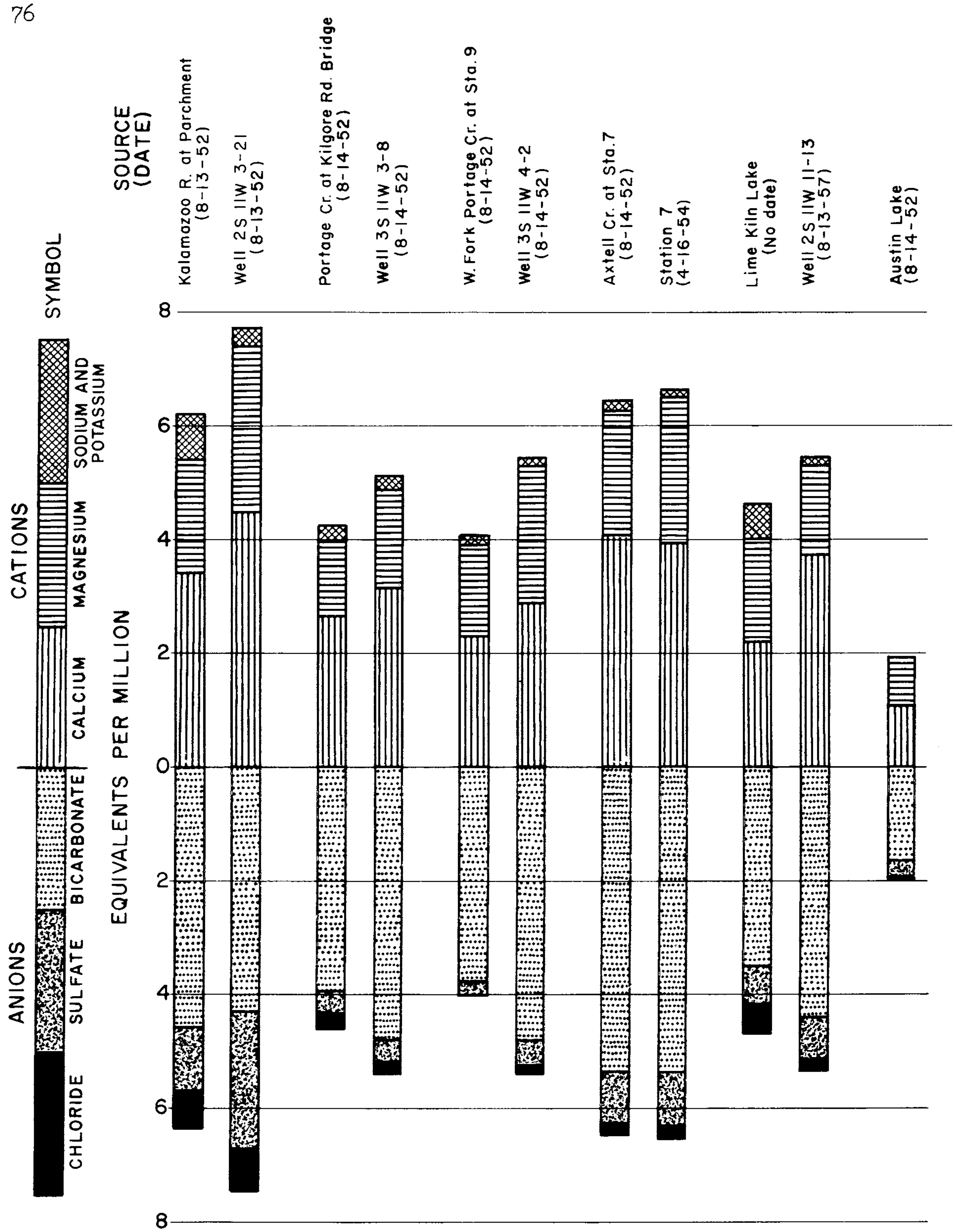



Figure 21. Diagrams showing the relation in chemical composition of ground water and surface water from nearby sources.

## CONCLUSIONS AND SUGGESTIONS FOR FUTURE STUDIES

The glacial-drift aquifers within the Kalamazoo area are adequate for present municipal and suburban demands and also for considerable additional development. With proper use and husbandry of the resource guided by continuing scientific development and research, ground-water supplies in the area will be adequate to satisfy future requirements greatly exceeding present demands. An accurate quantitative appraisal of the total resource, however, cannot be made on the basis of presently available information.

Data from the Axtell Creek area indicate that under normal climatic conditions the present high water levels (and low pumping lifts) can be maintained if the total annual pumpage is restricted to the present rate of about 3 to 3.5 billion gallons per year, and if the surface recharge ponds are maintained at present efficiency. Construction of artificial-recharge facilities comparable to those already in operation probably would result in considerably increased yields at other pumping stations without significant lowering of water levels. Continuous observations of water levels should be made in and near major well fields to determine the amount of drawdown caused by pumping. This information would reveal if pumping is exceeding recharge, if recharge facilities are declining in efficiency, and if the cones of depression in the well fields are expanding.

The city's program of construction of well fields, at widely spaced sites where surface water can be utilized as a supplementary source of recharge to the aquifer, has met with considerable success, especially at the stations where surface storage capacity has been artificially increased. Continuation of this program will most likely result in the location of new sites where additional large supplies of water may be obtained.

Although the Kalamazoo River is a potential source of recharge to ground water far in excess of foreseeable demands by industry, areas where geologic conditions are most favorable for recharge have not been delineated. Also, at present the extent to which recharge is impeded by natural and artificial sealing of the river bottom is not known. Methods of effectively maintaining hydraulic connection between the river and the streamside aquifers and of inducing recharge should be investigated.

Quantitative appraisals of the effective recharge from surface sources to the aquifers at various well fields, and of the effect of sedimentation on the amount of recharge, should be made. A complementary study of the effects of recharging operations on water quality would also be desirable. The Kalamazoo area would provide an ideal field laboratory where such a study could be made. Results of such studies are of considerable potential value not only to water users in the Kalamazoo area but also to numerous communities in similar hydrologic settings elsewhere.

Test drilling and detailed geologic studies would be desirable, to enable determining more accurately the location, thickness, and extent of permeable sand and gravel deposits within the buried valleys in the bedrock surface, both in the vicinity of existing high-capacity well fields and in the vicinity of new ones constructed in the future.

# REFERENCES CITED


Bennett, S. V., and Jordan, J. E., 1950, Resources for industry in Kalamazoo: W. E. Upjohn Inst. Community Research (Kalamazoo), mimeo. rept., 32 p.

Corps of Engineers, 1958, Flood emergency plan and disaster operating procedures, pt. 1: U. S. Dept. Army, Corps Engineers, Detroit Dist. rept.

Deutsch, Morris, Burt, E. M., and Vanlier, K. E., 1959, Summary of ground-water investigations in the Holland area, Michigan: Michigan Geol. Survey Prog. Rept. 20.

Douglass, C. C., 1928, Report of January 12, 1840 to the State Geologist in Fuller, G. N., ed., Geological reports of Douglass Houghton: Michigan Hist. Comm., p. 416-438.

Ferris, J. G., 1948, Ground-water hydraulics as a geophysical aid: Michigan Geol. Survey Tech. Rept. 1.

Giroux, P. R., 1958, Summary of ground-water conditions in Michigan, 1957: Michigan Geol. Survey Water-Supply Rept. 2.

Kalamazoo City Utilities, 1954, The annual report for the year 1954: Kalamazoo Dept. City Light and Water Utilities Ann. Rept.

Lane, A. C., 1895, The geology of Lower Michigan, with reference to deep borings (edited from notes of C. E. Wright): Michigan Geol. Survey v. 5, pt. 2.

__________ 1899, Lower Michigan mineral waters, a study into the connection between their chemical composition and mode of occurrence: U. S. Geol. Survey Water-Supply Paper 31.

Leverett, Frank, 1906a, Water supplies of Kalamazoo County, in Leverett and others, Flowing wells and municipal water supplies in the southern portion of the Southern Peninsula of Michigan: U. S. Geol. Survey Water-Supply Paper 182, p. 127-130.

__________ 1906b, Geological conditions of municipal and institutional water supplies in Michigan: Michigan Acad. Sci. Ann. Rept., v. 8, p. 99-136.

__________ 1912, Surface geology and agricultural conditions of the Southern Peninsula of Michigan: Michigan Geol. Survey Pub. 9.

Leverett, Frank, 1917, Surface geology and agricultural conditions in Michigan: Michigan Geol. Survey Pub. 25, pt. 2, chap. 2.

Leverett, Frank, and Taylor, F. B., 1915, The Pleistocene of Indiana and Michigan and the history of the Great Lakes: U. S. Geol. Survey Mon. 53.

Martin, H. M., compiler, 1955, Map of the surface formations of the Southern Peninsula of Michigan: Michigan Geol. Survey Pub. 49.

__________ 1957, Outline of the geologic history of Kalamazoo County: Michigan Geol. Survey dupl. rept.

Michigan Department of Health, 1948, Chemical analyses and their interpretations - Public water supplies in Michigan: Michigan Dept. Health Eng. Bull. 4.

Michigan Water Resources Commission, 1957, Flood conditions in the Kalamazoo area: Michigan Water Resources Comm. dupl. rept.

Norman, E. E., 1949, The annual report for the year 1949: Kalamazoo Dept. City Light and Water Utilities Ann. Rept.

Paulsen, C. G., and others, 1950, Surface water water supply of the United States, 1948, Part 4, St. Lawrence River Basin: U. S. Geol. Survey Water-Supply Paper 1114.

Sisson, W. H., 1955, Recharge operations at Kalamazoo (Mich.): Am. Waterworks Assoc. Jour., v. 47, no. 9, p. 914-922.

Taylor, H. C., 1956, The population of Kalamazoo County, Michigan - Estimates as of July 1, 1956 and forecasts to 1975: W. E. Upjohn Inst. Community Research (Kalamazoo) dupl. rept., 22 p., Sept.

Terwilliger, F. W., compiler, 1958, Map of the bedrock topography of southwestern Michigan: Michigan Geol. Survey ms. map, unpub.

Theis, C. V., 1935, The relation between lowering of the piezometric surface and the rate and duration of discharge of a well using ground-water storage: Am. Geophys. Union Trans., p. 519-524, Aug.

Wells, J. V. B., and others, 1958, Surface water supply of the United States, 1956, Part 4, St. Lawrence River Basin: U. S. Geol. Survey Water-Supply Paper 1437.

Table 1.--Records of wells, test holes, and foundation borings in the Kalamazoo Area

Owner: Includes owner's designation where applicable. City, City of Kalamazoo; MSHD, Michigan State Highway Department.

Driller: Dr. Co., Drilling Company; City Utilities, City of Kalamazoo Utilities Dept.; Raymond Conc., Raymond Concrete Pile Co.

Altitude: Land-surface datum in feet above mean sea level. Altitudes of observation wells determined by instrumental leveling; all others reported by owner or driller, or estimated from U. S. Geological Survey topographic maps.

Use: B, foundation boring; D, domestic; G, gas or oil well or test; I, industrial; O, observation; P, public supply; T, test hole; W, well field pilot hole.

Water level: In feet below or above (+) land-surface datum. H, refers to hydrographs shown on figs. 8 and 17-20 or to data indexed by fig. 16; M, measured; R, reported.

Remarks: MDC log, Michigan Department of Conservation log. (In requesting complete logs and related information refer to permit number listed.)

| Well number | Location in section ¼ | ¼ | ¼ | Owner | Driller | Year drilled | Depth (ft.) | Diameter (in.) | Altitude | Use | Water level | M or R | Date | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Alamo Township (T. 1 S., R. 12 W.) | | | | | | | | | |
| 1S 12W | | | | | | | | | | | | | | |
| 25-1 | - | SE | SE | Twin Lakes School | - | - | 100 | 2 | - | P | - | - | - | Formerly called Wilson School. |
| | | | | | Cooper Township (T. 1 S., R. 11 W.) | | | | | | | | | |
| 1S 11W | | | | | | | | | | | | | | |
| 20-1 | - | SE | SE | Adren Rice | Adren Rice | 1950 | 103 | 3 | - | D | 70 | R | 1954 | Fine sand aquifer. |
| 20-2 | - | SE | SE | Do. | Do. | - | 138 | 2 | - | D | 70 | R | 1954 | Coarse sand aquifer. |
| 22-1 | - | SW | SW | Clyde Lancaster | Carrol Waite | 1954 | 70 | 2 | - | D | 30 | R | 1954 | |
| 24-1 | NW | NW | SW | Herbert Warden | - | - | 12 | - | - | D | 6 | R | 1947 | Sand aquifer. |
| 26-1 | - | NW | NW | William Nayle | William Nayle | 1938 | 28 | $1\frac{1}{4}$ | - | D | 18 | R | 1946 | Fine gravel aquifer. |
| 30-1 | - | SE | SE | Harry Talbot | - | - | - | - | - | D | - | R | - | Water reported hard. |
| 31-1 | NW | NE | SW | W. H. Thorlby | J. C. Arthur | 1938 | 1571 | 6 | 952.8 | G | - | - | - | MDC log 4974. |
| 33-1 | - | SE | SE | Morris Markin | - | 1946 | 65 | 3 | - | D | 20 | R | 1954 | Gravel aquifer. |
| 33-2 | - | SE | SE | Jacob Meeuwse | Adren Rice | 1952 | 73 | 2 | - | D | 20 | R | 1954 | Do. |
| 33-3 | - | SE | NE | M. H. Gideum | - | 1936 | 70 | $2\frac{1}{2}$ | - | D | 62 | R | 1957 | Do. |
| 33-4 | - | NE | SE | C. O. Dann | Garrett Reer | 1944 | 74 | 2 | - | D | - | - | - | |
| 34-1 | SE | SE | SW | Kalamazoo Vegetable Parchment Co. TW 53 | C. S. Raymer | 1950 | 52 | 6 | 755.24 | T | .75 | M | 3-10-50 | |
| 34-2 | SE | SE | SW | Do. TW 54 | Do. | 1950 | 88 | 6 | 754.27 | T | - | - | - | |
| 34-3 | SW | SW | SE | Do. TW 55 | Do. | 1950 | 77 | 6 | 755.23 | T | .25 | M | 3-31-50 | |
| 34-4 | SE | SE | SW | Do. TW 56 | Do. | 1950 | 54 | 6 | 756.85 | T | - | - | - | |
| 34-5 | NE | SE | SW | Do. TW 57 | Do. | 1950 | 52 | 6 | 754.52 | T | - | - | - | |
| 34-6 | NE | SE | SW | Do. TW 58 | Do. | 1950 | 51 | 6 | 753.77 | T | - | - | - | |
| 34-7 | NE | SE | SW | Do. 59 | Do. | 1950 | 48 | 2 | 755.32 | I | - | - | - | Pumped well in aquifer test. |
| 34-17 | NE | SE | SW | Do. SE 1 | Do. | 1950 | - | $1\frac{1}{4}$ | 755.08 | T | .84 | M | 6- 7-52 | |
| 34-22 | SE | SW | SE | Do. TW 60 | Do. | 1950 | 60 | 6 | 763.68 | T | - | - | - | |
| 34-23 | NE | NW | SE | Do. TW 63 | Do. | 1951 | 99 | 6 | 754.51 | T | - | - | - | |
| 34-24 | SW | SW | SE | Do. 64 | Do. | 1952 | 53 | 12 | 754 | I | 7 | R | 3-17-53 | |
| 34-25 | SE | SE | SW | Do. 65 | Do. | 1951 | 55 | 12 | 759 | I | 5.5 | R | 3-16-53 | |
| 34-26 | NE | SE | SW | Do. 66 | Do. | 1951 | 55 | 12 | 759 | I | 6.2 | R | 3-13-53 | |
| 34-27 | SE | NE | SW | Do. 67 | Do. | 1951 | 46 | 12 | 759 | I | 5.4 | R | 3-12-53 | |
| 34-28 | SE | NE | SW | Do. 68 | Do. | 1952 | 62 | 12 | 759 | I | 5.5 | R | 3-10-53 | |
| 34-29 | NW | NW | SE | Do. 69 | Do. | 1952 | 55 | 12 | 759 | I | 5.5 | R | 3- 9-53 | |
| 35-1 | SW | NW | SE | Kalamazoo Vegetable Co. School | Do. | 1952 | 39 | 6 | 779 | P | 1.5 | R | 3-17-52 | |
| | | | | | Richland Township (T. 1 S., R. 10 W.) | | | | | | | | | |
| 1S 10W | | | | | | | | | | | | | | |
| 32-1 | - | NW | NW | Harry Lammers | - | - | 24 | $1\frac{1}{4}$ | - | D | - | - | - | |
| 32-2 | NW | NW | SW | Twin Dr. Co. | Twin Dr. Co. | - | 1706 | 8 | 913.3 | G | - | - | - | MDC log 6370. Bedrock at 200 ft. |

Table 1.--Records of wells, test holes, and foundation borings in the Kalamazoo Area.--Continued

| Well number | Location in section ¼ ¼ ¼ | Owner | Driller | Year drilled | Depth (ft.) | Diameter (in.) | Altitude | Use | Water level | M or R | Date | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Oshtemo Township (T. 2 S., R. 12 W.) | | | | | | | | | |
| 2S 12W | | | | | | | | | | | | |
| 1-1 | SE SE NE | F. W. Jones | - | - | 126 | 2 | - | D | 108 | R | 1947 | Water reported hard. |
| 12-1 | NE NE SE | B. H. Aukerman | - | - | 90 | 2 | - | D | - | - | - | Used also for stock. |
| 13-1 | - NE SE | Laura Gorkin | - | - | 80 | 2 | - | D | - | - | - | Water reported hard. |
| 25-1 | NE SE SE | Kalamazoo State Hospital TW 2 | Dunbar Dr. Co. | 1954 | 206 | 6 | 940 | T | 73 | R | 12-31-54 | |
| 26-1 | NW NE NW | F. M. W. Oil Co. | J. C. Arthurs, Inc. | 1938 | 1542 | 8 | 985.8 | G | - | - | - | MDC log 5062. Bedrock at 297 ft. |
| 35-1 | NE NE SW | Pinecrest Sanitarium 1 | J. C. Newman | 1937 | 127 | 8 | - | P | 78 | R | 1947 | |
| 35-2 | NE NE SW | Do. 2 | Dunbar Dr. Co. | 1946 | 140 | 8' | - | P | 79.77 | M | 8- 9-46 | Screened. |
| 35-3 | NW NE NW | G. A. White | Louis Sanders | 1950 | 99 | 2 | - | D | 60 | R | 1954 | Water reported hard. |
| | | | Kalamazoo Township, City of Kalamazoo City of Parchment (T. 2 S., R. 11 W.) | | | | | | | | | |
| 2S 11W | | | | | | | | | | | | |
| 2-1 | NW NW SW | Kalamazoo Vegetable Parchment Co. TW 41 | C. S. Raymer | 1946 | 100 | 1½ | 780.41 | T | 17 | R | 1946 | Bedrock at 96 ft. |
| 2-2 | NW NW SW | Do. TW 42 | Do. | 1946 | 92 | 1½ | 797.85 | T | - | - | - | Bedrock at 92 ft. |
| 2-3 | NW NW SW | Do. TW 43 | Do. | 1946 | 102 | 2 | 805.65 | T | - | - | - | Bedrock at 100 ft. |
| 2-4 | NW NW SW | Do. TW 44 | Do. | 1946 | 108 | 2 | 805.65 | T | 17.5 | R | 10- 2-46 | Finished in sand. |
| 2-5 | SW NW SW | Do. TW 45 | Do. | 1947 | 104 | 6 | 789.10 | T | - | - | - | Bedrock at 103 ft. |
| 2-6 | NW NW SW | Do. TW 46 | Do. | 1947 | 133 | 6 | 805.65 | T | 17.7 | R | 12-14-47 | Bedrock at 114 ft. |
| 2-7 | - - SE | Cleon Smith | - | - | 86 | 2 | - | D | - | - | - | |
| 3-2 | SE NE SE | Kalamazoo Vegetable Parchment Co. 2 | - | - | 115 | - | - | I | 15 | R | 8- 4-39 | Abandoned |
| 3-5 | SE NE SE | Do. 5 | F. P. Rust | - | 131 | 12 | - | I | 20 | R | ? | Do. |
| 3-6 | SE NE SE | Do. 6 | Do. | - | 119 | 12 | - | I | 17.75 | R | ? | Do. |
| 3-10 | NE NE SE | Do. 10 | Do. | - | 110 | 12 | - | I | 19.1 | R | ? | Equipped with slotted casing. |
| 3-11 | SW SE NE | Do. | C. S. Raymer | 1944 | 29 | 2 | - | D | 15:9 | R | 1944 | Company-owned house. |
| 3-12 | SW SE NE | Do. | Do. | 1944 | 34 | 2 | - | D | 14.9 | R | 1944 | Do. |
| 3-13 | NE NE SE | Do. 11 | - | - | 123 | - | - | I | 34 | R | ? | Abandoned, poor yield. |
| 3-15 | NE NE SE | Do. 13 | F. P. Rust | - | 63 | 12 | 767.17 | O | H | - | - | Formerly KoPT 13. |
| 3-18 | SE SE NE | Do. 16 | Do. | 1939 | 133 | 12 | - | I | 17.25 | R | ? | Abandoned, high iron content. |
| 3-19 | NE SE NE | Do. 17 | - | - | 44 | 8 | - | I | 19.7 | R | ? | Abandoned, sand-locked bowls. |
| 3-20 | SE SE NE | Do. 18 | C. S. Raymer | 1941 | 38 | 12 | - | I | 21.3 | R | 1947 | |
| 3-21 | NW SE NE | Do. 20 | Do. | 1941 | 38 | 12 | 770 | I | 18.3 | R | 1941 | |
| 3-22 | SE NE NE | Do. 33 | Do. | 1941 | 31 | 12 | 769.08 | I | 17.7 | R | 10- 4-41 | |
| 3-23 | NE NE SE | Do. 35 | Do. | 1941 | 35 | 12 | 769.99 | I | 17.9 | R | 1941 | Abandoned. |
| 3-24 | SE NE SE | Do. 37 | Do. | 1945 | 65 | 12 | 763.77 | I | 12 | R | ? | Abandoned. |
| 3-25 | NE SE NE | Do. 38 | Do. | 1945 | 36 | 12 | 772.41 | I | 20.75 | R | ? | |
| 3-26 | NE SE NE | Do. 47 | Do. | 1948 | 34 | 12 | 771.21 | I | 19.5 | R | 1948 | |
| 3-27 | SE SE NE | Do. 48 | Do. | 1948 | 28 | 12 | 769.34 | I | 17 | R | 6-21-48 | Struck boulder, abandoned. |
| 3-28 | SW SE NE | Do. 49 | Do. | 1948 | 37 | 12 | 769.90 | I | 17.9 | R | 9- 9-48 | |
| 3-29 | NE SE NE | Do. 50 | Do. | 1948 | 39 | 12 | 774.05 | O | H | M | - | Formerly KoPT 50. |
| 3-30 | NW SE SW | Do. | Ohio Dr. Co. | 1929 | 60 | 20 | - | I | 13.0 | R | 1929 | |
| 3-31 | NW SE SE | Do. | Do. | 1929 | 60 | 3 | - | T | 13.0 | R | 1929 | Site of well 2S 1W 30-3. |
| 3-32 | SE NE SE | Do. TW 1 | C. S. Raymer | 1939 | 128 | 6 | 762 | T | 14 | R | 1939 | |
| 3-33 | - NE SE | Do. TW 2 | Do. | 1939 | 86 | 6 | 762 | T | 20.7 | R | 1939 | Site of well 2S 1W 3-21. |
| 3-34 | NE NE NE | Do. TW 3 | Do. | 1939 | 75 | 2 | - | T | 10 | R | ? | |
| 3-35 | NW NE NE | Do. TW 4 | Do. | 1939 | 45 | 2 | - | T | 6.33 | R | ? | |
| 3-36 | NW NE NE | Do. TW 5 | Do. | 1939 | 55 | 2 | - | T | 15 | R | ? | |
| 3-37 | NE NE NE | Do. TW 6 | Do. | 1939 | 25 | 2 | 766.93 | O | H | M | - | Formerly KoPT 6. |
| 3-38 | NW SE NE | Do. TW 20 | Do. | 1941 | 58 | 2 | 769.98 | T | 18.3 | R | 8-21.41 | Yielded 20 gpm. |
| 3-39 | SE NE NE | Do. TW 21 | Do. | 1941 | 60 | 2 | 768.75 | T | 14.9 | R | 8-27-41 | Yielded 10 gpm. |
| 3-40 | SE NE NE | Do. TW 22 | Do. | 1941 | 37 | 2 | 770.64 | T | 16.5 | R | 8-28-41 | Yielded 20 gpm. |
| 3-41 | NE NE SE | Do. TW 23 | Do. | 1941 | 35 | 2 | 775.03 | T | 23.9 | R | 8-28-41 | |
| 3-42 | NE NE SE | Do. TW 24 | Do. | 1941 | 87 | 2 | 777.26 | T | 24.9 | R | 9- 3-41 | Yielded 20 gpm. |
| 3-43 | NE NE SE | Do. TW 25 | Do. | 1941 | 41 | 2 | 764.84 | T | - | - | - | |
| 3-44 | NE NE SE | Do. TW 26 | Do. | 1941 | 66 | 2 | 763.88 | T | 13.7 | R | 9-10-41 | Yielded 5 gpm. |

Table 1.--Records of wells, test holes, and foundation borings in the Kalamazoo Area.--Continued

| Well number | Location in section ¼ ¼ ¼ | Owner | Driller | Year drilled | Depth (ft.) | Diameter (in.) | Altitude | Use | Water level | M or R | Date | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | T. 2 S., R. 11 W., Continued | | | | | | | | |
| 2S 11W | | | | | | | | | | | | |
| 3-45 | SW NE NE | Kalamazoo Vegetable Parchment Co. TW 27 | Do. | 1941 | 35 | 2 | 764.13 | T | 12.1 | R | 9-11-41 | Yielded 20 gpm. |
| 3-46 | SE SE NE | Do. TW 28 | Do. | 1941 | 42 | 2 | 776.39 | T | 24.7 | R | 9-12-41 | Yielded 20 gpm. |
| 3-47 | SW NE NE | Do. TW 29 | Do. | 1941 | 35 | 2 | 765.48 | T | 13.75 | R | 9-15-41 | |
| 3-48 | SW NE NE | Do. TW 30 | Do. | 1941 | 33 | 2 | 762.50 | T | 10 | R | 9-16-41 | |
| 3-49 | SE NE SE | Do. TW 31 | Do. | 1941 | 50 | 2 | 770.22 | T | 19.9 | R | 9-25-41 | |
| 3-50 | SE NE SE | Do. TW 32 | Do. | 1941 | 77 | 2 | 764.08 | T | 14 | R | 9-26-41 | |
| 3-51 | SE NE NE | Do. TW 33 | Do. | 1941 | 33 | 2 | 769.08 | T | 17 | R | 9-29-41 | Site of well 2S 11W 3-22. |
| 3-52 | SE NE SE | Do. TW 34 | Do. | 1941 | 55 | 2 | 773.51 | T | 21.2 | R | 10- 7-41 | Yielded 20 gpm. |
| 3-53 | NE NE SE | Do. TW 35 | Do. | 1941 | 35 | 2 | 769.99 | T | 17.8 | R | 10-13-41 | Site of well 2S 11W 3-23. |
| 3-54 | SE NE SE | Do. TW 36 | Do. | 1945 | 40 | 12 | 774.13 | T | 21 | R | ? | |
| 3-55 | SE NE SE | Do. TW 39 | Do. | 1945 | 61 | 12 | 765.21 | T | - | - | - | |
| 3-56 | NE NE SE | Do. TW 40 | Do. | 1945 | 31 | 12 | 767.65 | O | H | M | - | Formerly KoPT 40. |
| 3-57 | SE SE NE | Do. TW 48A | Do. | 1948 | 37 | 12 | 774.09 | T | - | - | - | Thin water-bearing zone. |
| 3-58 | SW NE SE | Do. TW 51 | Do. | 1950 | 82 | 6 | 755.73 | T | 1.60 | R | 2-14-50 | Bedrock at 80 ft. |
| 3-59 | SE SE SE | Do. TW 52 | Do. | 1950 | 77 | 6 | 757.18 | T | 4.5 | R | 2-27-50 | Bedrock at 75 ft. |
| 3-60 | NE NE NE | Do. TW 61 | Do. | 1951 | 36 | 6 | 764.35 | T | 10.48 | M | 7-17-56 | |
| 3-61 | SE NW NE | Do. TW 62 | Do. | 1951 | 64 | 6 | 760.47 | T | - | - | - | |
| 4-1 | SW SE SW | Kalamazoo State Hospital | - | 1939 | 80 | 8 | - | P | - | - | - | At Brook Farm. |
| 4-2 | SW SE SW | Do. TW 1 | Paul Sabo | 1946 | 169 | 6 | 840 | T | 27 | R | 1946 | Bedrock at 126 ft. |
| 4-3 | SW SE SW | Do. 1 | Dunbar Dr. Co. | 1944 | 105 | 8 | - | P | 18.1 | R | 3- 2-46 | |
| 4-4 | SW SE SW | Do. 2 | Do. | 1944 | 105 | 8 | - | P | +5 | R | 1944 | Flowed. |
| 5-1 | NE NW NE | Jack Knobloch | J. C. Newman | 1952 | 125 | 2 | - | D | - | - | - | Water reported hard. |
| 6-1 | - NE NW | City | City | 1957 | 167 | 12 | - | - | 2.12 | R | 1-14-57 | Station 19. Yielded 400 gpm. |
| 8-1 | SE NE SE | Casper Haas | - | - | - | 2 | 891 | D | - | - | - | Improved spring flowing at 3 gpm. |
| 8-2 | - NW SW | E. J. Redeker | - | 1923 | 115 | 3 | - | D | - | - | - | Coarse gravel aquifer. |
| 9-2 | - - NW | F. M. Sellers | - | - | - | 1¼ | 826 | D | - | - | - | Flow reported. |
| 9-3 | NW SE SW | Hammond Mach. Corp. | Ohio Dr. Co. | 1945 | 53 | 6 | 791 | I | - | - | - | |
| 9-4 | NW SW SW | Determann Bros. | - | - | 78 | 2 | 836 | I | - | - | - | |
| 9-5 | - SE NW | D. C. Worden | - | 1937 | 65 | 3 | - | D | - | - | - | Flow reported. |
| 9-6 | NW SE SW | Hammond Mach. Corp. | Layne-Northern Co. | 1956 | 102 | - | 791 | T | 14.5 | R | 7-11-56 | |
| 9-7 | NW SE SW | Do. | Do. | 1956 | 76 | 16 | 791 | I | 14 | R | 8-10-56 | |
| 10-1 | NW NW NE | - | - | - | 28 | 2 | 761 | D | 8.37 | M | 6- 6-47 | Abandoned. |
| 10-2 | - NE SW | Purity Dairy Co. | Garrett Reer | 1944 | 40 | 3 | 768 | I | 15 | R | 1944 | |
| 10-3 | - NW SE | E. J. Kelly Div. | Ohio Dr. Co. | 1941 | 50 | 10 | 761 | I | 20 | R | 1941 | |
| 10-4 | - NW SE | Do. | Do. | 1941 | 50 | 10 | 761 | I | - | - | - | |
| 10-5 | - SW NE | Checker Cab Mfg. Corp. | Do. | 1930 | 230 | 18 | 761 | I | 10 | R | 1931 | |
| 10-6 | - SW NE | Do. | Do. | 1931 | 47 | 14 | 762 | I | - | - | - | |
| 10-7 | - SW NE | Atlas Press Co. | Do. | 1934 | 51 | 10 | 761 | I | 13 | R | 1934 | Peak use 2,000 gpd. |
| 10-8 | - SW NE | Do. | Do. | 1945 | 50 | 10 | 761 | I | 18 | R | 1945 | |
| 10-9 | - NW SE | Kalamazoo Stove and Furnace Co. | Do. | 1942 | 79 | 12 | 762 | I | 17 | R | 1942 | Bedrock at 72 ft. |
| 10-10 | - NW SE | Do. | Do. | - | 72 | 12 | 762 | I | - | - | - | |
| 10-11 | SE SE SE | Sutherland Paper Co. | - | - | 52 | 2 | 759.94 | O | H | M | - | Formerly KoKO 136. Destroyed in 1954. |
| 10-12 | SW NE SE | Do. TH A | - | 1940 | 64 | 6 | 757 | T | 18 | R | 3- 5-40 | |
| 10-13 | SE SW SE | Do. TH B | Smith-Monroe Co. | 1940 | 51 | 6 | 756 | T | 17 | R | 2-22-40 | Bedrock at 42 ft. Formerly KoKO 127. |
| 10-14 | NW SW SE | Do. TH C | Do. | 1940 | 54 | 6 | 760 | T | - | - | - | Bedrock at 52 ft. |
| 10-15 | SW SW SE | Do. TH D | Do. | 1940 | 56 | 6 | 764 | T | - | - | - | Formerly KoKO 129. |
| 10-16 | NE SW SE | Do. TH E | Do. | 1940 | 50 | 6 | 762 | T | 26 | R | 2- 8-40 | Poor yield. |
| 10-17 | NW SW SE | Do. TH F | Do. | 1939 | 45 | 6 | 764 | T | 26 | R | 12-12-39 | |
| 10-18 | NE SW SE | Do. TH G | Do. | 1938 | 54 | 3 | 761 | T | 22 | R | 11- 1-38 | Bedrock at 53 ft. |
| 10-19 | SE SW SE | Do. TH H | Do. | 1938 | 61 | 3 | 765 | T | 23.5 | R | 11- 4-38 | Bedrock at 58 ft. Formerly KoKO 133. |
| 10-20 | NE SW SE | Do. TH I | Do. | 1938 | 66 | 3 | 764 | T | 18 | R | 11- 6-38 | Bedrock at 65 ft. |
| 10-21 | SE SE SE | Do. TH J | Ohio Dr. Co. | 1934 | 50 | 3 | 757 | T | - | - | - | |
| 10-22 | SW SW SE | Do. 1 | Smith-Monroe Co. | 1931 | 53 | 12 | 757 | I | 22 | R | 12-30-39 | |

Table 1.--Records of wells, test holes, and foundation borings in the Kalamazoo Area.--Continued

| Well number | Location ¼ ¼ ¼ in section | Owner | Driller | Year drilled | Depth (ft.) | Diameter (in.) | Altitude | Use | Water level | M or R | Date | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | T. 2 S., R. 11 W., Continued | | | | | | | | |
| 2S 11W | | | | | | | | | | | | |
| 10-23 | SW SW SE | Sutherland Paper Co. | Smith-Monroe Co. | 1939 | 53 | 6 | 763 | I | 25 | R | 12- 7-39 | |
| 10-24 | SE SW SE | Do. 2A | Do. | 1942 | 48 | 16 | 762 | I | 26 | R | 1-30-42 | Abandoned in 1944. |
| 10-26 | SE SE SE | Do. T 4 | Ohio Dr. Co. | 1938 | 80 | 3 | 757 | T | 17 | R | 1938 | |
| 10-27 | SE SE SE | Do. 4 | - | - | 64 | 52 | 757 | I | - | - | - | |
| 10-28 | SE SE SE | Do. 5 | A. D. Cook, Inc. | 1928 | 56 | 40 | 756 | I | - | - | - | |
| 10-29 | SE SE SE | Do. T 5 | Smith-Monroe Co. | - | 53 | 6 | 756 | T | 27 | R | 12-14-39 | |
| 10-31 | NW SW SE | Do. 6N | Do. | 1944 | 70 | 12 | 762 | I | 30 | R | 2- 8-44 | Formerly KoKO 143 |
| 10-32 | NE SW SE | Do. 7 | Do. | 1935 | 52 | 18 | 762 | I | - | - | - | |
| 10-33 | NE SW SE | Do. T 7 | - | 1934 | 50 | 3 | 762 | T | 10 | R | 1944 | |
| 10-34 | SW SW SE | Do. TH 5 | Ohio Dr. Co. | 1936 | 400 | 3 | 763 | T | 22 | R | 1936 | Bedrock at 60 ft. Formerly KoKO 165. |
| 10-35 | SW SW SE | Do. 8 | Smith-Monroe Co. | 1935 | 400 | 8 | 763 | I | 22 | R | 5-19-44 | Back filled to 84 ft. |
| 10-36 | SW SW SE | Do. 9 | Do. | - | 53 | 20 | 765 | I | - | - | - | |
| 10-37 | NE SW SE | Do. 10 | Do. | 1940 | 51 | 12 | 762 | I | 27 | R | 1-23-40 | |
| 10-38 | NE SW SE | Do. T 10 | Do. | 1940 | 51 | 6 | 762 | T | 27 | R | 1-23-40 | |
| 10-39 | SW SW SE | Do. 11 | Do. | 1940 | 58 | 12 | 764 | I | 21 | R | 1940 | |
| 10-40 | NW SW SE | Do. 11N | Ohio Dr. Co. | 1952 | 50 | 16 | 763 | I | 15 | R | 1952 | |
| 10-41 | SW SW SE | Do. 12 | Smith-Monroe Co. | 1940 | 45 | 12 | 764 | I | - | - | - | Converted from test well. |
| 10-42 | SW SW SE | Do. | Layne-Northern Co. | 1932 | 52 | 26 | 764 | I | 21 | R | 11-19-32 | |
| 10-43 | SW SW SE | Do. 13 | Smith-Monroe Co. | 1940 | 54 | 12 | 764 | I | 21 | R | 1940 | Abandoned. Formerly KoKO 150. |
| 10-44 | SE NW SE | Do. 14 | Do. | 1940 | 88 | 12 | 761 | I | 10 | R | 7- 5-40 | Abandoned 1943. |
| 10-45 | SE SE SE | Do. 14A | Do. | 1942 | 57 | 12 | 757 | I | 9 | R | 7-17-42 | |
| 10-46 | NE SE SE | Do. 15 | Do. | 1941 | 87 | 12 | 756 | I | 12 | R | 2-19-41 | |
| 10-47 | NE SE SE | Do. T 15 | Do. | 1941 | 90 | 4 | 758 | T | 38 | R | 1-31-41 | Bedrock at 84 ft. |
| 10-48 | NW SW SE | Do. 17 | Do. | 1943 | 47 | 12 | 762 | I | 16 | R | 8-13-43 | |
| 10-49 | NW SW SE | Do. 17N | Do. | 1946 | 47 | 12 | 762 | I | 20 | R | 1946 | |
| 10-50 | NW SW SE | Do. T 17 | Do. | 1943 | 60 | 2 | 765.01 | O | H | M | - | Formerly KoKO 137. Destroyed. |
| 10-51 | NE SE SE | Do. 18 | Do. | 1944 | 72 | 16 | 757 | I | 10 | R | 10- 3-44 | |
| 10-52 | NE SE SE | Do. 19 | Do. | 1945 | 80 | 12 | 756 | I | 7 | R | 3-30-45 | Formerly KoKO 156. |
| 10-53 | NE SE SE | Do. T 19 | Do. | 1945 | 89 | 6 | 756 | T | - | - | - | |
| 10-54 | NE SE SE | Do. 20 | - | 1946 | 86 | 6 | 756 | I | - | - | - | |
| 10-55 | NE SE SE | Do. 21 | - | 1946 | 78 | 6 | 756 | I | 5 | R | 9- 4-46 | |
| 10-56 | NW SE SE | Do. 22 | - | 1946 | 78 | 6 | 757 | I | - | - | - | Formerly KoKO 159. |
| 10-57 | NE SE SE | Do. 23 | - | 1946 | 82 | 6 | 756 | I | - | - | - | Formerly KoKO 160. |
| 10-58 | SW SW SE | Do. | - | 1946 | 65 | 6 | 764 | T | - | - | - | |
| 10-59 | NW SE SE | Do. R 1 | Ranney Methods Water Supply Co. | 1944 | 73 | 6 | 758 | T | - | - | - | |
| 10-60 | NW SE SE | Do. R 2 | Do. | 1944 | 70 | 6 | 756 | T | - | - | - | |
| 10-61 | NE SE SE | Do. R 3 | Do. | 1944 | 74 | 6 | 757 | T | - | - | - | |
| 10-62 | NE SE SE | Do. R 4 | Do. | 1944 | 78 | 6 | 757 | T | - | - | - | |
| 10-63 | NE SE SE | Do. R 5 | Do. | 1944 | 78 | 6 | 756 | T | - | - | - | On island in river. |
| 10-64 | NE SE SE | Do. R 6 | Do. | 1944 | 77 | 6 | 756 | T | - | - | - | Do. |
| 10-65 | SE SE SE | Do. R 7 | Do. | 1944 | 68 | 6 | 756 | T | - | - | - | Do. |
| 10-66 | NE NW NE | Checker Cab Mfg. Co. | Raymond Conc. | 1946 | 45 | - | 756.6 | B | 6.0 | R | 11- 7-46 | |
| 10-68 | NE NW NE | Do. TB 3 | Do. | 1946 | 54 | - | 762.3 | B | 11.75 | R | 11- 7-46 | |
| 10-72 | SW NW NE | Do. TB 17 | Do. | 1946 | 52 | - | 762.2 | B | 12.75 | R | 11- 7-46 | |
| 10-73 | SW NE SE | City TH 1 | James Crays | 1945 | 18 | - | 757.46 | B | 7.8 | R | 7- ?-45 | Sewage treatment plant site. |
| 10-74 | SW NE SE | Do. TH 2 | Do. | 1945 | 25 | - | 754.06 | B | 4.65 | R | 7- ?-45 | Do. |
| 10-78 | SW NE SE | Do. TH 6 | Do. | 1945 | 26 | - | 757.2 | B | 6.8 | R | 7- ?-45 | Do. |
| 10-80 | SW NE SE | Do. TH 8 | Do. | 1945 | 28 | - | 757.96 | B | 8.0 | R | 7- ?-45 | Do. |
| 10-82 | SE SE SE | Sutherland Paper Co. 25 | Ohio Dr. Co. | - | 51 | 12 | - | I | - | - | - | |
| 10-83 | - SW SW | John Grooten | W. P. Donnell | 1945 | 47 | 2 | 779 | D | 18 | R | 6- 4-46 | Gravel aquifer. |
| 11-1 | NW SE NE | City Henson 101 | - | - | 235 | - | - | T | - | - | - | Henson field. |
| 11-2 | NW SE NE | Do. 102 | - | - | 135 | - | - | T | - | - | - | Bedrock at 153 ft. |
| 11-3 | NW SE NE | Do. 103 | - | - | 126 | - | - | T | - | - | - | |
| 11-4 | SW SE NE | Do. 104 | - | - | 124 | - | - | T | - | - | - | |
| 11-5 | NW SE NE | Do. TW 1 | Harmon-Ness Co. | 1930 | 104 | 6 | 806.1 | O | 5.75 | R | 11-11-30 | |
| 11-6 | SW NE NE | Do. TW 2 | Do. | 1930 | 73 | 6 | 803.8 | T | 5.0 | R | 11-18-30 | |
| 11-7 | SE SW NE | Do. TW 3 | Do. | 1930 | 87 | 6 | 812.4 | T | 8.0 | R | 11-24-30 | |
| 11-8 | SW NE NE | Do. TW 4 | Do. | 1930 | 98 | 6 | 810.5 | T | 9.0 | R | 12- 9-30 | |

Table 1.--Records of wells, test holes, and foundation borings in the Kalamazoo Area.--Continued

| Well number | Location in section ¼ ¼ ¼ | Owner | Driller | Year drilled | Depth (ft.) | Diameter (in.) | Altitude | Use | Water level | M or R | Date | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | T. 2 S., R. 11 W., Continued | | | | | | |
| 2S 11W | | | | | | | | | | | | |
| 11-9 | SW SE NE | City TW 5 | Harmon-Ness Co. | 1929 | 218 | 2 | 806.45 | O | H | M | - | Formerly KoKo 5. Plugged. |
| 11-10 | NW SW SE | M. Way | - | - | 30 | 1½ | - | D | - | - | - | Coarse gravel aquifer. |
| 11-11 | NW NE SE | Harry Davies | Morris Dee | 1939 | 56 | 2 | - | D | - | - | - | Fine gravel aquifer. |
| 11-12 | NW SE NE | City 1 | City | 1957 | - | 12 | - | P | - | - | - | Station 14. |
| 11-13 | NE SE NE | Do. 2 | Do. | 1957 | 112 | 12 | - | P | - | - | - | Do. |
| 11-14 | NE SE NE | Do. 3 | Do. | 1957 | 126 | 12 | - | P | 11 | R | 1957 | Do. |
| 11-15 | SE NE NE | Do. 4 | Do. | 1957 | 120 | 12 | - | P | 4 | R | 1957 | Do. |
| 12-1 | - NW NE | Nazareth Academy | - | - | - | 6 | 861 | P | - | - | - | Pumps 20,000 gpd. |
| 12-2 | - SE NW | J. A. Jennings | Smith-Monroe Co. | 1930 | 90 | 8 | 861 | - | 38 | R | ? | |
| 12-3 | - - NW | J. R. Harris | - | - | - | - | - | - | - | - | - | Flows. Coarse sand aquifer. |
| 12-4 | SW SE SW | W. J. Dorgan | J. C. Newman | - | 60 | 2 | - | D | - | - | - | Water reported hard. |
| 12-5 | NW SE SW | D. W. Ripley | - | 1929 | 88 | 2 | - | D | 55 | R | ? | Fine gravel aquifer. |
| 12-7 | NW SE SW | Mary Sterenberg | Louis Sanders | 1930 | 100 | - | - | D | - | - | - | Gravel aquifer. |
| 14-1 | NW SE SE | City L 1A | - | 1921 | - | 12 | 759.4 | P | - | - | - | |
| 14-2 | NW SE SE | Do. L 1B | City | - | - | 2 | 757.3 | T | - | - | - | Pilot well for 14-1. |
| 14-3 | NW SE SE | Do. L 2B | - | 1921 | - | 12 | 765.7 | P | - | - | - | |
| 14-4 | NW SE SE | Do. | - | - | 30 | 2 | 762.40 | O | H | - | - | Formerly KoKo 15. |
| 14-5 | NW SE SE | Do. L 3B | - | - | - | 12 | - | P | - | - | - | |
| 14-6 | NW SE SE | Do. | - | - | - | 2 | 757.7 | T | - | - | - | Pilot well for 14-5. |
| 14-7 | NW SE SE | Do. L 4B | - | - | - | 12 | - | P | - | - | - | Formerly KoKo 19. |
| 14-8 | NW SE SE | Do. | - | - | - | 12 | - | T | - | - | - | Pilot well for 14-7. |
| 14-9 | NW SE SE | Sutherland Paper Co. 1 | - | - | 91 | 16 | - | I | - | - | - | |
| 14-10 | NW SE SE | Do. 2 | Layne Bowler Co. | 1939 | - | 24 | - | I | 24 | R | 7-25-39 | Well gravel packed. |
| 14-12 | NE SW SE | Do. T 5 | Smith-Monroe Co. | 1940 | 92 | 2 | - | T | 19 | R | 7- 1-40 | Originally 6-inch test. |
| 14-13 | NE SW SE | Do. 5 | Do. | 1940 | 92 | 12 | 766 | I | 19 | R | 7-10-40 | Site of 14-12. |
| 14-14 | NE SW SE | Do. 6 | Do. | 1941 | 84 | 12 | - | I | - | - | - | |
| 14-15 | NE SW SE | Do. T 7 | Do. | 1944 | 85 | 6 | - | T | 18 | R | 3-20-44 | |
| 14-16 | NE SW SE | Do. 7 | Do. | 1944 | 84 | 12 | 766 | I | 17 | R | 4- 6-44 | Site of 14-15. Formerly KoKo 95. |
| 14-19 | NE SW SE | Do. T 10 | Do. | 1946 | 88 | 6 | - | T | - | - | - | Bedrock at 73 ft. |
| 14-20 | NE SW SE | Do. 10 | Do. | 1946 | 93 | 12 | - | I | 13 | R | 1-28-46 | |
| 14-21 | NE SW SE | Do. 11 | Do. | - | 102 | 12 | - | I | - | - | - | |
| 14-22 | NE SW SE | Do. T 6 | Do. | 1946 | 89 | 6 | - | T | - | - | - | |
| 14-24 | NW SE SE | Do. T 12 | Do. | 1940 | 92 | 6 | 766 | T | 18 | R | 6-21-40 | Bedrock at 88 ft. |
| 14-25 | NE SW SE | Do. T 14 | Do. | 1944 | 80 | 6 | - | T | - | - | - | |
| 14-26 | NE SW SE | Do. T 15 | Do. | 1945 | 97 | 6 | - | T | - | - | - | |
| 14-27 | NE SW SE | Do. T 16 | Do. | 1941 | 95 | 6 | - | T | - | - | - | |
| 14-28 | NE SW SE | Do. T 17 | Do. | 1941 | 95 | 6 | - | T | 17 | R | 11-17-41 | |
| 14-29 | SE SW SE | Do. T 18 | Do. | 1941 | 46 | 2 | 861.01 | O | H | M | - | Formerly KoKO 186. |
| 14-30 | SW SE SE | Do. T 19 | Do. | 1945 | 111 | 6 | 766 | T | 26 | R | 11-15-45 | |
| 14-31 | SW SE SE | Do. T 20 | Do. | 1945 | 108 | 6 | 766 | T | 18 | R | 11- 2-45 | |
| 14-32 | NW SE NE | A. S. Kent | - | - | 106 | 2 | - | - | - | D | - | Coarse gravel aquifer. |
| 14-33 | NW NW SW | Kalamazoo Steel Process Co. | Ohio Dr. Co. | 1953 | 85 | 3 | - | T | 9 | R | 4- 8-53 | |
| 14-34 | SE SW NE | Ella Ladendorf | - | 1925 | 68 | 2 | 821 | D | - | - | - | Destroyed. |
| 14-36 | - NE SW | Munger Laundry Co. 1 | - | - | 58 | 3 | - | I | - | - | - | Two wells yield 45 gpm. |
| 14-37 | - NE SW | Do. 2 | - | - | 58 | 3 | - | I | - | - | - | |
| 14-38 | NW NW SW | MSHD TH 1 | MSHD | 1935 | 28 | - | 763.5 | B | - | - | - | |
| 14-41 | NW NW SW | Do. TH 4 | Do. | 1935 | 33 | - | 764.7 | B | - | - | - | |
| 14-47 | NW NW SW | Do. TH 10 | Do. | 1935 | 17 | - | 761.9 | B | - | - | - | |
| 14-54 | NW NW SW | Do. TH 17 | Do. | 1935 | 39 | - | 761.7 | B | - | - | - | |
| 14-57 | SW NW SW | City | Raymond Conc. | 1952 | 23 | 2½ | 761.82 | B | 8.0 | R | 12-27-52 | |
| 14-60 | NW SW SE | City TB 1 | Raymond Conc. | 1952 | 22 | 2½ | 762.9 | B | 12.8 | R | 12-27-52 | Sand aquifer. |
| 15-1 | NW SE SW | First National Bank and Trust Co. | J. C. Newman | 1948 | 164 | 2 | - | T | - | - | - | Site of 6-inch air-conditioning and recharge wells. |
| 15-2 | NE NE SW | Shakespeare Fishing Tackle Co. TW 1 | Ohio Dr. Co. | 1939 | 90 | 3 | 774 | T | 19 | R | 8-14-39 | |
| 15-3 | NE NE SW | Do. | Do. | 1939 | 66 | 12 | 774 | I | 17 | R | 6- ?-39 | Air-conditioning use |
| 15-4 | NW SE SW | F. W. Woolworth 1 | J. C. Newman | 1941 | 89 | 10 | 786 | I | - | - | - | Do. |

Table 1.--Records of wells, test holes, and foundation borings in the Kalamazoo Area.--Continued

| Well number | Location in section ¼ ¼ ¼ | Owner | Driller | Year drilled | Depth (ft.) | Diameter (in.) | Altitude | Use | Water level | M or R | Date | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | T. 2 S., R. 11 W., Continued | | | | | | | | | |
| 2S 11W | | | | | | | | | | | | |
| 15-5 | NW SE SW | F. W. Woolworth 2 | J. C. Newman | 1941 | 90 | 10 | 786 | I | - | - | - | Recharge well. |
| 15-6 | SE SE SW | Upjohn Co. TH 1 | Ohio Dr. Co. | 1939 | 86 | 3 | 776 | T | 18 | R | 8- ?-39 | |
| 15-7 | SE SE SW | Do. TH 2 | Do. | 1939 | 75 | 3 | 776 | T | 20 | R | 8- ?-39 | |
| 15-8 | SE SE SW | Do. TH 3 | Do. | 1939 | 60 | 3 | 776 | T | 21 | R | 8- ?-39 | |
| 15-9 | SE SE SW | Do. TH 4 | Do. | 1939 | 72 | 3 | 776 | T | 22 | R | 8- ?-39 | |
| 15-10 | NE NW SW | Taylor Produce Co. | Do. | 1936 | 85 | 8 | 781 | I | 21 | R | 1936 | |
| 15-11 | NE NW SW | Saniwan Paper Co. | Do. | 1941 | 75 | 8 | 781 | I | 22 | R | 3- ?-41 | |
| 15-12 | - NW SW | Precision Casting Co. TW 1 | Do. | 1946 | 76 | 3 | 784 | T | 24 | R | 12- ?-46 | |
| 15-13 | - NW SW | Do. TW 2 | Do. | 1940 | 94 | 3 | 784 | T | - | - | - | |
| 15-14 | - NW SW | Do. | Do. | 1940 | 63 | 12 | 784 | I | 20 | R | 8- 9-54 | |
| 15-15 | SW NE SE | Kalamazoo Stove and Furnace Co. 1 | Do. | 1932 | 75 | 16 | 761 | I | 6 | R | 12- 5-32 | |
| 15-16 | NW NE SE | Do. 2 | Do. | 1942 | 94 | 12 | 761 | I | - | - | - | |
| 15-17 | NE NE SE | Do. 3 | Do. | 1942 | 99 | 12 | 761 | I | 10 | R | ? | Bedrock at 95 ft. Formerly KoKO 237. |
| 15-18 | - NE SE | Consumers Power Co. | - | - | 64 | 12 | 766.17 | O | H | M | - | Formerly KoKO 211. |
| 15-19 | SW SW SE | Do. | Howard Cowell | 1940 | 73 | 12 | 764 | I | - | - | - | Bedrock at 73 ft. |
| 15-20 | NE NW SE | Do. | Brewer Bros. | 1947 | 70 | 10 | 761 | I | 10 | R | 10-11-47 | Bedrock at 70 ft. Formerly KoKO 213. |
| 15-21 | NE NE SW | Kalamazoo Ice and Fuel Co. | - | 1935 | 59 | 4 | 781 | I | - | - | - | |
| 15-22 | NE NE SW | Do. | Smith-Monroe Co. | 1940 | 77 | 12 | 781 | I | 21 | R | 3- ?-40 | |
| 15-23 | NE NE SW | Do. | - | - | 100 | 12 | - | I | - | - | - | |
| 15-24 | NE NE SW | Do. | F. P. Rust | - | 140 | 12 | - | I | 18 | R | ? | |
| 15-25 | SW SE SW | City TW 1 | Kelley Well Co. | 1924 | 107 | - | 786 | T | 25 | R | 3- ?-24 | |
| 15-26 | SE NW SW | Kalamazoo Laundry Co. | Ohio Dr. Co. | 1942 | 123 | 12 | 781 | I | 27 | R | 1942 | |
| 15-27 | SE SW NW | Brundage Mfg. Co. | Louis Sanders | 1948 | 65 | 4 | 779 | I | - | - | - | Air conditioning. |
| 15-28 | SW SE SW | Butterfield Theatres | J. C. Newman | - | 89 | 10 | 785 | I | - | - | - | Do. |
| 15-29 | SW SE SW | Do. | Do. | - | 90 | 10 | 785 | I | - | - | - | Do. |
| 15-30 | SE SW NW | Kalamazoo Label Co. | Ohio Dr. Co. | 1935 | 69 | 8 | 779 | I | 15 | R | 1935 | |
| 15-31 | - NW SW | Wigginton Co. | - | - | 68 | 6 | 781.37 | O | H | M | - | Formerly KoKO 228. |
| 15-32 | - NW SW | Do. | - | - | 73 | 8 | 781 | O | 20.17 | M | 4- 2-52 | Formerly KoKO 228A. |
| 15-33 | - NE SW | Columbian Hotel | - | - | 69 | 5 | 769.46 | I | H | M | - | Formerly KoKO 311. |
| 15-34 | - SE SW | Hanselman Building | - | - | 80 | 4 | 761.27 | O | H | M | - | Formerly KoKO 227. |
| 15-38 | NW NE SE | Do. TH 3 | MSHD | 1946 | 39 | - | 756.2 | B | - | - | - | |
| 15-40 | SW SE SE | City TB 5 | Raymond Conc. | 1952 | 20 | 2½ | 763.2 | B | 11.1 | R | 12-27-52 | |
| 15-41 | SE NE SE | Do. TB 6 | Do. | 1952 | 32 | 2½ | 766.1 | B | 13.2 | R | 12-27-52 | |
| 15-46 | NE SE NE | Do. TB 15 | Do. | 1952 | 25 | 2½ | 764 | B | 9.9 | R | 12-27-52 | |
| 16-1 | NE SE NE | Hilton and Haas Dairy | - | 1920 | 35 | 4 | - | I | - | - | - | |
| 16-2 | SE NE NW | M. and D. Dairy | - | 1934 | 18 | 1½ | 793 | I | - | - | - | |
| 16-3 | - SW NW | City TW 1 | Layne Bowler Co. | 1924 | 160 | - | 845.6 | T | 24 | R | 5- ?-24 | |
| 17-1 | NW NW NW | S. M. Farr | Adren Rice | 1944 | 100 | 2 | 936 | D | - | - | - | Yields 4 gpm. |
| 17-2 | SW SE NW | Donald Boudeman | Chris. Roth | - | 111 | - | - | D | - | - | - | |
| 17-4 | SE SW NE | C. H. Shiley | - | - | 132 | 2 | - | D | - | - | - | Abandoned. |
| 17-5 | - SE SE | Victor Himes | - | 1929 | 74 | 2 | - | D | 20 | R | 1947 | Coarse gravel aquifer. |
| 17-7 | NW SW NE | V. C. Maltby | - | - | 90 | 2 | - | D | - | - | - | Sand and gravel aquifer. |
| 17-8 | SE SE NW | D. B. Fooy | - | 1927 | 100 | 1½ | - | D | - | - | - | Water reported hard. |
| 17-9 | NE NE SE | O. D. Brown | - | - | 105 | 2 | - | D | - | - | - | Do. |
| 18-1 | - NW SE | Farmers Chemical | J. C. Newman | 1950 | 182 | 8 | - | I | 31 | R | 1950 | |
| 18-2 | - NW SE | Elk Country Club | Ohio Dr. Co. | 1931 | 160 | - | - | P | 78 | R | 3- ?-31 | |
| 18-3 | NW NW SW | Robert Gorham | J. C. Newman | - | 80 | 2 | - | D | - | - | - | |
| 18-4 | - NE SE | F. Hungerford | - | 1940 | 125 | - | - | D | - | - | - | Water reported hard. |
| 18-5 | - NE SE | O. E. Moser | - | 1923 | 110 | 2 | - | D | - | - | - | Used also for irrigation. |
| 20-1 | NW NW NW | City 1 | City | 1953 | 181 | 12 | - | P | 23 | R | 11- ?-53 | Station 11. |
| 20-2 | NW NW NW | Do. 2 | Do. | 1954 | 143 | 12 | - | P | 24 | R | 11- 4-54 | Do. |
| 20-3 | NW NW NW | Do. 3 | Do. | 1954 | 133 | 12 | - | - | 25 | R | 12- ?-54 | Do. |
| 20-4 | SE NE SE | Kalamazoo State Hospital | - | - | 25 | 240 | - | P | - | - | - | Dug well 2. |
| 20-5 | SE NE SE | Do. TW 1 | Layne-Northern Co. | 1940 | 162 | 6 | - | T | 6 | R | 1940 | |

Table 1.--Records of wells, test holes, and foundation borings in the Kalamazoo Area.--Continued

| Well number | Location in section ¼ ¼ ¼ | Owner | Driller | Year drilled | Depth (ft.) | Diameter (in.) | Altitude | Use | Water level | M or R | Date | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | T. 2 S., R. 11 W., Continued | | | | | | | | | |
| 2S 11W | | | | | | | | | | | | |
| 20-6 | SE NE SE | Kalamazoo State Hospital N 1 | L. L. Oberlin | 1941 | 133 | 12 | 830 | P | - | - | - | Flowed 1940. |
| 20-7 | - SW SE | Western Mich. Univ. | - | - | 78 | 8 | 868.68 | O | H | M | - | Formerly KoKo 42 |
| 20-8 | NE NE NE | Kalamazoo College | City | 1947 | 247 | 6 | 836 | T | 45 | R | 1947 | |
| 20-9 | NW SE SE | Kalamazoo State Hospital TW 3 | Dunbar Dr. Co. | 1955 | 189 | 6 | - | T | 9 | R | 1-14-55 | |
| 20-10 | SE NE SE | Do. | B. J. Lewis and Son | 1956 | 141 | 12 | - | P | 10.5 | R | 4-13-56 | |
| 21-1 | NW NW SW | Do. | F. P. Rust | 1918 | 218 | 12 | 836 | P | - | - | - | |
| 21-2 | NW NW SW | Do. | - | - | 25 | 240 | - | P | - | - | - | Dug well 1. |
| 21-3 | NW NW SW | Do. TW 2 | Layne-Northern Co. | 1940 | 185 | 6 | - | T | 3 | R | 10- ?-40 | |
| 21-4 | NW NW SW | Do. N 2 | L. L. Oberlin | 1941 | 90 | 12 | - | P | +2 | R | 4- ?-41 | Flowed 1941. |
| 21-5 | - - SW | Do. 1 | - | - | 130 | - | - | P | - | - | - | Pipe pulled back to 66 ft. Yield 50,000 gpd. |
| 21-6 | - - SW | Do. 2 | - | - | 130 | - | - | P | - | - | - | Pipe pulled back to 124 ft. Yield 165,000 gpd. |
| 21-7 | - - SW | Do. 3 | - | - | 120 | - | - | P | - | - | - | Yield 60,000 gpd. |
| 21-8 | - - SW | Do. 4 | - | - | 130 | - | - | P | - | - | - | Pipe pulled back to 73 ft. Yield 50,000 gpd. |
| 21-9 | - - SW | Do. 5 | - | - | 110 | - | - | P | - | - | - | Pipe pulled back to 78 ft. Yield 25,000 gpd. |
| 21-10 | NW SW SE | Balch Severens | J. C. Newman | 1945 | 140 | 3 | 886 | D | - | R | 1945 | |
| 21-11 | - NW NE | Western Mich. Univ. | Ohio Dr. Co. | 1940 | 80 | 10 | - | P | 34 | R | 3- ?-40 | Abandoned. |
| 21-12 | NW SW SW | Kalamazoo State Hosp. | Dunbar Dr. Co. | 1955 | 146 | 6 | 835.2 | T | 9 | R | 1-21-55 | |
| 22-1 | NW NE SW | City AA | - | 1872 | 30 | 240 | 770.48 | P | 6.4 | R | 12-20-85 | Central dug well. |
| 22-2 | NW NE SW | Do. AB | - | - | - | 2 | 770.15 | W | - | - | - | In central dug well. |
| 22-3 | NW NE SW | Do. AC | City | - | - | 2 | 769.07 | W | - | - | - | |
| 22-4 | NW NE SW | Do. BA | - | 1932 | 128 | 40 | 764.9 | P | H | R | 10-17-32 | Station B. Formerly KoKO 1 |
| 22-5 | NW NE SW | Do. TW 4 | Ohio Dr. Co. | 1932 | 150 | 3 | 764.6 | T | - | - | - | Do. |
| 22-6 | NW NE SW | Do. | - | - | 115 | 6 | 777.45 | O | H | - | - | Formerly KoKO 114. |
| 22-7 | NW NE SW | Do. TW 5 | Ohio Dr. Co. | 1932 | 148 | 3 | 764.4 | T | 18 | R | 9-17-32 | Do. |
| 22-8 | NW NE SW | Do. BC | City | - | - | 2 | 765.7 | W | - | - | - | |
| 22-9 | NW NE SW | Do. BD | Do. | - | - | 2 | 764.9 | W | - | - | - | |
| 22-10 | NW NE SW | Do. BE | Do. | - | - | 2 | 764.7 | W | - | - | - | |
| 22-11 | NW NE SW | Do. BF | Do. | - | - | 2 | 765 | W | - | - | - | |
| 22-12 | SW NE SW | Do. TW 2 | Ohio Dr. Co. | 1932 | 167 | 3 | 765 | T | 11 | R | 3-24-32 | Station C. |
| 22-13 | SW NE SW | Do. CA | Do. | 1932 | 151 | 40 | 765.34 | P | H | M | - | Do. Formerly KoKO 2 |
| 22-14 | SW NE SW | Do. CB | Do. | - | 100 | 2 | 765 | W | - | - | - | Do. |
| 22-16 | SW NE SW | Do. H 2 | Do. | 1942 | 145 | 6 | - | - | - | - | - | Do. Acid injection well for 22-B. |
| 22-17 | SW NE SW | Do. H 3 | Do. | 1942 | 167 | 6 | - | - | - | - | - | Do. Station C. |
| 22-18 | NW NE SW | Do. CC | Do. | - | - | 2 | 766.1 | W | - | - | - | Do. |
| 22-19 | NE SE SW | Do. CD | Do. | 1932 | 165 | 3 | 764.14 | T | - | - | - | Do. Destroyed. |
| 22-20 | SE NW SW | Do. D 1A | Smith-Monroe Co. | 1941 | 130 | 12 | 762.82 | P | 11 | R | 3-25-41 | Station D. Abandoned. |
| 22-21 | SE NW SW | Do. D 1B | City | - | - | 2 | 762.81 | W | - | - | - | Do. |
| 22-22 | SE NW SW | Do. D 2A | Smith-Monroe Co. | 1941 | 153 | 12 | 762.8 | P | 11 | R | 4- 7-41 | Do. |
| 22-23 | SE NW SE | Do. D 2B | City | - | - | 2 | 762.9 | W | - | - | - | Do. |
| 22-24 | SE NW SE | Do. | Do. | 1947 | - | 2 | - | W | - | - | - | Do. |
| 22-25 | SE NW SW | Do. D 3A | Smith-Monroe Co. | 1941 | 122 | 12 | 762.8 | P | 10 | R | 1941 | Do. |
| 22-26 | SE NW SW | Do. D 3B | City | - | - | 2 | 762.9 | W | - | - | - | Do. |
| 22-27 | SE NW SW | Do. DC | Smith-Monroe Co. | 1941 | 96 | - | - | - | 19 | R | 1941 | Do. |
| 22-28 | SE NW SW | Do. | Do. | 1941 | 135 | 6 | 762.9 | T | 6 | R | 3-13-41 | Do. |
| 22-29 | SW NE SW | Do. BNA | Layne-Bowler Co. | 1924 | 120 | 18 | 752.7 | P | - | - | - | Born Court Station. |
| 22-30 | SW NE SW | Do. TW 2 | Do. | 1924 | 123 | 4 | - | T | - | - | - | Do. |
| 22-31 | SW NE SW | Do. BNC | City | - | - | 2 | 760.0 | W | - | - | - | Do. |
| 22-32 | SW NE SW | Do. TW 1 | J. C. Newman | 1944 | 172 | 4 | 765.1 | T | - | - | - | Project 8 (Station CC). |

Table 1.--Records of wells, test holes, and foundation borings in the Kalamazoo Area.--Continued

| Well number | Location in section ¼ ¼ ¼ | Owner | | Driller | Year drilled | Depth (ft.) | Diameter (in.) | Altitude | Use | Water level | M or R | Date | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | T. 2 S., R. 11 W., Continued | | | | | | | | | |
| 2S 11W | | | | | | | | | | | | | |
| 22-33 | SW NE SW | City | TW 2 | City | 1946 | 150 | 6 | 763.8 | T | - | - | - | Project 8 (Station CC). |
| 22-34 | SW NE SW | Do. | TW 3 | J. C. Newman | 1944 | 175 | 4 | 764.0 | T | - | - | - | Do. |
| 22-35 | SW NE SW | Do. | TW 4 | City | 1945 | 172 | 6 | 762.3 | T | - | - | - | Do. |
| 22-36 | SW NE SW | Do. | TW 5 | Do. | 1945 | 179 | 6 | 762.3 | T | - | - | - | Do. |
| 22-37 | SW NE SW | Do. | TW 6 | Do. | 1945 | 173 | 6 | 762.68 | T | - | - | - | Do. Site of 22-39. |
| 22-38 | SW NE SW | Do. | TW 6A | H. E. Cowell | - | 174 | 6 | 762.3 | T | - | - | - | Project 8 (Station CC). |
| 22-39 | SW NE SW | Do. | C-1-1 | Do. | 1945 | 175 | 12 | 765.6 | P | 24.44 | M | 3-19-46 | Do. |
| 22-41 | SW NE SW | Do. | TW 7 | City | 1945 | 177 | 6 | - | T | - | - | - | Do. |
| 22-42 | SW NE SW | Do. | TW 8 | Do. | 1945 | 172 | 6 | 766.3 | T | - | - | - | |
| 22-43 | NW SE SW | Do. | TW 9 | Do. | 1945 | 142 | 6 | - | T | - | - | - | Do. Site of 22-44. |
| 22-44 | NW SE SW | Do. | C-1-3 | H. E. Cowell | 1945 | 143 | 12 | 765.6 | P | - | - | - | Project 8 (Station CC). |
| 22-46 | NW SE SW | Do. | TW 10 | City | 1945 | 162 | 6 | 763 | T | - | - | - | Do. Site of 22-47. |
| 22-47 | NW SE SW | Do. | C-1-2 | H. E. Cowell | 1945 | 162 | 12 | 766.3 | P | - | - | - | Project 8 (Station CC). |
| 22-50 | NW SE SW | Do. | TW 11 | City | 1945 | 178 | 6 | - | - | - | - | - | Do. Site of 22-51. |
| 22-51 | NW SE SW | Do. | C-1-4 | H. E. Cowell | 1945 | 178 | 12 | 766.3 | P | - | - | - | |
| 22-53 | SE NW SW | Do. | TW 12 | City | 1945 | 183 | 4 | 766.3 | T | - | - | - | Project 8 (Station CC). |
| 22-54 | SE NW SW | Do. | TW 12A | Do. | 1945 | 143 | 6 | - | T | - | - | - | Do. Site of 22-55. |
| 22-55 | SE NW SW | Do. | C-2-1 | H. E. Cowell | 1945 | 143 | 12 | 766.3 | P | - | - | - | Project 8 (Station CC). |
| 22-57 | SE NW SW | Do. | TW 13 | City | 1945 | 192 | 4 | - | T | - | - | - | Do. Site of 22-58. |
| 22-58 | SE NW SW | Do. | C-2-2 | H. E. Cowell | 1945 | 192 | 12 | 761.3 | P | 20.0 | R | 7-25-45 | Project 8 (Station CC). |
| 22-60 | NE SW SW | Do. | TW 14 | City | 1945 | 191 | 4 | - | T | - | - | - | Do. Site of 22-61. |
| 22-61 | NE SW SW | Do. | C-2-3 | H. E. Cowell | 1945 | 191 | 12 | 766.3 | P | 24.7 | R | 7-24-45 | Project 8 (Station CC). |
| 22-63 | NE SW SW | Do. | TW 15 | City | 1945 | 132 | 4 | - | T | - | - | - | Do. Site of 22-64. |
| 22-64 | NE SW SW | Do. | C-2-4 | H. E. Cowell | 1945 | 132 | 12 | 766.1 | P | 22.3 | R | 6-31-45 | Project 8 (Station CC). |
| 22-66 | NE SW SW | Do. | TW 16 | City | 1945 | 187 | 4 | - | T | - | - | - | Do. Site of 22-67. |
| 22-67 | NE SW SW | Do. | C-2-5 | Do. | 1945 | 184 | 12 | 766.3 | P | 23.7 | R | 6-28-45 | Project 8 (Station CC). |
| 22-70 | NW SW SW | Do. | TW 1 | Layne-Northern Co. | 1942 | 182 | 6 | 761.1 | T | - | - | - | Station 7. Destroyed. |
| 22-71 | NW SW SW | Do. | 1 | J. C. Newman | 1944 | 189 | 12 | 760.7 | P | 14.6 | R | 10- 2-44 | Do. |
| 22-72 | NW SW SW | Do. | | Do. | 1944 | 192 | 4 | 761.3 | T | - | - | - | Do. Site of 22-71. |
| 22-74 | NW SW SW | Do. | 2 | Do. | 1944 | 170 | 12 | 759.3 | P | 16.0 | R | 2- 5-45 | Station 7. |
| 22-76 | NW SW SW | Do. | 3 | Do. | 1944 | 170 | 12 | 760.0 | P | 8.7 | R | 4-10-44 | Do. |
| 22-77 | NW SW SW | Do. | TW 3 | Do. | 1944 | 169 | 12 | 766.3 | T | 14.0 | R | 4- 7-44 | Do. Site of 22-76. |
| 22-78 | NW SW SW | Do. | 3B | Do. | 1944 | 145 | 2 | 762.3 | W | 10.0 | R | 3- 3-46 | Station 7. Site of 22-76. |
| 22-79 | NW SW SW | Do. | 4 | Do. | 1944 | 160 | 12 | 760.7 | P | 10.7 | R | 6- 1-44 | Station 7. |
| 22-80 | NW SW SW | Do. | 4B | Do. | 1944 | 150 | 2 | - | W | - | - | - | Do. Site of 22-79. |
| 22-81 | NW SW SW | Do. | TW 5 | Do. | 1944 | 170 | 4 | 765.7 | T | - | - | - | Do. Destroyed. |
| 22-82 | NW SW SW | Do. | 5A | Do. | 1944 | 187 | 12 | 759.7 | P | 10.2 | R | 7-24-44 | Do. |
| 22-83 | NW SW SW | Do. | TW 5A | Do. | 1944 | 182 | 4 | 771.3 | T | - | - | - | Do. Site of 22-82. |
| 22-84 | NW SW SW | Do. | 5B | Do. | 1944 | 170 | 2 | - | W | - | W | - | Do. |
| 22-85 | SE SW SW | Do. | TW 1 | Ohio Dr. Co. | 1932 | 176 | - | 762 | T | - | - | - | Balch St. Station. |
| 22-86 | SE SW SW | Do. | B 1A | F. P. Rust | 1915 | 120 | 12 | 769 | P | H | M | - | Formerly KoKO 3. |
| 22-88 | SE SW SW | Do. | B 1C | City | - | 30 | 2 | 767.50 | O | H | - | - | Balch St. Station. |
| 22-89 | SE SW SW | Do. | B 2A | F. P. Rust | 1918 | 114 | 12 | 769 | P | 26.22 | M | 2-27-46 | |
| 22-91 | SE SW SW | Do. | B 3A | Do. | 1918 | 210 | 12 | 769 | P | 26.94 | M | 2-27-46 | |

Table 1.--Records of wells, test holes, and foundation borings in the Kalamazoo Area.--Continued

| Well number | Location ¼ ¼ ¼ in section | Owner | Driller | Year drilled | Depth (ft.) | Diameter (in.) | Altitude | Use | Water level | M or R | Date | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | T. 2 S., R. 11 W., Continued | | | | | | | | | |
| 2S 11W | | | | | | | | | | | | |
| 22-94 | SW SE SW | City TW 2 | Layne-Northern Co. | 1942 | 213 | - | 770.7 | T | - | - | - | Balch St. Station. Destroyed. |
| 22-95 | SE SW SW | Do. TW 3 | Do. | 1942 | 208 | - | 765 | T | - | - | - | Balch St. Station. Destroyed. |
| 22-96 | SE SW SW | Do. TW 4 | Do. | 1942 | 210 | - | 769 | T | - | - | - | Balch St. Station. Destroyed. |
| 22-97 | SE NW SE | Do. TW 1 | J. C. Newman | 1944 | 150 | 4 | 761 | T | - | - | - | Collins St. Formerly KoKO 93. |
| 22-98 | SE NW SE | Do. TW 2 | Do. | 1944 | 110 | 4 | 761 | T | 12.5 | R | 3- ?-44 | Collins St. |
| 22-99 | SW NW SE | Do. TW 6 | City | 1946 | 150 | 6 | 766 | T | - | - | - | Stockbridge Ave. |
| 22-100 | SE NW SE | Do. TW 7 | Do. | 1946 | 151 | 6 | 759 | T | - | - | - | Do. |
| 22-101 | - NE SE | Kalamazoo Creamery | Ohio Dr. Co. | 1939 | 95 | 3 | 770 | T | 20 | R | 8- 6-39 | Abandoned. Formerly KoKO 241. |
| 22-102 | - NE SE | Do. | - | - | 61 | 12 | 773.19 | O | H | M | - | Formerly KoKO 242. |
| 22-103 | - NE SE | Do. | Kelly Well Co. | 1924 | 106 | 8 | - | I | 18 | R | 3- ?-24 | Abandoned. |
| 22-104 | - NW NE | Eck-Rich Sausage Co. 1 | C. S. Raymer | 1944 | 102 | 12 | 756 | I | 20 | R | 4- ?-44 | Yielded 400,000 gpd. |
| 22-105 | - NW NE | Do. 2 | Ohio Dr. Co. | 1937 | 86 | 12 | 766.40 | O | H | M | - | Formerly KoKO 222. |
| 22-106 | NW NW NE | Bronson Hospital | - | - | 31 | 4 | 786 | T | - | - | - | |
| 22-107 | SE SW SE | Bryant Paper Co. 8 | Kelly Well Co. | 1930 | 104 | 25 | 801 | I | 13 | R | 1930 | Milham Plant. |
| 22-108 | SE SW SE | Do. TW 6 | Ohio Dr. Co. | 1939 | 137 | 3 | - | T | - | - | - | Do. Site of 22-109. |
| 22-109 | SE SW SE | Do. 9 | Do. | 1940 | - | 16 | 801 | I | - | - | - | Milham Plant. Yield 1,288 gpm. |
| 22-110 | SW SW SE | Do. 10 | Smith-Monroe Co. | 1942 | 122 | 12 | 801 | I | 15.8 | R | 5-20-42 | Milham Plant. |
| 22-111 | NW NE NW | Butterfield Theatres | J. C Newman | - | 91 | 12 | 786 | I | - | - | - | Air-conditioning disposal well. |
| 22-112 | NE NW NE | City TB 4 | Raymond Conc. | 1952 | 20 | 2½ | 763.5 | B | 7.2 | R | 12-27-54 | Intercepting sewer system. |
| 22-113 | NE SE NE | Borg-Warner Corp. | Do. | 1944 | 65 | 2½ | 761.3 | B | 3.2 | R | 5-10-44 | Ingersoll Steel and Disc Div. |
| 22-116 | NE SE NE | Do. TB 1 | Do. | 1945 | 52 | - | - | B | 6.6 | R | 5-19-45 | Do. |
| 22-121 | NE SE NE | Do. TB 6 | Do. | 1945 | 50 | - | - | B | 7.5 | R | 5-19-45 | Do. |
| 22-129 | NE SE NE | Do. TB 14 | Do. | 1945 | 50 | - | - | B | 6.5 | R | 5-19-45 | Do. |
| 22-133 | NE SE NE | Do. TB 18 | Do. | 1945 | 40 | - | - | B | 7.6 | R | 5-19-45 | Do. |
| 22-136 | NE SE NE | Do. TB 21 | Do. | 1945 | 30 | - | - | B | 5.2 | R | 5-19-45 | Do. |
| 22-137 | NW SW SW | City TB 1 | Do. | 1951 | 95 | 2½ | 760.1 | B | - | - | - | Axtell Creek bridge. |
| 22-138 | NE SW SW | Do. TB 2 | Do. | 1951 | 39 | 2½ | 762.3 | B | - | - | - | Do. |
| 22-139 | SE NE SE | Sears, Roebuck and Co. TB 1 | Do. | 1950 | 47 | 2½ | 771.2 | B | 1.8 | R | 12- 4-50 | |
| 22-142 | SE NE SE | Do. TB 4 | Do. | 1950 | 45 | 2½ | 762.8 | B | 1.4 | R | 12- 3-50 | |
| 22-144 | SE NE SE | Do. TB 6 | Do. | 1950 | 74 | 2½ | 762.8 | B | 1.6 | R | 12- 4-50 | |
| 23-1 | SE SW SE | Reed Foundry and Machine Co. | - | - | 90 | 4 | 763 | I | 12 | R | ? | |
| 23-4 | SE SW SE | Kalamazoo Railroad Supply Co. | J. C. Newman | 1945 | 85 | 6 | 763 | I | 9 | R | ? | Gravel aquifer. |
| 23-5 | NW NW SE | Allied Paper Co. TW 1 | Do. | 1945 | 40 | 4 | 766 | T | 14.5 | R | ? | King Division. |
| 23-6 | NW NW SE | Do. TW 2 | Do. | 1945 | 40 | 4 | 766 | T | - | - | ? | Do. |
| 23-7 | NW NW SE | Do. 1 | Indiana-Michigan Co. | 1940 | 48 | 12 | 774 | I | 7 | R | 9- 3-40 | Do. |
| 23-8 | NW NW SE | Do. 2 | Do. | 1940 | 54 | 12 | 774 | I | 14.5 | R | 11-26-40 | Do. |
| 23-9 | NW NW SE | Do. 3 | Do. | 1940 | 51 | 12 | 774 | I | 9 | R | 12- ?-40 | Do. |
| 23-10 | NW NW SE | Do. 4 | Do. | 1940 | 52 | 12 | 774 | I | 9 | R | 12- ?-40 | Do. |
| 23-11 | NW NW SE | Do. | Do. | 1940 | 70 | 6 | 764 | T | - | - | - | Do. Formerly KoKO 101. |
| 23-12 | NW NE SE | City TW 1 | City | 1946 | 67 | - | 761 | T | - | - | - | Riverside project. Formerly KoKO 8. |
| 23-13 | SW SE NE | Do. TW 2 | Do. | 1946 | 126 | 6 | 761 | T | - | - | - | Riverside project. |
| 23-14 | SW SW SE | Kalamazoo Paraffin Co. | Ohio Dr. Co. | 1941 | 70 | 8 | 770 | I | 11 | R | 1- ?-41 | Formerly KoKo 108. |
| 23-15 | SW SW SE | Do. | Do. | 1935 | 70 | 8 | - | I | 11 | R | 1- ?-35 | |
| 23-16 | SE NE NE | Kalamazoo Paper Co. TW 3 | Do. | 1941 | 87 | - | - | T | 22 | R | 4- ?-41 | |
| 23-17 | SW NE NE | Do. TW 6 | Do. | 1946 | 75 | 3 | 765 | T | 10 | R | 6-26-46 | Formerly KoKo 70. |
| 23-18 | SE NE NE | National Gypsum Co. TW 1 | - | - | 47 | - | - | T | 25 | R | ? | |

Table 1.--Records of wells, test holes, and foundation borings in the Kalamazoo Area.--Continued

| Well number | Location in section ¼ ¼ ¼ | Owner | Driller | Year drilled | Depth (ft.) | Diameter (in.) | Altitude | Use | Water level | M or R | Date | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | T. 2 S., R. 11 W., Continued | | | | | | | | | |
| 2S 11W | | | | | | | | | | | | |
| 23-19 | SE NE NE | National Gypsum Co. TW 3 | - | - | 51 | - | - | T | 24.5 | R | ? | |
| 23-20 | SE NE NE | Do. TW 2 | Layne-Northern Co. | 1949 | 38 | 8 | - | T | 16 | R | 4-12-49 | |
| 23-21 | SE NE NE | Do. TW 3 | Do. | 1949 | 40 | 8 | - | T | 15 | R | 4-15-49 | |
| 23-22 | SE NE NE | Do. 5 | - | 1953 | 51 | 12 | - | I | - | - | - | Site of 23-21. |
| 23-23 | NE SE NE | MSHD TH 1 | MSHD | 1929 | 20 | - | 758.8 | B | - | - | - | Kalamazoo R. bridge. |
| 23-26 | NE SE NE | Do. TH 4 | Do. | 1929 | 24 | - | 761.4 | B | - | - | - | Do. |
| 23-27 | NW NW SE | City TB 1 | Raymond Conc. | 1952 | 17 | 2½ | 766.7 | B | 13 | B | 12-17-52 | Intercepting sewer system. |
| 23-29 | SE NE NE | National Gypsum Co. TB 1 | Do. | 1951 | 37 | 2½ | - | B | 9.7 | B | 10-23-54 | |
| 23-32 | NE NE NE | Kalamazoo Paper Co. TB 7 | Do. | 1953 | 31 | 2½ | - | B | 16.7 | R | 9- ?-53 | |
| 24-1 | SW NW NW | National Gypsum Co. TW 2 | - | - | 40 | - | - | T | 24.5 | R | ? | |
| 24-2 | SW NW NW | Do. TW 1 | Layne-Northern Co. | 1949 | 60 | 8 | - | T | 10 | R | 4-11-49 | |
| 24-3 | SW NW NW | Do. TW 4 | Do. | 1949 | 38 | 8 | - | T | - | - | - | |
| 24-4 | SW NW NW | Do. 1 | - | - | 132 | 12 | - | I | 17 | R | 9-23-46 | |
| 24-5 | SW NW NW | Do. 2 | - | - | 126 | 12 | - | I | 17.3 | R | 10- 2-46 | |
| 24-6 | SW NW NW | Do. 3 | F. P. Rust | 1918 | 123 | 12 | - | I | 19 | R | 10- 4-46 | Abandoned 1949. |
| 24-7 | SW NW NW | Do. 4 | Layne-Northern Co. | 1949 | 37 | 16 | - | I | 13 | R | 4- 3-49 | |
| 24-8 | SW SW SW | City TW 1 | City | 1946 | 132 | 6 | 768 | T | - | - | - | Recreation Park. |
| 24-9 | SW SW SW | Do. TW 2 | Do. | 1946 | 98 | 6 | 768 | T | - | - | - | Do. |
| 24-10 | NE SE SW | Kalamazoo Co. Race Track | - | 1910 | 36 | 4 | 773 | D | 7 | R | ? | |
| 24-11 | SW NE NW | Hawthorne Paper Co. | Ohio Dr. Co. | 1941 | 82 | 12 | 764.1 | I | 8 | R | 10-24-41 | |
| 24-12 | SE NW NW | 6 | | | | | | | | | | |
| 24-12 | SE NW NW | Do. 7 | Do. | 1942 | 92 | 12 | 772.6 | I | 18 | R | 11-16-42 | |
| 24-13 | SE NW NW | Do. 8 | Do. | 1944 | 85 | 12 | 773.8 | I | 19 | R | 5-15-44 | |
| 24-14 | SE NW NW | Do. TW 9 | Do. | 1945 | 97 | 3 | 764.3 | T | 10 | R | 11- ?-45 | |
| 24-15 | NE NE NW | Do. TW 10 | Do. | 1945 | 92 | 3 | 761.3 | T | 5 | R | 11-24-45 | |
| 24-16 | SW NE NW | Do. TW 11 | Do. | 1945 | 92 | 3 | 764.3 | T | 15 | R | 11-26-45 | |
| 24-17 | SW NE NW | Do. TW 12 | Do. | 1945 | 96 | 3 | 763.3 | T | 12 | R | 12- 7-45 | |
| 24-19 | NE SW SE | Elmer Padgett | Elmer Padgett | 1939 | 18 | 1¼ | - | D | 8.8 | R | ? | Gravel aquifer. |
| 24-20 | NW NW SW | Jesse Bush | Jesse Bush | 1936 | 17 | 1¼ | - | D | - | - | - | Do. |
| 24-22 | NW SW SE | Ralph Brown | - | - | 20 | - | - | D | - | - | - | |
| 24-25 | SW NW NW | Kalamazoo Paper Co. 1 | Ohio Dr. Co. | 1941 | 59 | 16 | 764.3 | I | 9.2 | R | 5-15-41 | Site of 22-27. |
| 24-26 | SW NW NW | Do. 2 | Do. | 1946 | 89 | 12 | - | I | 10.5 | R | 1-14-46 | |
| 24-27 | SW NW NW | Do. TW 2 | Do. | 1941 | 70 | - | - | T | 12 | R | ? | |
| 24-28 | SW NW NW | Do. TW 4 | Do. | 1945 | 77 | 16 | - | T | 16 | R | 12-12-45 | |
| 24-29 | SW NW NW | Do. TW 5 | Do. | 1946 | 96 | 3 | - | T | 8 | R | 1-14-46 | |
| 24-30 | SW NW NW | Do. TW 7 | Do. | 1946 | 62 | 3 | 765 | T | 10 | R | 6-24-46 | |
| 24-31 | SE NW SE | Ottis Ressequie | Ottis Ressequie | - | 16 | 1½ | - | D | - | - | - | Sand aquifer. |
| 24-32 | NW NW NW | Kalamazoo Paper Co. TB 1 | Raymond Conc. | 1947 | 50 | 2½ | 770.3 | B | 16 | R | 7-23-47 | |
| 24-35 | SE NW NW | Do. TB 2 | Do. | 1953 | 50 | 2½ | - | B | 14.4 | R | 9- ?-53 | |
| 24-37 | SE NW NW | Do. TB 4 | Do. | 1953 | 34 | 2½ | - | B | 15.5 | R | 9- ?-53 | |
| 24-40 | SW NW NW | Do. TB 6 | Do. | 1953 | 28 | 2½ | - | B | 15.0 | R | 9- ?-53 | |
| 25-1 | SW NW NW | International Paper Co. | Layne-Northern Co. | 1954 | 93 | 12 | - | I | 8.5 | R | 9-10-54 | |
| 25-2 | SE SW NW | Do. | Do. | 1954 | 65 | 6 | - | T | - | - | - | |
| 25-3 | SE SW NW | Do. | Do. | 1954 | 125 | 6 | - | T | - | - | - | |
| 25-4 | SW NE NW | American Cyanamid Corp. TW 1 | Ohio Dr. Co. | 1946 | 149 | 3 | 790 | T | 20 | R | 9-14-46 | |
| 25-5 | NW SE NW | Do. TW 2 | Do. | 1946 | 134 | 3 | 785 | T | 16 | R | 9-20-46 | |
| 25-6 | SE NE NW | Do. TW 3 | Do. | 1946 | 140 | 3 | 781 | T | 20 | R | 9-25-46 | Site of 25-11. |
| 25-7 | SE NE NW | Do. TW 4 | Do. | 1946 | 111 | 3 | 781 | T | 4 | R | 10- 6-46 | |
| 25-8 | SE NW NW | Do. TW 5 | Do. | 1948 | 114 | 3 | 790 | T | 9 | R | 4-17-48 | |
| 25-9 | SW NE NW | Do. 1N | Smith-Monroe Co. | 1939 | 91 | 8 | 797 | I | 20 | R | 7-20-39 | |
| 25-10 | NW SE NW | Do. 2S | Do. | 1940 | 106 | 8 | 795 | I | 17.3 | R | 10-14-40 | |
| 25-11 | SE NE NW | Do. 3E | Ohio Dr. Co. | 1946 | 71 | 8 | 781 | I | 20 | R | 9-25-46 | |
| 26-1 | SW NE NE | Ruud Mfg. Co. | Do. | 1936 | 104 | 8 | 796 | I | 21.5 | R | 1936 | Abandoned. |
| 26-3 | NW NE NE | Reed Land Co. | - | 1910 | 41 | 6 | 773.71 | O | H | M | - | Formerly KoKO 240. |
| 26-4 | SE NE NE | Morris Handelsman | - | 1912 | 160 | 6 | 796 | I | 22 | R | ? | Sand and gravel aquifer. |

Table 1.--Records of wells, test holes, and foundation borings in the Kalamazoo Area.--Continued

| Well number | Location in section ¼ ¼ ¼ | Owner | Driller | Year drilled | Depth (ft.) | Diameter (in.) | Altitude | Use | Water level | M or R | Date | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | T. 2 S., R. 11 W., Continued | | | | | | | | | |
| 2S 11W | | | | | | | | | | | | |
| 26-7 | SW NW NE | Kalasign Co. | - | - | 90 | 4 | - | I | - | - | - | |
| 27-1 | NW NW NW | City TW 107 | City | 1947 | 206 | 6 | 770 | T | - | - | - | |
| 27-2 | NE NW NW | Do. TW 108 | Do. | 1947 | 206 | 6 | 770 | T | - | - | - | Site of 27-3 and 4. |
| 27-3 | NE NW NW | Do. 4 | Do. | - | 115 | 12 | 770 | P | - | - | - | Balch St. Station. |
| 27-4 | NE NW NW | Do. | Do. | - | 105 | 2 | 770 | W | - | - | - | Do. |
| 27-5 | NW NW NW | Do. TW 109 | Do. | 1947 | 197 | 6 | 770 | T | - | - | - | |
| 27-6 | NW NW NW | Do. TW 110 | Do. | 1947 | 179 | 6 | 770 | T | - | - | - | |
| 27-7 | SW NW SW | Paul Pitman | - | 1925 | 100 | 2 | - | D | - | - | - | Coarse gravel aquifer. |
| 27-8 | SW NE SW | E. H. Welch | E. H. Welch | 1930 | 90 | - | - | D | - | - | - | Fine gravel aquifer. |
| 27-16 | NE SW SW | M. C. Roundhouse | Garrett Reer | 1943 | 85 | 2 | - | D | 8 | R | 1943 | |
| 27-19 | NE SE NE | C. P. Austin | - | 1919 | 60 | 2 | - | D | - | - | - | |
| 27-20 | SW SW SE | J. Veldkamp | J. Veldkamp | 1927 | 18 | 2 | 811 | D | - | - | - | Adequate supply for greenhouse. |
| 27-23 | NE NW NE | St. Regis Paper Co. 1 | F. P. Rust | 1917 | 212 | 12 | 801 | I | - | - | - | Milham Div. |
| 27-24 | NE NW NE | Do. 2 | Do. | 1917 | 219 | 12 | 801 | I | - | - | - | Do. |
| 27-25 | NW NW NE | Do. 3 | Do. | 1917 | 218 | 12 | 801 | I | - | - | - | Do. Yielded 233 gpm. |
| 27-26 | NW NW NE | Do. 4 | Do. | 1917 | 220 | 12 | 801 | I | - | - | - | Milham Div. Yielded 198 gpm. |
| 27-27 | NW NW NE | Do. 5 | Do. | 1917 | 221 | 12 | 801 | I | - | - | - | Milham Div. Yielded 272 gpm. |
| 27-28 | NW NW NE | Do. 6 | Do. | 1918 | 204 | 12 | 801 | I | - | - | - | Milham Div. Yielded 536 gpm. |
| 27-29 | NW NW NE | Do. 7 | Do. | 1918 | 222 | 12 | 801 | I | - | - | - | Milham Div. Plugged below 93 ft. |
| 27-30 | NW SW NE | Do. 1 | Do. | 1917 | 186 | 12 | - | I | - | - | - | Superior Div. Abandoned 1940. |
| 27-31 | NW SW NE | Do. 2 | Do. | 1917 | 197 | 12 | 794 | I | - | - | - | Superior Div. Abandoned 1937. |
| 27-32 | SW SW NE | Do. 3 | Kelly Well Co. | 1923 | 92 | 18 | 798 | I | 22 | R | 11- ?-23 | Superior Div. Abandoned 1937. |
| 27-33 | NW SW NE | Do. 4 | Do. | 1924 | 129 | 18 | 798 | I | 16 | R | 2- ?-24 | Superior Div. Abandoned 1936. |
| 27-34 | NW SW NE | Do. 5 | Do. | 1930 | 115 | 18 | 798 | I | 12.7 | R | 12-21-41 | Superior Div. Yielded 300 gpm. |
| 27-35 | SW SW NE | Do. 6 | Smith-Monroe Co. | 1937 | 116 | 12 | 801 | I | - | - | - | Superior Div. Abandoned 1943. |
| 27-36 | NW SW NE | Do. 7 | Do. | 1941 | 127 | 12 | 798 | I | 14.7 | R | 12-21-41 | Superior Div. Abandoned. |
| 27-37 | SW SW NE | Do. 8 | Do. | 1941 | 112 | 12 | 800 | I | 22 | R | 10- ?-41 | Superior Div. |
| 27-38 | SW SW NE | Do. 9 | Do. | - | 121 | - | 798 | I | - | - | - | Do. |
| 27-39 | SW NW NE | Do. 1 | Ohio Dr. Co. | 1940 | 155 | - | 801 | I | 18 | R | 1- ?-40 | Imperial Div. |
| 27-40 | SE NW NE | Do. 1 | F. P. Rust | 1918 | 211 | 10 | 774 | I | - | - | - | No. 1 Bryant Div. |
| 27-41 | SE NW NE | Do. 2 | Do. | 1918 | 211 | 12 | 774 | I | - | - | - | Do. Destroyed. |
| 27-42 | SE NW NE | Do. 3 | Do. | 1918 | 211 | 12 | 774 | I | - | - | - | No. 1 Bryant Div. Abandoned 1936. |
| 27-43 | SE NW NE | Do. 4 | Do. | 1918 | 213 | 12 | 801 | I | - | - | - | No. 1 Bryant Div. Abandoned 1941. |
| 27-44 | SE NW NE | Do. 1 | Do. | 1918 | 185 | 12 | 801 | I | - | - | - | No. 2 Bryant Div. |
| 27-45 | SE NW NE | Do. 2 | Do. | 1918 | 185 | 12 | 801 | I | - | - | - | Do. Abandoned 1943. |
| 27-46 | SW NE NE | Do. 1 | Do. | 1918 | 207 | 12 | 801 | I | - | - | - | No. 3 Bryant Div. |
| 27-47 | SW NE NE | Do. 2 | Do. | 1918 | 207 | 12 | 801 | I | - | - | - | Do. Yielded 148 gpm. |
| 27-48 | SW NE NE | Do. 3 | Do. | 1918 | - | - | 801 | I | - | - | - | No. 3 Bryant Div. Yielded 80 gpm. |
| 27-49 | SW NE NE | Do. 4 | Do. | 1918 | 192 | 12 | 801 | I | - | - | - | No. 3 Bryant Div. Yielded 80 gpm. |
| 27-50 | SW NE NE | Do. 5 | Do. | 1919 | 192 | 12 | 801 | T | - | - | - | No. 3 Bryant Div. Yielded 80 gpm. |
| 27-51 | SE NW NE | Do. 6 | Ohio Dr. Co. | 1939 | 167 | 12 | 801 | T | 64 | R | 12- 9-39 | No. 3 Bryant Div. Formerly KoKO 283. |
| 27-52 | SW NE NE | Do. 7 | Smith-Monroe Co. | 1942 | 115 | 12 | 802.39 | O | H | M | - | No. 3 Bryant Div. Formerly KoKO 284. |

Table 1.--Records of wells, test holes, and foundation borings in the Kalamazoo Area.--Continued

| Well number | Location in section ¼ ¼ ¼ | Owner | Driller | Year drilled | Depth (ft.) | Diameter (in.) | Altitude | Use | Water level | M or R | Date | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | T. 2 S., R. 11 W., Continued | | | | | | | |
| 2S 11W | | | | | | | | | | | | |
| 27-53 | SW NE NE | St. Regis Paper Co. 24 | - | 1900 | 125 | 6 | - | I | - | - | - | Reported to flow. |
| 27-54 | SW SW NE | Do. TB 1 | Raymond Conc. | 1946 | 40 | - | 795.3 | B | 9.0 | R | 1-12-46 | |
| 27-58 | SW SW NE | Do. TB 5 | Do. | 1946 | 35 | - | 797 | B | 10.4 | R | 1-12-46 | |
| 27-60 | SW SW NE | Do. TB 7A | Do. | 1946 | 30 | - | 798 | B | 12.2 | R | 1-12-46 | |
| 27-63 | SW SW NE | Do. TB 4 | Do. | 1950 | 45 | $2\frac{1}{2}$ | 794 | B | 6.4 | R | 12- ?-50 | Panelyte Div. |
| 27-66 | SW SW NE | Do. TB 9 | Do. | 1950 | 26 | $2\frac{1}{2}$ | 794 | B | 6.4 | R | 12- ?-50 | Do. |
| 27-67 | SW SW NE | Do. TB 1 | Do. | 1951 | 32 | $2\frac{1}{2}$ | 792 | B | 6.9 | R | 3- ?-51 | Bryant Div. |
| 27-73 | SW SW NE | Do. TB 4 | Do. | 1951 | 35 | $2\frac{1}{2}$ | 792 | B | 5.6 | R | 3- ?-51 | Do. |
| 27-76 | SW SW NE | Do. TB 12 | Do. | 1951 | 26 | $2\frac{1}{2}$ | 792 | B | 5.6 | R | 3- ?-51 | Do. |
| 28-1 | SE NW SW | City TW 106 | City Utilities | 1947 | 332 | 6 | 906 | T | - | - | - | Crane Park |
| 28-2 | SW NE NE | Do. M 1A | F. P. Rust | 1922 | 100 | 12 | 764 | W | 15 | R | 1922 | Maple St. Station. Abandoned. |
| 28-4 | SE NW NE | Do. M 2A | Do. | 1922 | 150 | 12 | 762 | O | H | M | - | Maple St. Station Formerly KoKO 39. |
| 28-5 | SW NE NE | Do. M 3A | Do. | 1922 | 152 | 12 | 763 | P | - | - | - | Maple St. Station Yielded 250 gpm. |
| 28-6 | SE NW NE | Do. 2 | City | 1954 | 175 | 12 | 771 | P | +19 | R | 3- ?-54 | Maple St. Station. Flowed. |
| 28-7 | SW NE NE | Do. 3 | Do. | 1954 | 168 | 12 | 767 | P | +14 | R | 2-24-54 | Maple St. Station. Flowed. |
| 28-8 | SE NW NE | Do. 4 | Do. | 1954 | 141 | 12 | 769 | P | +18 | R | 1954 | Maple St. Station. Flowed. |
| 28-9 | - SE SE | Chicken Charlies | J. C. Newman | 1946 | 61 | 6 | 886 | D | 14 | R | 6-19-46 | |
| 28-10 | SE SW SE | L. B. Saye | - | - | 70 | 2 | - | D | 6 | R | ? | |
| 28-11 | SE NE SE | J. D. Hates | A. A. Bishop | 1943 | 70 | 2 | - | D | - | | - | |
| 28-15 | NE SW NE | T. J. Simpson | William Donnell | 1945 | 60 | $2\frac{1}{2}$ | - | D | - | - | - | |
| 28-17 | SW NE SE | C. P. Jackson | - | - | 100 | 3 | - | D | - | - | - | Coarse gravel aquifer. |
| 29-1 | NW SW SW | City | City | 1946 | 272 | 12 | 901 | T | 51.7 | R | 1946 | Kelly Orchard. |
| 29-2 | NW NW NW | Do. 1 | Do. | 1954 | 175 | 12 | - | P | 11.9 | R | 10-29-54 | Station 12. |
| 29-3 | SE SW SE | Oakwood, Inc. | - | - | 47 | 2 | 880.72 | O | H | M | - | Formerly KoKo 43. |
| 29-4 | SE SE SE | F. C. Strome | A. A. Bishop | - | 70 | 2 | - | D | - | - | - | Fine sand aquifer. |
| 29-5 | NW NW NW | City 2 | City | 1954 | 176 | 12 | - | P | 9 | R | 6- ?-55 | Station 12. |
| 29-6 | NW NW NW | Do. 3 | Do. | 1955 | 175 | 12 | - | P | 15 | R | 1955 | Do. |
| 30-1 | SW NE SW | Kalamazoo State Hospital | - | 1922 | 210 | 2 | - | P | 40 | R | 12- 1-22 | Colony Farm. |
| 30-2 | SW NE SW | Do. | Kelly Well Co. | 1923 | 65 | 18 | - | P | 37 | R | 3-24-23 | Do. |
| 30-3 | SW NE SW | Do. TW 1 | Do. | 1927 | 115 | 6 | - | T | - | - | - | Do. Flowed. |
| 30-4 | SW NE SW | Do. | Do. | 1928 | 77 | 42 | - | P | - | - | - | |
| 30-5 | NW SE SW | Do. TW 1 | Dunbar Dr. Co. | 1954 | 257 | 6 | 910 | T | 60 | R | 12-13-54 | |
| 30-6 | - NW SE | E. D. Geunich | H. C. Berry | 1939 | 75 | 3 | - | D | - | - | - | Water reported hard. |
| 31-1 | SW NW SW | John Hettinga | Henry Zantjer | 1954 | 90 | 2 | - | D | 60 | R | 1954 | Do. |
| 32-1 | - SE NW | Henry Schnell | H. C. Berry | 1930 | 50 | $1\frac{1}{4}$ | - | D | - | - | - | Gravel aquifer. |
| 32-2 | SE SE NW | T. A. Balch | - | - | 60 | $2\frac{1}{2}$ | - | D | - | - | - | Do. |
| 32-4 | NW NE NW | L. I. Huyser | - | 1929 | 75 | 3 | - | D | - | - | - | |
| 32-7 | SE SE NE | D. J. Meints | Garrett Reer | - | 82 | - | - | D | - | - | - | Do. |
| 33-1 | SW NE NE | M. D. Wright | - | 1922 | 65 | 2 | - | D | 40 | R | 1922 | Water reported hard. |
| 33-2 | SW NE NW | R. J. Hubbell | Louis Sanders | 1936 | 91 | 3 | - | D | 40 | R | 1936 | Do. |
| 33-3 | NE NE NW | L. H. Mayer | - | - | 90 | 2 | - | D | - | - | - | Sand and gravel aquifer. |
| 33-4 | NW NE NW | Hugo Aach | - | 1927 | 90 | 2 | - | D | - | - | - | Gravel aquifer. |
| 34-1 | NE SW NE | City TW 111 | City Utilities | 1947 | 192 | 6 | 812.96 | T | - | - | - | Formerly KoKo 21. |
| 34-2 | SE SW NE | Do. TW 112 | Do. | 1947 | 190 | 6 | 817.42 | T | - | - | - | |
| 34-3 | SE SW NE | Do. TW 113 | Do. | 1947 | 173 | 6 | 813.26 | T | - | - | - | Formerly KoKo 23. |
| 34-4 | NW NW NE | Do. TW 114 | Do. | 1948 | 223 | 6 | 803.52 | T | - | - | - | Formerly KoKo 24. |
| 34-5 | NW NW NE | Do. TW 115 | Do. | 1948 | 196 | 6 | 795.53 | T | - | - | - | |
| 34-6 | SW NW NE | Do. TW 116 | Do. | 1948 | 196 | 6 | 804.0 | T | - | - | - | |
| 34-7 | NE SW SE | Do. TW 117 | Do. | 1948 | 197 | 6 | 816.89 | T | - | - | - | Formerly KoKo 27. |
| 34-8 | SE SW SE | Do. TW 118 | Do. | 1948 | 154 | 6 | 821.86 | T | - | - | - | |
| 34-9 | SE SE SE | Do. TW 130 | Do. | - | 143 | - | - | T | - | - | - | |
| 34-10 | NW SW SE | B. W. Hull | J. C. Newman | 1932 | 60 | 4 | - | D | - | - | - | Gravel aquifer. |
| 34-11 | NE SW SE | Do. | - | 1907 | 90 | 3 | - | D | - | - | - | High iron content. |
| 34-13 | NW NE NW | Roderick McCallum | - | 1937 | 45 | - | - | D | 3.8 | R | 1947 | |
| 34-14 | NW SW NW | C. H. Peters | - | 1926 | 25 | 2 | - | D | 9 | R | 1947 | |
| 34-15 | NW NE NE | Allied Paper Co. | Layne-Northern Co. | - | 60 | 12 | 811.95 | D | H | M | - | Formerly KoKo 121. |

Table 1.--Records of wells, test holes, and foundation borings in the Kalamazoo Area.--Continued

| Well number | Location in section ¼ ¼ ¼ | Owner | Driller | Year drilled | Depth (ft.) | Diameter (in.) | Altitude | Use | Water level | M or R | Date | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | T. 2 S., R. 11 W., Continued | | | | | | |
| 2S 11W | | | | | | | | | | | | |
| 35-1 | SE SW SW | City TW 129 | City Utilities | 1949 | 175 | - | - | T | - | - | - | |
| 35-2 | SE NW NE | Do. 1 | Layne-Northern Co. | 1938 | 130 | 10 | 861.09 | O | H | M | - | Milwood Community. Formerly KoKo 136. Destroyed. |
| 35-3 | SW NE NW | Do. TW 1 | Do. | 1942 | 256 | 6 | - | T | 39.5 | R | 4-30-42 | Milwood Community. Cased to 80 ft. |
| 35-4 | NW SW NE | Do. E 2 | Do. | 1939 | 140 | 10 | 861 | P | 40 | R | 1939 | Milwood Community. |
| 35-5 | SE NE NE | Do. 3 | Do. | 1940 | 154 | 12 | 861 | P | 35 | R | 1940 | Do. Formerly KoKo 138. |
| 35-6 | SW NE NW | Do. 4 | Do. | 1946 | 253 | - | 861 | P | - | - | - | Site of 35-3. |
| 35-7 | SE NW NE | Do. 1A | Do. | 1948 | 162 | - | 861 | P | 36.3 | R | 1948 | |
| 35-8 | NE SE NE | Do. 3A | Do. | 1953 | 158 | 34 | - | P | - | - | - | |
| 35-9 | NE SE NE | Do. TW 5 | Do. | - | 225 | 4 | 860 | T | 40 | R | 7- ?-47 | Site of 35-7. |
| 35-10 | SW SW NW | L. H. Sterner | Louis Sanders | 1939 | 48 | 2 | - | D | 14.5 | R | ? | Coarse gravel aquifer. |
| 36-1 | SE SW SW | C. B. S. Hytron 1 | Layne-Northern Co. | 1953 | 160 | 8 | - | I | 29.7 | R | 5-29-53 | |
| 36-2 | NE SW SW | Do. 2 | Do. | 1953 | 160 | 30 | - | I | - | - | - | Sand and gravel aquifer. |
| 36-3 | SW SE SE | City 1 | City Utilities | 1955 | 153 | 12 | - | P | - | - | - | Station 13. |
| 36-4 | SW SE SE | Do. 2 | Do. | 1955 | 160 | 12 | - | P | 7.5 | R | 1955 | Do. |
| 36-5 | SW SE SE | Do. 3 | Do. | 1955 | 197 | 12 | - | P | 15 | R | 10- ?-55 | Do. |
| 36-6 | SE NW SW | Do. 2 | Do. | 1958 | 190 | 12 | - | P | 31 | R | 1958 | Station 18. |
| 36-7 | SE NW SW | Do. 3 | Do. | 1958 | 220 | 12 | - | P | - | - | - | Do. |
| 36-8 | - NW SW | Do. TW 6 | Layne-Northern Co. | 1952 | 131 | 6 | - | T | 34 | R | 7- 3-52 | Drilled for Milwood Community. |
| 36-9 | SW NW SW | Do. 7 | Do. | 1955 | 130 | 34 | - | P | 38 | R | 7-13-55 | Do. |
| 36-10 | SE NW SW | Do. 4 | City Utilities | 1958 | 254 | 12 | - | P | 30.8 | M | 3-25-58 | Station 18. |
| | | | | | | Comstock Township (T. 2 S., R. 10 W.) | | | | | | |
| 2S 10W | | | | | | | | | | | | |
| 5-1 | SE SW SW | G. F. Lister | Hoyt and Palmer | 1950 | 1433 | 5 | 884.3 | G | - | - | - | MDC log 15701. |
| 5-2 | SE SE SW | W. C. Vandenberg | Do. | 1949 | 1435 | 5 | 890.5 | G | - | - | - | MDC log 15434. |
| 5-3 | SW NE SW | Ford Oil Co. | Ford Oil Co. | 1951 | 1468 | 6 | 902.3 | G | - | - | - | MDC log 16790. |
| 5-4 | SW SW SE | G. F. Lister | Hoyt and Palmer | 1949 | 1415 | 5 | 896.7 | G | - | - | - | MDC log 15612. |
| 6-1 | NE NE NE | Twin Dr. Co. | Twin Dr. Co. | 1939 | 1488 | 10 | 915.5 | G | - | - | - | MDC log 6489. |
| 8-1 | NE SW NW | G. F. Lister | Hoyt and Palmer | 1949 | 1407 | 5 | 855.2 | G | - | - | - | MDC log 15538. |
| 8-2 | NE NE NW | Ford Oil Co. | Ford Oil Co. | 1951 | 1464 | 6 | 898.2 | G | - | - | - | MDC log 16838. |
| 17-1 | NW SW SW | Comstock School | Smith-Monroe Co. | - | 128 | - | 790 | P | 30 | R | ? | |
| 17-2 | NW SW SW | Do. 1 | Kelly Well Co. | - | 39 | 8 | - | P | 33.2 | R | ? | |
| 17-3 | NW SW SW | Do. TW 1 | J. C. Newman | - | 103 | 2 | - | T | - | - | - | Site of well 17-4. |
| 17-4 | NW SW SW | Do. | Do. | - | 103 | 4 | - | P | - | - | - | Yielded 50 gpm. |
| 17-5 | NW SW SW | Do. TW 2 | Do. | - | 100 | 2 | - | T | - | - | - | |
| 17-6 | NW SW SW | Do. TW 3 | Do. | 1951 | 65 | 2 | - | T | - | - | - | Site of well 17-6. |
| 17-7 | NW SW SW | Do. | Do. | 1951 | 65 | 6 | - | P | - | - | - | Yielded 75 gpm. |
| 17-8 | SW SW SW | MSHD TH 1 | MSHD | 1939 | 15 | - | 774.9 | B | +0.1 | - | - | Comstock Cr. bridge. |
| 17-9 | SW SW SW | Do. TH 2 | Do. | 1939 | 15 | - | 776.1 | B | 1.1 | R | 1939 | Do. |
| 19-1 | SE SW NE | Roscoe Bixler | - | 1944 | 113 | 1¼ | - | D | 3 | R | 1954 | Water reported hard. |
| 19-2 | NW SE NE | Comstock Township | - | 1950 | 32 | 3 | - | D | 6 | R | 2-26-54 | |
| 19-3 | SE SW NE | Earl Kindle | - | - | 80 | 2 | - | D | 8 | R | 7-13-54 | Water reported very hard. |
| 20-1 | NW NW NW | D. H. Reed | - | - | 60 | 4 | - | P | - | - | - | Supplies five businesses. |
| 20-2 | NW NW SE | O. H. Osborn | - | - | 40 | 2 | - | D | - | - | - | |
| 20-3 | SE SE NW | Walter Jennings | Walter Jennings | 1954 | 28 | 1¼ | - | D | 20 | R | 1954 | Water reported hard. |
| 20-4 | SE SE NW | Do. | - | - | 18 | 1¼ | - | D | 10 | R | 1954 | Water contaminated. Well abandoned. |
| 20-5 | SW NW NW | Mrs. Wm. Denaway | - | - | 25 | 1¼ | - | D | - | - | - | |
| 20-6 | NW NW NW | MSHD TH 3 | MSHD | 1939 | 12 | - | 774.1 | B | +.9 | - | 1939 | Comstock St. bridge. |
| 20-7 | NW NW NW | Do. TH 4 | Do. | 1939 | 21 | - | 774.4 | B | +.6 | - | 1939 | Do. |
| | | | | | | Texas Township (T. 3 S., R. 12 W.) | | | | | | |
| 3S 12W | | | | | | | | | | | | |
| 14-1 | - SW SW | E. H. Ramp | J. A. Johnson | 1949 | 56 | 2 | - | D | 20 | R | 6- ?-49 | Water reported hard. |
| 35-1 | NW NE NW | W. J. Cline | Muskegon Development Co. | 1939 | 1267 | 8 | 879.3 | G | - | - | - | |

Table 1.--Records of wells, test holes, and foundation borings in the Kalamazoo Area.--Continued

| Well number | Location in section ¼ ¼ ¼ | Owner | Driller | Year drilled | Depth (ft.) | Diameter (in.) | Altitude | Use | Water level | M or R | Date | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Portage Township (T. 3 S., R. 11 W.) | | | | | | | | | |
| 3S 11W | | | | | | | | | | | | |
| 1-1 | - NE NW | City TW 126 | City Utilities | 1948 | 228 | 6 | 845 | T | 4.5 | R | 10-13-48 | |
| 1-2 | - SE SE | Leslie Dean | Adren Rice | 1948 | 65 | 2 | - | D | 19 | R | 7- ?-52 | |
| 2-1 | NW SW SE | Kalamazoo Airport | H. C. Berry | 1927 | 80 | 6 | - | D | - | - | - | |
| 2-2 | SE SE SE | Kalamazoo Flying Service | J. C. Newman | 1946 | 61 | 2 | 860 | D | 20 | R | 7-20-46 | Formerly KoPg 49. |
| 2-3 | - NW NE | City 124 | City Utilities | 1948 | 216 | 6 | 865 | T | 31 | R | 8- ?-48 | |
| 2-4 | NE NW NE | Do. 125 | Do. | 1948 | 184 | 6 | 860 | T | 21 | R | 9-20-48 | |
| 2-5 | NE NE NE | Do. 127 | Do. | 1948 | 221 | 6 | 855 | T | - | - | - | Formerly KoPg 16. |
| 2-6 | - NW NE | Do. 128 | Do. | 1948 | 222 | 6 | - | T | - | - | - | |
| 3-1 | NW NW NE | Do. 1 | Do. | 1948 | 130 | 12 | - | P | - | - | - | Station 8. |
| 3-2 | NW NW NE | Do. 2 | Do. | 1948 | 156 | 12 | 829 | P | 3 | R | 11-11-48 | Do. |
| 3-3 | SW NW NE | Do. 3 | Do. | 1948 | 132 | 12 | 832 | P | 4 | R | 1948 | Do. |
| 3-4 | SW NW NE | Do. 4 | Do. | 1948 | 134 | 12 | 833 | P | 6.9 | R | 1948 | Do. |
| 3-5 | SW NW NE | Do. 5 | Do. | - | - | - | - | P | - | - | - | Do. Site of well 3-8. |
| 3-6 | SW NW NE | Do. 6 | Do. | 1948 | 144 | 12 | - | P | - | - | - | Station 8. |
| 3-7 | NE NW NE | Do. TW 119 | Do. | 1948 | 152 | 6 | 830 | T | - | - | - | Do. |
| 3-8 | SW NW NE | Do. TW 120 | Do. | 1948 | 192 | 6 | 834 | T | - | - | - | Do. |
| 3-9 | SW NW NE | Do. TW 122 | Do. | 1948 | 137 | 6 | 836 | T | - | - | - | Do. |
| 3-10 | SE NW NE | Do. TW 123 | Do. | 1948 | 123 | 6 | 824 | T | - | - | - | Do. |
| 3-11 | SW NW NE | Do. N-1 | Do. | - | 131 | 2 | 831 | - | - | - | - | Do. Aquifer test.observation well. |
| 3-12 | SW NW NE | Do. S-1 | Do. | - | 117 | 2 | 833 | - | - | - | - | Station 8. Aquifer test observation well. |
| 3-13 | SW NW NE | Do. E-1 | Do. | - | 131 | 2 | 830 | - | - | - | - | Do. |
| 3-14 | SW NW NE | Do. W-1 | Do. | - | 124 | 2 | 834 | - | - | - | - | Do. |
| 3-15 | - NE NE | Cool Farm Dairy | J. C. Newman | 1946 | 112 | 6 | 830 | I | +3 | - | ? | Reported flow of 10 gpm. |
| 3-16 | NE SE SW | Sutherland Paper Co. 1 | Layne-Northern Co. | 1954 | 153 | 20 | - | I | 10 | R | 9-22-54 | Milham Rd. plant. |
| 3-17 | NE SE SW | Do. TW 1 | Do. | 1954 | 150 | 8 | - | T | - | - | - | Do. |
| 3-18 | NE SE SW | Do. | Do. | 1954 | 85 | 8 | - | I | - | - | - | Do. Temporary supply well. |
| 3-19 | NE SE SW | Do. 2 | Do. | 1954 | 158 | 12 | - | I | 9.5 | R | 9-22-54 | Milham Rd. plant. |
| 3-20 | SW NW SW | W. T. Koehlinger | - | 1937 | 30 | 1¼ | - | D | 6 | R | ? | Coarse sand aquifer. |
| 4-1 | SE NW NE | City 1 (136) | City Utilities | 1950 | 162 | 12 | - | P | - | - | - | Station 9. |
| 4-2 | SE NW NE | Do. 2 (135) | Do. | 1950 | 163 | 12 | - | P | - | - | - | Do. |
| 4-3 | SE NW NE | Do. 3 (134) | Do. | 1949 | 164 | 12 | 855 | P | 4.6 | R | 10-13-49 | Do. |
| 4-4 | NE SW NE | Do. 4 (137) | Do. | 1950 | 162 | 12 | - | P | 4 | R | 4- 7-50 | Do. |
| 4-5 | NE SW NE | Do. 5 (138) | Do. | 1950 | 167 | 12 | - | P | 3 | R | 4-26-50 | Do. |
| 4-6 | NW SW NE | Do. 6 (141) | Do. | 1951 | 166 | 12 | - | P | - | - | - | Do. |
| 4-7 | SE NW NE | Do. 7 | Do. | 1951 | 158 | 12 | - | P | - | - | - | Do. |
| 4-8 | NW SE NE | Do. 8 | Do. | 1951 | 159 | 12 | - | P | - | - | - | Do. |
| 4-9 | NE SE NE | Do. 9 | Do. | 1951 | 161 | 12 | - | P | - | - | - | Do. |
| 4-10 | NW SE NE | Do. 10 | Do. | 1951 | 162 | 12 | - | P | - | - | - | Do. |
| 4-11 | NW SE NE | Do. 11 | Do. | 1951 | 168 | 12 | - | P | - | - | - | Do. |
| 4-12 | NE SW NE | Do. 12 | Do. | 1951 | 162 | 12 | - | P | - | - | - | Do. |
| 4-13 | SE NE NE | Do. TW 131 | Do. | 1949 | 200 | - | - | T | - | - | - | Do. |
| 4-14 | SW NE NE | Do. TW 132 | Do. | 1949 | 196 | - | - | T | - | - | - | Do. |
| 4-15 | SW NE NE | Do. TW 133 | Do. | 1949 | 260 | - | - | T | - | - | - | Do. |
| 4-16 | SE NW NE | Do. TW 139 | Do. | 1950 | 130 | 6 | - | T | - | - | - | Do. |
| 4-17 | SW NW NE | Do. TW 140 | Do. | 1950 | 164 | 6 | - | T | - | - | - | Do. |
| 4-18 | SE NW NE | Do. A | Do. | 1949 | - | - | - | - | 5.62 | R | 10-13-49 | Do. One of 5 similar wells used as observation points in aquifer test. |
| 8-1 | NW NE NE | Howard Corbus | - | - | 65 | 3 | - | D | - | - | - | Water reported hard. |
| 9-1 | SW NE NE | Cahill Farms, Inc. | Leo Reigler | 1957 | - | 6 | 868.87 | T | 20.38 | R | 10-21-57 | |
| 9-2 | SW NE NE | Do. | Do. | 1957 | 185 | 12 | 869.24 | P | 20.82 | R | 10- 9-57 | |
| 10-1 | NW NW SE | Russell Wiley | - | 1937 | 21 | 1½ | - | D | 14 | R | 1937 | |
| 10-2 | SW SW NE | Paul Ottney | Paul Ottney | 1941 | 22 | 1¼ | - | D | 7 | R | 1941 | Coarse gravel aquifer. |

Table 1.--Records of wells, test holes, and foundation borings in the Kalamazoo Area.--Continued

| Well number | Location ¼ ¼ ¼ in section | Owner | Driller | Year drilled | Depth (ft.) | Diameter (in.) | Altitude | Use | Water level | M or R | Date | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | T. 3 S., R. 11 W., Continued | | | | | | | | |
| 3S 11W | | | | | | | | | | | | |
| 11-1 | SW SE SE | Upjohn Co. 8 | Ohio Dr. Co. | 1951 | 213 | 16 | 862.25 | I | 17 | R | 7- 3-51 | Site of test hole 11-3. |
| 11-2 | SE SE SE | Do. 13 | Do. | - | 215 | - | 862 | I | - | - | - | Site of test hole 11-7. |
| 11-3 | SW SE SE | Do. TW 30 | Do. | 1950 | 224 | 3 | 862.25 | T | 13 | R | 9- 1-50 | |
| 11-4 | SW SE SE | Do. TW 33 | Do. | 1950 | 192 | 3 | - | T | - | - | - | |
| 11-5 | SW SE SE | Do. TW 34 | Do. | 1950 | 210 | 3 | 868.70 | T | 16 | R | 11- ?-50 | |
| 11-6 | SW SE SE | Do. P 34 | Do. | - | 50 | - | - | W | - | - | - | |
| 11-7 | SE SE SE | Do. TW 35 | Do. | 1950 | 230 | 3 | 862 - | T | 14 | R | 10-29-50 | |
| 11-8 | SE SE SE | Do. TW 36 | Do. | - | 215 | 3 | - | T | - | - | - | |
| 11-10 | NE SE SE | Do. TW 38 | Do. | 1952 | 255 | 3 | - | T | - | - | - | |
| 11-11 | SW SE SE | Do. TW 43 | Do. | 1952 | 200 | 3 | - | T | 25 | R | 10-28-52 | |
| 11-12 | SE SE SE | Do. TW 52 | Do. | - | - | 3 | 862.15 | T | - | - | - | |
| 13-1 | NW NW NW | Do. 17 | Do. | - | 174 | - | 869.1 | I | 30 | R | 1954 | Site of test hole 13-4. |
| 13-2 | SW NW NW | Do. TW 47 | Do. | 1953 | 121 | 3 | 869.2 | I | 10 | R | 2-25-53 | |
| 13-3 | NW NW NW | Do. TW 48 | Do. | 1953 | 194 | 3 | 868.2 | T | 23 | R | 3-16-53 | |
| 13-4 | NW NW NW | Do. TW 49 | Do. | 1953 | 192 | 3 | 869.1 | T | 27 | R | 4-17-53 | |
| 13-5 | NW NE NE | A. J. Poffhauser | A. J. Poffhauser | 1944 | 22 | 1½ | - | D | 16.5 | R | ? | Gravel aquifer. |
| 13-6 | SW SW NW | Upjohn Co. D 2 | Busk and Ormiston | 1954 | 1476 | 6 | 868.6 | - | - | - | - | Disposal well. MDC log BD92. |
| 13-7 | NE NE NW | Vanco Oil and Gas Co. | Fisher McCall Co. | 1945 | 1294 | 6 | 866.7 | G | - | - | - | MDC log 11696. |
| 14-1 | NE SW NE | Upjohn Co. 1 | Ohio Dr. Co. | 1946 | 120 | 16 | 871 | P | 20 | R | 1946 | Site of test hole 14-41. |
| 14-2 | NE SW NE | Do. 2 | Do. | 1947 | 103 | 16 | 869 | O | H | M | - | Formerly KoPg 47. |
| 14-3 | NW SE NE | Do. 3 | Do. | 1947 | 134 | 18 | 871 | P | 25 | R | 1947 | |
| 14-4 | NW SE NE | Do. 4 | Do. | - | 133 | - | - | I | - | - | - | |
| 14-5 | NE SW NE | Do. 5 | Do. | 1950 | 160 | 16 | 871.8 | I | 22.5 | R | 6- 1-51 | |
| 14-6 | NW SE NE | Do. 6 | Do. | 1950 | 175 | 16 | 869.5 | I | - | - | - | |
| 14-7 | SW SE SW | Do. A | Do. | 1951 | 120 | 3 | 871.35 | - | 25 | R | 11-15-51 | Aquifer test observation well. |
| 14-8 | SW SE NE | Do. A-1 | Do. | 1951 | 32 | - | 871.45 | - | 26 | - | 11-21-51 | Do. |
| 14-9 | SW SE NE | Do. B (N-1) | Do. | 1951 | 115 | 3 | 870.06 | - | - | - | - | Do. |
| 14-10 | SW SE NE | Do. C (S-1) | Do. | 1951 | 120 | 3 | 866.73 | - | - | - | - | Do. |
| 14-11 | SW SE NE | Do. D | Do. | 1951 | 125 | 3 | 864.01 | - | 18 | - | 11-11-51 | Do. |
| 14-12 | SW SE NE | Do. D-1 | Do. | 1951 | 22 | - | 864 | - | 16 | - | 11-21-51 | Do. |
| 14-13 | NW NE SE | Do. E | Do. | 1951 | 116 | 3 | 864.71 | - | - | - | - | Do. |
| 14-14 | SE SW NE | Do. F | Do. | 1951 | 116 | 3 | 871.06 | - | - | - | - | Do. |
| 14-15 | SE SW NE | Do. F-1 | Do. | 1951 | 30 | - | 871.12 | - | - | - | - | Do. |
| 14-16 | SW SE NE | Do. G (W-2) | Do. | 1951 | 118 | 3 | 869.38 | - | 24- | - | 11- 6-51 | Do. |
| 14-17 | SW SE NE | Do. H (W-1) | Do. | 1951 | 116 | 3 | 869.03 | - | - | - | - | Do. |
| 14-18 | SW SE NE | Do. J (E-1) | Do. | 1951 | 118 | 3 | 869.52 | - | - | - | - | Do. |
| 14-19 | SW SE NE | Do. J-1 | Do. | 1951 | 30 | - | 869.54 | - | - | - | - | Do. |
| 14-20 | SW SE NE | Do. K (E-2) | Do. | 1951 | 116 | 3 | 869.67 | - | - | - | - | Do. |
| 14-21 | SE SE NE | Do. L | Do. | 1951 | 118 | 3 | 869.10 | - | 23 | - | 11- 3-51 | Do. |
| 14-22 | NW NE NE | Do. 7 | Do. | 1951 | 202 | 16 | 868.17 | I | 20.5 | - | 6- 5-51 | Site of test hole 14-68. |
| 14-23 | SW SE NE | Do. 9 | Do. | - | 109 | - | - | I | - | - | - | Site of test hole 14-54. |
| 14-24 | NW SE NE | Do. 10 | Do. | - | 109 | - | - | I | - | - | - | Site of test hole 14-44. |
| 14-25 | NW SE NE | Do. 11 | Do. | - | 137 | - | - | I | - | - | - | Site of test hole 14-49. |
| 14-26 | NE NE NE | Do. 12 | Do. | 1951 | 131 | 16 | 869.8 | I | 25 | - | 4-24-51 | Site of test hole 14-65. |
| 14-27 | NW NE SE | Do. 14 | Do. | - | 170 | - | - | I | - | - | - | Site of test hole 14-71. |
| 14-28 | NW NE SE | Do. 15 | Do. | 1952 | 215 | 16 | - | I | 27.5 | - | 9-18-52 | Site of test hole 14-74. |
| 14-29 | NE NW NE | Do. 16 | Do. | - | 109 | - | - | I | - | - | - | Site of test hole 14-77. |
| 14-30 | NE SW NE | Do. N-1 | - | 1947 | - | - | - | A | - | - | - | One of 8 similar wells used as observation wells in aquifer test. |

Table 1.--Records of wells, test holes, and foundation borings in the Kalamazoo Area.--Continued

| Well number | Location in section ¼ | ¼ | ¼ | Owner | Driller | Year drilled | Depth (ft.) | Diameter (in.) | Altitude | Use | Water level | M or R | Date | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | T. 3 S., R. 11 W., Continued | | | | | | | | | |
| 3S 11W | | | | | | | | | | | | | | |
| 14-38 | NE | NW | NE | Upjohn Co. TW 1 | Ohio Dr. Co. | 1945 | 123 | 3 | 874 | T | 23 | - | 12- ?-45 | |
| 14-39 | NE | SW | NE | Do. TW 2 | Do. | 1946 | 109 | 3 | 870 | T | 15 | - | 1- 3-46 | |
| 14-40 | NW | SW | NE | Do. TW 3 | Do. | 1946 | 140 | 3 | 875 | T | 23 | - | 1- 8-46 | Formerly KoPg 43. |
| 14-41 | NE | SW | NE | Do. TW 4 | Do. | 1946 | 120 | 3 | 872 | T | 24 | - | 3-12-46 | |
| 14-42 | NE | NW | NE | Do. TW 5 | Do. | 1946 | 130 | 3 | 873 | T | 25 | - | 4-11-46 | |
| 14-43 | NW | SE | NE | Do. TW 6 | Do. | 1948 | 137 | 3 | 871 | T | - | - | - | |
| 14-44 | NW | SE | NE | Do. TW 7 | Do. | 1950 | 145 | 3 | - | T | 22 | - | 2- 2-50 | |
| 14-45 | NE | SW | NE | Do. TW 8 | Do. | 1950 | 140 | 3 | - | T | 21 | - | 2-13-50 | |
| 14-46 | NE | SW | NE | Do. TW 9 | Do. | 1950 | 150 | 3 | - | T | 23 | - | 2-24-50 | |
| 14-47 | NW | SE | NE | Do. TW 10 | Do. | 1950 | 146 | 3 | - | T | 24 | - | 3- 3-50 | |
| 14-48 | NE | SW | NE | Do. TW 11 | Do. | 1950 | 138 | - | - | T | 23 | - | 3-11-50 | |
| 14-49 | NW | SE | NE | Do. TW 12 | Do. | 1950 | 155 | 3 | - | T | 29 | - | 3-17-50 | |
| 14-50 | NE | SE | NE | Do. TW 13 | Do. | 1950 | 150 | 3 | - | T | 20 | - | 3-31-50 | |
| 14-51 | SE | NE | NE | Do. TW 14 | Do. | 1950 | 148 | 3 | - | T | 18 | - | 4- 6-50 | |
| 14-52 | NE | SW | NE | Do. TW 15 | Do. | 1950 | 170 | 3 | 871.8 | T | 18 | - | 4-18-50 | |
| 14-53 | SW | SE | NE | Do. TW 16 | Do. | 1950 | 175 | 3 | 869.5 | T | 13 | - | 4-29-50 | |
| 14-54 | SW | SE | NE | Do. TW 17 | Do. | 1950 | 172 | 3 | - | T | 10 | - | 5- 5-50 | |
| 14-55 | SE | SW | NE | Do. TW 18 | Do. | 1950 | 175 | 3 | - | T | 12 | - | 5-16-50 | |
| 14-56 | SW | SE | NE | Do. TW 19 | Do. | 1950 | 150 | 3 | - | T | 16 | - | 5-22-50 | |
| 14-57 | SW | SE | NE | Do. TW 20 | Do. | 1950 | 175 | 3 | - | T | 9 | - | 6- 1-50 | |
| 14-58 | SW | SE | NE | Do. TW 21 | Do. | 1950 | 160 | 3 | - | T | 8 | - | 6- 6-54 | |
| 14-59 | SW | SE | NE | Do. TW 22 | Do. | 1950 | 155 | 3 | - | T | 8 | - | 6-12-50 | |
| 14-60 | SE | SW | NE | Do. TW 23 | Do. | 1950 | 165 | 3 | - | T | 12 | - | 6-20-50 | |
| 14-61 | NW | SE | NE | Do. TW 24 | Do. | 1950 | 165 | 3 | 872 | T | - | - | - | |
| 14-62 | SW | SE | NE | Do. TW 25 | Do. | 1950 | 205 | 3 | 872- | T | 18 | - | 7-18-50 | |
| 14-63 | NW | NE | NE | Do. TW 26 | Do. | 1950 | 165 | 3 | 871.11 | O | 26.04 | R | 10-10-51 | |
| 14-64 | NW | NE | NE | Do. P 26 | Do. | - | 50 | - | - | W | - | - | - | Site of test hole 14-63. |
| 14-65 | NE | NE | NE | Do. TW 27 | Do. | 1950 | 150 | 3 | 869.8 | T | 14 | - | 8- 5-50 | |
| 14-66 | SE | NE | NE | Do. TW 28 | Do. | 1950 | 125 | 3 | - | T | 17 | - | 8-16-50 | |
| 14-67 | SW | NW | NE | Do. TW 29 | Do. | 1950 | 145 | 3 | - | T | 19 | - | 8-23-50 | |
| 14-68 | NW | NE | NE | Do. TW 31 | Do. | 1950 | 208 | 3 | 868.17 | T | - | - | - | |
| 14-69 | NE | NE | NE | Do. TW 32 | Do. | 1950 | 222 | 3 | - | T | 10 | - | 10- 3-50 | |
| 14-70 | SE | NE | NE | Do. TW 39 | Do. | 1952 | 189 | 3 | - | T | 20 | - | 5- 3-52 | |
| 14-71 | NW | NE | SE | Do. TW 40 | Do. | 1952 | 163 | 3 | - | T | 16 | - | 5-21-52 | |
| 14-72 | SE | SE | NE | Do. TW 41 | Do. | 1952 | 240 | 3 | - | T | 19 | - | 6- 6-52 | |
| 14-73 | SE | NE | NE | Do. TW 42 | Do. | 1952 | 200 | 3 | - | T | 22 | - | 7- 3-52 | |
| 14-74 | NW | NE | SE | Do. TW 44 | Do. | 1952 | 200 | 3 | - | T | 10 | - | 11-12-52 | |
| 14-75 | SW | NE | SE | Do. TW 45 | Do. | 1952 | 205 | 3 | - | T | 5 | - | 12- 3-52 | |
| 14-76 | SW | NE | SE | Do. TW 46 | Do. | 1953 | 188 | 3 | 861.4 | T | 15 | - | 2-11-53 | |
| 14-77 | NE | NW | NE | Do. TW 50 | Do. | 1953 | 150 | 3 | - | T | 28 | - | 11- 2-53 | |
| 14-78 | NE | NE | NE | Do. TW 51 | Do. | 1953 | 184 | 3 | 870 | T | 28 | - | 12-16-53 | |
| 14-79 | NE | NE | NE | Do. TW 53 | - | - | - | - | - | T | - | - | - | |
| 14-84 | SW | NE | NE | Do. RT 1 | A. L. Webster | 1953 | 22 | 2 | 864 | - | 16.3 | - | 1- 2-53 | Observation point for recharge test. |
| 14-85 | SE | NE | NW | Do. RT 1d | Do. | 1953 | 92 | 2 | 864 | - | 19.3 | - | 1- 2-53 | Do. |
| 14-86 | SW | NE | NW | Do. RT 2 | Do. | 1953 | 11 | 2 | 853 | - | 18.4 | - | 1- 2-53 | Do. |
| 14-87 | SW | NE | NW | Do. RT 3 | Do. | 1953 | 11 | 2 | 853 | - | 18.5 | - | 1- 2-53 | Do. |
| 14-88 | SE | NE | NW | Do. RT 3d | Do. | 1953 | 81 | 2 | 853 | - | 18.6 | - | 1- 2-53 | Do. |
| 14-89 | SE | NE | NW | Do. RT 4 | Do. | 1953 | 20 | 2 | 862 | - | 17.6 | - | 1- 2-53 | Do. |
| 14-90 | SE | NE | NW | Do. RT 5 | Do. | 1953 | 27 | 2 | 869 | - | 24.8 | - | 1- 2-53 | Do. |
| 14-91 | SE | NE | NW | Do. RT 5d | Do. | 1953 | 97 | 2 | 869 | - | 24.9 | - | 1- 2-53 | Do. |
| 14-92 | SE | NE | NW | Do. RT 6 | Do. | 1953 | 36 | 2 | 878 | - | 33.9 | - | 1- 2-53 | Do. |
| 14-93 | SE | NE | NW | Do. RT 6d | Do. | 1953 | 106 | 2 | 878 | - | 34.2 | - | 1- 2-53 | Do. |
| 14-94 | NE | NE | NW | Do. RT 7 | Do. | 1953 | 24 | 2 | 866 | - | 21.7 | - | 1- 2-53 | Do. |
| 14-95 | SE | NE | NW | Do. RT 8 | Do. | 1953 | 12 | 2 | 854 | - | 9.6 | - | 1- 2-53 | Do. |
| 14-96 | SE | NE | NW | Do. RT 8d | Do. | 1953 | 82 | 2 | 854 | - | 9.4 | - | 1- 2-53 | Do. |
| 14-97 | SE | NE | NW | Do. RT 9 | Do. | 1953 | 12 | 2 | 854 | - | 9.6 | - | 1- 2-53 | Do. |
| 14-98 | SE | NE | NW | Do. RT 10 | Do. | 1953 | 24 | 2 | 866 | - | 21.2 | - | 1- 2-53 | Do. |
| 14-99 | SW | SE | SE | Do. D-1 | Busk and Ormiston | 1954 | 1532 | 6 | 869.3 | - | - | - | - | Disposal well. MDC BD87. |
| 15-1 | - | NW | NW | J. W. Bouma | - | - | 35 | 1¼ | - | D | 10 | - | 6- 8-54 | |
| 21-1 | SE | SW | NE | Cashway Lumber Co. | Lombard | 1954 | 44 | 2 | - | D | - | - | - | Used also for public supply. |
| 21-2 | NE | NW | SE | Gordon Meyers | Gordon Meyers | - | 26 | 1¼ | - | D | 18 | - | 6- ?-54 | |
| 21-3 | SE | SW | NE | American Box Board Co. 1 | Ohio Dr. Co. | 1955 | 88 | 8 | - | I | 26.73 | M | 2-26-58 | Abandoned. Poor yield. |

Table 1.--Records of wells, test holes, and foundation borings in the Kalamazoo Area.--Continued

| Well number | Location in section ¼ | ¼ | ¼ | Owner | Driller | Year drilled | Depth (ft.) | Diameter (in.) | Altitude | Use | Water level | M or R | Date | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | T. 3 S., R. 11 W., Continued | | | | | | | | | |
| 3S 11W | | | | | | | | | | | | | | |
| 21-4 | SE | SW | NE | American Box Board Co. 2 | Ohio Dr. Co. | 1957 | 81 | 8 | - | I | 29 | - | 3- 4-57 | |
| 21-5 | SE | SE | NE | Portage School 3 | Layne-Northern Co. | 1956 | 102 | 12 | - | P | 20 | R | 10-12-56 | At athletic field. |
| 22-1 | SW | NW | NW | Do. 1 | J. C. Newman | - | 68 | 6 | - | P | - | - | - | |
| 22-2 | NW | SW | NW | Do. 2 | Layne-Northern Co. | 1957 | 102 | 12 | - | P | 27 | R | 2- 2-57 | |
| 23-1 | - | - | SE | Amos Zylman | Amos Zylman | 1945 | 22 | 2 | - | D | 13 | R | ? | Fine gravel aquifer. |
| 25-1 | - | - | SE | Ray Dingman | - | - | 30 | 1¼ | - | D | - | - | - | Sand aquifer. |
| 25-2 | NE | NE | SE | C. A. Branch | - | 1939 | 22 | 1¼ | - | D | - | - | - | Near lake. Water reported soft. |
| 27-1 | NW | SE | NW | L. G. Stevenson | - | - | 31 | - | - | P | - | - | - | |
| 27-2 | SW | SE | SW | McClanahan Oil Co. | McClanahan Oil Co. | 1939 | 1291 | 10 | 888 | G | - | - | - | |
| 29-1 | SE | NW | SE | Robert Snyder | Robert Snyder | 1951 | 30 | 1¼ | - | D | 13 | R | 1951 | Sand aquifer. |
| 31-1 | SW | NW | SW | M. B. Keeler | Kalvan Drillers | 1939 | 1290 | 8 | 892.5 | G | - | - | - | MDC log 6899. Bedrock reported at 300 ft. |
| | | | | | Pavilion Township (T. 3 S., R. 10 W.) | | | | | | | | | |
| 3S 10W | | | | | | | | | | | | | | |
| 7-1 | - | NW | SE | Charles Smith | - | - | 28 | 1½ | - | - | 10 | R | ? | Gravel aquifer. |
| 8-1 | SW | SW | SE | Muskegon Development Co. | Muskegon Development Co. | 1942 | 1307 | 8 | 863.4 | G | - | - | - | MDC log 9714. |

Table 2.--Selected logs of wells and test borings in the Kalamazoo area.

Alt: Altitude approximate or estimated in feet above mean sea level.

Thickness in feet. Depth in feet below land surface.

| | Thickness | Depth |
|---|---|---|
| 1S 11W 31-1 Alt. 952.8 | | |
| Sand and boulders | 40 | 40 |
| Sand and gravel | 215 | 255 |
| Mud and gravel | 35 | 290 |
| Sand | 10 | 300 |
| Mud | 75 | 375 |
| Shale, gray | 173 | 548 |
| Total depth - 1571 ft. | | |
| 1S 11W 34-1 Alt. 755.24 | | |
| Cinders | 3 | 3 |
| Muck | 3 | 6 |
| Muck and sand | 5 | 11 |
| Clay, sand, and gravel | 5 | 16 |
| Clay, gray | 6 | 22 |
| Gravel, "good", heaves | 30 | 52 |
| 1S 11W 34-2 Alt. 754.27 | | |
| Cinders | 2 | 2 |
| Muck | 2 | 4 |
| Clay and gravel, heaves | 6 | 10 |
| Gravel, "good" | 6 | 16 |
| Clay | 7 | 23 |
| Gravel, "good", heaves | 25 | 48 |
| Clay and fine gravel | 18 | 66 |
| Clay and sand | 4 | 70 |
| Gravel, sand, and clay | 8 | 78 |
| Clay and sand, "dirty" | 7 | 85 |
| Shale | 3 | 88 |
| 1S 11W 34-6 Alt. 753.77 | | |
| Muck | 2 | 2 |
| Clay and gravel, yellow | 2 | 4 |
| Gravel, clayey | 4 | 8 |
| Gravel, "good," heaves | 6 | 14 |
| Clay | 6 | 20 |
| Gravel, coarse | 30 | 50 |
| Clay | 1 | 51 |
| 1S 11W 34-22 Alt. 763.68 | | |
| Topsoil | 1 | 1 |
| Sand | 7 | 8 |
| Sand and gravel | 5 | 13 |
| Sand, gravel, and very silty clay | 2 | 15 |
| Clay, blue | 10 | 25 |
| Gravel, coarse, heaves | 12 | 37 |
| Gravel, fine, sand and red clay balls | 2 | 39 |
| Sand, coarse, and red clay balls | 6 | 45 |
| Gravel, gray, coarse | 6 | 51 |
| Clay, blue, and fine gravel, traces of shale | 3 | 54 |
| Clay, sandy, gravelly | 5 | 60 |
| 1S 11W 34-23 | | |
| Fill, cinders | 1 | 1 |
| Clay and gravel | 10 | 11 |
| Gravel, fine, clean, heaves | 4 | 15 |
| Gravel and sand, silty, clayey, heaves | 19 | 34 |
| Gravel, and sand, heaves | 11 | 45 |
| Clay, sand and gravel heaves | 18 | 63 |
| Clay, sand and gravel | 22 | 85 |
| Shale, sandy | 7 | 92 |
| Shale, limestone, little gravel | 2 | 94 |
| Shale and limestone creviced | 5 | 99 |
| 1S 11W 34-26 Alt. 759 | | |
| Fill | 2 | 2 |
| Fill, clay | 3 | 5 |
| Muck | 7 | 12 |
| Gravel, coarse | 9 | 21 |
| Gravel, coarse, few clay balls | 9 | 30 |
| Gravel, coarse, clean | 24 | 54 |
| Sand and clay | 1 | 55 |
| 1S 11W 34-27 Alt. 759 | | |
| Fill, sand and gravel | 7 | 7 |
| Sand and fine gravel, very silty | 7 | 14 |
| Gravel, medium, and sand, heaves | 2 | 16 |
| Gravel, coarse, and sand, heaves | 2 | 18 |
| Clay, gray | 6 | 24 |
| Gravel and clay, very silty | 3 | 27 |
| Gravel, coarse, heaves | 12 | 39 |
| Gravel, medium, sandy, heaves | 6 | 45 |
| Gravel, coarse, with clay hardpan | 1 | 46 |
| 1S 11W 34-29 Alt. 759 | | |
| Fill, sand and gravel, "dirty" | 6 | 6 |
| Gravel, medium, and sand | 3 | 9 |
| Sand, fine, and gravel, heaves | 9 | 18 |
| Clay, gray | 6 | 24 |
| Gravel, medium, clayey, silty | 4 | 28 |
| Gravel, medium, very clean, heaves | 14 | 42 |
| Gravel, coarse, clean, heaves | 9 | 51 |
| Clay, gray, gravelly | 1 | 52 |
| 1S 11W 35-1 Alt. 779 | | |
| Sand, yellow | 10 | 10 |
| Sand, white, fine, gravelly | 4 | 14 |
| Sand, white, fine, gravelly, silty traces of clay | 2 | 16 |
| Sand, fine, and gravel, silty | 4 | 20 |
| Sand, fine, gravelly, heaves | 7 | 27 |
| Gravel, coarse, and sand, heaves | 5 | 32 |
| Gravel, very coarse, sandy | 6 | 38 |
| Gravel, coarse, sandy, clay balls | 1 | 39 |
| 2S 12W 25-1 Alt. 940 | | |
| Topsoil | 5 | 5 |
| Sand, yellow, gravelly | 45 | 50 |
| Sand, yellow | 55 | 105 |
| Sand and clay | 15 | 120 |
| Clay, sandy | 5 | 125 |
| Gravel, dirty | 6 | 131 |
| Sand and clay | 11 | 142 |
| Sand, fine to medium | 37 | 179 |
| Sand and clay | 2 | 181 |
| Clay and gravel | 1 | 182 |
| Gravel | 8 | 190 |
| Sand and gravel | 2 | 192 |
| Sand, fine to coarse | 14 | 206 |
| 2S 11W 2-1 Alt. 780.41 | | |
| Topsoil | 1 | 1 |
| Gravel, fine | 9 | 10 |
| Sand, fine | 13 | 23 |
| Sand and fine gravel, heaves | 6 | 29 |
| Sand, fine gravel, and clay balls | 2 | 31 |
| Clay, red | 9 | 40 |
| Sand and clay | 2 | 42 |
| Sand, coarse | 5 | 47 |
| Clay and gravel, hard | 3 | 50 |
| Clay, hardpan, and "quicksand" | 8 | 58 |
| Sand and clay | 5 | 63 |
| Clay and gravel | 21 | 84 |
| Clay and coarse gravel | 1 | 85 |
| Shale, blue | 3 | 88 |
| Gravel, water-bearing | 3 | 91 |
| Sand and gravel, water-bearing | 4 | 95 |
| Sand and shale | 1 | 96 |
| Shale, blue | 4 | 100 |
| 2S 11W 2-4 Alt. 805.65 | | |
| Topsoil | 2 | 2 |
| Sand, coarse, boulders | 18 | 20 |
| Sand, fine, boulders | 17 | 37 |
| Clay, "soupy" | 3 | 40 |
| Sand, coarse, water-bearing | 10 | 50 |
| Sand, fine, water-bearing | 2 | 52 |
| Sand, water-bearing | 24 | 76 |
| Sand and gravel, fine, water-bearing | 8 | 84 |
| Gravel and sand, water-bearing | 5 | 89 |
| Sand, water-bearing | 10 | 99 |
| Sand, fine, water-bearing | 1 | 100 |
| Sand, coarse, water-bearing | 8 | 108 |
| 2S 11W 2-5 Alt. 789.10 | | |
| Sand, yellow, dry | 5 | 5 |
| Sand and gravel, boulders, dry | 10 | 15 |
| Sand, gravel, and cobbles, dry | 10 | 25 |
| Sand, gravelly | 9 | 34 |
| Clay, sandy, hardpan | 30 | 64 |
| Sand, fine and coarse gravel, "struck dirty water" | 2 | 66 |
| Gravel and hardpan, gray, sandy | 24 | 90 |
| Clay, gray, hardpan | 2 | 92 |
| Clay hardpan, gravelly | 5 | 97 |
| Sand and gravel, "very dirty" | 6 | 103 |
| Shale | 1 | 104 |
| 2S 11W 3-12 Alt. 760 | | |
| Sand, dry | 20 | 20 |
| Clay | 3 | 23 |
| Gravel | 13 | 36 |
| Clay | 2 | 38 |
| 2S 11W 3-20 | | |
| Sand, "dirty" | 16 | 16 |
| Sand and clay | 2 | 18 |
| Sand, coarse, and gravel, water-bearing | 2 | 20 |

Table 2.--Selected logs of wells and test borings in the Kalamazoo area.--Continued

| | Thick-ness | Depth |
|---|---|---|
| 2S 11W 3-20 Continued | | |
| Gravel, clean, water-bearing | 4 | 24 |
| Sand and gravel, water-bearing | 1 | 25 |
| Gravel | 6 | 31 |
| Sand and gravel | 2 | 33 |
| Gravel, coarse, and clay | 3 | 36 |
| Clay | 2 | 38 |
| 2S 11W 3-24 Alt. 763.77 | | |
| Fill, cinders | 11 | 11 |
| Clay, sandy | 11 | 22 |
| Sand, clay, and gravel | 1 | 23 |
| Clay | 6 | 29 |
| Sand, clay, and gravel, "dirty" | 3 | 32 |
| Sand, "dirty" | 3 | 35 |
| Sand, "good", heaves | 14 | 49 |
| Sand, gravelly | 3 | 52 |
| Sand, clay balls | 4 | 56 |
| Sand, gravelly, "good" | 8 | 64 |
| Sand and clay | 3 | 67 |
| Shale, blue | 23 | 90 |
| 2S 11W 3-26 Alt. 771.21 | | |
| Fill | 1 | 1 |
| Sand and gravel, clayey | 13 | 14 |
| Sand, medium | 6 | 20 |
| Sand and gravel | 2 | 22 |
| Clay, red, and gravel | 2 | 24 |
| Gravel and sand, silty, cobbles, hardpan | 10 | 34 |
| 2S 11W 3-28 | | |
| Fill | 1 | 1 |
| Clay, sandy | 12 | 13 |
| Sand, dirty | 7 | 20 |
| Clay, sand, and gravel | 3 | 23 |
| Gravel and sand, medium to coarse, "very good" water-bearing | 2 | 25 |
| Gravel, sandy | 12 | 37 |
| 2S 11W 3-29 Alt. 774.05 | | |
| Fill | 4 | 4 |
| Sand and red clay | 13 | 17 |
| Sand, fine | 6 | 23 |
| Clay, blue | 4 | 27 |
| Sand, coarse, and coarse gravel | 12 | 39 |
| Gravel, coarse, and blue clay balls | - | - |
| 2S 11W 3-32 Alt. 762 | | |
| No record | 9 | 9 |
| Sand, dry | 3 | 12 |
| Sand, water-bearing | 13 | 25 |
| Gravel, fine to coarse, water-bearing | 6 | 31 |
| Gravel, clayey, sandy | 2 | 33 |
| Sand, coarse, "dirty", clay balls | 6 | 39 |
| Clay, blue, sandy, gravelly | 17 | 56 |
| Sand, coarse to very coarse, water-bearing | 7 | 63 |
| Gravel and sand, clay balls | 4 | 67 |
| Clay, hard | 20 | 87 |
| Shale, soft to firm | 9 | 96 |
| Sandstone and shale | 7 | 103 |
| Shale, sandy, and sand-stone | 25 | 128 |
| 2S 11W 3-37 Alt. 766.93 | | |
| Fill | 1 | 1 |
| Clay, sandy | 6 | 7 |
| Sand | 8 | 15 |
| Sand and gravel, clayey | 6 | 21 |
| Sand, stable | 2 | 23 |
| Sand, clean, heaves | 3 | 26 |
| Sand and gravel | 4 | 30 |
| Sand, clay, and gravel | 16 | 46 |
| 2S 11W 3-39 Alt. 768.75 | | |
| Topsoil | 2 | 2 |
| Clay | 2 | 4 |
| Sand, dry | 14 | 18 |
| Gravel and sand, water-bearing | 5 | 23 |
| Gravel and sand, very tight | 6 | 29 |
| Sand, medium to coarse, clean | 3 | 32 |
| Sand | 3 | 35 |
| Sand, gray, "dirty" | 2 | 37 |
| Clay, sand, and gravel | 23 | 60 |
| 2S 11W 3-41 Alt. 775.03 | | |
| Sand and clay, gravelly | 6 | 6 |
| Sand and gravel | 9 | 15 |
| Clay, sandy | 2 | 17 |
| Gravel, very hard, dry | 6 | 23 |
| Gravel and sand, water-bearing | 7 | 30 |
| Gravel, clean, bouldery | 5 | 35 |
| 2S 11W 3-43 Alt. 764.84 | | |
| Topsoil | 1 | 1 |
| Clay | 5 | 6 |
| Sand, dry | 6 | 12 |
| Gravel, clean, water-bearing | 13 | 25 |
| Sand, clay, and gravel | 13 | 38 |
| Boulders | - | - |
| 2S 11W 3-46 Alt. 776 | | |
| Topsoil | 1 | 1 |
| Sand, dry | 2 | 3 |
| Clay | 3 | 6 |
| Sand, dry | 13 | 19 |
| Clay, sandy | 2 | 21 |
| Gravel and sand, dry | 4 | 25 |
| Gravel and sand, water-bearing | 16 | 41 |
| Gravel and clay | 1 | 42 |
| 2S 11W 3-50 Alt. 764.08 | | |
| Topsoil | 1 | 1 |
| Sand | 13 | 14 |
| Clay, soft | 7 | 21 |
| Sand, gravelly | 4 | 25 |
| Gravel and sand, silty | 8 | 33 |
| Sand, gray | 9 | 42 |
| Sand and gravel | 5 | 47 |
| Sand and gravel, clayey | 8 | 55 |
| Clay, gravel, and sand | 22 | 77 |
| Shale | - | - |
| 2S 11W 3-51 Alt. 769.08 | | |
| Cinders | 1 | 1 |
| Clay, sandy | 2 | 3 |
| Sand, clayey | 4 | 7 |
| Sand, clean, dry | 10 | 17 |
| Sand, "dirty", water-bearing | 1 | 18 |
| Sand, coarse | 13 | 31 |
| Gravel, hard | 2 | 33 |
| 2S 11W 3-56 Alt. 767.65 | | |
| Fill | 2 | 2 |
| Sand | 5 | 7 |
| Clay | 1 | 8 |
| Sand | 8 | 16 |
| Sand, gravelly, boulders | 2 | 18 |
| Gravel | 12 | 30 |
| Gravel, sand, and clay | 2 | 32 |
| No record | 4 | 36 |
| 2S 11W 3-59 Alt. 757.18 | | |
| Fill, cinders | 6 | 6 |
| Muck | 3 | 9 |
| Clay, white | 5 | 14 |
| Gravel, coarse | 12 | 26 |
| Gravel, fine, and sand | 2 | 28 |
| Clay and gravel, fine | 5 | 33 |
| Sand, fine, and clay | 35 | 68 |
| Clay and sand, gravelly | 4 | 72 |
| Clay and sand, traces of shale | 3 | 75 |
| Shale | 2 | 77 |
| 2S 11W 3-61 Alt. 760.47 | | |
| Topsoil | 1 | 1 |
| Sand, clayey | 3 | 4 |
| Sand, gravelly | 1 | 5 |
| Gravel, fine | 1 | 6 |
| Clay, red, and gravel | 1 | 7 |
| Gravel, very silty | 7 | 14 |
| Sand and clay, gravelly | 4 | 18 |
| Gravel and sand, clayey | 2 | 20 |
| Gravel, coarse, silty | 2 | 22 |
| Gravel and sand, silty, clay hardpan | 2 | 24 |
| Sand, fine, gravel, and clay | 2 | 26 |
| Sand and clay, silty, "dirty", heaves | 2 | 28 |
| Sand, coarse, silty, "dirty" | 8 | 36 |
| Gravel and sand, fine, clayey | 2 | 38 |
| Gravel, fine to coarse, sand, heaves | 6 | 44 |
| Clay, sand, and gravel, traces of shale, heaves | 5 | 49 |
| Clay, red, sandy, gravelly | 10 | 59 |
| Clay, red, sandy | 5 | 64 |
| 2S 11W 4-2 Alt. 840 | | |
| Clay | 4 | 4 |
| Sand, coarse, and fine gravel | 16 | 20 |
| Gravel and fine sand | 10 | 30 |
| Gravel, fine, and coarse sand | 10 | 40 |
| Sand, coarse, gravelly | 27 | 67 |
| Clay, blue-gray | 5 | 72 |
| Gravel, fine and coarse sand | 7 | 79 |
| Silt and fine sand | 6 | 85 |
| Sand, coarse and fine gravel | 6 | 91 |
| Gravel, fine and coarse sand | 8 | 99 |
| Sand, fine to medium | 5 | 104 |
| Sand, fine, and silt | 5 | 109 |
| Sand, fine | 6 | 115 |
| Clay and silt | 6 | 121 |
| Sand, fine, and clay | 5 | 126 |
| Shale, blue, traces of fine gravel | 43 | 169 |
| 2S 11W 4-3 | | |
| Clay hardpan, red | 10 | 10 |
| Gravel, red, "dirty" | 5 | 15 |

Table 2.--Selected logs of wells and test borings in the Kalamazoo area.--Continued

| | Thickness | Depth |
|---|---|---|
| **2S 11W 4-3 Continued** | | |
| Gravel, red and yellow | 40 | 55 |
| Sand, coarse, and gravel | 15 | 70 |
| Gravel, coarse | 5 | 75 |
| Sand, fine | 10 | 85 |
| Sand, coarse, and gravel | 20 | 105 |
| **2S 11W 6-1** | | |
| Muck | 2 | 2 |
| Sand and gravel | 10 | 12 |
| Gravel, coarse | 4 | 16 |
| Sand and gravel | 6 | 22 |
| Clay and marly sand | 12 | 34 |
| Clay | 10 | 44 |
| Clay, sandy, gravelly | 11 | 55 |
| Clay and silt | 11 | 66 |
| Gravel hardpan | 20 | 86 |
| Gravel, sand, and clay | 10 | 96 |
| Sand and clay | 5 | 101 |
| Gravel and clay | 7 | 108 |
| Gravel hardpan | 26 | 134 |
| Gravel, coarse, and boulders | 13 | 147 |
| Gravel and hardpan | 9 | 156 |
| Hardpan | 11 | 167 |
| **2S 11W 9-6 Alt. 791** | | |
| Fill | 4 | 4 |
| Clay, gravelly | 26 | 30 |
| Sand, fine | 11 | 41 |
| Sand, clean | 2 | 43 |
| Sand and gravel | 4 | 47 |
| Clay | 2 | 49 |
| Sand and gravel | 7 | 56 |
| Clay and streaks of gravel | 6 | 62 |
| Gravel and boulders | 9 | 71 |
| Sand, clean | 3 | 74 |
| Clay | 28 | 102 |
| **2S 11W 9-7** | | |
| Fill | 2 | 2 |
| Topsoil | 2 | 4 |
| Clay, gravelly | 26 | 30 |
| Sand | 10 | 40 |
| Sand and gravel | 6 | 46 |
| Clay, brown | 2 | 48 |
| Sand, clean | 4 | 52 |
| Clay, brown | 8 | 60 |
| Sand, gravel and boulders | 12 | 72 |
| Sand, medium, clean | 2 | 74 |
| Sand, fine, clayey | 1 | 75 |
| Clay, gray | 1 | 76 |
| **2S 11W 10-5 Alt. 761.3** | | |
| Sand and gravel | 10 | 10 |
| Gravel and sand | 5 | 15 |
| Sand and gravel, clayey | 15 | 30 |
| Gravel and sand | 5 | 35 |
| Sand and clay | 5 | 40 |
| Sand, gravel, and clay | 5 | 45 |
| Clay | 18 | 63 |
| Boulder | 2 | 65 |
| Shale (?), boulder reported at 171 feet | 165 | 230 |
| **2S 11W 10-9** | | |
| Sand and gravel, clay | 20 | 20 |
| Gravel and sand | 5 | 25 |
| Sand and gravel, clayey | 5 | 30 |
| Gravel and sand | 5 | 35 |
| Clay, sandy | 20 | 55 |
| Sand | 8 | 63 |
| Sand, clayey | 5 | 68 |
| Sand and gravel, clayey | 4 | 72 |
| Shale | 7 | 79 |
| **2S 11W 10-12** | | |
| Muck and fine sand | 8 | 8 |
| Clay, blue, and gravel | 13 | 21 |
| Clay, blue | 8 | 29 |
| Sand, fine | 35 | 64 |
| **2S 11W 10-14 Alt. 766** | | |
| Boulder | 14 | 14 |
| Clay and gravel | 4 | 18 |
| Sand | 18 | 36 |
| Sand, fine | 3 | 39 |
| Gravel and clay | 3 | 42 |
| Sand, dirty | 4 | 46 |
| Clay | 2 | 48 |
| Sand, fine, dirty | 3 | 51 |
| Clay | 1 | 52 |
| Shale | 2 | 54 |
| **2S 11W 10-15** | | |
| Gravel and boulders | 15 | 15 |
| Gravel | 21 | 36 |
| Clay, blue | 4 | 40 |
| Sand, gravel, and clay interbeds | 12 | 52 |
| Clay | 4 | 56 |
| **2S 11W 10-18** | | |
| Fill | 11 | 11 |
| Gravel and clay | 7 | 18 |
| Gravel and sand | 13 | 31 |
| Clay and sand | 22 | 53 |
| Shale | - | - |
| **2S 11W 10-19** | | |
| Fill | 11 | 11 |
| Gravel, clay | 5 | 16 |
| Gravel and sand, clayey | 14 | 30 |
| Sand, fine | 18 | 48 |
| Clay and sand | 6 | 54 |
| Clay and boulders | 4 | 58 |
| Shale | 2 | 60 |
| **2S 11W 10-21** | | |
| Sand and gravel | 15 | 15 |
| Sand, clayey | 5 | 20 |
| Sand and clay | 25 | 45 |
| Clay, blue, and boulders | 5 | 50 |
| **2S 11W 10-23** | | |
| Topsoil | 4 | 4 |
| Gravel, boulders, and clay, dry | 11 | 15 |
| Gravel and boulders | 10 | 25 |
| Gravel, water-bearing | 15 | 40 |
| Sand | 4 | 44 |
| Gravel | 4 | 48 |
| Sand and gravel, "dirty" | 5 | 53 |
| **2S 11W 10-26** | | |
| Sand, clay | 11 | 11 |
| Gravel and sand | 14 | 25 |
| Gravel | 6 | 31 |
| Gravel and sand | 6 | 37 |
| Sand and clay | 6 | 43 |
| Sand and gravel | 10 | 53 |
| Gravel and sand | 6 | 59 |
| Sand, fine | 10 | 69 |
| Sand and clay | 6 | 75 |
| Clay and sand | 5 | 80 |
| **2S 11W 10-29** | | |
| Clay and gravel | 15 | 15 |
| Gravel, dry | 11 | 26 |
| Gravel, water-bearing | 13 | 39 |
| Clay, blue, soft | 3 | 42 |
| Sand, fine, compacted | 11 | 53 |
| **2S 11W 10-34** | | |
| Sand and gravel | 26 | 26 |
| Sand and gravel, trace of clay | 5 | 31 |
| Sand, gravelly | 10 | 41 |
| Sand, clean | 5 | 46 |
| Sand, clayey | 10 | 56 |
| Clay | 4 | 60 |
| Shale, soft | 277 | 337 |
| Limestone, sandy | 18 | 355 |
| Shale, soft | 45 | 400 |
| **2S 11W 10-38** | | |
| Clay, yellow, and boulders | 15 | 15 |
| Gravel, dry | 12 | 27 |
| Gravel and sand | 24 | 51 |
| Clay | - | - |
| **2S 11W 10-40 Alt. 763** | | |
| Sand and clay | 14 | 14 |
| Gravel, coarse | 27 | 41 |
| Sand, medium | 9 | 50 |
| **2S 11W 10-44** | | |
| Topsoil | 12 | 12 |
| Gravel, water-bearing from 18 to 30 feet | 18 | 30 |
| Clay | 2 | 32 |
| Sand, "dirty" | 8 | 40 |
| Gravel, coarse from 51 to 59 feet | 19 | 59 |
| Sand | 4 | 63 |
| Clay and sand | 4 | 67 |
| Sand, fine, packed | 7 | 74 |
| Sand, water-bearing from 79 to 84 feet | 10 | 84 |
| Sand, coarse, water-bearing | 4 | 88 |
| **2S 11W 10-45** | | |
| Muck and fill | 7 | 7 |
| Gravel and sand, yellow | 24 | 31 |
| Clay, blue | 6 | 37 |
| Sand, yellow, coarse | 4 | 41 |
| Gravel, gray, and sand | 16 | 57 |
| Clay | 2 | 59 |
| **2S 11W 10-46** | | |
| Fill | 8 | 8 |
| Sand, yellow, and gravel | 18 | 26 |
| Gravel, gray, and sand | 19 | 45 |
| Clay | 12 | 57 |
| Sand and gravel | 26 | 83 |
| Sand | 4 | 87 |
| **2S 11W 10-47** | | |
| Fill | 12 | 12 |
| Clay and gravel | 10 | 22 |
| Sand, fine, "dirty" | 12 | 34 |
| Sand, fine, clean | 18 | 52 |
| Clay, blue | 6 | 58 |
| Sand, clean | 12 | 70 |
| Sand, gravelly | 7 | 77 |
| Clay, blue, and shale | 7 | 84 |
| Sand, coarse | 1 | 85 |
| Shale, blue, hard | 5 | 90 |
| **2S 11W 10-50 Alt. 765.01** | | |
| Fill | 3 | 3 |
| Gravel, dry | 15 | 18 |
| Sand, "dirty" | 8 | 26 |
| Gravel, clean, water-bearing | 19 | 45 |
| Gravel, "dirty" | 10 | 55 |
| Clay and hardpan | 5 | 60 |
| **2S 11W 10-51** | | |
| Topsoil | 7 | 7 |
| Gravel, clean | 25 | 32 |
| Gravel, coarse | 6 | 38 |
| Clay, blue | 6 | 44 |
| Gravel, clean | 10 | 54 |

Table 2.--Selected logs of wells and test borings in the Kalamazoo area.--Continued

| | Thickness | Depth |
|---|---|---|
| **2S 11W 10-51 Continued** | | |
| Clay and gravel | 3 | 57 |
| Gravel, clean | 15 | 72 |
| Clay, blue | 2 | 74 |
| **2S 11W 10-53** | | |
| Soil | 10 | 10 |
| Sand, yellow | 4 | 14 |
| Sand, white | 4 | 18 |
| Sand and coarse gravel | 18 | 36 |
| Sand, fine and gravel | 11 | 47 |
| Sand and gravel, coarse, clayey | 21 | 68 |
| Sand, fine | 17 | 85 |
| Clay | 4 | 89 |
| **2S 11W 10-55** | | |
| Muck | 12 | 12 |
| Sand, clean | 23 | 35 |
| Gravel, clean | 5 | 40 |
| Hardpan and gravel | 2 | 42 |
| Gravel, clean | 29 | 71 |
| Clay | 7 | 78 |
| **2S 11W 10-59** | | |
| Clay, yellow | 1 | 1 |
| Sand, yellow, coarse | 5 | 6 |
| Sand, coarse, and pea gravel | 9 | 15 |
| Sand, coarse, and coarse sand | 11 | 26 |
| Sand, white, fine | 8 | 34 |
| Clay, white, sandy | 1 | 35 |
| Sand, white, fine | 2 | 37 |
| Sand, white, and blue clay | 10 | 47 |
| Clay and gravel, coarse | 8 | 55 |
| Gravel, coarse, and sand, clayey | 9 | 64 |
| Sand, white, fine | 1 | 65 |
| Sand, coarse, gravelly | 2 | 67 |
| Clay, blue, hard | 3 | 70 |
| Sand, coarse, and fine gravel | 2 | 72 |
| Clay, blue, hard | 1 | 73 |
| **2S 11W 10-62** | | |
| Soil, black | 2 | 2 |
| Gravel, clean, and sand | 44 | 46 |
| Gravel, clayey | 10 | 56 |
| Gravel, clean, coarse, and sand | 14 | 70 |
| Sand, clean, coarse, gravelly | 7 | 77 |
| Clay, blue | 1 | 78 |
| **2S 11W 10-65** | | |
| Soil, black | 2 | 2 |
| Sand and gravel | 30 | 32 |
| Sand, coarse | 21 | 53 |
| Sand, coarse, and fine gravel | 9 | 62 |
| Clay, white, hard | 6 | 68 |
| **2S 11W 10-68 Alt. 762.3** | | |
| Loam, sandy | 2 | 2 |
| Sand, yellow, fine to medium, compact, and gravel | 1 | 3 |
| Sand, yellow, medium to coarse, compact | 8 | 11 |
| Sand, gray, coarse, and fine to coarse gravel | 38 | 49 |
| Sand, gray, medium, compact, clayey | 2 | 51 |
| Sand, gray, fine to medium, compact, clayey | 3 | 54 |
| **2S 11W 10-72 Alt. 762.2** | | |
| Fill, cinders | 1 | 1 |
| Loam | 1 | 2 |
| Sand, brown, medium, gravelly, clayey | 2 | 4 |
| Sand, yellow, medium to coarse, compact, and medium gravel | 3 | 7 |
| Sand, coarse, and fine to coarse gravel | 5 | 12 |
| Sand, gray, coarse, and fine to coarse gravel | 19 | 31 |
| Sand, gray, coarse, and fine to medium gravel | 17 | 48 |
| Sand, gray, fine, clayey, gravelly | 4 | 52 |
| **2S 11W 10-74 Alt. 754.06** | | |
| Muck | 2 | 2 |
| Muck and sand | 1 | 3 |
| Sand, coarse, and shale | 3 | 6 |
| Sand, coarse and fine gravel | 10 | 16 |
| Sand, gray, medium to coarse | 2 | 18 |
| Sand, very fine, silty | 1 | 19 |
| Sand, coarse, and fine gravel | 3 | 22 |
| Gravel, medium to coarse | 3 | 25 |
| **2S 11W 10-78 Alt. 757.2** | | |
| Sand, yellow, fine, loamy | 1 | 1 |
| Sand, gray, medium and gravelly | 3 | 4 |
| Gravel, fine | 4 | 8 |
| Silt and very fine gray sand | 3 | 11 |
| Sand, gray, medium, silty | 6 | 17 |
| Sand, gray and gravel, silty | 9 | 26 |
| **2S 11W 10-80 Alt. 757.96** | | |
| Muck | 1 | 1 |
| Sand, yellow, fine to medium | 2 | 3 |
| Sand and fine gravel | 2 | 5 |
| Gravel, fine | 3 | 8 |
| Silt and sand, very fine | 3 | 11 |
| Sand and gravel | 1 | 12 |
| Gravel, fine to medium | 9 | 21 |
| Gravel and sand, silty | 7 | 28 |
| **2S 11W 11-1** | | |
| Muck and marl | 10 | 10 |
| Gravel, coarse | 32 | 42 |
| Sand and gravel, coarse | 65 | 107 |
| Gravel, sand, and silt | 16 | 123 |
| Gravel | 4 | 127 |
| Clay, blue | 26 | 153 |
| Shale | 82 | 235 |
| **2S 11W 11-4** | | |
| Topsoil, sand, and gravel | 6 | 6 |
| Muck | 2 | 8 |
| Marl and sand | 4 | 12 |
| Sand and gravel, water-bearing | 33 | 45 |
| Gravel, clean | 24 | 69 |
| Gravel, coarse, water-bearing | 14 | 83 |
| Sand, clay, and silt | 19 | 102 |
| Sand and clay | 7 | 109 |
| Sand and clay, interbedded | 6 | 115 |
| Sand and gravel, blue clay | 9 | 124 |
| **2S 11W 11-5 Alt. 806.1** | | |
| Sand, "dirty", and gravel | 10 | 10 |
| Sand, gravelly | 17 | 27 |
| Gravel, sandy | 19 | 46 |
| Sand, coarse | 3 | 49 |
| Gravel, fine and sand | 5 | 54 |
| Sand and gravel | 11 | 65 |
| Gravel, sandy | 10 | 75 |
| Sand, gravelly | 25 | 100 |
| Gravel | 1 | 101 |
| Sand, coarse | 3 | 104 |
| Sand and gravel | - | - |
| **2S 11W 11-7 Alt. 812.4** | | |
| Gravel and sand | 5 | 5 |
| Muck or peat | 4 | 9 |
| Marl | 9 | 18 |
| Gravel and sand | 64 | 82 |
| Clay, blue | 5 | 87 |
| **2S 11W 11-9 Alt. 806.43** | | |
| Muck and marl | 10 | 10 |
| Sand, fine, and gravel, water-bearing | 70 | 80 |
| Shale | 30 | 110 |
| Gravel (?) water-bearing | 4 | 114 |
| Shale | 82 | 196 |
| Sandstone (?), water-bearing | 4 | 200 |
| Shale | 3 | 203 |
| Sandstone (?), water-bearing | 15 | 218 |
| **2S 11W 11-14** | | |
| Topsoil | 1 | 1 |
| Sand and gravel | 1 | 2 |
| Sand and clay | 6 | 8 |
| Sand and gravel, clayey | 12 | 20 |
| Gravel and brown clay | 30 | 50 |
| Gravel, coarse, boulders | 9 | 59 |
| Gravel | 8 | 67 |
| Sand, gravel, and clay | 13 | 80 |
| Sand and gravel | 7 | 87 |
| Sand, fine, and clay | 24 | 111 |
| Sand | 15 | 121 |
| **2S 11W 14-12 Alt. 766** | | |
| Topsoil and muck | 26 | 26 |
| Sand and gravel | 34 | 60 |
| Gravel, clean | 13 | 73 |
| Sand, clean, and gravel | 13 | 86 |
| Gravel and sand | 6 | 92 |
| Clay | - | - |
| **2S 11W 14-19** | | |
| Fill | 10 | 10 |
| Sand, brown | 10 | 20 |
| Sand and gravel | 40 | 60 |
| Clay | 5 | 65 |
| Sand, dirty, and gravel | 8 | 73 |
| Shale, blue | 15 | 88 |
| **2S 11W 14-20** | | |
| Fill | 10 | 10 |
| Sand, yellow | 10 | 20 |
| Sand, yellow, and gravel | 40 | 60 |
| Shale (reported) | 5 | 65 |
| Sand and gravel | 19 | 84 |
| Gravel | 9 | 93 |
| **2S 11W 14-24 Alt. 766** | | |
| Topsoil | 12 | 12 |
| Gravel, water-bearing from 18 to 30 feet | 18 | 30 |
| Clay | 1 | 31 |

Table 2.--Selected logs of wells and test borings in the Kalamazoo area.--Continued

| | Thickness | Depth |
|---|---|---|
| 2S 11W 14-24 Continued | | |
| Clay and sand | 9 | 40 |
| Gravel, water-bearing | 9 | 49 |
| Sand | 11 | 60 |
| Clay and sand | 5 | 65 |
| Sand, fine to coarse, water-bearing from 74 to 79 feet | 23 | 88 |
| Shale | 4 | 92 |
| 2S 11W 14-27 | | |
| Topsoil | 20 | 20 |
| Gravel, "dirty" | 5 | 25 |
| Clay and gravel | 13 | 38 |
| Gravel, clean | 7 | 45 |
| Clay, white and sand | 33 | 78 |
| Sand, clean, water-bearing | 12 | 90 |
| Gravel, coarse | 3 | 93 |
| Clay, blue | 2 | 95 |
| 2S 11W 14-30 | | |
| Topsoil | 10 | 10 |
| Clay and sand | 20 | 30 |
| Sand, fine to coarse, yellow | 32 | 62 |
| Hardpan | 11 | 73 |
| Sand, gray, fine | 36 | 109 |
| Clay | 2 | 111 |
| 2S 11W 14-33 | | |
| Fill | 5 | 5 |
| Muck | 7 | 12 |
| Sand and gravel | 7 | 19 |
| Sand, coarse | 4 | 23 |
| Gravel and sand | 6 | 29 |
| Sand and clay, gravelly, boulders | 7 | 36 |
| Gravel and sand, clayey, boulders | 11 | 47 |
| Clay, sand, and gravel | 16 | 63 |
| Clay | 2 | 65 |
| Sand and gravel, clayey | 2 | 67 |
| Clay, gravelly | 1 | 68 |
| Sand, fine, and clay, gravelly | 6 | 74 |
| Clay, gravelly | 3 | 77 |
| Shale (?) | 8 | 85 |
| 2S 11W 14-38 Alt. 763.5 | | |
| Sand, yellow | 5 | 5 |
| Gravel, clayey | 5 | 10 |
| Sand, gray, medium, clayey | 7 | 17 |
| Gravel, clayey | 11 | 28 |
| 2S 11W 14-41 Alt. 764.7 | | |
| Fill | 4 | 4 |
| Gravel, clayey | 4 | 8 |
| Sand, gray, clayey | 5 | 13 |
| Gravel, clayey | 3 | 16 |
| Clay, blue | 2 | 18 |
| Sand, gray, clayey | 10 | 28 |
| Gravel, coarse | 5 | 33 |
| "Too coarse to penetrate" | - | - |
| 2S 11W 14-47 Alt. 761.9 | | |
| Fill, sand | 7 | 7 |
| Peat, brown | 6 | 13 |
| Gravel, fine | 4 | 17 |
| 2S 11W 14-54 Alt. 761.7 | | |
| Stone fill | 6 | 6 |
| Peat, brown | 5 | 11 |
| Gravel, fine, stony | 14 | 25 |
| Sand, fine, yellow | 3 | 28 |
| Gravel, fine, stony | 11 | 39 |
| Boulders | - | - |
| 2S 11W 14-57 Alt. 761.22 | | |
| Fill, cinders and sand | 7 | 7 |
| Sand, medium gray, gravelly | 6 | 13 |
| Sand and gravel, gray, fine to coarse | 6 | 19 |
| Sand, gray, fine to medium, interbedded sand | 4 | 23 |
| 2S 11W 14-60 Alt. 762.26 | | |
| Fill, sand, cinders, and gravel | 4 | 4 |
| Sand, yellow, medium to coarse, gravelly, clayey | 4 | 8 |
| Sand, yellow, coarse, gravelly | 5 | 13 |
| Sand, gray, medium to coarse, gravelly | 9 | 22 |
| 2S 11W 15-1 | | |
| No record | 20 | 20 |
| Gravel | 10 | 30 |
| Gravel and sand | 10 | 40 |
| Sand and clay | 7 | 47 |
| Clay | 5 | 52 |
| Sand and clay | 2 | 54 |
| Sand | 9 | 63 |
| Gravel | 19 | 82 |
| Clay | 5 | 87 |
| Clay, gravel, sand, and boulders | 58 | 145 |
| Mud | 19 | 164 |
| Boulder | - | - |
| 2S 11W 15-2 Alt. 774 | | |
| Gravel, sand, and clay | 10 | 10 |
| Gravel and sand | 6 | 16 |
| Sand and gravel | 6 | 22 |
| Sand | 8 | 30 |
| Sand, fine and blue clay | 11 | 41 |
| Gravel and sand, water-bearing | 4 | 45 |
| Gravel, water-bearing | 10 | 55 |
| Gravel, clayey | 5 | 60 |
| Gravel and sand, water-bearing | 6 | 66 |
| Clay and boulders | 7 | 73 |
| Sand, gravel, and clay | 4 | 77 |
| Sand | 13 | 90 |
| 2S 11W 15-4 Alt. 786 | | |
| Coarse gravel | 39 | 39 |
| Clay and sand | 8 | 47 |
| Clay, hard | 2 | 49 |
| Clay, gravelly | 21 | 70 |
| Sand, water-bearing | 17 | 87 |
| Shale | 2 | 89 |
| 2S 11W 15-6 Alt. 776 | | |
| Clay and boulders | 10 | 10 |
| Sand and gravel | 10 | 20 |
| Gravel, clayey | 3 | 23 |
| Gravel and sand, water-bearing | 12 | 35 |
| Sand | 10 | 45 |
| Sand, gray, and streaks of gravel | 12 | 57 |
| Clay, blue, and boulders | 19 | 76 |
| Clay, blue, sand, and boulders | 10 | 86 |
| 2S 11W 15-12 Alt. 784 | | |
| Gravel, clay, and sand | 14 | 14 |
| Sand, clay, and gravel | 6 | 20 |
| 2S 11W 15-12 Continued | | |
| Sand, gravel, and clay | 6 | 26 |
| Sand and clay | 10 | 36 |
| Sand and clay, gravelly | 6 | 42 |
| Sand and gravel | 16 | 58 |
| Clay, sand, and gravel | 14 | 72 |
| Clay, and fine sand | 4 | 76 |
| 2S 11W 15-17 Alt. 761 | | |
| Fill | 7 | 7 |
| Sand and gravel | 14 | 21 |
| Sand | 14 | 35 |
| Sand, clayey | 22 | 57 |
| Sand and gravel | 21 | 78 |
| Sand, gravel, and clay | 17 | 95 |
| Shale | 4 | 99 |
| 2S 11W 15-19 Alt. 764 | | |
| Fill and cinders | 4 | 4 |
| Topsoil, clay, and gravel | 14 | 18 |
| Clay and gravel | 7 | 25 |
| Silt, blue, fine | 7 | 32 |
| Sand, fine | 3 | 35 |
| Sand, fine, gravelly | 9 | 44 |
| Clay, sandy, and gravel | 6 | 50 |
| Gravel, water-bearing | 21 | 71 |
| Silt, fine | 3 | 74 |
| Shale | - | - |
| 2S 11W 15-22 Alt. 781 | | |
| Fill | 9 | 9 |
| Gravel, dry | 15 | 24 |
| Clay | 5 | 29 |
| Hardpan | 11 | 40 |
| Gravel and sand, red | 10 | 50 |
| Sand and clay | 2 | 52 |
| Gravel and sand | 25 | 77 |
| 2S 11W 15-25 Alt. 786 | | |
| Clay | 3 | 3 |
| Gravel, dry | 17 | 20 |
| Sand | 5 | 25 |
| Gravel | 3 | 28 |
| Sand, fine | 2 | 30 |
| Sand and gravel | 3 | 33 |
| Sand, fine | 5 | 38 |
| Clay and boulders | 6 | 44 |
| Sand | 15 | 59 |
| Sand, water-bearing | 7 | 66 |
| Clay | 1 | 67 |
| Sand | 6 | 73 |
| Sand, fine | 22 | 95 |
| Sand and gravel | 5 | 100 |
| Clay, hard, and boulders | 7 | 107 |
| 2S 11W 15-26 Alt. 781 | | |
| Sand and clay | 43 | 43 |
| Sand | 12 | 55 |
| Sand, gravel, and clay | 12 | 67 |
| Sand and clay | 20 | 87 |
| Sand and gravel | 10 | 97 |
| Sand | 11 | 108 |
| Clay | 2 | 110 |
| Sand | 2 | 112 |
| Sand, fine, and clay | 11 | 123 |
| 2S 11W 15-28 Alt. 785 | | |
| Fill | 5 | 5 |
| Clay and gravel | 3 | 8 |

Table 2.--Selected logs of wells and test borings in the Kalamazoo area.--Continued

| | Thickness | Depth |
|---|---|---|
| 2S 11W 15-28 Continued | | |
| Gravel, coarse | 4 | 12 |
| Sand | 4 | 16 |
| Gravel, coarse | 17 | 33 |
| Clay, hard | 9 | 42 |
| Sand, fine, and clay | 11 | 53 |
| Clay, hard | 4 | 57 |
| Sand, clayey | 12 | 69 |
| Sand, fine | 4 | 73 |
| Sand, water-bearing | 5 | 78 |
| Gravel, coarse | 11 | 89 |
| Gravel and clay, hard | - | - |
| 2S 11W 15-38 Alt. 756.2 | | |
| Topsoil, dark, loamy | 2 | 2 |
| Sand, peaty, woody, stony with shells and marl | 5 | 7 |
| Sand, gray, gravelly with marl and shells | 4 | 11 |
| Gravel and yellow sand with marl and shells | 1 | 12 |
| Sand, yellow, stony, clay in suspension | 4 | 16 |
| Sand, fine to medium yellow, with clay in suspension, stony | 8 | 24 |
| Sand, yellow, fine to medium | 14 | 38 |
| Compact, fine gravel | 1 | 39 |
| "Stone could not pass" | - | - |
| 2S 11W 15-41 Alt. 765.50 | | |
| Fill, cinders, sand and wood | 11 | 11 |
| Sand, gray, fine to coarse, gravelly, seams of peat | 7 | 18 |
| Sand and gravel, yellow, fine to coarse | 5 | 23 |
| Sand, gray, extremely fine grain | 9 | 32 |
| 2S 11W 15-46 Alt. 763.39 | | |
| Fill, sand and cinders | 8 | 8 |
| Gravel and sand, yellow, fine to coarse, clayey | 12 | 20 |
| Sand, gray, fine, gravelly, clayey | 5 | 25 |
| 2S 11W 16-3 Alt. 845.6 | | |
| Clay, gritty, and gravel | 29 | 29 |
| Sand and gravel, clayey | 13 | 42 |
| Sand, yellow, and gravel | 11 | 53 |
| Gravel, coarse | 4 | 57 |
| Gravel, medium, and sand | 13 | 70 |
| Sand, medium | 7 | 77 |
| Sand, medium, and gravel | 5 | 82 |
| Gravel and sand | 8 | 90 |
| Clay, hard, gritty | 10 | 100 |
| Gravel, muddy | 1 | 101 |
| Clay, hard, gritty | 36 | 137 |
| Sand and gravel | 12 | 149 |
| Clay, hard, gritty | 11 | 160 |
| 2S 11W 18-1 | | |
| Sand and gravel, interbedded | 55 | 55 |
| Clay | 8 | 63 |
| Gravel | 17 | 80 |
| Clay | 1 | 81 |
| Sand, gravel, and clay | 25 | 106 |
| Clay | 30 | 136 |
| Sand, gravel, and clay | 25 | 161 |
| Sand | 21 | 182 |
| 2S 11W 18-2 | | |
| Sand and gravel | 6 | 6 |
| Sand, coarse | 6 | 12 |
| Sand and gravel | 6 | 18 |
| Sand | 5 | 23 |
| Sand and gravel | 6 | 29 |
| Sand and clay | 5 | 34 |
| Sand, clayey | 22 | 56 |
| Sand | 5 | 61 |
| Sand and gravel | 11 | 72 |
| Sand | 11 | 83 |
| Sand, coarse | 7 | 90 |
| Sand | 6 | 96 |
| Sand and gravel | 5 | 101 |
| Clay, sand, and gravel | 13 | 114 |
| Sand, clay, and boulders | 5 | 119 |
| Clay, sand, and stones | 17 | 136 |
| Sand, gravel, and clay | 5 | 141 |
| Gravel and sand, clayey | 5 | 146 |
| Sand, gravel, and clay | 2 | 148 |
| Clay, boulders, and sand | 12 | 160 |
| 2S 11W 20-1 | | |
| Topsoil | 3 | 3 |
| Sand and yellow clay | 2 | 5 |
| Sand and gravel | 23 | 28 |
| Sand and clay hardpan | 15 | 43 |
| Sand and clay | 14 | 57 |
| Sand, gravel, and boulder-clay hardpan | 4 | 61 |
| Sand, gravel, and brown clay | 18 | 79 |
| Sand and gravel | 6 | 85 |
| Hardpan | 6 | 91 |
| Gravel | 25 | 116 |
| Gravel and reddish clay hardpan | 4 | 120 |
| Sand, fine, and clay | 10 | 130 |
| Sand, silt, and clay | 8 | 138 |
| Clay, silt, and sand | 9 | 147 |
| Clay, silt | 26 | 173 |
| Clay | 8 | 181 |
| 2S 11W 20-5 | | |
| Topsoil | 2 | 2 |
| Sand | 1 | 3 |
| Sand and gravel, clayey | 6 | 9 |
| Sand and gravel | 1 | 10 |
| Clay, sand, and gravel | 6 | 16 |
| Clay, sandy | 9 | 25 |
| Sand, coarse | 5 | 30 |
| Sand and gravel | 8 | 38 |
| Clay, gravelly | 51 | 89 |
| Sand, medium to coarse | 9 | 98 |
| Clay, sandy | 14 | 112 |
| Gravel, fine | 8 | 120 |
| Sand, medium | 5 | 125 |
| Sand and gravel | 6 | 131 |
| Clay, gravelly | 5 | 136 |
| Sand, fine | 4 | 140 |
| Sand and gravel, clayey | 5 | 145 |
| Clay, gravelly and sandy | 16 | 161 |
| Sandstone | 1 | 162 |
| 2S 11W 20-8 Alt. 836 | | |
| Fill and topsoil | 4 | 4 |
| Sand and gravel | 16 | 20 |
| Sand, medium to coarse | 20 | 40 |
| Sand, coarse, and gravel | 9 | 49 |
| Sand, medium | 8 | 57 |
| Gravel, sand, and clay | 2 | 59 |
| Sand, medium, gravelly | 6 | 65 |
| Sand, medium to coarse, clayey | 7 | 72 |
| 2S 11W 20-8 Continued | | |
| Gravel and clay | 8 | 80 |
| Clay, gray | 10 | 90 |
| Gravel and clay | 8 | 98 |
| Clay, gray, hardpan | 1 | 99 |
| Clay, fine gravel, and sand | 14 | 113 |
| Clay, blue-gray | 3 | 116 |
| Sand, fine to coarse | 35 | 151 |
| Sand, fine to coarse, gravelly | 13 | 164 |
| Clay, sandy, pebbly | 7 | 171 |
| Sand and clay | 8 | 179 |
| Clay, gray, and gravel | 7 | 186 |
| Clay, blue, and sand | 7 | 193 |
| Clay, blue-gray | 5 | 198 |
| Sand and clay, pieces of "lignite" | 9 | 207 |
| Clay and gravel | 8 | 215 |
| Shale, gravel, and clay | 32 | 247 |
| 2S 11W 20-10 | | |
| Topsoil | 5 | 5 |
| Sand | 10 | 15 |
| Gravel | 5 | 20 |
| Clay, blue, and sand | 50 | 70 |
| Sand, gravel, and clay, dirty | 10 | 80 |
| Sand, clean | 5 | 85 |
| Sand, fine, "dirty" | 30 | 115 |
| Sand | 15 | 130 |
| Sand, coarse, gravelly | 11 | 141 |
| 2S 11W 21-1 Alt. 836 | | |
| Muck, sand, and gravel | 45 | 45 |
| Clay, brown | 35 | 80 |
| Sand, water-bearing | 45 | 125 |
| Gravel, fine | 80 | 205 |
| Clay, blue | 13 | 218 |
| 2S 11W 21-3 | | |
| Fill, topsoil, and sand | 4 | 4 |
| Clay, gravelly and sandy | 12 | 16 |
| Clay, hard, sandy, and boulders | 11 | 27 |
| Sand and gravel | 12 | 39 |
| Clay, gravelly and sandy | 27 | 66 |
| Sand, medium to coarse | 14 | 80 |
| Sand and gravel | 3 | 83 |
| Sand, fine to coarse | 12 | 95 |
| Sand, fine, clayey | 10 | 105 |
| Clay, sandy | 31 | 136 |
| Sand, fine | 28 | 164 |
| Sand, clayey | 16 | 180 |
| 2S 11W 21-4 | | |
| Topsoil | 2 | 2 |
| Clay, sandy, gravel and boulders | 25 | 27 |
| Sand and gravel | 12 | 39 |
| Clay and gravel | 27 | 66 |
| Sand, fine, and clay | 9 | 75 |
| Sand, medium, water-bearing | 15 | 90 |
| 2S 11W 21-5 | | |
| Sand and gravel | 20 | 20 |
| Clay and sand | 5 | 25 |
| Clay | 12 | 37 |
| Clay and sand | 18 | 55 |
| Clay and gravel | 1 | 56 |
| Sand and gravel | 1 | 57 |
| Clay and gravel | 3 | 60 |
| Sand | 6 | 66 |
| Sand and clay | 4 | 70 |

Table 2.--Selected logs of wells and test borings in the Kalamazoo area.--Continued

| | Thick-ness | Depth |
|---|---|---|
| 2S 11W 21-5 Continued | | |
| Sand | 10 | 80 |
| Sand and gravel | 25 | 105 |
| Gravel | 1 | 106 |
| Sand and clay | 24 | 130 |
| 2S 11W 22-5 Alt. 764.6 | | |
| Sand and clay, gravelly | 16 | 16 |
| Clay and sand | 5 | 21 |
| Sand, fine, gravelly | 6 | 27 |
| Sand, coarse to fine | 6 | 33 |
| Gravel and sand | 5 | 38 |
| Sand, medium to fine, gravelly | 16 | 54 |
| Gravel and sand, clayey | 6 | 60 |
| Gravel, fine, sandy | 5 | 65 |
| Sand and fine gravel | 9 | 74 |
| Sand and gravel, clayey | 4 | 78 |
| Sand and fine gravel | 7 | 85 |
| Sand, coarse to medium | 6 | 91 |
| Sand, coarse, and gravel | 6 | 97 |
| Gravel and sand | 13 | 110 |
| Gravel, silty | 6 | 116 |
| Sand, gravelly | 14 | 130 |
| Sand, gravelly, clayey | 6 | 136 |
| Shale | 17 | 153 |
| 2S 11W 22-17 | | |
| Sand and gravel, clayey | 23 | 23 |
| Sand, fine, gravelly | 6 | 29 |
| Gravel, fine and coarse sand | 5 | 34 |
| Sand, coarse, and gravel | 5 | 39 |
| Gravel and coarse sand | 11 | 50 |
| Sand, coarse | 5 | 55 |
| Gravel and sand | 5 | 60 |
| Gravel, sandy, and clayey | 10 | 70 |
| Sand and fine gravel | 5 | 75 |
| Sand and gravel, clayey | 5 | 80 |
| Sand and gravel | 10 | 90 |
| Gravel, fine, and coarse sand | 5 | 95 |
| Gravel, fine sand, and silt | 20 | 115 |
| Gravel, fine, and sand | 6 | 121 |
| Gravel, sandy, silty | 7 | 128 |
| Gravel | 6 | 134 |
| Gravel, sandy | 7 | 141 |
| Gravel and clay | 5 | 146 |
| Sand, medium to coarse | 5 | 151 |
| Sand, fine to medium, clayey, iron-stained | 2 | 153 |
| Gravel, sandy and clayey | 6 | 159 |
| Sand, fine, clayey, iron-stained | 2 | 161 |
| Clay, gray | 4 | 165 |
| Shale and gravelly clay | 2 | 167 |
| 2S 11W 22-22 Alt. 762.8 | | |
| Muck | 22 | 22 |
| Marl | 2 | 24 |
| Gravel, yellow | 4 | 28 |
| Sand, yellow | 37 | 65 |
| Gravel, yellow | 20 | 85 |
| Sand, gray | 5 | 90 |
| Sand, gray, and gravel | 6 | 96 |
| Gravel | 11 | 107 |
| Sand | 20 | 127 |
| Gravel | 26 | 153 |
| 2S 11W 22-27 | | |
| No record | 30 | 30 |
| Gravel, sandy | 15 | 45 |
| Sand, medium to coarse | 10 | 55 |
| Gravel, sandy, thin layer of fine sandy clay at 65 feet | 10 | 65 |
| 2S 11W 22-27 Continued | | |
| Sand, coarse, and fine gravel | 15 | 80 |
| Sand, fine to medium | 7 | 87 |
| Sand, coarse, and fine gravel | 9 | 96 |
| 2S 11W 22-30 Alt. 757.7 | | |
| Peat | 26 | 26 |
| Gravel and sand | 10 | 36 |
| Sand, coarse | 12 | 48 |
| Gravel | 14 | 62 |
| Sand, coarse | 26 | 88 |
| Gravel | 10 | 98 |
| Clay | 5 | 103 |
| Gravel, large | 20 | 123 |
| Gravel | - | - |
| 2S 11W 22-32 Alt. 765.1 | | |
| Fill | 4 | 4 |
| Muck | 3 | 7 |
| Silt, sand, and fine gravel | 25 | 32 |
| Sand, clean | 6 | 38 |
| Sand, gravel, and silt | 8 | 46 |
| Gravel, sandy | 11 | 57 |
| Gravel, fine to coarse, and sand | 16 | 73 |
| Sand, clean | 24 | 97 |
| Sand, silty | 7 | 104 |
| Sand, gravelly, silty | 9 | 113 |
| Sand, fine to coarse, and fine gravel | 11 | 124 |
| Gravel, fine, and sand | 9 | 133 |
| Gravel and sand, silty | 6 | 139 |
| Gravel, silty | 3 | 142 |
| Sand, fine to coarse, gravelly | 2 | 144 |
| Gravel, sand, and silt hardpan | 2 | 146 |
| Sand and gravel, silty | 13 | 159 |
| Sand, fine, silty, gravelly, very hard | 12 | 171 |
| Clay, blue | 1 | 172 |
| 2S 11W 22-42 Alt. 766.3 | | |
| Muck | 10 | 10 |
| Sand, fine to coarse, and gravel, silty | 4 | 14 |
| Sand, fine to medium, iron-stained from 8 to 22 feet, gravelly | 20 | 34 |
| Sand and gravel, clayey | 10 | 44 |
| Sand, medium to coarse, iron-stained from 66 to 76 feet, gravel layers, interbedded | 38 | 82 |
| Sand, coarse | 6 | 88 |
| Sand, medium to coarse, gravel layers, interbedded | 23 | 111 |
| Sand, medium to coarse | 5 | 116 |
| Gravel and coarse sand | 12 | 128 |
| Sand, gravelly | 11 | 139 |
| Sand, coarse to medium, and fine gravel | 16 | 155 |
| Sand, fine to coarse, silty and clayey from 161 to 167 feet | 12 | 167 |
| Sand, fine to medium, and gravel | 4 | 171 |
| Shale (?) | 1 | 172 |
| 2S 11W 22-57 Alt. 761.3 | | |
| Muck, marl, and gravel | 20 | 20 |
| 2S 11W 22-57 Continued | | |
| Sand and gravel | 35 | 55 |
| Gravel, brown | 10 | 65 |
| Gravel and sand | 10 | 75 |
| Gravel | 15 | 90 |
| Gravel, silt and boulders | 5 | 95 |
| Silt | 20 | 115 |
| Sand, fine, clay layer at 133 feet | 18 | 133 |
| Gravel | 2 | 135 |
| Sand, fine | 5 | 140 |
| Silt, sand, and gravel | 5 | 145 |
| Sand, gravel, and clay layers, interbedded | 39 | 184 |
| Shale (?), blue, gravelly | 8 | 192 |
| 2S 11W 22-70 Alt. 761.15 | | |
| Muck | 1 | 1 |
| Sand, coarse, and gravel | 19 | 20 |
| Sand, coarse | 5 | 25 |
| Sand, coarse, and gravel | 14 | 39 |
| Gravel and medium to coarse sand | 44 | 83 |
| Sand, coarse | 33 | 116 |
| Gravel and coarse sand | 3 | 119 |
| Sand and layers of gravel, interbedded | 59 | 178 |
| Shale (?) | 4 | 182 |
| 2S 11W 22-82 Alt. 759.7 | | |
| Soil, sandy, clayey | 4 | 4 |
| Sand, medium, and gravel | 6 | 10 |
| Sand, medium to coarse | 14 | 24 |
| Gravel and coarse sand | 9 | 33 |
| Sand, coarse, gravelly | 10 | 43 |
| Gravel, fine, and sand | 37 | 80 |
| Sand, coarse | 12 | 92 |
| Sand, gravelly | 8 | 100 |
| Sand, medium to coarse | 22 | 122 |
| Gravel, fine, and coarse sand | 3 | 125 |
| Sand, fine to coarse, gravel layers, interbedded | 22 | 147 |
| Gravel | 8 | 155 |
| Gravel and fine to coarse sand layers, interbedded | 14 | 169 |
| Sand, fine to coarse, and gravel layers, interbedded | 9 | 178 |
| Gravel, sandy | 2 | 180 |
| Sand, fine to coarse, and fine gravel | 2 | 182 |
| Shale, gray | 6 | 188 |
| 2S 11W 22-94 Alt. 770.7 | | |
| Topsoil and sand | 3 | 3 |
| Sand and gravel | 15 | 18 |
| Clay | 1 | 19 |
| Sand and gravel | 19 | 38 |
| Sand, coarse, gravelly | 70 | 108 |
| Gravel, sandy | 20 | 128 |
| Sand, coarse | 15 | 143 |
| Sand, medium | 44 | 187 |
| Sand, gravelly | 18 | 205 |
| Sand, medium | 6 | 211 |
| Clay | 2 | 213 |
| 2S 11W 22-97 Alt. 761.3 | | |
| Muck, sand, and gravel | 9 | 9 |
| Sand and fine gravel | 8 | 17 |
| Sand, fine, and clay | 2 | 19 |
| Sand and soft clay | 2 | 21 |
| Sand, clay, and gravel | 6 | 27 |
| Sand and silt | 7 | 34 |
| Sand, medium, clean | 5 | 39 |
| Sand and fine gravel | 9 | 48 |

Table 2.--Selected logs of wells and test borings in the Kalamazoo area.--Continued

| | Thickness | Depth |
|---|---|---|
| **2S 11W 22-97 Continued** | | |
| Gravel, fine | 6 | 54 |
| Sand and fine to coarse gravel | 6 | 60 |
| Gravel | 8 | 68 |
| Sand | 4 | 72 |
| Sand and silt | 2 | 74 |
| Sand, medium, water-bearing | 4 | 78 |
| Sand and gravel, water-bearing | 4 | 82 |
| Shale | 68 | 150 |
| **2S 11W 22-100 Alt. 759** | | |
| Silt, sand, and blue clay | 18 | 18 |
| Sand, fine, and silt, clayey | 2 | 20 |
| Gravel, silt, and sand | 15 | 35 |
| Sand, fine to coarse, and gravel | 15 | 50 |
| Gravel, coarse sand, and clay | 10 | 60 |
| Sand, medium to coarse, gravel and clay | 10 | 70 |
| Sand, medium | 22 | 92 |
| Sand, fine to coarse | 11 | 103 |
| Sand, fine to coarse, gravelly | 20 | 123 |
| Sand, fine to coarse | 28 | 151 |
| Shale | - | - |
| **2S 11W 22-101 Alt. 770** | | |
| Fill | 17 | 17 |
| Gravel, sand, clay | 8 | 25 |
| Sand, fine, water-bearing | 10 | 35 |
| Gravel and sand, water-bearing | 5 | 40 |
| Sand and gravel, water-bearing | 10 | 50 |
| Gravel and sand, water-bearing | 10 | 60 |
| Sand and gravel, water-bearing | 10 | 70 |
| Sand, coarse, water-bearing | 5 | 75 |
| Sand, fine from 80 to 84 feet | 9 | 84 |
| Clay, blue, and gravel | 11 | 95 |
| **2S 11W 22-106 Alt. 786** | | |
| Fill, cinder | 1 | 1 |
| Clay and gravel | 5 | 6 |
| Gravel, sandy | 15 | 21 |
| Clay, sand, and fine gravel | 3 | 24 |
| Clay, soft, loose, gravelly | 3 | 27 |
| Clay, soft, "sticky", and gravel | 1 | 28 |
| Gravel, fine | 2 | 30 |
| Clay, hard | 1 | 31 |
| **2S 11W 22-108 Alt. 790** | | |
| Sand | 26 | 26 |
| Sand, coarse, and gravel | 5 | 31 |
| Gravel and coarse sand | 5 | 36 |
| Gravel and clay | 5 | 41 |
| Sand and fine gravel | 6 | 47 |
| Gravel, clay, and sand, interbedded | 15 | 62 |
| Gravel | 5 | 67 |
| Sand, coarse | 5 | 72 |
| Sand, coarse, and gravel | 5 | 77 |
| Sand, fine to coarse | 29 | 106 |
| Sand, gravel, and clay | 9 | 115 |
| Sand, fine, and clay | 9 | 124 |
| Sand, coarse | 5 | 129 |
| **2S 11W 22-108 Continued** | | |
| Sand, coarse, gravel, and clay | 4 | 133 |
| Shale (?) | 4 | 137 |
| **2S 11W 22-111 Alt. 786.3** | | |
| Basement | 10 | 10 |
| Gravel | 18 | 28 |
| Gravel, fine, and sand | 15 | 43 |
| Clay, hard | 4 | 47 |
| Clay, silt, and sand | 6 | 53 |
| Sand | 2 | 55 |
| Gravel, fine, and sand | 2 | 57 |
| Clay, hard | 1 | 58 |
| Sand, fine, and clay | 8 | 66 |
| Sand, water-bearing | 5 | 71 |
| Sand, gravelly | 2 | 73 |
| Gravel | 18 | 91 |
| Clay, hard | - | - |
| **2S 11W 22-113 Alt. 760.7** | | |
| Fill, brown, medium sand, clayey | 5 | 5 |
| Fill, foundry sand | 1 | 6 |
| Fill, brown, medium, sand, clayey and gravelly | 3 | 9 |
| Peat, black, soft, and cinders | 4 | 13 |
| Peat, black, soft, "some light spongy material" | 8 | 21 |
| Silt, gray, soft | 12 | 33 |
| Sand, gray, medium | 11 | 44 |
| Sand, gray, medium, silty | 3 | 47 |
| Sand, gray, coarse, and gravel, silty | 6 | 53 |
| Sand, "failed to recover sample" | 2 | 55 |
| Sand, coarse, and gravel, medium, varicolored sand | 10 | 65 |
| **2S 11W 22-116** | | |
| Fill, sand, gravel and cinders | 12 | 12 |
| Peat, black | 6 | 18 |
| Silt, gray, soft | 2 | 20 |
| Sand, gray, loose, medium | 3 | 23 |
| Peat, black | 1 | 24 |
| Silt, gray, soft, gravelly | 1 | 25 |
| Sand, gray, fine to medium | 15 | 40 |
| Sand, gray, compact, medium,and gravel, clayey | 3 | 43 |
| Sand, yellow to gray, coarse,and gravel | 9 | 52 |
| **2S 11W 22-121** | | |
| Fill, sand, gravel, and miscellaneous | 13 | 13 |
| Sand, gray, fine to medium, silty | 5 | 18 |
| Sand, gray, medium, and gravel | 4 | 22 |
| Sand, gray, coarse, and gravelly | 5 | 27 |
| Sand, gray, medium | 5 | 32 |
| Sand, gray, coarse | 1 | 33 |
| Sand, gray, fine, compact | 2 | 35 |
| Sand, gray, coarse, gravelly | 2 | 37 |
| Sand, gray, medium | 5 | 42 |
| Sand, gray, fine to medium, compact, gravelly | 8 | 50 |
| **2S 11W 22-129** | | |
| Fill, cinders, sand, brick and gravel | 9 | 9 |
| Peat, black, soft | 4 | 13 |
| Sand, gray, medium | 3 | 16 |
| Sand, yellow, coarse, and gravel | 15 | 31 |
| Sand, gray, compact, medium | 7 | 38 |
| Sand, compact, fine, gray, clayey | 4 | 42 |
| Sand, gray, compact, medium | 8 | 50 |
| **2S 11W 22-133** | | |
| Asphalt and gravel | 1 | 1 |
| Fill, compact, medium yellow sand, gravelly | 3 | 4 |
| Fill, yellow, medium sand, and trace of clay and gravel | 3 | 7 |
| Fill, compact medium yellow sand, trace of clay and gravel | 5 | 12 |
| Fill, foundry sand, some clay, medium yellow sand, and fine gravel, silty | 5 | 17 |
| Peat, black, soft | 10 | 27 |
| Sand, gray, medium, silty | 2 | 29 |
| Peat, black | 1 | 30 |
| Sand, gray, coarse, and gravel | 4 | 34 |
| Sand, gray, compact, medium, and coarse gravel | 6 | 40 |
| **2S 11W 22-136** | | |
| Fill, coarse sand, and gravel, and cinders | 10 | 10 |
| Peat, black, soft, some cinders | 1 | 11 |
| Sand, gray, coarse, and gravel | 6 | 17 |
| Sand, gray, fine, clayey | 5 | 22 |
| Sand, gray, medium | 8 | 30 |
| **2S 11W 22-137 Alt. 759.5** | | |
| Fill, sand, gravel, and miscellaneous | 8 | 8 |
| Peat, black, soft, silty, few sand partings | 34 | 42 |
| Marl, gray, soft, gray, very gritty | 5 | 47 |
| Sand, gray, medium to coarse, gravelly, silty and decayed wood | 12 | 59 |
| Sand, coarse, medium to gravelly | 8 | 67 |
| Sand and gravel, yellow, coarse to medium | 28 | 95 |
| **2S 11W 22-138 Alt. 761.7** | | |
| Fill, sand, gravel, cinders, miscellaneous | 7 | 7 |
| Peat, black, soft, sandy | 25 | 32 |
| Sand, gray, medium to coarse, silty | 4 | 36 |
| Sand, yellow, medium to coarse, gravelly, silty | 3 | 39 |
| **2S 11W 22-139 Alt. 770.62** | | |
| Fill, cinders, sand, concrete and miscellaneous | 17 | 17 |
| Peat, black, soft, some shells | 3 | 20 |

Table 2.--Selected logs of wells and test borings in the Kalamazoo area.--Continued

| | Thickness | Depth |
|---|---|---|
| **2S 11W 22-139 Continued** | | |
| Sand, gray, coarse and fine gravel, few boulders | 11 | 31 |
| Sand, gray, extremely fine, gravelly | 8 | 39 |
| Gravel, fine, and coarse gray sand | 8 | 47 |
| **2S 11W 22-142 Alt. 762.8** | | |
| Peat, black, soft | 10 | 10 |
| Marl, white, very soft, peaty | 11 | 21 |
| Peat, black, soft | 9 | 30 |
| Sand, gray, coarse, and fine to medium gravel | 13 | 43 |
| Record illegible | 2 | 45 |
| **2S 11W 22-144** | | |
| Peat, black, soft | 10 | 10 |
| Marl, white, very soft, peaty | 13 | 23 |
| Peat, black, soft | 8 | 31 |
| Gravel, fine to medium, and coarse sand | 13 | 44 |
| Sand, gray, fine, gravelly | 3 | 47 |
| Gravel, fine to medium, and coarse gray sand | 2 | 49 |
| Sand, yellow, gravelly, medium to coarse | 6 | 55 |
| Sand, gray, very fine, gravelly, "bulls liver" | 2 | 57 |
| Sand, yellow, gravelly, medium to coarse | 17 | 74 |
| **2S 11W 23-7 Alt. 774** | | |
| Fill | 10 | 10 |
| Clay and sand, dry | 8 | 18 |
| Clay and gravel | 5 | 23 |
| Gravel | 25 | 48 |
| **2S 11W 23-11 Alt. 764** | | |
| Fill and fine sand | 21 | 21 |
| Sand, water-bearing | 13 | 34 |
| Sand, coarse | 13 | 47 |
| Hardpan | 23 | 70 |
| Shale | - | - |
| **2S 11W 23-12 Alt. 761** | | |
| No record | 6 | 6 |
| Sand and gray clay | 20 | 26 |
| Clay, gray, sandy, gravelly | 9 | 35 |
| Clay, gray, coarse sand, and fine gravel | 10 | 45 |
| Clay, gray, sandy | 22 | 67 |
| **2S 11W 23-13 Alt. 761** | | |
| Gravel and sand, silty | 8 | 8 |
| Sand, fine | 19 | 27 |
| Gravel and coarse sand | 20 | 47 |
| Sand, gravel, and clay | 8 | 55 |
| Clay, blue, sandy | 10 | 65 |
| Shale (?), blue, sandy, gravelly | 61 | 126 |
| **2S 11W 23-14 Alt. 770** | | |
| Sand, gravel, and clay | 28 | 28 |
| Clay, blue | 2 | 30 |
| Sand, fine | 10 | 40 |
| Sand and gravel | 10 | 50 |
| Sand | 5 | 55 |
| Sand, fine | 5 | 60 |
| Gravel and sand | 10 | 70 |
| **2S 11W 23-16** | | |
| Cinders | 5 | 5 |
| Clay | 15 | 20 |
| **2S 11W 23-16 Continued** | | |
| Gravel and sand | 25 | 45 |
| Sand, fine | 27 | 72 |
| Gravel, water-bearing | 12 | 84 |
| Sand, very fine | 3 | 87 |
| **2S 11W 23-17 Alt. 765** | | |
| Clay | 6 | 6 |
| Sand, gravel, and clay | 7 | 13 |
| Sand and gravel | 17 | 30 |
| Clay, sand, and gravel | 3 | 33 |
| Sand and gravel | 7 | 40 |
| Sand and gravel, clayey | 5 | 45 |
| Sand and clay | 2 | 47 |
| Clay and boulders | 4 | 51 |
| Sand, gravel, and clay | 2 | 53 |
| Clay and boulders | 7 | 60 |
| Shale, blue | 14 | 74 |
| Shale | 1 | 75 |
| **2S 11W 23-19** | | |
| Fill | 11 | 11 |
| Sand | 4 | 15 |
| Sand and gravel | 1 | 16 |
| Sand | 3 | 19 |
| Gravel | 31 | 50 |
| Shale | 1 | 51 |
| **2S 11W 23-21** | | |
| Fill | 2 | 2 |
| Sand and gravel, clayey | 16 | 18 |
| Gravel | 11 | 29 |
| Clay | 11 | 40 |
| **2S 11W 23-23 Alt. 758.8** | | |
| Sand, yellow | 8 | 8 |
| Gravel, coarse | 1 | 9 |
| Sand, gray, and gravel | 4 | 13 |
| Gravel, coarse | 7 | 20 |
| **2S 11W 23-26 Alt. 761.4** | | |
| Sand, black | 4 | 4 |
| Sand, yellow | 3 | 7 |
| Sand, yellow | 4 | 11 |
| Gravel | 3 | 14 |
| Sand, gray | 1 | 15 |
| Gravel, hard, coarse | 9 | 24 |
| **2S 11W 23-27 Alt. 766.12** | | |
| Fill, cinders, sand and gravel | 4 | 4 |
| Sand, yellow, medium | 9 | 13 |
| Sand and gravel, yellow, fine to coarse | 4 | 17 |
| **2S 11W 23-29** | | |
| Concrete | 1 | 1 |
| Fill, cinders, sand, concrete and miscellaneous | 6 | 7 |
| Sand, yellow, medium, gravelly and silt | 1 | 8 |
| Silt, soft, very sandy, vari-colored | 4 | 12 |
| Silt, black, soft, sandy, peaty | 2 | 14 |
| Silt, gray, medium to coarse, gravelly | 9 | 23 |
| Clay, blue, sandy, medium, gravelly | 2 | 25 |
| Sand, gray, medium to coarse, and gravel | 2 | 27 |
| Clay, blue, medium, sandy, some gravel, seams of sand | 7 | 34 |
| Sand and gravel, coarse, gray | 3 | 37 |
| **2S 11W 23-32 Alt. 793.6** | | |
| Fill, yellow sand, peaty and cinders | 12 | 12 |
| Sand, yellow, medium to coarse, gravelly | 2 | 14 |
| Sand, yellow, fine, clayey | 5 | 19 |
| Sand, gray, fine to very fine | 8 | 27 |
| Sand, gray, coarse, and gravel, interbedded clayey sand | 4 | 31 |
| **2S 11W 24-1** | | |
| Fill | 15 | 15 |
| Gravel | 5 | 20 |
| Sand, fine, "dirty" | 8 | 28 |
| Gravel | 10 | 38 |
| Hardpan | 2 | 40 |
| **2S 11W 24-2** | | |
| Fill, cinders | 2 | 2 |
| Sand and gravel, clayey | 28 | 30 |
| Gravel, water-bearing | 6 | 36 |
| Clay | 24 | 60 |
| **2S 11W 24-3** | | |
| Sand and gravel, clayey | 18 | 18 |
| Gravel | 18 | 36 |
| Clay and gravel | 2 | 38 |
| Shale | - | - |
| **2S 11W 24-8 Alt. 768** | | |
| Sand, fine to medium, and gravel | 16 | 16 |
| Gravel, fine, and coarse sand | 32 | 48 |
| Sand, fine to coarse layers | 28 | 76 |
| Sand, medium, and gravel | 8 | 84 |
| Clay, gray, and gravel | 3 | 87 |
| Sand and fine gravel | 7 | 94 |
| Sand, gravelly | 6 | 100 |
| Sand, fine to medium | 12 | 112 |
| Sand, coarse, and gravel | 9 | 121 |
| Gravel and sand | 11 | 132 |
| **2S 11W 24-9 Alt. 768** | | |
| Sand, fine, and silt | 24 | 24 |
| Sand, fine to coarse, and fine gravel | 27 | 51 |
| Sand, fine | 8 | 59 |
| Sand, medium to coarse, and gravel | 8 | 67 |
| Gravel, fine and coarse sand | 8 | 75 |
| Sand, coarse, and gravel | 5 | 80 |
| Gravel and medium to coarse sand | 6 | 86 |
| Sand, medium to coarse, and fine gravel | 10 | 96 |
| Shale | 2 | 98 |
| **2S 11W 24-11 Alt. 764.1** | | |
| Fill, clay, and sand | 15 | 15 |
| Sand, coarse | 5 | 20 |
| Gravel, sand, and clay | 5 | 25 |
| Gravel, fine, and sand | 5 | 30 |
| Gravel and clay | 5 | 35 |
| Gravel | 5 | 40 |
| Sand and gravel | 5 | 45 |
| Sand, clayey, heaved | 5 | 50 |
| Sand and clay layers | 5 | 55 |
| Sand, clayey | 5 | 60 |
| Sand and fine gravel | 5 | 65 |
| Sand, boulders, and clay | 5 | 70 |
| Gravel and sand, clayey | 5 | 75 |
| Sand, coarse, clayey | 6 | 81 |
| Shale | 3 | 84 |

Table 2.--Selected logs of wells and test borings in the Kalamazoo area.--Continued

| | Thickness | Depth |
|---|---|---|
| **2S 11W 24-12 Alt. 772.6** | | |
| Sand, gravel, and clay | 20 | 20 |
| Sand | 5 | 25 |
| Sand and gravel | 5 | 30 |
| Gravel and sand | 5 | 35 |
| Sand and gravel | 10 | 45 |
| Sand | 10 | 55 |
| Sand and gravel | 5 | 60 |
| Gravel | 20 | 80 |
| Sand, coarse | 10 | 90 |
| Clay, blue | 2 | 92 |
| **2S 11W 24-26** | | |
| Fill | 22 | 22 |
| Muck | 5 | 27 |
| Sand and gravel | 8 | 35 |
| Clay | 6 | 41 |
| Sand, fine to coarse | 9 | 50 |
| Sand and fine gravel | 10 | 60 |
| Sand | 3 | 63 |
| Sand and fine gravel | 3 | 66 |
| Sand, fine to coarse | 23 | 89 |
| **2S 11W 24-28** | | |
| Fill and sand | 15 | 15 |
| Sand and fine gravel | 8 | 23 |
| Gravel, fine and sand | 16 | 39 |
| Sand and clay | 5 | 44 |
| Sand, fine | 12 | 56 |
| Sand, water-bearing | 6 | 62 |
| Sand, coarse, gravelly | 5 | 67 |
| Sand and gravel | 5 | 72 |
| Shale | 5 | 77 |
| **2S 11W 24-32 Alt. 770.3** | | |
| Fill, cinders, sand, miscellaneous | 8 | 8 |
| Sand, yellow, medium, and small gravel | 4 | 12 |
| Sand, yellow, coarse, and small gravel | 8 | 20 |
| Sand, yellow, coarse, and fine to medium gravel | 2 | 22 |
| Sand, gray, medium | 9 | 31 |
| Sand, gray, fine | 6 | 37 |
| Sand, coarse, and fine to coarse gravel | 5 | 42 |
| Sand, gray, coarse, and fine to coarse gravel | 6 | 48 |
| Sand, gray, coarse, and fine to medium gravel | 2 | 50 |
| **2S 11W 24-35** | | |
| Fill, cinders, and sand | 6 | 6 |
| Sand, dark, fine, silty, peaty and cinders, fill | 2 | 8 |
| Sand, yellow, medium to coarse, gravelly | 3 | 11 |
| Sand, yellow, and gravel, silty | 11 | 22 |
| Sand, yellow, fine, gravelly | 4 | 26 |
| Sand, gray, very fine, clayey | 1 | 27 |
| Sand, yellow, coarse, and gravel | 16 | 43 |
| Sand, yellow, medium, gravelly | 7 | 50 |
| **2S 11W 24-37** | | |
| Fill, yellow sand | 7 | 7 |
| Fill, silty, fine dark sand, peaty and cinders | 3 | 10 |
| Sand and gravel, medium to coarse, yellow | 7 | 17 |
| **2S 11W 24-37 Continued** | | |
| Sand, yellow, medium, gravelly | 6 | 23 |
| Sand, gray, very fine | 4 | 27 |
| Sand and gravel | 7 | 34 |
| **2S 11W 24-40** | | |
| Fill, sand, cinders, clay, and miscellaneous | 8 | 8 |
| Sand, yellow, medium to coarse, gravelly | 10 | 18 |
| Sand, yellow, medium, gravelly | 3 | 21 |
| Sand, gray, very fine | 5 | 26 |
| Sand, gray, medium, gravelly | 2 | 28 |
| **2S 11W 25-3** | | |
| Sand, "dirty" | 25 | 25 |
| Sand and clay | 10 | 35 |
| Sand and gravel | 4 | 39 |
| Clay | 6 | 45 |
| Sand and gravel | 5 | 50 |
| Clay | 6 | 56 |
| Sand | 2 | 58 |
| Clay | 8 | 66 |
| Sand | 11 | 77 |
| Sand and gravel | 7 | 84 |
| Clay | 2 | 86 |
| Sand and gravel | 6 | 92 |
| Clay | 28 | 120 |
| Sand, fine, "dirty" | 5 | 125 |
| **2S 11W 25-4 Alt. 790** | | |
| Clay, sand, and gravel | 7 | 7 |
| Sand, gravel, and clay | 16 | 23 |
| Clay and sand layers, interbedded | 12 | 35 |
| Sand, clay, and gravel | 6 | 41 |
| Sand, gravel, and clay | 5 | 46 |
| Clay and stones | 6 | 52 |
| Sand | 11 | 63 |
| Fine sand, clayey | 9 | 72 |
| Clay | 29 | 101 |
| Sand and clay | 5 | 106 |
| Sand and clay, gravelly | 5 | 111 |
| Sand, gravelly | 5 | 116 |
| Sand | 15 | 131 |
| Sand, gravel, and clay | 5 | 136 |
| Sand, clayey | 4 | 140 |
| Sand | 9 | 149 |
| **2S 11W 25-6 Alt. 781** | | |
| Clay | 2 | 2 |
| Sand, gravel, and clay layers, interbedded | 26 | 28 |
| Sand, clayey | 21 | 49 |
| Clay | 5 | 54 |
| Sand, coarse, and clay layers | 6 | 60 |
| Sand, gravelly, clayey | 6 | 66 |
| Sand and gravel | 5 | 71 |
| Clay and gravel, sand layers, interbedded | 14 | 85 |
| Sand and clay | 5 | 90 |
| Sand, "tight" | 6 | 96 |
| Clay | 19 | 115 |
| Sand | 5 | 120 |
| Clay, sand, and gravel, "tight" | 7 | 127 |
| Sand, gravel, and clay, "tight" | 5 | 132 |
| Clay, blue, hard | 8 | 140 |
| **2S 11W 27-1 Alt. 770** | | |
| Muck, black | 3 | 3 |
| Sand, fine to coarse | 23 | 26 |
| Sand, medium, and gravel | 13 | 39 |
| Sand, medium | 7 | 46 |
| Sand, light-brown, fine to medium | 23 | 69 |
| Sand, medium to coarse | 10 | 79 |
| Sand, medium to coarse, and gravel | 8 | 87 |
| Sand, fine to coarse | 35 | 122 |
| Sand, medium to coarse, and gravel | 12 | 134 |
| Sand, fine to coarse | 6 | 140 |
| Sand, fine to medium, and fine gravel | 16 | 156 |
| Sand, fine to coarse | 6 | 162 |
| Sand, medium to coarse, and gravel | 9 | 171 |
| Sand, fine to coarse | 20 | 191 |
| Shale | 15 | 206 |
| **2S 11W 27-6 Alt. 770** | | |
| No record | 3 | 3 |
| Clay, brown to blue, sandy | 19 | 22 |
| Sand, medium, and fine gravel | 36 | 58 |
| Sand, medium to coarse, gravelly | 17 | 75 |
| Sand, gray to brown, medium | 10 | 85 |
| Sand, gray, medium | 54 | 139 |
| Sand, gray, medium to coarse | 11 | 150 |
| Sand, gray to brown, medium | 29 | 179 |
| Shale, blue | - | - |
| **2S 11W 27-32** | | |
| Fill, cinder | 2 | 2 |
| Clay, blue, soft | 3 | 5 |
| Clay and gravel | 4 | 9 |
| Sand, coarse | 1 | 10 |
| Sand and gravel | 5 | 15 |
| Sand, coarse | 9 | 24 |
| Sand, fine | 10 | 34 |
| Clay, yellow, hard, and gravel | 8 | 42 |
| Clay and fine sand layers | 5 | 47 |
| Sand, fine, water-bearing | 8 | 55 |
| Clay, yellow, soft | 2 | 57 |
| Sand, coarse, water-bearing | 1 | 58 |
| Clay, dark, brittle | 1 | 59 |
| Sand, coarse | 2 | 61 |
| Clay, yellow, sandy | 12 | 73 |
| Gravel, coarse, and sand | 9 | 82 |
| Gravel and boulders, cemented | 4 | 86 |
| Gravel, coarse, and boulders, hard-packed | 6 | 92 |
| **2S 11W 27-33** | | |
| Fill, cinders | 8 | 8 |
| Clay, soft | 2 | 10 |
| Gravel and boulders | 5 | 15 |
| Gravel, clay, and boulders | 4 | 19 |
| Clay, sandy | 2 | 21 |
| Gravel and clay | 5 | 26 |
| Clay, sandy, and boulders | 11 | 37 |
| Sand, fine | 3 | 40 |
| Clay, sandy | 15 | 55 |
| Clay, gravel, and boulders, sandy | 5 | 60 |
| Sand, cemented | 1 | 61 |
| Sand, fine, gravel, and clay | 7 | 68 |

Table 2.--Selected logs of wells and test borings in the Kalamazoo area.--Continued

| | Thick-ness | Depth |
|---|---|---|
| 2S 11W 27-33 Continued | | |
| Sand, fine | 2 | 70 |
| Clay, sandy, hard | 11 | 81 |
| Sand, cemented | 14 | 95 |
| Sand and gravel | 5 | 100 |
| Gravel and boulders, cemented | 1 | 101 |
| Sand and gravel | 4 | 105 |
| Sand, fine to coarse | 24 | 129 |
| 2S 11W 27-38 Alt 798 | | |
| Fill, cinder | 8 | 8 |
| Topsoil | 8 | 16 |
| Gravel, yellow | 24 | 40 |
| Sand, yellow | 15 | 55 |
| Clay and sand | 10 | 65 |
| Sand, very fine | 27 | 92 |
| Clay, blue | 13 | 105 |
| Sand and gravel, dirty, clayey | 13 | 118 |
| Sand, fine | 3 | 121 |
| 2S 11W 27-39 Alt. 801 | | |
| Fill, ashes | 5 | 5 |
| Sand | 6 | 11 |
| Sand, coarse, and boulders | 6 | 17 |
| Sand, coarse, and gravel | 5 | 22 |
| Clay, blue | 6 | 28 |
| Clay, dark, and boulders | 5 | 33 |
| Clay and gravel, hard-packed | 2 | 35 |
| Sand, coarse, and clay | 4 | 39 |
| Sand, coarse, and fine gravel | 5 | 44 |
| Clay and sand, tight | 5 | 49 |
| Sand, fine, clay, and gravel | 6 | 55 |
| Clay, gray | 10 | 65 |
| Clay, sand, and gravel | 6 | 71 |
| Clay, gray | 6 | 77 |
| Clay and sand | 25 | 102 |
| Sand, coarse, gravel, and clay | 5 | 107 |
| Sand, coarse, and fine gravel | 5 | 112 |
| Clay and gravel | 4 | 116 |
| Gravel and coarse sand, clayey | 5 | 121 |
| Gravel, sand, and clay | 5 | 126 |
| Gravel, sand, clay, and boulders | 5 | 131 |
| Gravel, sand, and clay | 4 | 135 |
| Gravel and clay | 10 | 145 |
| Sand and clay | 10 | 155 |
| 2S 11W 27-51 Alt. 801 | | |
| Sand and clay | 11 | 11 |
| Sand, yellow | 11 | 22 |
| Sand, gravel, and boulders, clayey | 39 | 61 |
| Sand, clay, and boulders | 2 | 63 |
| Sand, coarse | 3 | 66 |
| Clay, yellow and blue, sandy | 30 | 96 |
| Sand, coarse, gravelly, loose | 10 | 106 |
| Gravel and clay | 5 | 111 |
| Sand, coarse, and gravel, loose | 5 | 116 |
| Clay, gravel, and boulders | 44 | 160 |
| Clay, gravel, and sand | 7 | 167 |
| 2S 11W 27-52 Alt. 802.59 | | |
| Sand | 10 | 10 |
| Hardpan and boulders | 28 | 38 |
| Clay and gravel | 7 | 45 |
| Clay | 38 | 83 |
| Sand | 26 | 109 |
| Sand and gravel | 34 | 143 |
| 2S 11W 27-58 Alt. 797 | | |
| Fill, cinders, rotted wood and miscellaneous | 9 | 9 |
| Sand, gray, medium, gravelly, clayey | 3 | 12 |
| Sand, yellow, coarse, compact, and gravel, clayey | 7 | 19 |
| Sand, yellow, coarse, and gravel | 4 | 23 |
| Sand, gray, medium, clayey, gravelly | 10 | 33 |
| Clay, blue, sandy, medium, gravelly | 2 | 35 |
| 2S 11W 27-63 Alt. 793.6 | | |
| Fill | 8 | 8 |
| Peat, black, soft | 1 | 9 |
| Sand, gray, compact, medium to coarse, and gravel, silty | 4 | 13 |
| Sand, yellow, compact, fine to medium, gravelly, clayey | 11 | 24 |
| Clay, gray, medium, sandy, and gravel | 4 | 28 |
| Sand, yellow, medium, gravelly | 7 | 35 |
| Clay, gray, medium, sandy, and gravel | 1 | 36 |
| Sand, gray, very fine | 9 | 45 |
| 2S 11W 27-66 Alt. 793.6 | | |
| Fill, cinders | 9 | 9 |
| Sand, yellow, compact, medium to coarse | 5 | 14 |
| Sand, yellow, compact, medium to coarse, interbedded sandy clay | 6 | 20 |
| Sand, yellow, compact, medium to coarse | 6 | 26 |
| 2S 11W 27-67 Alt. 792 | | |
| Fill | 8 | 8 |
| Silt, peaty | 1 | 9 |
| Sand, yellow, compact, medium to coarse, and gravel | 3 | 12 |
| Sand, gray, medium, gravelly, clayey | 15 | 27 |
| Sand, gray, compact, medium | 5 | 32 |
| 2S 11W 27-73 Alt. 792.94 | | |
| Fill, medium to coarse, yellow sand and gravel, clayey | 6 | 6 |
| Sand, gray, medium, silty and vegetation | 3 | 9 |
| Sand, yellow, medium to coarse, gravelly, clayey | 8 | 17 |
| Clay, gray, medium, sandy | 6 | 23 |
| Sand, gray, medium to coarse, gravelly interbedded clay | 8 | 31 |
| Sand, gray, fine, clayey and gravelly | 4 | 35 |
| 2S 11W 27-76 Alt. 791.9 | | |
| Fill, cinders | 14 | 14 |
| Peat, dark, soft, sandy | 2 | 16 |
| Sand, gray, medium, gravelly, clayey | 2 | 18 |
| Sand and gravel, yellow, compact, fine to coarse | 8 | 26 |
| 2S 11W 28-1 Alt. 906.3 | | |
| Sand, medium to coarse, red and brown | 46 | 46 |
| Sand, fine to very coarse, gravelly | 18 | 64 |
| Sand, fine to medium, gravelly | 26 | 90 |
| Clay, blue | 12 | 102 |
| Sand, fine to medium | 32 | 134 |
| Sand, fine, clayey | 28 | 162 |
| Sand and clay | 12 | 174 |
| Clay, silty | 11 | 185 |
| Clay, sandy, fine | 10 | 195 |
| Sand, fine to medium | 29 | 224 |
| Sand, medium to coarse | 6 | 230 |
| Sand, fine to medium, clayey | 10 | 240 |
| Sand, fine to coarse | 38 | 278 |
| Sand, medium, gravelly | 12 | 290 |
| Sand, medium to coarse | 4 | 294 |
| Shale, blue-black | 38 | 332 |
| 2S 11W 28-6 | | |
| Sand, gravel, and brown clay | 18 | 18 |
| Gravel and brown clay | 12 | 30 |
| Sand, gravel, and clay | 27 | 57 |
| Hardpan | 1 | 58 |
| Sand, fine, and clay | 10 | 68 |
| Hardpan | 2 | 70 |
| Sand, fine, and clay | 34 | 104 |
| Sand, gravel, and clay | 20 | 124 |
| Sand and clay | 11 | 135 |
| Sand | 6 | 141 |
| Sand and gravel layers, interbedded | 34 | 175 |
| 2S 11W 28-8 | | |
| Fill | 3 | 3 |
| Muck | 18 | 21 |
| Sand and gravel, silty, clayey | 13 | 34 |
| Sand and brown clay, gravelly, water-bearing | 38 | 72 |
| Sand, gravel, and clay | 69 | 141 |
| 2S 11W 29-1 | | |
| Soil, clayey | 10 | 10 |
| Sand, gravel, and boulders | 9 | 19 |
| Sand and brown clay | 7 | 26 |
| Sand, gravelly | 11 | 37 |
| Sand, coarse from 48 to 59 feet | 22 | 59 |
| Sand, clayey | 11 | 70 |
| Sand and brown clay | 7 | 77 |
| Gravel, clean | 9 | 86 |
| Sand, fine to coarse, clean | 41 | 127 |
| Gravel, clean | 4 | 131 |
| Clay, sand, and gravel | 15 | 146 |
| Gravel, clayey | 5 | 151 |
| Gravel and sand, clayey, "dirty" | 14 | 165 |
| Sand, clayey, "dirty" | 10 | 175 |
| Sand, gravelly | 10 | 185 |
| Sand, gravelly, clayey | 10 | 195 |
| Sand and clay, "dirty" | 5 | 200 |
| Clay, sand, and gravel | 5 | 205 |
| Sand and gravel, clayey | 10 | 215 |
| Gravel, sandy, and clayey | 8 | 223 |
| Clay, sandy, gravelly | 9 | 232 |
| Clay, trace of sand and gravel | 20 | 252 |
| Clay and fine sand | 5 | 257 |
| Clay, sandy | 7 | 264 |
| Clay, dark, trace of sand | 6 | 270 |
| Shale, blue, solid | 2 | 272 |

Table 2.--Selected logs of wells and test borings in the Kalamazoo area.--Continued

| | Thickness | Depth |
|---|---|---|
| **2S 11W 29-6** | | |
| Muck and marl | 3 | 3 |
| Sand, clay, and gravel | 7 | 10 |
| Clay and gravel | 9 | 19 |
| Clay hardpan, dry | 71 | 90 |
| Clay hardpan, some water | 12 | 102 |
| Sand, fine, and clay, some water | 32 | 134 |
| Sand and clay, some water | 10 | 144 |
| Sand and gravel | 31 | 175 |
| **2S 11W 30-1** | | |
| Sand, coarse, and clay | 46 | 46 |
| Sand, fine | 16 | 62 |
| Sand and fine gravel | 16 | 78 |
| Sand, fine | 38 | 116 |
| Sand, fine, and gravel | 8 | 124 |
| Clay, blue | 25 | 149 |
| Gravel and clay | 10 | 159 |
| Clay, blue | 6 | 165 |
| Clay and gravel | 5 | 170 |
| Sand, very fine, soft | 9 | 179 |
| Clay and gravel | 2 | 181 |
| Sand, very fine | 2 | 183 |
| Sand and clay | 5 | 188 |
| Gravel and clay | 1 | 189 |
| Sand and clay | 21 | 210 |
| **2S 11W 30-5** | | |
| Clay | 5 | 5 |
| Sand, yellow, dirty | 15 | 20 |
| Sand, yellow, gravelly | 15 | 35 |
| Sand, yellow to gray | 90 | 125 |
| Clay | 15 | 140 |
| Clay, gravelly | 10 | 150 |
| Clay, sandy, gravelly | 90 | 240 |
| Hardpan | 15 | 255 |
| Shale | 2 | 257 |
| **2S 11W 34-1 Alt. 812.96** | | |
| Topsoil | 2 | 2 |
| Clay hardpan, red | 4 | 6 |
| Clay, red, pebbly | 17 | 23 |
| Sand, clay | 11 | 34 |
| Sand, gravelly | 12 | 46 |
| Sand and clay hardpan | 18 | 64 |
| Sand, clayey, soft | 9 | 73 |
| Sand, clayey, trace of gravel | 8 | 81 |
| Sand, gravelly, dirty, water-bearing | 31 | 112 |
| Gravel and clay | - | - |
| Sand, fine, red | - | 123 |
| Sand, clayey, red, water-bearing | 4 | 127 |
| Clay, sand, and gravel layers, interbedded | 5 | 132 |
| Sand and silt, clayey | 10 | 142 |
| Silt and clay, gravelly | 19 | 161 |
| Silt and clay, firm | 6 | 167 |
| Clay and silt | 11 | 178 |
| Clay and silt, gravelly | 6 | 184 |
| Shale (?), blue, gravelly | 8 | 192 |
| **2S 11W 34-3 Alt. 813.26** | | |
| Topsoil | 1 | 1 |
| Clay, sandy, water saturated | 5 | 6 |
| Sand, gravel, and clay hardpan | 16 | 22 |
| Sand and clay, brown to gray | 12 | 34 |
| Sand and brown clay, gravelly water under pressure | 13 | 47 |
| Clay, sand, and gravel hardpan | 10 | 57 |
| Sand, clay | 21 | 78 |
| **2S 11W 34-3 Continued** | | |
| Sand, coarse, gravelly, water under pressure | 4 | 82 |
| Sand, gravel, and a thin layer of brown clay at 86 feet | 4 | 86 |
| Gravel and sand, clean, water-bearing | 6 | 92 |
| Sand and dark-brown clay | 14 | 106 |
| Sand, gravel, boulders, and brown clay | 9 | 115 |
| Sand, coarse, clean | 4 | 119 |
| Sand and red clay, gravelly | 8 | 127 |
| Clay, gray, sand and gravel, hard | 10 | 137 |
| Sand and clay | 6 | 143 |
| Clay, green and brown, sandy, gravelly, very hard | 7 | 150 |
| Clay, green, sandy, dry | 7 | 157 |
| Shale (?), gray to blue, sandy | 16 | 173 |
| **2S 11W 34-4 Alt. 803.52** | | |
| Muck, black | 15 | 15 |
| Sand, fine and clay | 16 | 31 |
| Clay, blue | 11 | 42 |
| Sand, yellow, fine | 6 | 48 |
| Sand, yellow, boulders and gravel | 29 | 67 |
| Clay, blue | 3 | 70 |
| Clay and sand | 30 | 100 |
| Sand and gravel, gray, water-bearing | 10 | 110 |
| Clay, pink to brown, and hardpan | 21 | 131 |
| Hardpan, carbonate | 9 | 140 |
| Clay and gravel hardpan | 2 | 142 |
| Sand and clay | 43 | 185 |
| Sand and gravel | 2 | 137 |
| Clay and sand | 20 | 207 |
| Shale, black | 16 | 223 |
| **2S 11W 34-6 Alt. 804.0** | | |
| Muck, black | 12 | 12 |
| Sand, yellow | 12 | 24 |
| Sand and clay | 32 | 56 |
| Hardpan | 46 | 102 |
| Gravel and clay | 6 | 108 |
| Gravel, coarse | 9 | 117 |
| Sand, fine to coarse | 25 | 142 |
| Clay and sand | 40 | 182 |
| Hardpan | 4 | 186 |
| Shale, black | 10 | 196 |
| **2S 11W 34-7 Alt. 816.89** | | |
| Muck, black | 8 | 8 |
| Gravel, gray | 7 | 15 |
| Clay, pink, and sand | 15 | 30 |
| Sand and gravel | 5 | 35 |
| Sand and clay | 5 | 40 |
| Hardpan | 20 | 60 |
| Sand, yellow, and clay | 23 | 83 |
| Sand, coarse, and gravel | 31 | 114 |
| Hardpan | 6 | 120 |
| Sand and clay | 3 | 123 |
| Hardpan | 40 | 163 |
| Sand and clay | 20 | 183 |
| Shale, sandy | 7 | 190 |
| Shale, black | 7 | 197 |
| **2S 11W 34-8** | | |
| Topsoil | 1 | 1 |
| Sand, gray to yellow, and gravel | 13 | 14 |
| **2S 11W 34-8 Continued** | | |
| Sand, gray, and clay | 16 | 30 |
| Gravel, gray, and clay | 16 | 46 |
| Sand, yellow, and clay | 65 | 111 |
| Clay and sand | 3 | 114 |
| Sand, gray | 6 | 120 |
| Sand, gray, and gravel | 14 | 134 |
| Shale, black | 20 | 154 |
| **2S 11W 34-9** | | |
| Fill | 3 | 3 |
| Muck | 1 | 4 |
| Marl | 2 | 6 |
| Sand, gravel, and gray clay, water-bearing | 14 | 20 |
| Clay, brown, gravel, and sand | 28 | 48 |
| Sand, brown, and clay | 7 | 55 |
| Sand and gravel hardpan and brown clay | 14 | 69 |
| Sand, gray to brown, and clay, hard | 26 | 95 |
| Sand and gravel, clayey | 14 | 109 |
| Sand, gray | 2 | 111 |
| Gravel, coarse, clean | 7 | 118 |
| Sand, coarse, gravelly | 8 | 126 |
| Clay, gray, and sand | 1 | 127 |
| Sand, brown, gravelly | 8 | 135 |
| Clay, blue | 8 | 143 |
| **2S 11W 35-2 Alt. 861.09** | | |
| Topsoil | 2 | 2 |
| Gravel | 20 | 22 |
| Clay, blue, and gravel | 18 | 40 |
| Gravel | 3 | 43 |
| Clay, yellow, and gravel | 10 | 53 |
| Gravel | 2 | 55 |
| Clay, yellow, and gravel | 26 | 81 |
| Gravel, clayey | 5 | 86 |
| Gravel, clean | 2 | 88 |
| Sand | 4 | 92 |
| Sand and gravel | 9 | 101 |
| Clay | 2 | 103 |
| Clay, sandy | 6 | 109 |
| Sand | 11 | 120 |
| Sand and gravel | 12 | 132 |
| **2S 11W 35-3** | | |
| Topsoil | 5 | 5 |
| Sand, medium and gravel, brown | 25 | 30 |
| Sand, fine, clean | 5 | 35 |
| Sand and gravel, medium, brown | 13 | 48 |
| Clay, sandy | 26 | 74 |
| Sand, brown, fine to medium | 15 | 89 |
| Clay, sandy | 31 | 120 |
| Sand, medium, dark-brown | 18 | 138 |
| Sand and gravel, brown, medium | 5 | 143 |
| Sand, brown, medium | 5 | 148 |
| Sand, medium, and gravel | 2 | 150 |
| Gravel, medium, and sand, clean | 12 | 162 |
| Sand, coarse, and gravel, clean | 5 | 167 |
| Sand, fine, clean | 5 | 172 |
| Clay, sandy | 32 | 213 |
| Sand, fine to coarse, clean | 14 | 256 |
| **2S 11W 35-5 Alt. 861** | | |
| Topsoil | 3 | 3 |
| Sand and gravel | 12 | 15 |
| Clay and gravel, sandy | 80 | 95 |

Table 2.--Selected logs of wells and test borings in the Kalamazoo area.--Continued

| | Thickness | Depth |
|---|---|---|
| **2S 11W 35-5 Continued** | | |
| Gravel and sand | 18 | 113 |
| Clay and gravel | 13 | 126 |
| Sand | 3 | 129 |
| Clay and gravel | 7 | 136 |
| Gravel and sand | 18 | 154 |
| Clay | - | - |
| **2S 11W 35-7** | | |
| Topsoil | 2 | 2 |
| Sand | 20 | 22 |
| Clay and gravel, hard | 2 | 24 |
| Clay, sandy, red | 16 | 40 |
| Sand, fine | 6 | 46 |
| Clay, sandy | 5 | 51 |
| Sand and clay, gray | 24 | 75 |
| Sand and clay | 6 | 88 |
| Sand, muddy | 14 | 102 |
| Sand, fine | 8 | 110 |
| Sand and clay | 4 | 114 |
| Sand and gravel | 30 | 154 |
| Sand, gravel, and clay layers | 8 | 162 |
| **2S 11W 35-9** | | |
| Fill and topsoil | 3 | 3 |
| Gravel, fine, and sand | 7 | 10 |
| Sand and gravel | 14 | 24 |
| Clay, hard, boulders | 2 | 26 |
| Clay, red, sandy | 14 | 40 |
| Sand | 5 | 45 |
| Clay, red, sandy | 8 | 53 |
| Clay, gray, sandy | 25 | 78 |
| Sand, fine | 4 | 82 |
| Sand, clay | 6 | 88 |
| Sand, fine | 18 | 106 |
| Clay, sandy | 4 | 110 |
| Sand, clayey | 4 | 114 |
| Sand, fine to medium | 19 | 133 |
| Sand, coarse | 31 | 164 |
| Clay, blue, gravelly, hard | 15 | 179 |
| Gravel and sand | 5 | 184 |
| Clay, blue-green, gravelly | 9 | 193 |
| Sand | 5 | 198 |
| Clay, soft | 10 | 208 |
| Shale, blue, soft | 17 | 225 |
| **2S 11W 36-1** | | |
| Topsoil and clay | 3 | 3 |
| Gravel and boulders | 17 | 20 |
| Clay and gravel | 25 | 45 |
| Sand, fine, muddy | 10 | 55 |
| Sand, clean | 13 | 68 |
| Clay, sandy | 22 | 90 |
| Clay | 23 | 113 |
| Sand, muddy | 17 | 130 |
| Sand | 8 | 138 |
| Clay | 1 | 139 |
| Sand and gravel | 16 | 155 |
| Clay | 1 | 156 |
| Sand and gravel | 4 | 160 |
| Clay | - | - |
| **2S 11W 36-5** | | |
| Topsoil | 1 | 1 |
| Gravel, clayey | 20 | 21 |
| Sand and gravel, clayey, dry | 13 | 34 |
| Sand and clay, dry | 10 | 44 |
| Clay hardpan, gravelly, dry | 18 | 62 |
| Sand and clay | 8 | 70 |
| Sand, gravel, and clay | 6 | 76 |
| Gravel, and gray to brown clay | 24 | 100 |
| **2S 11W 36-5 Continued** | | |
| Gravel, coarse, clean | 12 | 112 |
| Hardpan | 19 | 131 |
| Sand and clay | 9 | 140 |
| Hardpan | 21 | 161 |
| Gravel, clayey | 8 | 169 |
| Clay, dark, pebbly | 5 | 174 |
| Hardpan | 17 | 191 |
| Clay, blue, dry | 6 | 197 |
| **2S 11W 36-6** | | |
| Topsoil | 6 | 6 |
| Sand and gravel | 24 | 30 |
| Sand and gravel, clayey | 35 | 65 |
| Sand, gravel, and clay | 10 | 75 |
| Gravel and red clay | 10 | 85 |
| Sand and clay | 10 | 95 |
| Clay, blue | 23 | 118 |
| Clay, red | 4 | 122 |
| Sand, fine, and silt | 7 | 129 |
| Sand and gravel | 14 | 143 |
| Sand | 5 | 148 |
| Sand and gravel | 7 | 155 |
| Sand, gravel, and clay | 7 | 162 |
| Sand and gravel | 11 | 173 |
| Clay, red | 17 | 190 |
| **2S 11W 36-9** | | |
| Topsoil | 1 | 1 |
| Clay | 4 | 5 |
| Sand and gravel | 17 | 22 |
| Clay, gray | 11 | 33 |
| Sand and gravel | 8 | 41 |
| Clay, brown | 37 | 78 |
| Sand and gravel, brown | 7 | 85 |
| Sand and gravel, gray | 33 | 118 |
| Sand, gravel, and boulders | 3 | 121 |
| Sand, medium, gray | 9 | 130 |
| **2S 10W 5-3 Alt. 902.3** | | |
| Sand, gravel, and mud | 190 | 190 |
| Mud and sand | 50 | 240 |
| Gravel, water-bearing | 20 | 260 |
| Mud, sand, and gravel | 35 | 295 |
| Gravel | 35 | 330 |
| Mud, blue, brittle (shale) | 59 | 389 |
| Total depth - 1468 ft. | | |
| **2S 10W 6-1 Alt. 915.5** | | |
| Sand | 60 | 60 |
| Sand and gravel | 63 | 123 |
| Sand | 2 | 125 |
| Clay, blue | 3 | 128 |
| Sand and gravel | 34 | 162 |
| Sand | 16 | 178 |
| Clay, blue, and gravel | 37 | 215 |
| Gravel | 14 | 229 |
| Clay, blue | 10 | 239 |
| Gravel | 2 | 241 |
| Clay, blue | 8 | 249 |
| Gravel | 4 | 253 |
| Shale, blue | 16 | 269 |
| Total depth - 1488 ft. | | |
| **2S 10W 8-2 Alt. 898.2** | | |
| Sand and gravel | 50 | 50 |
| Gravel and mud | 166 | 216 |
| Mud | 39 | 255 |
| Gravel | 15 | 270 |
| Sand and mud | 20 | 290 |
| Shale, blue | 55 | 345 |
| Total depth - 1464 ft. | | |
| **2S 10W 17-1 Alt. 790** | | |
| Sand and gravel, dry | 41 | 41 |
| Clay, red | 2 | 43 |
| Sand and gravel | 7 | 50 |
| **2S 10W 17-1 Continued** | | |
| Clay | 10 | 60 |
| Sand, water-bearing | 5 | 65 |
| Clay | 8 | 73 |
| Sand, water-bearing | 3 | 76 |
| Clay and hardpan | 30 | 106 |
| Gravel | 1 | 107 |
| Hardpan | 8 | 115 |
| Clay and gravel | 4 | 119 |
| Sand, water-bearing | 9 | 128 |
| **2S 10W 17-2** | | |
| No record (pit) | 11 | 11 |
| Sand and clay | 19 | 30 |
| Sand, fine | 4 | 34 |
| Sand, very fine, and gravel | 5 | 39 |
| Boulders | 1 | 40 |
| **2S 10W 17-3** | | |
| Gravel | 24 | 24 |
| Clay | 20 | 44 |
| Sand, "dirty" | 2 | 46 |
| Clay, sand, and gravel | 10 | 56 |
| Sand, silty | 31 | 87 |
| Clay | 4 | 91 |
| Clay and sand | 7 | 98 |
| Gravel and clay | 2 | 100 |
| Clay | 1 | 101 |
| Shale | 2 | 103 |
| **2S 10W 17-4** | | |
| No record (pit) | 5 | 5 |
| Gravel and boulders | 27 | 32 |
| Clay, sand, and gravel | 13 | 45 |
| Sand | 2 | 47 |
| Sand and clay | 8 | 55 |
| Sand | 12 | 67 |
| Clay | 4 | 71 |
| Sand and clay, interbedded | 19 | 90 |
| Sand, clay binder | 3 | 93 |
| Sand, few clay balls | 5 | 98 |
| Sand and hard shale | 2 | 100 |
| Shale | - | - |
| **2S 10W 17-5** | | |
| Sand and gravel | 24 | 24 |
| Sand and gravel | 5 | 29 |
| Clay and gravel | 2 | 31 |
| Sand, water-bearing | 6 | 37 |
| Clay | 6 | 43 |
| Sand, fine, clean | 2 | 45 |
| Clay | 1 | 46 |
| Sand and gravel, clean | 17 | 63 |
| Clay, sand, and gravel, hard | 2 | 65 |
| **2S 10W 17-7 Alt. 774.9** | | |
| Gravel and boulders | 3 | 3 |
| Sand, gravel and boulders | 12 | 15 |
| Bed of boulders | - | - |
| Hole bored in stream bed | | |
| **2S 10W 17-8 Alt. 776.1** | | |
| Sand, yellow, gravel, and boulders | 15 | 15 |
| Bed of boulders, impossible to penetrate | - | - |
| **2S 10W 20-6 Alt. 774.0** | | |
| Sand, yellow, gravel, and boulders | 12 | 12 |
| Boulders | - | - |
| Hole bored in stream bed | | |
| **3S 12W 35-1 Alt. 897.3** | | |
| Gravel | 70 | 70 |
| Sand and gravel | 110 | 180 |

Table 2.--Selected logs of wells and test borings in the Kalamazoo area.--Continued

| | Thick-ness | Depth |
|---|---|---|
| 3S 12W 35-1 Continued | | |
| Sand, muddy | 110 | 290 |
| Sand | 20 | 310 |
| Sand, heaving | 3 | 313 |
| Shale, blue | 7 | 320 |
| Total depth - 1267 ft. | | |
| 3S 11W 1-1 Alt. 845 | | |
| Sand, yellow, and clay | 17 | 17 |
| Sand, gray, and gravel | 23 | 40 |
| Clay, blue | 5 | 45 |
| Hardpan | 37 | 82 |
| Gravel and gray clay | 21 | 103 |
| Sand, fine, "clean" | 9 | 112 |
| Gravel and coarse sand | 6 | 118 |
| Clay, hardpan, and boulders | 18 | 136 |
| Sand and "clean" gravel | 8 | 144 |
| Sand and gray gravel | 9 | 153 |
| Sand, "dirty", and clayey gravel | 17 | 170 |
| Sand, fine, and clay | 2 | 172 |
| Sand, fine, and clay | 20 | 192 |
| Hardpan, shale | 36 | 228 |
| 3S 11W 2-3 Alt. 865 | | |
| Topsoil | 3 | 3 |
| Sand, yellow, and gravel | 13 | 16 |
| Gravel, gray | 5 | 21 |
| Sand, yellow, and clay | 69 | 90 |
| Hardpan | 24 | 114 |
| Sand, gray, "dirty" | 25 | 139 |
| Sand, gray, and gravel | 29 | 168 |
| Gravel, gray, coarse | 5 | 173 |
| Sand, gray, fine | 9 | 182 |
| Sand, gray, medium | 5 | 187 |
| Hardpan | 4 | 191 |
| Gravel, coarse, and clay | 9 | 200 |
| Hardpan | 8 | 208 |
| Shale, black, and lime | 2 | 210 |
| Shale, black | 6 | 216 |
| 3S 11W 2-4 | | |
| Topsoil | 3 | 3 |
| Sand, yellow, and clay | 23 | 26 |
| Clay | 6 | 32 |
| Hardpan | 43 | 75 |
| Sand, gray, and clay | 5 | 80 |
| Sand, yellow, and clay | 12 | 92 |
| Sand, gray, and gravel | 5 | 97 |
| Sand and gray, "dirty" gravel | 13 | 110 |
| Sand, gray, fine | 15 | 125 |
| Sand, gray, and gravel | 5 | 130 |
| Gravel, coarse, and brown clay | 10 | 140 |
| Gravel, coarse, and sand, boulders | 5 | 145 |
| Sand, gray, coarse | 5 | 150 |
| Gravel, coarse | 17 | 167 |
| Sand, gray, coarse, and clay | 8 | 175 |
| Hardpan | 9 | 184 |
| 3S 11W 2-5 Alt. 855 ft. | | |
| Topsoil | 2 | 2 |
| Sand, yellow, and gravel | 16 | 18 |
| Sand, gray, and gravel | 20 | 38 |
| Hardpan | 10 | 48 |
| Gravel and clay | 16 | 64 |
| Gravel, gray | 6 | 70 |
| Gravel and brown clay | 10 | 80 |
| Clay, blue | 10 | 90 |
| Hardpan | 32 | 122 |
| Sand and clay | 17 | 139 |
| Sand, yellow, coarse | 17 | 156 |
| Sand, gray, coarse, and clay | 34 | 190 |
| 3S 11W 2-5 Continued | | |
| Shale (?), hardpan | 25 | 215 |
| Lime and shale | 2 | 217 |
| Shale, black | 4 | 221 |
| 3S 11W 2-6 | | |
| Topsoil | 1 | 1 |
| Sand, yellow, and gravel | 25 | 26 |
| Clay, yellow, and sand | 17 | 43 |
| Gravel and brown clay | 27 | 70 |
| Gravel and blue clay | 34 | 104 |
| Sand, yellow, and gravel, clayey | 6 | 110 |
| Hardpan | 13 | 123 |
| Sand, gray, fine, and clay | 12 | 135 |
| Sand, gray, coarse | 5 | 140 |
| Gravel, gray, and sand | 30 | 170 |
| Sand, gray, fine | 10 | 180 |
| Gravel, coarse | 10 | 190 |
| Sand, fine and clay | 3 | 193 |
| Gravel, coarse | 3 | 196 |
| Sand, fine, and clay | 7 | 203 |
| Gravel, coarse, and pink clay | 3 | 206 |
| Hardpan | 8 | 214 |
| Shale, black | 8 | 222 |
| 3S 11W 3-2 Alt. 829 | | |
| Sand, yellow | 10 | 10 |
| Gravel, coarse, water-bearing | 10 | 20 |
| Sand and clay | 10 | 30 |
| Sand and clay-dirty, water-bearing | 15 | 45 |
| Sand, and gray clay layers interbedded | 12 | 57 |
| Clay, gray, boulders, gravelly | 8 | 65 |
| Clay, brownish, gravelly and broken boulders | 10 | 75 |
| Gravel, coarse, clayey | 5 | 80 |
| Gravel, coarse, very large boulders, water-bearing | 12 | 92 |
| Sand, brown, clayey, water-bearing | 18 | 110 |
| Sand, gray | 11 | 121 |
| Sand and gravel, water-bearing | 17 | 138 |
| Sand, coarse and fine gravel | 8 | 146 |
| Sand, coarse, and gravel, large boulders | 2 | 148 |
| Gravel with clay | 6 | 154 |
| 3S 11W 3-7 Alt. 830 | | |
| Topsoil | 3 | 3 |
| Sand, yellow | 15 | 18 |
| Sand, gray and gravel | 8 | 26 |
| Clay, blue | 4 | 30 |
| Hardpan | 30 | 60 |
| Sand, gray | 8 | 68 |
| Sand, gray, and clay | 7 | 75 |
| Sand, gray, and gravel | 10 | 85 |
| Sand, yellow, and gravel | 5 | 90 |
| Sand, gray, and clay | 5 | 95 |
| Sand, gray | 5 | 100 |
| Sand, gray, and lime | 10 | 110 |
| Sand, gray, lime and clay | 5 | 115 |
| Sand, gray, lime, and sandy clay | 5 | 120 |
| Sand, coarse, and gravel | 15 | 135 |
| Hardpan | 5 | 140 |
| Shale, black | 12 | 152 |
| 3S 11W 3-8 Alt. 834 | | |
| Topsoil | 5 | 5 |
| Sand, yellow, and clay | 10 | 15 |
| 3S 11W 3-8 Continued | | |
| Sand, gray, and clay | 5 | 20 |
| Clay | 6 | 26 |
| Sand, gray, and clay | 9 | 35 |
| Clay, blue, and sand | 12 | 47 |
| Sand and gravel, clayey | 10 | 57 |
| Sand, yellow, and clay | 5 | 62 |
| Sand, gray, and clay | 16 | 78 |
| Clay and gray gravel | 8 | 86 |
| Hardpan | 4 | 90 |
| Sand, gray, and clay | 5 | 95 |
| Sand, gray, fine | 5 | 100 |
| Clay, gray, water-bearing | 5 | 105 |
| Sand, gray, and gravel | 15 | 120 |
| Clay and gravel | 19 | 139 |
| Hardpan | 1 | 140 |
| Clay and gravel | 2 | 142 |
| Hardpan | 10 | 152 |
| Sand, gray | 2 | 154 |
| Hardpan | 18 | 172 |
| Shale, black | 5 | 177 |
| Shale and sand | 15 | 192 |
| 3S 11W 3-10 Alt. 824.47 | | |
| Topsoil | 4 | 4 |
| Sand, gray, and gravel | 12 | 16 |
| Clay | 19 | 35 |
| Hardpan | 10 | 45 |
| Sand, yellow, and clay | 7 | 52 |
| Sand, yellow, "solid" | 12 | 64 |
| Sand, yellow | 31 | 95 |
| Sand, gray | 5 | 100 |
| Sand, gray, and gravel | 25 | 125 |
| Gravel, gray, coarse | 3 | 128 |
| 3S 11W 3-16 | | |
| Sand and clay fill | 3 | 3 |
| Sand | 17 | 20 |
| Sand, gravel, and large boulders | 32 | 52 |
| Clay, brown, sandy | 43 | 95 |
| Sand, "clean" | 8 | 103 |
| Clay, brown, sandy | 7 | 110 |
| Sand and gravel, clayey | 5 | 115 |
| Sand and gravel, "clean" | 38 | 153 |
| 3S 11W 3-17 | | |
| Fill and clay | 3 | 3 |
| Sand | 17 | 20 |
| Sand and gravel | 26 | 46 |
| Clay, soft, sandy | 49 | 95 |
| Sand and gravel, "not clean" | 25 | 120 |
| Sand and gravel | 30 | 150 |
| 3S 11W 3-19 | | |
| Clay fill | 3 | 3 |
| Sand, yellow | 14 | 17 |
| Sand and gravel with boulders | 43 | 60 |
| Clay, gray, sandy | 16 | 76 |
| Sand, clayey | 3 | 79 |
| Clay, gray, sandy | 14 | 93 |
| Sand, clayey | 14 | 107 |
| Clay, gray, sandy | 5 | 112 |
| Sand, fine to medium | 8 | 120 |
| Sand and gravel, clean | 38 | 158 |
| 3S 11W 4-2 | | |
| No record | 77 | 77 |
| Sand, clay, and stones | 3 | 80 |
| Clay and hardpan, large boulders | 2 | 82 |
| Sand and gravel | 10 | 92 |
| Gravel, and brown clay | 10 | 102 |
| Gravel and brown to gray clay | 7 | 109 |
| Clay and gravel, hardpan | 3 | 112 |

Table 2.--Selected logs of wells and test borings in the Kalamazoo area.--Continued

| | Thick-ness | Depth |
|---|---|---|
| **3S 11W 4-2 Continued** | | |
| Sand, clayey | 11 | 123 |
| Sand, coarse | 7 | 130 |
| Sand | 5 | 135 |
| Sand and gravel | 28 | 163 |
| **3S 11W 4-3 Alt. 855** | | |
| No record | 96 | 96 |
| Sand | 9 | 105 |
| Sand and gravel | 43 | 148 |
| Gravel | 10 | 158 |
| Sand | 6 | 164 |
| **3S 11W 4-6** | | |
| Fill | 3 | 3 |
| Muck | 3 | 6 |
| Sand | 16 | 22 |
| Sand, clay | 16 | 38 |
| Hardpan | 6 | 44 |
| Gravel, clay | 26 | 70 |
| Sand and gravel | 18 | 88 |
| Sand, fine to coarse | 12 | 100 |
| Gravel and brown clay | 11 | 111 |
| Sand, fine, and brown clay | 9 | 120 |
| Sand | 5 | 125 |
| Sand, brown, coarse | 8 | 133 |
| Sand, coarse, and clay | 7 | 140 |
| Sand, gravelly | 6 | 146 |
| Sand and gravel, clean | 20 | 166 |
| Clay hardpan | - | - |
| **3S 11W 4-7** | | |
| Fill | 3 | 3 |
| Topsoil and muck | 2 | 5 |
| Sand and marl | 15 | 20 |
| Sand and gravel, clayey | 10 | 30 |
| Sand and clay | 10 | 40 |
| Sand, coarse, clayey | 12 | 52 |
| Sand and gravel, clayey | 5 | 57 |
| Gravel | 21 | 78 |
| Sand, clean | 11 | 89 |
| Sand, gravel and large boulders | 8 | 97 |
| Sand and gravel, hardpan | 9 | 106 |
| Sand and brown clay, hardpan | 7 | 123 |
| Sand and soft clay | 6 | 129 |
| Sand and gravel | 23 | 152 |
| Gravel | 6 | 158 |
| Hardpan | - | - |
| **3S 11W 4-9** | | |
| Fill | 3 | 3 |
| Muck | 3 | 6 |
| Sand, marl, clayey | 25 | 31 |
| Clay, blue, soft | 8 | 39 |
| Sand, gravel with soft brown clay | 6 | 45 |
| Sand and gravel | 15 | 60 |
| Sand and gravel, clayey | 8 | 68 |
| Sand, gravel, boulders, and clay | 12 | 80 |
| Clay, very hard, and boulders | 8 | 88 |
| Sand and gravel, clayey | 16 | 104 |
| Sand and gravel, boulders, clayey | 10 | 114 |
| Sand and clay, gravelly | 10 | 124 |
| Sand, gravelly | 6 | 130 |
| Sand and gravel | 31 | 161 |
| Hardpan | - | - |
| **3S 11W 4-11** | | |
| Fill | 3 | 3 |
| Muck | 3 | 6 |
| Sand, yellow, and gravel | 14 | 20 |
| Sand, brown, and gravel | 26 | 46 |
| Gravel | 31 | 77 |
| **3S 11W 4-11 Continued** | | |
| Clay hardpan | 6 | 83 |
| Gravel hardpan | 10 | 93 |
| Sand hardpan | 8 | 101 |
| Gravel hardpan | 8 | 109 |
| Sand hardpan | 6 | 115 |
| Gravel hardpan | 11 | 126 |
| Sand and gravel | 42 | 168 |
| Hardpan | - | - |
| **3S 11W 4-12** | | |
| No record | 12 | 12 |
| Sand | 62 | 74 |
| Gravel | 11 | 85 |
| Sand and gravel | 20 | 105 |
| Sand and clay | 23 | 128 |
| Gravel | 6 | 134 |
| Sand, gravelly | 9 | 143 |
| Sand, gravel, and clay | 9 | 152 |
| Sand and gravel | 8 | 160 |
| Sand, gray | 2 | 162 |
| Sand, gravel, and hardpan | - | - |
| **3S 11W 4-15 Alt. 855** | | |
| Muck, black | 2 | 2 |
| Sand, black, fine | 8 | 10 |
| Sand, yellow | 25 | 35 |
| Sand, gray, coarse, and gravel | 61 | 96 |
| Sand, gray, fine | 7 | 103 |
| Sand, yellow and gravel, brown boulders | 5 | 108 |
| Sand, yellow, and clay | 4 | 112 |
| Hardpan | 10 | 122 |
| Sand, gray, and clay | 14 | 136 |
| Sand, gray, and gravel, clayey | 4 | 140 |
| Gravel, gray, coarse, and sand, boulders | 22 | 162 |
| Hardpan | 68 | 230 |
| Hardpan, blue | 10 | 240 |
| Lime and shale hardpan | 16 | 256 |
| Shale, black | 4 | 260 |
| **3S 11W 4-16** | | |
| Topsoil, sandy | 5 | 5 |
| Sand, and marl | 10 | 15 |
| Sand and gravel, clayey | 10 | 25 |
| Gravel, clayey | 9 | 34 |
| Sand and gravel, clayey | 14 | 48 |
| Gravel, coarse, large boulders, clayey | 10 | 58 |
| Gravel, coarse, and large boulders, less clayey | 9 | 67 |
| Gravel, "cleaner", clayey | 10 | 77 |
| Sand and gravel | 8 | 85 |
| Sand and gravel, clayey | 9 | 94 |
| Sand, gravelly, and light brown clay | 9 | 103 |
| Gravel, coarse, with brown clay | 6 | 109 |
| Sand, fine, and clay | 7 | 116 |
| Sand and gravel, dayey | 14 | 30 |
| **3S 11W 4-17** | | |
| Topsoil | 5 | 5 |
| Topsoil, sandy with brown clay | 15 | 20 |
| Sand, with grayish clay | 10 | 30 |
| Sand, "clean" | 21 | 51 |
| Sand and fine gravel, "clean" | 9 | 60 |
| Sand and coarse gravel | 10 | 70 |
| Sand and gravel | 8 | 78 |
| Sand, clayey | 6 | 84 |
| Sand and gravel, clayey | 10 | 94 |
| Sand and coarse gravel | 9 | 103 |
| **3S 11W 4-17 Continued** | | |
| Clay, gray, and gravel hardpan | 8 | 111 |
| Sand and gravel, clayey | 10 | 121 |
| Sand and gravel | 9 | 130 |
| Sand and gravel, large boulders | 10 | 140 |
| Clay, brown, and gravel hardpan | 3 | 143 |
| Clay, brown, and sand | 7 | 150 |
| Sand, gray | 9 | 159 |
| Sand, coarse | 3 | 162 |
| Sand, coarse, gravelly | 2 | 164 |
| **3S 11W 9-2** | | |
| Fill sand | 3 | 3 |
| Topsoil | 1 | 4 |
| Sand and gravel, dry | 17 | 21 |
| Sand, fine, water-bearing | 5 | 26 |
| Sand and gravel | 6 | 32 |
| Clay, sandy | 11 | 43 |
| Sand, fine | 17 | 60 |
| Sand, fine to coarse | 15 | 75 |
| Sand, medium | 17 | 92 |
| Sand, medium, and fine gravel | 8 | 100 |
| Sand, coarse, brown, gravelly | 10 | 110 |
| Sand, medium to coarse | 70 | 180 |
| No record | 5 | 185 |
| **3S 11W 11-3 Alt. 862.25** | | |
| Fill | 4 | 4 |
| Clay, muck | 2 | 6 |
| Sand, clay and gravel | 8 | 14 |
| Sand, gravel, clayey | 14 | 28 |
| Sand, gravelly | 5 | 33 |
| Gravel and sand | 5 | 38 |
| Sand, fine, clayey | 8 | 46 |
| Sand, gravel, and clay "tight" | 34 | 80 |
| Sand, gravelly | 6 | 86 |
| Sand, fine, gravelly and clayey, "tight" | 20 | 106 |
| Sand, gravel, clayey | 4 | 110 |
| Sand, fine, clay, "tight" | 5 | 115 |
| Sand, fine, gravelly clay streaks | 6 | 121 |
| Clay and fine sand | 10 | 131 |
| Sand, gravelly and clay, "tight" | 4 | 135 |
| Sand, fine, gravelly and clay, "tight" | 5 | 140 |
| Sand, fine, gravelly and clay, "tight" | 12 | 152 |
| Sand, gravel, clayey | 7 | 159 |
| Sand, fine, clay, gravelly, "tight" | 5 | 164 |
| Gravel, sand, clayey | 5 | 169 |
| Sand, fine, clay, gravelly | 2 | 171 |
| Gravel, sand, and clay | 4 | 175 |
| Gravel, sand, clay, and boulders | 21 | 196 |
| Gravel and clay | 5 | 201 |
| Gravel, medium sand, and clay | 5 | 206 |
| Gravel, sand, clay streaks and boulders | 5 | 211 |
| Gravel, sand, clay, and boulders | 9 | 220 |
| Gravel, sand, and clay | 4 | 224 |

Table 2.--Selected logs of wells and test borings in the Kalamazoo area.--Continued

| | Thickness | Depth |
|---|---|---|
| **3S 11W 11-7 Alt. 862.0** | | |
| Sand, clay | 12 | 12 |
| Sand, gravel, clayey | 15 | 27 |
| Clay and fine sand | 1 | 28 |
| Sand, gravelly, clayey | 7 | 35 |
| Clay and fine sand | 2 | 37 |
| Sand, clayey and gravel | 3 | 40 |
| Clay and fine sand | 3 | 43 |
| Sand, fine, gravelly, and clay, "tight" | 8 | 51 |
| Sand, gravelly and clay | 4 | 55 |
| Sand, fine, gravelly, clayey (tight) | 10 | 65 |
| Sand, gravelly, clayey | 5 | 70 |
| Sand, fine, gravelly, clay, "tight" | 22 | 92 |
| Sand, fine, gravelly, clay, "tight" | 28 | 120 |
| Sand and gravel | 6 | 126 |
| Sand, fine, and clay, gravelly | 7 | 133 |
| Sand, fine, gravelly, clay "tight" | 8 | 141 |
| Sand, gravel, clayey, "tight" | 9 | 150 |
| Clay, sand, gravelly | 16 | 166 |
| Sand, fine, gravelly, clay "tight" | 5 | 171 |
| Sand, gravel, clayey | 27 | 198 |
| Gravel, large, and clay, sandy | 6 | 204 |
| Sand and large gravel, clayey | 5 | 209 |
| Gravel, large, sand and clay | 5 | 214 |
| Sand and gravel, clayey | 4 | 218 |
| Gravel, sand, clay | 7 | 225 |
| Clay, gravel and hardpan | 5 | 230 |
| **3S 11W 11-10** | | |
| Clay and sand | 3 | 3 |
| Sand and clay | 5 | 8 |
| Gravel and sand | 10 | 18 |
| Sand, clay and gravel | 5 | 23 |
| Gravel, sand, clayey | 7 | 30 |
| Sand and clay, gravelly | 14 | 44 |
| Clay, sand, gravel, hardpan | 3 | 47 |
| Sand, gravelly, and clay | 11 | 58 |
| Gravel and sand, clayey | 18 | 76 |
| Sand, fine, gravelly, clayey | 3 | 79 |
| Sand | 6 | 85 |
| Sand, fine, gravelly, clayey | 26 | 111 |
| Sand, fine, and clay | 15 | 126 |
| Sand, fine, gravelly, clayey | 6 | 132 |
| Clay and fine sand | 7 | 139 |
| Sand, fine, gravelly, and clay | 40 | 179 |
| Clay, sand, and gravel | 13 | 192 |
| Sand, gravelly, and clay | 3 | 195 |
| Clay, sand and gravel | 3 | 198 |
| Sand, gravel, and clay | 5 | 203 |
| Clay, sand, gravel hardpan | 2 | 205 |
| Sand, clay and gravel | 16 | 221 |
| Clay, sand, gravel hardpan | 2 | 223 |
| Gravel, sand | 1 | 224 |
| Sand and clay, gravelly | 4 | 228 |
| Clay, sand, gravel hardpan | 27 | 255 |
| **3S 11W 11-11** | | |
| Sand, gravelly, and clay | 24 | 24 |
| Gravel and sand, clayey | 7 | 31 |
| Sand, gravelly, and clay | 25 | 56 |
| Clay, sand, gravel and boulders | 18 | 74 |
| Sand and gravel, clayey | 27 | 118 |
| Sand, fine, clayey | 13 | 131 |
| **3S 11W 11-11 Continued** | | |
| Sand, gravelly, and clay | 5 | 136 |
| Clay and fine sand | 3 | 139 |
| Sand, fine, gravelly, and clay | 45 | 184 |
| Sand, fine, and clay | 8 | 192 |
| Sand and clay, "tight" | 8 | 200 |
| **3S 11W 13-2** | | |
| Clay, sand | 9 | 9 |
| Sand, clayey | 11 | 20 |
| Clay, sand, stones, hardpan and boulders | 29 | 49 |
| Sand, fine, clay, hardpan and boulders | 4 | 53 |
| Clay, sand, gravel, boulders, and hardpan | 6 | 59 |
| Clay and sand | 12 | 71 |
| Sand, clay, gravel, and hardpan | 10 | 81 |
| Clay, sand, stones, hardpan | 40 | 121 |
| **3S 11W 13-3** | | |
| Clay, sand | 5 | 5 |
| Sand, clay | 5 | 10 |
| Sand, gravelly, and clay | 19 | 29 |
| Clay, sand, and gravel | 22 | 51 |
| Sand, clay, and gravel | 4 | 55 |
| Gravel, sand and clay | 3 | 58 |
| Clay, sand, stones and hardpan | 15 | 73 |
| Sand, clay, gravel | 14 | 87 |
| Sand, fine, and clay | 5 | 92 |
| Sand, fine, gravelly, and clay | 30 | 122 |
| Sand, gravelly | 11 | 133 |
| Sand, fine, and clay | 7 | 140 |
| Sand, fine, clay, gravelly | 18 | 158 |
| Sand, gravelly, and clay | 8 | 166 |
| Clay, sand, and gravel | 5 | 171 |
| Sand, gravelly and clay | 3 | 174 |
| Clay, sand, and gravel | 12 | 186 |
| Sand, fine, and clay | 8 | 194 |
| **3S 11W 14-2 Alt. 869** | | |
| Sand, gravel, and clay | 25 | 25 |
| Sand and gravel | 15 | 40 |
| Sand | 35 | 75 |
| Sand and gravel | 18 | 93 |
| Sand, medium | 5 | 98 |
| Sand, fine | 8 | 106 |
| **3S 11W 14-7 Alt. 871.35** | | |
| Clay, sand, and gravel | 5 | 5 |
| Sand and clay | 5 | 10 |
| Clay, stones, and sand | 10 | 20 |
| Sand and gravel | 7 | 27 |
| Gravel and sand | 14 | 41 |
| Sand and gravel | 7 | 48 |
| Gravel and sand | 7 | 55 |
| Sand, gravelly, clayey | 7 | 62 |
| Clay, and stones | 6 | 68 |
| Sand, fine, and clay | 8 | 76 |
| Gravel and fine sand, clayey | 6 | 82 |
| Sand, fine, gravel and clay | 11 | 93 |
| Sand, fine, gravelly, and clay | 5 | 98 |
| Sand, fine, gravel and clay | 6 | 104 |
| Sand, fine, gravelly, and clay | 6 | 110 |
| Sand and gravel, clayey | 5 | 115 |
| **3S 11W 14-11 Alt. 864.01** | | |
| Clay and sand | 2 | 2 |
| Sand, gravelly, clayey | 8 | 10 |
| Sand and clay | 5 | 15 |
| Sand and gravel | 5 | 20 |
| Gravel and sand | 7 | 27 |
| Clay, sand, and gravel hardpan | 25 | 52 |
| Sand, clay, gravel, streaks of hardpan | 8 | 60 |
| Clay | 2 | 62 |
| Sand, fine, and clay | 6 | 68 |
| Sand, and gravelly clay | 6 | 74 |
| Gravel and clayey sand | 7 | 81 |
| Sand and gravelly clay | 7 | 88 |
| Sand and gravel, clayey | 6 | 94 |
| Sand, fine, gravelly clay | 5 | 99 |
| Sand, gravel and little clay | 6 | 105 |
| Gravel and sand | 10 | 115 |
| Clay, fine sand | 10 | 125 |
| **3S 11W 14-18 Alt. 869.52** | | |
| Clay and fine gravel | 8 | 8 |
| Sand, clayey | 8 | 16 |
| Sand, gravel, clay and hardpan | 3 | 19 |
| Sand, gravelly, clayey | 7 | 26 |
| Sand and gravel, clayey | 13 | 39 |
| Sand and gravel, clayey | 3 | 42 |
| Sand, fine, and clay | 8 | 50 |
| Sand, gravelly, clayey | 4 | 54 |
| Gravel, clay, and sand | 7 | 61 |
| Sand, gravel, and clay | 7 | 68 |
| Sand and gravel, clayey | 7 | 75 |
| Sand, fine, gravelly, and clay | 7 | 82 |
| Sand, fine, gravelly, and clay | 7 | 89 |
| Sand, fine, gravelly, clayey | 7 | 96 |
| Sand and gravel, clayey | 7 | 103 |
| Sand, fine, gravelly, clayey | 6 | 109 |
| Sand, gravelly, clayey | 9 | 118 |
| **3S 11W 14-21 Alt. 869.10** | | |
| Clay, gravel and sand | 8 | 8 |
| Sand, gravelly, and clayey | 10 | 18 |
| Sand, clayey | 9 | 27 |
| Sand, gravelly, clayey | 8 | 35 |
| Sand and gravel | 6 | 41 |
| Sand, gravelly, and clayey | 7 | 48 |
| Clay, sand, and gravel | 8 | 56 |
| Gravel, clay, and sand | 2 | 58 |
| Clay, sand, and gravel | 10 | 68 |
| Sand, gravelly, and clay | 14 | 82 |
| Gravel and sand, clayey | 10 | 92 |
| Sand, fine, and clay | 7 | 99 |
| Sand, fine, clayey | 6 | 105 |
| Sand, fine, gravelly, and clayey | 13 | 118 |
| **3S 11W 14-38 Alt. 874** | | |
| Topsoil | 15 | 15 |
| Gravel, fine, and sand | 24 | 39 |
| Sand | 5 | 44 |
| Clay, sandy, hard, and hardpan | 13 | 57 |
| Sand | 8 | 65 |
| Sand, gravel, and clay | 3 | 68 |
| Sand | 4 | 72 |
| Sand and gravel | 16 | 88 |
| Sand and gravel, clayey | 4 | 92 |
| Sand and gravel | 10 | 102 |
| Sand and gravel, "tight" | 4 | 106 |
| Sand | 10 | 116 |
| Sand, clayey, and gravel | 7 | 123 |

Table 2.--Selected logs of wells and test borings in the Kalamazoo area.--Continued

| | Thickness | Depth |
|---|---|---|
| **3S 11W 14-39 Alt. 870.0** | | |
| Clay, surface, and sand | 16 | 16 |
| Sand, gravelly, and clay | 9 | 25 |
| Sand and gravel | 17 | 42 |
| Hardpan | 7 | 49 |
| Sand | 20 | 69 |
| Sand, "tight" | 4 | 73 |
| Sand, gravelly | 5 | 78 |
| Sand and small gravel | 23 | 101 |
| Sand | 8 | 109 |
| **3S 11W 14-42 Alt. 873** | | |
| Sand and clay | 20 | 20 |
| Sand, gravel, and clay | 6 | 26 |
| Sand, coarse | 30 | 56 |
| Sand and gravel | 12 | 68 |
| Sand | 57 | 125 |
| Sand and clay | 5 | 130 |
| **3S 11W 14-46** | | |
| Clay and sand | 8 | 8 |
| Sand, gravelly, clayey | 22 | 30 |
| Sand, clayey | 6 | 36 |
| Sand and gravel | 8 | 44 |
| Sand, fine, gravelly, clayey | 21 | 65 |
| Sand and gravel, clayey | 5 | 70 |
| Sand, gravelly, clayey | 6 | 76 |
| Gravel and sand | 10 | 86 |
| Sand, gravelly, clayey | 5 | 91 |
| Sand, clayey, "tight" | 7 | 98 |
| Sand, gravelly, and clay | 4 | 102 |
| Sand, gravelly | 17 | 119 |
| Gravel and sand | 5 | 124 |
| Sand, gravelly | 8 | 132 |
| Gravel and sand | 5 | 137 |
| Clay and fine sand | 13 | 150 |
| **3S 11W 14-49** | | |
| Fill, clay, and sand | 8 | 8 |
| Sand and clay | 6 | 14 |
| Gravel, sand, and boulders | 6 | 20 |
| Sand and gravel | 20 | 40 |
| Gravel and sand | 10 | 50 |
| Sand, fine, and clay, gravelly | 6 | 56 |
| Clay, sand, and gravel | 4 | 60 |
| Clay | 5 | 65 |
| Hardpan | 1 | 66 |
| Gravel and sand | 2 | 68 |
| Clay and sand, gravelly | 3 | 71 |
| Sand, gravelly, and clay | 5 | 76 |
| Sand and gravel, clayey | 5 | 81 |
| Sand, medium, and gravel | 15 | 96 |
| Sand, "tight" | 6 | 102 |
| Sand, fine, "tight" | 5 | 107 |
| Sand, fine, gravelly | 25 | 132 |
| Sand and gravel | 4 | 136 |
| Gravel and sand | 5 | 141 |
| Sand and gravel, clayey | 4 | 145 |
| Clay and fine sand | 10 | 155 |
| **3S 11W 14-51** | | |
| Clay and sand | 8 | 8 |
| Sand, clay, and gravel | 13 | 21 |
| Sand and gravel | 6 | 27 |
| Gravel and sand, gravelly | 6 | 33 |
| Sand, fine, gravelly, clayey | 6 | 39 |
| Clay, sand, and gravel | 11 | 50 |
| Sand, fine, gravel and clay | 5 | 55 |
| Clay, sand, gravel, and hardpan | 5 | 60 |
| Sand and gravel, clayey, "tight" | 9 | 69 |
| Sand and gravel, clayey, "tight" | 5 | 74 |
| **3S 11W 14-51 Continued** | | |
| Sand and gravel, clayey | 6 | 80 |
| Sand, gravelly, and clay | 5 | 85 |
| Sand, clayey, tight | 3 | 88 |
| Sand, fine, and clay | 2 | 90 |
| Sand and gravel, clayey | 5 | 95 |
| Sand, gravelly, clayey | 10 | 105 |
| Sand and gravel, clayey | 5 | 110 |
| Sand, gravelly, clayey | 5 | 115 |
| Sand, fine, and clay | 7 | 122 |
| Gravel and sand | 3 | 125 |
| Sand and gravel, clayey | 5 | 130 |
| Sand, gravelly | 5 | 135 |
| Sand, fine, and clay | 13 | 148 |
| **3S 11W 14-53** | | |
| Sand, clay, and gravel | 10 | 10 |
| Sand, gravel, and clay | 14 | 24 |
| Gravel and sand, clayey | 11 | 35 |
| Gravel and sand | 11 | 46 |
| Sand, clayey | 3 | 49 |
| Clay, sand, and gravel | 3 | 52 |
| Sand and gravel, clayey | 7 | 59 |
| Sand, fine, and clay | 10 | 69 |
| Sand, fine, gravelly, clayey | 11 | 80 |
| Sand, fine, clayey | 12 | 92 |
| Sand, clayey, "tight" | 4 | 96 |
| Sand, gravelly, clayey | 6 | 102 |
| Sand, gravelly | 5 | 107 |
| Sand and gravel | 5 | 112 |
| Gravel and sand | 13 | 125 |
| Sand, fine | 7 | 132 |
| Clay and fine sand | 8 | 140 |
| Clay, sand, and gravel | 2 | 142 |
| Gravel and sand | 4 | 146 |
| Sand and gravel | 10 | 156 |
| Gravel and sand | 11 | 167 |
| Sand, fine, and clayey gravel | 4 | 171 |
| Sand, fine and clay | 4 | 175 |
| **3S 11W 14-55** | | |
| Sand, clay, and gravel | 8 | 8 |
| Sand and gravel, clayey | 16 | 24 |
| Gravel, sand, and clay | 12 | 36 |
| Sand and gravel | 9 | 45 |
| Sand, fine, and gravelly clay | 7 | 52 |
| Gravel and sand | 5 | 57 |
| Sand, clay, gravel, "tight" | 8 | 65 |
| Gravel, sand, and clay | 4 | 69 |
| Sand, fine, clayey, "tight" | 24 | 93 |
| Sand, fine, gravelly | 9 | 102 |
| Sand, fine, clayey | 5 | 107 |
| Sand, fine, gravelly | 8 | 115 |
| Sand and gravel | 8 | 123 |
| Gravel and sand | 5 | 128 |
| Sand and gravel | 4 | 132 |
| Clay and fine sand | 13 | 145 |
| Sand, gravelly, clayey, "tight" | 6 | 151 |
| Sand, gravelly, clayey | 6 | 157 |
| Sand, fine, gravelly, clayey, "tight" | 4 | 161 |
| Sand, fine, and clay | 14 | 175 |
| **3S 11W 14-62** | | |
| Clay, sand and gravel | 10 | 10 |
| Gravel and sand, clayey | 23 | 33 |
| Sand, clayey | 8 | 41 |
| Gravel and sand | 2 | 43 |
| Sand, gravelly | 8 | 51 |
| Clay, sand, and gravel | 10 | 61 |
| Sand, fine, clay, and gravel | 5 | 66 |
| Sand, gravel, and clay, "tight" | 8 | 74 |
| **3S 11W 14-62 Continued** | | |
| Sand, gravelly, clayey, "tight" | 7 | 81 |
| Sand, fine, clayey | 12 | 93 |
| Sand, fine, gravelly | 16 | 109 |
| Sand, coarse | 4 | 113 |
| Sand, gravelly | 7 | 120 |
| Sand and gravel | 8 | 128 |
| Sand, fine, clayey, "tight" | 7 | 135 |
| Sand, fine, and clay | 7 | 142 |
| Clay and sand | 7 | 149 |
| Sand, fine, gravelly clay, "tight" | 6 | 155 |
| Sand, gravelly, clayey, "tight" | 10 | 165 |
| Sand and gravel, clayey | 7 | 172 |
| Gravel, clay, sand, and boulder | 4 | 176 |
| Sand, fine, clay, gravel | 4 | 180 |
| Sand, coarse | 3 | 183 |
| Sand, gravelly, and clay, "tight" | 3 | 186 |
| Gravel and sand, clayey | 7 | 193 |
| Clay, gravelly | 12 | 205 |
| **3S 11W 14-67** | | |
| Sand and clay | 5 | 5 |
| Sand, gravel, and clay | 14 | 19 |
| Sand, gravelly, clayey | 9 | 28 |
| Gravel and sand | 7 | 35 |
| Sand, fine, clayey | 4 | 39 |
| Sand, clay, and gravel | 5 | 44 |
| Gravel and sand, clayey | 4 | 48 |
| Sand, clay, and gravel | 10 | 58 |
| Sand, fine, clay, "tight" | 5 | 63 |
| Gravel and sand, clayey | 3 | 66 |
| Clay, sand, gravel, and hardpan | 3 | 69 |
| Sand, gravelly, clay, "tight" | 6 | 75 |
| Clay, sand, boulders | 2 | 77 |
| Sand, fine, gravelly, and clay, "tight" | 5 | 82 |
| Sand, gravel, and clay, "tight" | 7 | 89 |
| Sand, fine, gravelly, clayey, "tight" | 6 | 95 |
| Sand, gravelly, and clay, "tight" | 7 | 102 |
| Sand, fine, and clay | 5 | 107 |
| Sand, fine, gravelly, and clay, "tight" | 8 | 115 |
| Sand, fine, gravelly, clayey, "tight" | 7 | 122 |
| Sand, fine, gravelly, clayey, "tight" | 7 | 129 |
| Sand, gravel, clayey, "tight" | 5 | 134 |
| Sand, gravelly, clayey, "tight" | 5 | 139 |
| Clay, and fine sand | 6 | 145 |
| **3S 11W 14-69** | | |
| Fill, sand, gravel, and clay | 6 | 6 |
| Sand, clayey | 12 | 18 |
| Sand and gravel | 12 | 30 |
| Sand, fine, gravelly, clayey | 6 | 36 |
| Clay and fine sand | 2 | 38 |
| Sand, fine, clay, gravelly, and hardpan | 12 | 50 |
| Sand, fine, and clay, gravelly | 7 | 57 |
| Sand, fine, gravelly, clayey | 3 | 60 |

Table 2.--Selected logs of wells and test borings in the Kalamazoo area.--Continued

| | Thickness | Depth |
|---|---|---|
| 3S 11W 14-69 Continued | | |
| Gravel and sand | 4 | 64 |
| Clay and sand, gravelly | 12 | 76 |
| Sand and clay, gravelly, "tight | 3 | 79 |
| Sand and gravel, clayey, "tight" | 13 | 92 |
| Sand, gravelly, clayey, "tight" | 7 | 99 |
| Sand, fine, clayey, "tight" | 8 | 107 |
| Sand, fine, gravelly, clayey, "tight" | 7 | 114 |
| Sand, fine, gravelly, clayey, "tight" | 7 | 121 |
| Sand, fine, gravel, clayey, "tight" | 7 | 128 |
| Sand, fine, gravelly, clayey, "tight" | 9 | 137 |
| Clay and fine sand | 8 | 145 |
| Sand, fine, and gravel, clayey, "tight" | 8 | 153 |
| Sand and gravel, clayey, "tight" | 8 | 161 |
| Sand and gravel, and clayey | 5 | 166 |
| Clay and fine sand | 1 | 167 |
| Gravel and sand, clayey | 7 | 174 |
| Gravel, coarse sand, clayey | 5 | 179 |
| Gravel and coarse sand | 7 | 186 |
| Sand, fine, and clay, "tight" | 5 | 191 |
| Sand, and gravel, clayey, "tight" | 4 | 195 |
| Sand, gravelly, clayey, "tight" | 5 | 200 |
| Sand, fine, gravelly clay, "tight | 3 | 203 |
| Gravel and sand, clayey | 4 | 207 |
| Sand, fine, gravelly, clay, "tight" | 6 | 213 |
| Sand, clay, gravel, boulders, and hardpan | 9 | 222 |
| 3S 11W 14-72 | | |
| Clay and sand | 4 | 4 |
| Sand, gravelly, and clay | 14 | 18 |
| Sand and gravel | 7 | 25 |
| Gravel and sand | 7 | 32 |
| Clay, sand, and gravel | 18 | 50 |
| Sand, gravelly, clayey, boulder 70-77 | 27 | 77 |
| Sand, gravelly | 21 | 98 |
| Sand, gravelly, clayey | 20 | 118 |
| Sand and gravel | 12 | 130 |
| Gravel and sand | 6 | 136 |
| Sand, gravelly, clayey, "tight" | 6 | 142 |
| Clay and fine sand | 8 | 150 |
| Sand, medium, clayey | 4 | 154 |
| Sand, clay, gravelly | 17 | 171 |
| Clay and gravel | 7 | 178 |
| Sand, gravelly, clayey, "tight" | 4 | 182 |
| Clay, gravel, and sand | 3 | 185 |
| Gravel, sand, and clay | 10 | 195 |
| Clay, gravel, and sand | 2 | 197 |
| Gravel, sand, and clay | 2 | 199 |
| Clay and gravel | 2 | 201 |
| Gravel and sand, clayey | 3 | 204 |
| Clay and gravel, sandy | 2 | 206 |
| Gravel and sand, clayey | 4 | 210 |
| Clay and sand, gravelly | 3 | 213 |
| Sand, fine, gravelly and clay, "tight" | 4 | 217 |
| Clay and sand, gravelly | 23 | 240 |
| 3S 11W 14-75 | | |
| Clay, sand, and gravel | 5 | 5 |
| Gravel, sand, and clay | 12 | 17 |
| Sand, fine to coarse, clayey, gravel | 20 | 37 |
| Clay, sand, gravel and hardpan | 34 | 71 |
| Sand and clay, "tight" | 2 | 73 |
| Gravel, sand, clay, "tight" | 2 | 75 |
| Clay and stones | 4 | 79 |
| Sand and clay | 2 | 81 |
| Clay and fine sand | 8 | 89 |
| Sand, fine, gravelly and clay, "tight" | 37 | 126 |
| Clay and fine sand | 12 | 138 |
| Sand, clay, and gravel, "tight" | 24 | 162 |
| Gravel and sand, clayey and boulders | 5 | 167 |
| Sand and gravel, clayey and boulders | 3 | 170 |
| Gravel and sand, clayey | 12 | 182 |
| Sand, gravel, and clay | 5 | 187 |
| Sand, fine, clayey | 7 | 194 |
| Clay and fine sand | 11 | 205 |
| 3S 11W 21-3 | | |
| Clay and fine sand | 3 | 3 |
| Sand, fine, and clay | 14 | 17 |
| Sand, fine, gravelly, clayey | 28 | 45 |
| Sand and gravel | 6 | 51 |
| Sand, fine, gravelly | 2 | 53 |
| Sand, fine, and gravel | 5 | 58 |
| Sand, fine, and clay, gravelly | 3 | 61 |
| Sand and gravel, clayey | 5 | 66 |
| Gravel and sand, clayey | 6 | 72 |
| Sand, fine, gravelly | 4 | 76 |
| Sand, gravelly | 3 | 79 |
| Sand and gravel | 3 | 82 |
| Sand, fine, gravelly, clayey | 6 | 88 |
| 3S 11W 21-4 | | |
| Clay and sand | 24 | 24 |
| Sand, fine, gravelly | 22 | 46 |
| Sand and gravel | 6 | 52 |
| Sand, gravelly | 4 | 56 |
| Sand, fine | 3 | 59 |
| Sand, clay, and gravel | 1 | 60 |
| Sand, gravelly | 3 | 63 |
| Sand and gravel | 6 | 69 |
| Gravel and sand | 7 | 76 |
| Sand and gravel | 5 | 81 |
| 3S 11W 21-5 | | |
| Topsoil | 1 | 1 |
| Sand, muddy, and gravel | 34 | 35 |
| Sand, cleaner | 7 | 42 |
| Sand and gravel, clean | 5 | 47 |
| Clay, gray, sandy | 3 | 50 |
| Sand, fine, gravelly, clay balls | 5 | 55 |
| Clay, gravelly | 10 | 65 |
| Clay and gravel | 8 | 73 |
| Sand, muddy, and gravel | 2 | 75 |
| Sand, muddy, and gravel, cleaner | 3 | 78 |
| Sand, clean, gravelly | 17 | 95 |
| Gravel, sandy | 7 | 102 |
| Clay, sandy | - | 102 |
| 3S 11W 22-1 | | |
| No record | 5 | 5 |
| Sand, fine to coarse, gravel streaks | 47 | 52 |
| Clay, sand, and gravel | 7 | 59 |
| Sand and gravel, dirty | 9 | 68 |
| 3S 11W 22-2 | | |
| Sand, fine | 18 | 18 |
| Sand and gravel | 7 | 25 |
| Sand, coarse | 17 | 42 |
| Sand, medium | 10 | 52 |
| Clay, sandy | 12 | 64 |
| Clay and gravel | 3 | 67 |
| Sand, clean | 23 | 90 |
| Sand, clean, and fine gravel | 12 | 102 |
| Sand, dirty | - | 102 |
| 3S 11W 27-2 Alt. 888 | | |
| Sand | 125 | 125 |
| Sand and gravel | 27 | 152 |
| Sand | 99 | 251 |
| Shale | 10 | 261 |
| Total depth - 1291 ft. | | |
| 3S 10W 8-1 | | |
| Sand and gravel | 121 | 121 |
| Sand | 4 | 125 |
| Sand, heaving | 18 | 143 |
| Gravel | 36 | 179 |
| Shale, blue | 101 | 280 |
| Total depth - 1307 ft. | | |

**Table 3.--Specific capacities of wells in the Kalamazoo area**

Drawdown or discharge: E, estimated; M, measured; R, reported

| Well | number | Drawdown (feet) | Discharge (gpm) | | Specific capacity (gpm/ft) |
|---|---|---|---|---|---|
| 2S 12W | 25-1 | 30 | 200 | R | 7 |
| | | 21 | 150 | R | 7 |
| | 35-1 | 9 | 125 | R | 14 |
| | 35-2 | 17 | 400 | R | 23 |
| 2S 11W | 3-10 | 7 | 203 | R | 29 |
| | 3-13 | 30 | 130 | R | 4 |
| | 3-18 | 23 | 180 | R | 8 |
| | 3-20 | 6.7 | 87 | R | 13 |
| | | 6 | 127 | R | 21 |
| | 3-21 | 4.5 | 270 | R | 60 |
| | | 6 | 323 | R | 54 |
| | | 7 | 520 | R | 74 |
| | 3-22 | 3 | 143 | R | 48 |
| | 3-24 | 32 | 180 | R | 6 |
| | 3-25 | 7.8 | 210 | R | 27 |
| | 3-26 | 7 | 360 | R | 51 |
| | | 4 | 215 | R | 54 |
| | | 5 | 277 | R | 55 |
| | 3-28 | 12.7 | 690 | R | 54 |
| | 3-30 | 8 | 450 | R | 56 |
| | 3-31 | 8 | 450 | R | 56 |
| | 3-32 | 15 | 71 | R | 5 |
| | 3-33 | 8 | 120 | R | 15 |
| | 4-3 | 15 | 250 | R | 17 |
| | 4-4 | 2 | 255 | R | 127 |
| | 6-1 | 36 | 400 | R | 11 |
| | 10-3 | 6 | 300 | R | 50 |
| | 10-5 | 18 | 975 | R | 54 |
| | | 14 | 750 | R | 54 |
| | 10-6 | 10 | 750 | R | 75 |
| | 10-7 | 7 | 400 | R | 57 |
| | 10-22 | 39 | 175 | R | 4 |
| | 10-27 | 33 | 1150 | R | 35 |
| | 10-28 | 25 | 700 | R | 28 |
| | 10-31 | 20 | 200 | R | 10 |
| | 10-35 | 20 | 180 | R | 9 |
| | 10-41 | 4 | 200 | R | 50 |
| | 10-44 | 29 | 450 | R | 15 |
| | 10-45 | 23 | 600 | R | 26 |
| | 10-46 | 6 | 200 | E | 33 |
| | | 11 | 400 | E | 36 |
| | | 15 | 500 | E | 33 |
| | | 19 | 680 | E | 36 |
| | 10-51 | 20.2 | 450 | R | 22 |
| | | 23.2 | 500 | R | 22 |
| | | 26.5 | 550 | R | 21 |
| | | 29.7 | 600 | R | 20 |
| | | 32.8 | 650 | R | 20 |
| | | 35.2 | 700 | R | 20 |
| | 10-52 | 27 | 830 | R | 31 |
| | 12-2 | 58 | 150 | R | 3 |
| | 14-10 | 27 | 500 | R | 18 |
| 2S 11W | 14-13 | 16 | 450 | R | 28 |
| | | 23 | 600 | R | 26 |
| | 14-14 | 28 | 450 | R | 16 |
| | 14-16 | 15.2 | 250 | R | 16 |
| | | 31 | 350 | R | 11 |
| | | 30 | 300 | R | 10 |
| | | 48 | 600 | R | 12 |
| | 15-3 | 15 | 400 | R | 27 |
| | 15-4 | 15.5 | 475 | R | 32 |
| | 15-5 | 14 | 490 | R | 35 |
| | 15-11 | 18 | 80 | E | 4 |
| | 15-14 | 21 | 250 | R | 12 |
| | 15-15 | 30 | 985 | R | 33 |
| | 15-22 | 52 | 535 | R | 10 |
| | 15-24 | 9 | 265 | R | 29 |
| | 15-25 | 50 | 800 | E | 16 |
| | 15-26 | 87 | 600 | R | 7 |
| | 15-30 | 4.2 | 66 | R | 15 |
| | | 6.7 | 86 | R | 13 |
| | 18-1 | 17 | 300 | R | 18 |
| | | 6 | 100 | R | 17 |
| | | 10 | 200 | R | 20 |
| | 20-6 | 8 | 186 | R | 23 |
| | | 10 | 220 | R | 22 |
| | | 12 | 236 | R | 20 |
| | | 35 | 610 | R | 17 |
| | 20-10 | 46 | 475 | R | 10 |
| | | 51 | 550 | R | 11 |
| | | 62 | 629 | R | 10 |
| | 21-4 | 33 | 235 | R | 7 |
| | 21-12 | 61 | 220 | R | 4 |
| | 22-4 | - | - | R | 52 |
| | 22-20 | 18.1 | 750 | R | 41 |
| | 22-22 | 21.3 | 505 | R | 24 |
| | 22-25 | 24 | 560 | R | 23 |
| | 22-39 | 23 | 580 | R | 25 |
| | 22-58 | 16.4 | 750 | R | 46 |
| | 22-61 | 14 | 750 | R | 54 |
| | 22-64 | 19 | 750 | R | 39 |
| | 22-67 | 21 | 750 | R | 36 |
| | 22-71 | 27 | 750 | R | 28 |
| | 22-74 | 7 | 750 | R | 107 |
| | 22-76 | 12.2 | 750 | R | 61 |
| | 22-79 | 15.1 | 750 | R | 50 |
| | 22-82 | 19.2 | 750 | R | 39 |
| | 22-104 | 21 | 155 | R | 7 |
| | | 40 | 298 | R | 8 |
| | | 57 | 450 | R | 8 |
| | 22-105 | 30.2 | 300 | R | 10 |
| | | 40.2 | 400 | R | 10 |
| | | 43.9 | 500 | R | 11 |
| | 22-107 | 6 | 855 | R | 143 |
| | 22-110 | 32 | 775 | R | 24 |
| 2S 11W | 23-14 | 6.5 | 150 | R | 23 |
| | 23-15 | 6.5 | 100 | R | 15 |
| | 24-4 | 6 | 656 | M | 109 |
| | 24-5 | 9.2 | 655 | M | 71 |
| | 24-7 | 5.5 | 1000 | M | 182 |
| | 24-11 | 6 | 300 | R | 50 |
| | | 9 | 400 | R | 44 |
| | | 12 | 500 | R | 42 |
| | | 16 | 600 | R | 37 |
| | | 20 | 700 | R | 35 |
| | | 27 | 800 | R | 30 |
| | 24-12 | 31 | 500 | R | 16 |
| | 24-13 | 26 | 400 | R | 15 |
| | 24-25 | 16 | 200 | R | 12 |
| | 24-26 | 35.5 | 400 | R | 11 |
| | 25-1 | 50 | 402 | R | 8 |
| | 25-9 | 40 | 120 | R | 3 |
| | | 18 | 61 | R | 3 |
| | 25-10 | 22 | 140 | R | 6 |
| | 27-32 | 43 | 653 | R | 15 |
| | 27-33 | 35 | 765 | R | 22 |
| | 27-36 | 35 | 585 | R | 17 |
| | 27-37 | 25 | 525 | R | 21 |
| | | 35 | 930 | R | 27 |
| | 27-51 | 19 | 525 | R | 28 |
| | 27-52 | 16 | 560 | R | 35 |
| | 29-2 | - | - | R | 18 |
| | 30-2 | 9.5 | 400 | R | 42 |
| | 30-4 | 43 | 260 | R | 6 |
| | 34-11 | 3 | 30 | R | 10 |
| | 36-10 | 20.5 | 370 | R | 18 |
| 3S 11W | 9-2 | 9 | 250 | R | 29 |
| | | 18.5 | 525 | R | 28 |
| | | 24.4 | 670 | R | 27 |
| | 11-1 | 40 | 1180 | R | 29 |
| | 14-1 | 32 | 1000 | R | 31 |
| | 14-2 | 32 | 950 | R | 30 |
| | | 21 | 700 | R | 33 |
| | 14-3 | 44 | 2100 | R | 48 |
| | 14-5 | 79 | 880 | R | 11 |
| | 14-6 | 53 | 1000 | R | 19 |
| | 14-22 | 25 | 1200 | R | 48 |
| | 14-26 | 50 | 1000 | R | 20 |
| | 14-28 | - | - | R | 23 |
| | 21-3 | 16 | 180 | R | 11 |
| | 21-4 | 12 | 175 | R | 15 |
| | 21-5 | 22 | 402 | R | 18 |
| | 22-2 | 21 | 350 | R | 17 |

Table 4.--Records of screens reported in water wells in the Kalamazoo area

| Well number | Diameter (inches) | Screen Setting (feet) From | Screen Setting (feet) To | Effective opening (inches) |
|---|---|---|---|---|
| 1S 11W 34-7 | 12 | 23 | 48 | 0.125 |
| 34-24 | 12 | 35 | 53 | - |
| 34-25 | 12 | 33 | 55 | - |
| 34-26 | 12 | 38 | 46 | .150 |
| | - | 46 | 54 | .125 |
| 34-27 | 12 | 28 | 45 | .150 |
| 34-28 | 12 | 43 | 61 | - |
| 34-29 | 12 | 39 | 54 | - |
| 2S 12W 25-1 | 6 | 184 | 189 | .060 |
| 2S 11W 3-20 | 12 | 23 | 38 | - |
| 3-21 | 12 | 28 | 38 | - |
| 3-23 | 12 | 31 | 34 | .060 |
| 3-24 | 12 | 45 | 65 | .012 |
| 3-25 | 12 | 26 | 36 | .100 |
| 3-26 | 12 | 26 | 33 | .140 |
| | 12 | 33 | 34 | .070 |
| 3-28 | 12 | 31 | 37 | .250 |
| 3-29 | 12 | 33 | 39 | .250 |
| 3-30 | 20 | 15 | 35 | - |
| 3-32 | 6 | 25 | 30 | - |
| | 6 | 57 | 60 | - |
| 3-33 | 5 | 21 | 36 | - |
| 3-34 | 2 | 22 | 32 | - |
| 3-35 | 2 | - | 25 | - |
| 3-36 | 2 | - | 45 | - |
| 3-37 | 2 | - | 30 | - |
| 3-38 | 1¼ | 35 | 38 | - |
| 3-39 | 1¼ | 24 | 27 | - |
| 3-40 | 1¼ | 28 | 31 | - |
| 3-42 | 1¼ | 26 | 29 | - |
| 3-44 | 1¼ | 36 | 39 | - |
| 3-45 | 1¼ | 25 | 28 | - |
| 3-46 | 1¼ | 37 | 40 | - |
| 3-50 | 1¼ | 25 | 28 | - |
| | 1¼ | 44 | 47 | - |
| 3-51 | 1¼ | 30 | 33 | - |
| 3-52 | 1¼ | 41 | 44 | - |
| 3-53 | 1¼ | 31 | 34 | - |
| 4-3 | 8 | 95 | 105 | .060 |
| 4-4 | 8 | 90 | 105 | .050 |
| 10-3 | 10 | 35 | 50 | - |
| 10-5 | 18 | 20 | 35 | - |
| 10-8 | 10 | - | - | .100 |
| 10-12 | 6 | - | - | .015 |
| 10-22 | 12 | 22 | 35 | .060 |
| | - | 44 | 50 | .060 |
| 10-23 | 6 | 25 | 40 | .060 |
| | - | 44 | 48 | .060 |
| 10-24 | 14 | 38 | 48 | .100 |
| 10-31 | 12 | 49 | 70 | .050 |
| 10-35 | 8 | 61 | 83 | .250 |
| 10-39 | 12 | 28 | 36 | .080 |
| | - | 41 | 51 | .080 |
| | - | 51 | 56 | .040 |
| 10-41 | 12 | 30 | 40 | .060 |
| | 12 | 40 | 45 | .035 |
| 10-42 | 26 | 37 | 52 | .155 |
| 10-43 | 12 | 29 | 37 | .080 |
| | 10 | 42 | 54 | .030 |
| 10-44 | 12 | 40 | 50 | .060 |
| | 12 | 50 | 59 | .040 |
| 10-45 | 12 | 47 | 57 | .100 |
| 10-46 | 12 | 57 | 82 | .080 |
| 10-48 | 12 | 32 | 47 | .100 |
| 10-49 | 12 | 38 | 47 | .075 |
| 10-51 | 14 | 44 | 54 | .080 |
| | - | 62 | 72 | .080 |
| 10-52 | 12 | 55 | 75 | .080 |
| | 12 | 75 | 80 | .050 |
| 12-2 | 8 | 70 | 90 | .016 |
| 14-13 | 12 | 60 | 70 | .080 |
| | 12 | 70 | 90 | .030 |
| 2S 11W 14-14 | 12 | 54 | 84 | 0.050 |
| 14-16 | 10 | 61 | 84 | .018 |
| 14-20 | 12 | 83 | 93 | .045 |
| 15-4 | 10 | 81 | 87 | - |
| 15-5 | 10 | 75 | 90 | .187 |
| 15-19 | 12 | 55 | 70 | .125 |
| 15-20 | 10 | 35 | 43 | .080 |
| | 10 | 43 | 52 | .030 |
| | 10 | 52 | 60 | .080 |
| 15-22 | 12 | 61 | 77 | .050 |
| 15-30 | 5 | 59 | 69 | - |
| 18-1 | 8 | 161 | 182 | - |
| 18-2 | - | 100 | 118 | - |
| | - | 140 | 149 | - |
| 20-6 | 12 | 117 | 132 | .030 |
| 21-4 | 10 | 75 | 90 | .014 |
| 21-12 | 6 | 137 | 142 | .020 |
| 22-13 | 40 | 60 | 140 | .187 |
| 22-22 | 12 | 128 | 153 | .100 |
| 22-25 | 12 | 97 | 122 | .100 |
| 22-29 | 18 | 90 | 120 | - |
| 22-39 | 12 | 155 | 175 | .250 |
| 22-44 | 12 | 122 | 142 | .250 |
| 22-47 | 12 | 132 | 147 | .250 |
| 22-51 | 12 | 154 | 174 | .250 |
| 22-55 | 12 | 125 | 145 | .250 |
| 22-58 | 12 | 160 | 185 | .250 |
| 22-61 | 12 | 103 | 133 | .250 |
| 22-64 | 12 | 101 | 131 | .250 |
| 22-67 | 12 | 166 | 186 | - |
| 22-71 | 12 | 166 | 186 | .250 |
| 22-74 | 12 | 131 | 151 | .250 |
| 22-76 | 12 | 145 | 165 | .250 |
| 22-79 | 12 | 135 | 155 | .250 |
| 22-81 | 12 | 161 | 176 | - |
| 22-82 | 12 | 154 | 169 | .250 |
| 22-83 | 4 | 154 | 169 | .250 |
| 22-107 | 25 | 45 | 103 | - |
| 22-110 | 12 | 90 | 120 | .040 |
| 22-111 | 10 | 76 | 91 | - |
| 23-4 | 6 | - | - | .187 |
| 23-7 | 12 | 33 | 48 | .100 |
| 23-8 | 12 | 36 | 54 | .100 |
| 23-9 | 12 | 33 | 51 | .100 |
| 23-10 | 12 | 34 | 52 | .100 |
| 23-14 | 8 | 55 | 57 | .020 |
| | 8 | 57 | 60 | .040 |
| | 8 | 60 | 70 | .080 |
| 24-7 | 16 | 27 | 37 | .205 |
| 24-10 | 4 | 33 | 36 | - |
| 24-11 | 10 | 36 | 46 | .125 |
| | 10 | 72 | 82 | .125 |
| 24-12 | 10 | 60 | 80 | .070 |
| 24-13 | 12 | 59 | 79 | - |
| 24-25 | 14 | 56 | 70 | .060 |
| 24-26 | 8 | 55 | 60 | - |
| | 8 | 75 | 89 | - |
| 25-1 | 12 | 68 | 93 | .006 |
| 25-9 | 12 | 76 | 91 | .012 |
| 25-10 | 8 | 91 | 106 | .030 |
| 25-11 | 8 | 39 | 49 | - |
| | 8 | 56 | 71 | - |
| 27-2 | 6 | 85 | 88 | .040 |
| | 6 | 88 | 92 | .080 |
| | 6 | 92 | 98 | .150 |
| | 6 | 98 | 103 | .200 |
| 27-3 | 12 | 85 | 112 | - |
| 27-24 | 12 | 57 | 59 | - |
| | 12 | 68 | 78 | - |
| | 12 | 88 | 98 | - |
| | 12 | 160 | 164 | - |
| | 12 | 168 | 178 | - |
| 27-26 | 12 | 30 | 35 | - |
| | 12 | 109 | 114 | - |
| 2S 11W 27-26 | 12 | 116 | 121 | |
| | 12 | 150 | 152 | - |
| | 12 | 196 | 199 | - |
| 27-31 | 12 | 82 | 87 | - |
| | 12 | 88 | 92 | - |
| | 12 | 120 | 125 | - |
| | 12 | 129 | 134 | - |
| | 12 | 140 | 145 | - |
| | 12 | 155 | 160 | - |
| | 12 | 170 | 174 | - |
| 27-33 | 18 | 95 | 128 | - |
| 27-34 | 18 | 75 | 115 | - |
| 27-35 | 12 | 96 | 116 | - |
| 27-36 | 12 | 107 | 117 | 0.080 |
| | 12 | 117 | 127 | .040 |
| 27-37 | 12 | 85 | 105 | .050 |
| | 12 | 105 | 110 | .020 |
| 27-39 | 12 | 125 | 135 | .035 |
| | 12 | 135 | 155 | .070 |
| 27-40 | 12 | 87 | 93 | - |
| | 12 | 115 | 121 | - |
| | 12 | 170 | 173 | - |
| | 12 | 175 | 182 | - |
| | 12 | 184 | 190 | - |
| 27-46 | 12 | 58 | 65 | - |
| | 12 | 132 | 137 | - |
| | 12 | 140 | 145 | - |
| | 12 | 150 | 155 | - |
| | 12 | 160 | 170 | - |
| | 12 | 180 | 190 | - |
| 27-50 | 12 | 107 | 112 | - |
| | 12 | 113 | 117 | - |
| | 12 | 118 | 123 | - |
| | 12 | 140 | 155 | - |
| | 12 | 177 | 180 | - |
| 27-52 | 12 | 113 | 143 | .020 |
| 28-9 | 6 | - | - | .250 |
| 29-2 | 12 | 145 | 150 | .030 |
| | 12 | 150 | 160 | .050 |
| | 12 | 160 | 170 | .070 |
| 30-2 | 18 | 53 | 65 | - |
| 30-4 | 24 | 48 | 79 | - |
| 35-2 | 10 | 121 | 130 | - |
| 36-1 | 6 | 139 | 159 | - |
| 36-10 | 12 | 195 | 200 | .060 |
| | 12 | 200 | 210 | .150 |
| | 12 | 210 | 220 | .200 |
| 2S 10W 17-2 | 8 | 33 | 36 | .006 |
| | 8 | 36 | 39 | .008 |
| 3S 11W 3-9 | 2 | 131 | 137 | - |
| 3-12 | 3 | 114 | 117 | - |
| 3-14 | 2 | 121 | 124 | - |
| 3-16 | 12 | 133 | 153 | - |
| 3-19 | 12 | 137 | 157 | - |
| 4-3 | 6 | 158 | 164 | .100 |
| 9-2 | 12 | 139 | 149 | .016 |
| | 12 | 149 | 169 | .025 |
| | 12 | 169 | 185 | .040 |
| 11-1 | 16 | 183 | 213 | .070 |
| 14-1 | 10 | 85 | 95 | - |
| | 10 | 100 | 115 | - |
| 14-5 | 14 | 125 | 137 | .045 |
| | 14 | 150 | 160 | .045 |
| 14-6 | 14 | 115 | 125 | .045 |
| | 14 | 156 | 166 | .045 |
| 14-22 | 16 | 173 | 202 | .070 |
| 14-26 | 10 | 112 | 132 | - |
| 21-2 | 1¼ | 23 | 26 | - |
| 21-3 | 8 | 74 | 88 | .080 |
| 21-5 | 12 | 82 | 102 | .020 |
| 22-2 | 12 | 87 | 97 | .020 |
| | 12 | 97 | 102 | .030 |
| 29-1 | 1¼ | 27 | 30 | - |

Table 5.--Chemical analyses of ground-water samples in the Kalamazoo area

Analyst: B, Betz Co.
LN, Layne Northern Co.
M, Michigan Dept. Health
NA, National Aluminate Co.
NG, National Gypsum Co.
U, U.S. Geological Survey
UJ, Upjohn Co.
UM, University of Michigan

| Well number or station | Analyst | Date collected | Chemical constituents (parts per million) | | | | | | | | | | | | | | | Specific conductance (micromhos at 25°C.) | pH | Temperature (°F.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Silica ($SiO_2$) | Iron (Fe) | Calcium (Ca) | Magnesium (Mg) | Sodium (Na) | Na + K | Potassium (K) | Bicarbonate ($HCO_3$) | Carbonate ($CO_3$) | Sulfate ($SO_4$) | Chloride (Cl) | Fluoride (F) | Nitrate ($NO_3$) | Dissolved solids | Hardness as $CaCO_3$ | | | |
| Samples from individual wells | | | | | | | | | | | | | | | | | | | | |
| 1S 12W | | | | | | | | | | | | | | | | | | | | |
| 25-1 | U | 2-26-54 | 11 | 1.1 | 77 | 33 | 2.0 | | 0.8 | 346 | 0 | 38 | 1.9 | 0.1 | 0.0 | 335 | 328 | 569 | 7.5 | 52 |
| 1S 11W | | | | | | | | | | | | | | | | | | | | |
| 34-7 | - | 6-26-50 | - | 0.0 | - | - | - | | - | 290 | 0 | 4 | 5 | - | - | - | 324 | - | 7.6 | - |
| 34-24 | U | 2-24-54 | 14 | 0.0 | 78 | 31 | 5.3 | | 1.1 | 350 | 0 | 27 | 5.6 | .1 | 1.1 | 336 | 322 | 579 | 7.4 | 51 |
| 34-24 | M | 1- 2-56 | 9 | 0.0 | 77 | 26 | 7 | | 1.2 | 300 | - | 45 | 8 | 0.0 | 2 | 342 | 300 | 580 | 8.2 | - |
| 34-25 | M | 1- 2-56 | 11 | 2.5 | 82 | 28 | 7 | | 1.1 | 359 | - | 30 | 7 | 0.0 | 3 | 380 | 320 | 625 | 8.2 | - |
| 34-27 | M | 2-21-56 | 9 | 0.0 | 77 | 27 | 3 | | 1.0 | 312 | - | 35 | 6 | 0.0 | 3.4 | 309 | 309 | 570 | 8.2 | - |
| 34-29 | M | 1- 2-56 | 10 | 0.0 | 69 | 24 | 7 | | 1.0 | 280 | - | 36 | 7 | 0.0 | 0.0 | 300 | 272 | 530 | 8.2 | - |
| 2S 12W | | | | | | | | | | | | | | | | | | | | |
| 35-1 | M | - | - | - | 70 | 28 | | 10 | | 309 | 0 | 29 | 18 | .2 | - | 340 | 285 | - | - | - |
| 35-2 | U | 11-10-54 | 11 | .2 | 59 | 23 | 20 | | .8 | 276 | 0 | 26 | 24 | 0.0 | .2 | 300 | 243 | 531 | 7.8 | 51 |
| 2S 11W | | | | | | | | | | | | | | | | | | | | |
| 3-21 | M | 8-13-52 | 9 | 0.0 | 90 | 35 | | 8.2 | | 261 | 0 | 118 | 27 | 0.0 | 12 | 440 | 370 | 800 | 7.2 | 56 |
| 4-3 | U | 11- ?-44 | 5.6 | .5 | 75 | 28 | - | | - | 320 | 0 | 30 | 5 | .2 | - | 300 | 302 | - | - | - |
| 4-3 | M | 4-23-53 | 11 | .9 | 72 | 32 | | 6.8 | | 362 | 0 | 29 | 3 | 0.0 | 0.0 | 316 | 310 | 580 | 8.0 | 50 |
| 6-1 | M | 1-14-57 | 13 | 2.5 | 78 | 33 | 13 | | .6 | 376 | 0 | 33 | 8 | 0.0 | 0.0 | 362 | 330 | 730 | 7.5 | - |
| 8-1 | U | 2-26-54 | 12 | 0.0 | 70 | 23 | 3.5 | | 1.1 | 302 | 0 | 30 | 2.2 | .1 | 1.6 | 292 | 268 | 506 | 7.2 | 49 |
| 9-3 | M | 8-13-52 | 10 | 0.0 | 60 | 34 | | 9 | | 288 | 0 | 53 | 14 | 0.0 | 0.0 | 324 | 290 | 680 | 7.4 | 50.6 |
| 10-27 | M | 2-24-54 | - | - | - | - | - | | - | 455 | - | 78 | 30 | - | - | - | 420 | 910 | - | 58.2 |
| 10-27 | M | 9-23-54 | - | - | - | - | - | | - | 330 | - | 70 | 19 | - | - | - | 330 | 800 | - | 57.5 |
| 10-28 | M | 8-13-52 | 14.8 | 1.2 | 72 | 24 | | 14 | | 320 | - | 35 | 16 | .1 | 0.0 | 340 | 280 | 740 | 7.1 | 54.3 |
| 10-28 | M | 8-25-53 | - | - | - | - | - | | - | - | - | 39 | - | - | - | - | 410 | - | - | 59.0 |
| 10-40 | M | 9-24-52 | 8.3 | 1.3 | 154 | 47 | | 11 | | 412 | 0 | 225 | 21 | .1 | 0.0 | 726 | 580 | 650 | 7.1 | 55.2 |
| 10-40 | M | 9-23-54 | - | - | - | - | - | | - | 283 | - | 210 | 16 | - | - | - | 470 | 1050 | - | 55.5 |
| 10-82 | M | 4-14-55 | - | - | - | - | - | | - | 314 | - | 53 | 19 | - | - | - | 300 | 710 | - | 48.2 |
| 11-5 | M | 12- 3-30 | 14 | - | 66 | 23 | | 5.3 | | 273 | - | 31 | 11 | - | - | 286 | 250 | - | - | - |
| 11-7 | M | 12- 3-30 | 14 | - | 45 | 22 | | 14 | | 212 | 0 | 32 | 19 | - | - | 250 | 202 | - | - | - |
| 11-8 | M | 12-31-30 | 10 | - | 74 | 26 | | 16 | | 314 | 0 | 34 | 24 | - | - | 350 | 290 | - | - | - |
| 11-9 | M | 11- 8-29 | - | - | 69 | 22 | - | | - | 339 | 0 | - | - | - | - | - | 260 | - | - | - |
| 11-13 | M | 8-13-57 | 12 | .1 | 75 | 19 | 3.4 | | .5 | 266 | 0 | 35 | 7 | 0.0 | 9 | 292 | 265 | 510 | 7.3 | - |
| 14-5 | M | 9- 4-54 | 11 | 1.1 | 117 | 29 | | 7.6 | | 349 | - | 123 | 10 | 0.0 | - | 508 | 412 | 800 | 7.7 | - |
| 14-7 | M | 8-14-52 | 9 | .4 | 92 | 29 | | 7.3 | | 329 | 0 | 73 | 15 | 0.0 | 0.0 | 433 | 350 | 680 | 7.4 | 51.7 |
| 14-7 | M | 9-23-54 | - | - | - | - | - | | - | 210 | - | 105 | 24 | - | - | - | 275 | 800 | - | 56.5 |
| 14-7 | M | 4-14-55 | - | - | - | - | - | | - | - | - | - | - | - | - | - | - | 840 | - | 55.9 |
| 14-9 | M | 8-13-52 | 10 | 0.0 | 98 | 27 | | 10 | | 342 | 0 | 72 | 18 | .1 | 0.0 | 430 | 355 | 700 | 7.2 | 54.5 |
| 14-21 | M | 9-24-52 | 10 | .9 | 84 | 22 | | 9.4 | | 335 | 0 | 32 | 13 | .2 | 0.0 | 340 | 300 | 630 | 7.4 | 56.8 |
| 14-21 | M | 2-24-54 | - | - | - | - | - | | - | 382 | - | 18 | 13 | - | - | - | 325 | 690 | - | 57.4 |
| 14-21 | M | 9-23-54 | - | - | - | - | - | | - | 276 | - | 83 | 18 | - | - | - | 305 | 820 | - | 58.1 |
| 20-1 | M | 7- 9-54 | 13 | .6 | 66 | 22 | | 8.0 | | 312 | 0 | 15 | 2 | 0.0 | 0.0 | 254 | 255 | 490 | 7.5 | - |
| 20-10 | M | 2-10-58 | 14 | .7 | 62 | 24 | 5.3 | | .7 | 293 | 0 | 15 | 5.0 | 0.0 | 0.0 | 276 | 255 | 500 | 7.6 | - |
| 21-2 | M | 8-13-52 | 9.0 | - | 76 | 23 | | 4.5 | | 289 | 0 | 34 | 8.0 | .2 | 11 | 330 | 285 | 570 | 7.6 | 51.0 |
| 21-4 | U | 9- ?-44 | 7.2 | - | 65 | 22 | | 6.6 | | 314 | 0 | 8 | 3.0 | .1 | - | 270 | 252 | - | - | - |
| 21-7 | M | 2-24-48 | 5.6 | - | 63 | 24 | | 3.6 | | 305 | 0 | 8 | 3.0 | .1 | - | 264 | 252 | - | - | - |
| 21-8 | M | 2-24-48 | 3.2 | .8 | 63 | 22 | | 10 | | 317 | 0 | 6 | 3.0 | .1 | - | 262 | 248 | - | - | - |
| 22-4 | M | 8-15-52 | 10 | - | 114 | 36 | | 9.4 | | 371 | 0 | 117 | 19 | 0.0 | - | 550 | 435 | 800 | 7.2 | 52.9 |
| 22-4 | M | 8-25-53 | - | - | - | - | - | | - | - | - | 98 | - | - | - | - | 410 | - | - | 53.4 |
| 22-4 | M | 7- 9-54 | 14 | .2 | 120 | 34 | | 16 | | 390 | 0 | 117 | 20 | 0.0 | 3 | 564 | 440 | 750 | 7.2 | - |
| 22-13 | M | 8-14-52 | 9 | 1.2 | 124 | 39 | | 9.4 | | 375 | 0 | 166 | 15 | .2 | 3 | 592 | 470 | 850 | 7.3 | 52.9 |
| 22-13 | M | 2-25-54 | - | - | - | - | - | | - | 380 | - | 180 | 14 | - | - | - | 490 | 900 | - | 52.9 |
| 22-13 | M | 7- 9-54 | 12 | .5 | 130 | 36 | | 13 | | 386 | 0 | 145 | 16 | 0.0 | 2.6 | 560 | 472 | 810 | 7.6 | - |
| 22-71 | M | 9- 4-54 | 11 | .8 | 82 | 27 | | 10 | | 330 | - | 45 | 15 | 0.0 | 0.0 | 356 | 316 | 670 | 7.6 | - |
| 22-76 | M | 9- 4-54 | 9 | .2 | 86 | 30 | | 12 | | 324 | 0 | 55 | 29 | 0.0 | 0.0 | 424 | 340 | 720 | 7.4 | - |
| 22-79 | M | 9- 4-54 | 14 | .5 | 75 | 26 | | 9.7 | | 322 | - | 34 | 12 | 0.0 | 0.0 | 326 | 296 | 610 | 7.6 | - |
| 23-7 | NA | 11-18-40 | - | - | 164 | 28 | - | | - | 265 | - | - | - | - | - | 796 | 520 | - | 7.1 | - |
| 23-8 | NA | 12-17-54 | 18 | .5 | - | - | - | | - | 240 | 0 | - | - | - | - | 360 | 288 | - | 7.6 | - |
| 23-22 | NG | 9- 2-53 | 14 | - | 80 | 15 | - | | - | 220 | 0 | 20 | 14 | - | - | - | 260 | 380 | 7.7 | - |

Table 5.--Chemical analyses of ground-water samples in the Kalamazoo area.--Continued

| Well number or station | Analyst | Date collected | Chemical constituents (parts per million) | | | | | | | | | | | | | | | Specific conductance (micromhos at 25°C.) | pH | Temperature (°F.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Silica ($SiO_2$) | Iron (Fe) | Calcium (Ca) | Magnesium (Mg) | Sodium (Na) | Na + K | Potassium (K) | Bicarbonate ($HCO_3$) | Carbonate ($CO_3$) | Sulfate ($SO_4$) | Chloride (Cl) | Fluoride (F) | Nitrate ($NO_3$) | Dissolved solids | Hardness as $CaCO_3$ | | | |
| **Samples from individual wells (continued)** | | | | | | | | | | | | | | | | | | | | |
| 2S 11W | | | | | | | | | | | | | | | | | | | | |
| 23-22 | NG | 6-23-54 | 8.5 | - | 94 | 17 | - | | - | 240 | 0 | 92 | 14 | - | - | - | 306 | 450 | 7.4 | - |
| 23-22 | NG | 6-30-54 | 7.1 | - | 89 | 24 | - | | - | 240 | 0 | 104 | 26 | - | - | - | 320 | 490 | 7.8 | - |
| 24-7 | NG | 6-23-54 | - | - | 119 | 19 | - | | - | 276 | 0 | 108 | 14 | - | - | - | 378 | 540 | 7.6 | . |
| 25-1 | LN | 9-10-54 | - | .2 | - | - | - | | - | - | - | - | 0 | - | - | - | 340 | - | 7.6 | 50 |
| 25-9 | B | 7-13-54 | - | 2.2 | 144 | 44 | - | | - | 284 | 0 | 252 | 102 | - | - | - | 542 | 850 | 7.1 | - |
| 25-10 | B | 7-13-54 | - | 1.3 | 89 | 25 | - | | - | 250 | 0 | 80 | 6 | - | - | - | 324 | 450 | 7.5 | - |
| 25-11 | B | 7-13-54 | - | 1.2 | 90 | 23 | - | | - | 226 | 0 | 96 | 8 | - | - | - | 320 | 380 | 7.4 | - |
| 26-7 | M | 8-14-52 | 7.5 | .8 | 80 | 24 | | 3 | | 322 | 0 | 40 | 5 | .1 | 0 | 340 | 300 | 580 | 7.9 | 52.3 |
| 28-4 | M | 8- 9-23 | 10 | - | 69 | 28 | | 12 | | 328 | - | 22 | 13 | - | - | 332 | - | - | - | - |
| 28-6 | M | 4-16-54 | 13 | .5 | 60 | 26 | | 15 | | 308 | 0 | 17 | 16 | 0.0 | 0.0 | 296 | 260 | 560 | 7.9 | - |
| 28-7 | M | 7- 7-54 | 13 | .6 | 64 | 24 | | 12 | | 312 | 0 | 16 | 8 | 0.0 | 0.0 | 296 | 259 | 570 | 7.7 | - |
| 28-8 | M | 7- 9-54 | 14 | .9 | 74 | 27 | | 6.6 | | 330 | 0 | 30 | 6 | 0.0 | 0.0 | 322 | 295 | 570 | 7.7 | - |
| 30-1 | M | 12-29-22 | 19 | - | 61 | 22 | | 0 | | 283 | - | 12 | 0 | - | - | 260 | 245 | - | - | - |
| 30-4 | M | 8- ?-44 | 5.6 | - | 81 | 28 | | | | 334 | 0 | 30 | 8 | 0.0 | - | 325 | 320 | - | - | - |
| 32-1 | M | 8-13-52 | 10 | 0.0 | 54 | 12 | | 1 | | 206 | 0 | 21 | 0 | .1 | 0.0 | 214 | 185 | 395 | 7.5 | 52 |
| 32-1 | M | 2-24-54 | - | - | - | - | - | | - | 234 | - | 19 | 1 | - | - | - | 200 | 450 | - | 50.4 |
| 35-4 | M | 8-13-40 | 9.6 | - | 76 | 21 | | 13 | | 334 | 0 | 23 | 6 | .1 | - | 326 | 285 | - | - | - |
| 35-5 | M | 10- ?-44 | 11 | .2 | 70 | 21 | | 11 | | 311 | 0 | 16 | 10 | 0.0 | 0.0 | 300 | 262 | - | - | - |
| 35-7 | M | 2-24-54 | 12 | .5 | 88 | 18 | | 4.4 | | 320 | 0 | 30 | 5 | 0.0 | 1.3 | 302 | 295 | 630 | 7.6 | 50.9 |
| 36-2 | U | 4-14-55 | 13 | .1 | 73 | 20 | 3.7 | | .5 | 304 | 0 | 20 | 3.2 | 0.0 | .1 | 284 | 264 | 497 | 7.5 | 50.5 |
| 36-4 | M | 10-27-55 | 13 | 2.3 | 66 | 16 | | 11 | | 276 | - | 20 | 3 | - | 0.0 | 284 | 232 | 510 | 7.8 | - |
| 2S 10W | | | | | | | | | | | | | | | | | | | | |
| 17-6 | U | 4-14-55 | 14 | .3 | 56 | 19 | 55 | | 1.5 | 312 | 0 | 10 | 49 | .3 | .9 | 360 | 218 | 644 | 7.6 | 51.4 |
| 19-2 | U | 2-26-54 | 11 | 0.0 | 93 | 27 | 17 | | 1.9 | 336 | 0 | 63 | 19 | .1 | 2.7 | 400 | 344 | 676 | 7.3 | - |
| 3S 11W | | | | | | | | | | | | | | | | | | | | |
| 3-3 | M | 8- ?-48 | 4 | - | 66 | 23 | | 12 | | 303 | - | 27 | .7 | .1 | - | 292 | 260 | - | - | - |
| 3-8 | M | 8-14-52 | 10 | 1.2 | 64 | 21 | | 5.2 | | 294 | 0 | 19 | 6 | 0.0 | 0.0 | 278 | 245 | 510 | 7.6 | - |
| 3-8 | M | 2-25-54 | - | - | - | - | - | | - | 265 | - | 0 | 6 | - | - | - | 205 | 460 | - | - |
| 3-19 | U | 4-15-55 | 12 | .1 | 72 | 23 | 2.5 | | .5 | 293 | 0 | 23 | 3.5 | .3 | 1.2 | 283 | 274 | 509 | 7.5 | 50.9 |
| 4-2 | M | 8-14-52 | 10 | 7.5 | 58 | 29 | | 3.6 | | 293 | 0 | 20 | 4.0 | .1 | 0.0 | 302 | 265 | 500 | 7.6 | 52.1 |
| 11-1 | UJ | 2- ?-53 | 10 | .6 | 53 | 15 | 16 | | - | 214 | 1 | 28 | 5.0 | - | - | 228 | 208 | - | - | - |
| 11-2 | UJ | 2- ?-53 | 11 | .4 | 58 | 15 | 8.3 | | - | 223 | 1 | 17 | 1.0 | - | - | 241 | 226 | - | - | - |
| 14-1 | UJ | 2- ?-53 | 10 | 2.8 | 80 | 18 | 10 | | - | 266 | 1 | 47 | 3.0 | - | - | 345 | 260 | - | - | - |
| 14-4 | M | 8-14-52 | 10 | 3.3 | 90 | 27 | | 5.2 | | 364 | 0 | 30 | 22 | 0.0 | 0.0 | 380 | 335 | 650 | 7.0 | 53.5 |
| 14-4 | UJ | 2- ?-53 | 14 | 5.6 | 105 | 18 | 15 | | - | 370 | 1 | 19 | 3.0 | - | - | 418 | 303 | - | - | - |
| 14-6 | UJ | 2- ?-53 | 12 | 1.2 | 65 | 21 | 8.1 | | - | 255 | 1 | 25 | 5.0 | - | - | 250 | 252 | - | - | - |
| 14-22 | UJ | 2- ?-53 | 11 | 1.2 | 59 | 21 | 12 | | - | 260 | 1 | 24 | 1.0 | - | - | 232 | 223 | - | - | - |
| 14-23 | UJ | 2- ?-53 | 11 | .6 | 52 | 16 | 8.9 | | - | 218 | 1 | 21 | 2.0 | - | - | 215 | 212 | - | - | - |
| 14-25 | UJ | 2- ?-53 | 13 | .5 | 68 | 20 | 7.7 | | - | 264 | 1 | 32 | 5.0 | - | - | 295 | 250 | - | - | - |
| 14-28 | M | 2-25-54 | - | - | - | - | - | | - | 265 | - | 19 | 1.0 | - | - | - | 204 | 490 | - | 51.1 |
| **Composite samples from pumping stations** | | | | | | | | | | | | | | | | | | | | |
| Station 1 | UM | 7- ?-23 | - | - | 65 | 37 | - | | - | 331 | - | 40 | 14 | - | - | - | 325 | - | - | - |
| | M | 4-15-27 | 9.6 | - | 90 | 31 | | 8.9 | | 342 | - | 71 | 15 | - | - | 397 | 350 | - | - | - |
| | M | 9- 5-30 | 14 | - | 103 | 36 | | 12 | | 362 | 0 | 104 | 16 | - | - | 476 | 398 | - | - | - |
| | M | 1-14-47 | 7.2 | - | 94 | 30 | | 3.2 | | 326 | 0 | 74 | 14 | 0.0 | - | 408 | 355 | - | - | - |
| | M | 4-16-54 | 12 | .5 | 98 | 34 | | 7.1 | | 350 | 0 | 79 | 18 | .2 | 0.0 | 464 | 385 | 690 | 7.7 | - |
| Station 2 | M | 1924 | 10 | - | 77 | 27 | | 8 | | 336 | - | 37 | 5 | - | - | 314 | - | - | - | - |
| | M | 4- 5-27 | 11 | - | 81 | 27 | | 9.6 | | 320 | 0 | 54 | 10 | - | - | 316 | 311 | - | - | - |
| | M | 9- 5-30 | 12 | - | 88 | 30 | | 11 | | 333 | 0 | 71 | 14 | - | - | 398 | 342 | - | - | - |
| | M | 5- ?-47 | 9.6 | - | 128 | 38 | | 12 | | 395 | 0 | 153 | 16 | .1 | - | 558 | 480 | - | - | - |
| Station 3 | M | 4-15-27 | 14 | - | 79 | 27 | | 7.5 | | 321 | - | 44 | 12 | - | - | 363 | 310 | - | - | - |
| | M | 5-25-30 | 12 | - | 73 | 27 | | 8.5 | | 315 | 0 | 35 | 13 | - | - | 342 | 295 | - | - | - |
| | M | 1-14-47 | 9.6 | - | 120 | 38 | - | | - | 344 | 0 | 154 | 9 | 0.0 | - | 560 | 455 | - | - | - |
| | M | 4-16-54 | 12 | .2 | 78 | 28 | | 6.2 | | 316 | 0 | 42 | 12 | .6 | 0.0 | 360 | 310 | 600 | 7.4 | - |
| Station 4 | M | 4-16-27 | 11 | - | 74 | 28 | | 8.7 | | 329 | - | 28 | 17 | - | - | 324 | 300 | - | - | - |
| | M | 8-14-52 | 10 | 3.2 | 68 | 27 | | 11 | | 310 | 0 | 21 | 27 | 0.0 | 0.0 | 338 | 280 | 600 | 7.4 | 54.8 |
| Station 5 | UM | 7- ?-23 | - | - | 93 | 38 | - | | - | 335 | - | 49 | 14 | - | - | - | 385 | - | - | - |
| | M | 9- 5-30 | 14 | - | 106 | 33 | | 6.9 | | 350 | 0 | 104 | 13 | - | - | 468 | 400 | - | - | - |
| | M | 4-15-54 | 11 | .7 | 120 | 30 | | 12 | | 348 | 0 | 134 | 17 | 0.0 | 0.0 | 540 | 425 | 750 | 7.4 | - |
| Station 7 | M | 1-14-47 | 6.4 | - | 83 | 26 | | 6.2 | | 323 | 0 | 52 | 8 | 0.0 | - | 362 | 312 | - | - | - |
| | M | 4-16-54 | 12 | .3 | 80 | 30 | | 2.3 | | 327 | 0 | 45 | 12 | 0.0 | 0.0 | 364 | 325 | 600 | 7.3 | - |
| Station 8 | M | 4-15-54 | 13 | .7 | 64 | 22 | | 8.5 | | 290 | 0 | 18 | 8 | .8 | 0.0 | 290 | 250 | 520 | 7.9 | - |

Table 6.--Chemical analyses of surface-water samples in the Kalamazoo area

Analyst: B, Betz Co.; NG, National Gypsum Co.; U, U.S. Geological Survey; M, Michigan Dept. of Health; P, Permutit Co.

| Source | Analyst | Date collected | Chemical constituents (parts per million) | | | | | | | | | | | | | Specific conductance (micromhos at 25°C) | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Silica ($SiO_2$) | Iron (Fe) | Calcium (Ca) | Magnesium (Mg) | Sodium (Na) + Potassium (K) | Bicarbonate ($HCO_3$) | Carbonate ($CO_3$) | Sulfate ($SO_4$) | Chloride (Cl) | Fluoride (F) | Nitrate ($NO_3$) | Total solids | Hardness as $CaCO_3$ | | |
| **Kalamazoo River at:** | | | | | | | | | | | | | | | | | |
| Kalamazoo Paper Co. | B | 1-20-44 | 11 | 0.1 | - | - | - | 224 | 0 | 16 | 9.5 | - | - | 344 | 244 | - | 7.5 |
| National Gypsum Co. | NG | 10-14-53 | - | - | 71 | 21 | - | 210 | 0 | 52 | 10 | - | - | - | 262 | 390 | 7.7 |
| Do. | NG | 6-30-54 | 12 | - | 68 | 19 | - | 194 | 0 | 80 | 8 | - | - | - | 248 | 370 | 7.7 |
| Michigan Avenue Bridge | U | 11-17-06 | 17 | - | 63 | 18 | 6.5 | 271 | 0 | 25 | 3.8 | - | 2.4 | 284 | 231 | - | - |
| Do. | U | 12-28-06 | 20 | .1 | 68 | 21 | 5.8 | 234 | 17 | 31 | 3.6 | - | 3.2 | 289 | 256 | - | - |
| Do. | U | 2-28-07 | 3.4 | .1 | 22 | 17 | 7.4 | 121 | 19 | - | 3.1 | - | 0 | 140 | 125 | - | - |
| Do. | M | 8-13-52 | 5.8 | .4 | 50 | 21 | 11 | 217 | 0 | 43 | 17 | .1 | 0 | 384 | 210 | 560 | 7.4 |
| Do. | M | 8-25-53 | - | - | - | - | - | - | - | 52 | - | - | - | - | 240 | - | - |
| Do. | M | 2-25-54 | - | - | - | - | - | 178 | - | 78 | 8.0 | - | - | - | 232 | 510 | - |
| Do. | M | 9-23-54 | - | - | - | - | - | 285 | - | 50 | 22 | - | - | - | 260 | 600 | - |
| Parchment | M | 8-13-52 | 5.8 | .4 | 70 | 24 | 16 | 277 | 0 | 55 | 23 | .1 | 0 | 350 | 275 | 600 | 7.2 |
| Cooper Road Bridge | M | 3- 1-56 | 8.0 | .2 | 56 | 17 | 12 | 188 | - | 50 | 16 | - | 3.5 | 316 | 210 | - | 7.3 |
| **Portage Creek at:** | | | | | | | | | | | | | | | | | |
| Kilgore Road Bridge | M | 8-14-52 | 8.0 | .4 | 54 | 16 | 5.8 | 238 | 0 | 22 | 10 | 0 | 0 | 252 | 200 | 475 | 7.9 |
| Do. | M | 8-26-53 | - | - | - | - | - | - | - | 22 | - | - | - | - | 200 | - | - |
| Do. | M | 2-25-54 | - | - | - | - | - | 220 | - | 44 | 13 | - | - | - | 220 | 520 | - |
| Do. | M | 9-22-54 | - | - | - | - | - | - | - | - | - | - | - | - | - | 470 | - |
| Stockbridge Avenue Bridge | M | 8-14-52 | 7.5 | .3 | 70 | 20 | - | 320 | 0 | 40 | 41 | - | 0 | 832 | 255 | 650 | 7.3 |
| Allied Paper Co. | P | - | - | .1 | - | - | - | 178 | 8 | - | 7.0 | - | - | - | 202 | - | 8.3 |
| **West Fork Portage Creek at** Station 9 | M | 8-14-52 | 9.0 | 0 | 46 | 20 | 1.5 | 228 | 0 | 10 | - | .1 | 0 | 204 | 198 | 400 | 7.9 |
| Do. | M | 9-22-54 | - | - | - | - | - | 222 | - | 42 | 2.0 | - | - | - | 215 | 430 | - |
| **Axtell Creek at Station 7** | M | 8-14-52 | 10 | .9 | 82 | 26 | 4.2 | 325 | 0 | 45 | 8.0 | .1 | 0 | 370 | 318 | 600 | 7.6 |
| Do. | M | 8-25-53 | - | - | - | - | - | - | - | 120 | - | - | - | - | 365 | - | - |
| Do. | M | 2-25-54 | - | - | - | - | - | 305 | - | 78 | 10 | - | - | - | 295 | 680 | - |
| Do. | M | 9-23-54 | - | - | - | - | - | - | - | - | - | - | - | - | - | 590 | - |
| **Drainage ditch at Pitcher St.** near Mosel Avenue | M | 8-13-52 | 10 | .4 | 80 | 29 | 6.4 | 358 | 0 | 33 | 5.0 | .1 | - | 340 | 320 | 630 | 7.7 |
| Do. | M | 2-25-54 | - | - | - | - | - | 222 | - | 410 | 12 | - | - | - | 630 | 1100 | - |
| Do. | M | 9-23-54 | - | - | - | - | - | - | - | - | - | - | - | - | - | 640 | - |
| **Limekiln Lake** | M | - | 14 | - | 45 | 22 | 14 | 212 | 0 | 32 | 19 | - | - | 250 | 202 | - | - |
| **Spring at Limekiln Lake** | M | 11- 7-29 | - | - | 72 | 21 | - | 266 | 0 | - | - | - | - | - | 265 | - | - |
| Do. | M | 11- 8-29 | - | - | 72 | 21 | - | 275 | 0 | - | - | - | - | - | 268 | - | - |
| **Asylum Lake** | M | 9-27-22 | 17 | 0 | 53 | 23 | - | 263 | - | 0 | - | - | - | 251 | 227 | - | - |
| **Austin Lake** | M | 8-14-52 | - | .3 | 22 | 10 | 2.2 | 100 | 1 | 15 | 1.0 | .2 | 0 | 140 | 94 | 250 | 8.0 |