# PHYSICAL AND CHEMICAL DATA FOR GROUND WATER IN THE MICHIGAN BASIN, 1986-89

By G.T. Dannemiller and M.A. Baltusis, Jr.

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## CONVERSION FACTORS AND ABBREVIATIONS

| Multiply | By | To obtain |
|---|---|---|
| inch (in.) | 2.54 | centimeter (cm) |
| foot (ft) | 0.3048 | meter (m) |
| square mile ($mi^2$) | 2.590 | square kilometer ($km^2$) |
| gallon (gal) | 3.785 | liter (L) |
| pound (lb) | 453.6 | gram (g) |

Specific conductance, water temperature, and chemical concentration are given in metric units. Specific conductance of water is expressed in microsiemens per centimeter ($\mu$S/cm) at 25 degrees Celsius (°C). This unit is identical to micromhos per centimeter at 25 degrees Celsius, formerly used by the U.S. Geological Survey. Water temperature in degrees Fahrenheit (°F) can be converted to degrees Celsius (°C) by the following formula:

$$°C = (°F-32)/1.8$$

Chemical concentration in water is expressed in milligrams per liter (mg/L), micrograms per liter ($\mu$g/L), or picocuries per liter (pCi/L).

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## ABSTRACT

*Ground-water samples were collected from 459 wells located in the Michigan basin as part of a Regional Aquifer-System Analysis. Data on the physical and chemical characteristics of 476 ground-water samples from these wells represent ground-water characteristics in the Berea Sandstone, Coldwater Shale, Marshall Sandstone, Michigan Formation, Bayport Limestone, Saginaw Formation, Grand River Formation, and glacial deposits. Ground-water samples were measured in the field for specific conductance, temperature, and alkalinity. Analyses of ground water for concentrations of dissolved oxygen, ferrous iron, total iron, and sulfide were also done in the field. Additional laboratory analysis provided data on eight major and 18 minor inorganic constituents. Twenty-one samples were analyzed for tritium, 140 samples were analyzed for carbon-13, and 19 samples were analyzed for carbon-14. The stable-isotope ratio of deuterium to hydrogen was determined for 408 samples; the ratio of oxygen-18 to oxygen-16 was determined for 433 samples; and the ratio of sulfur-34 to sulfur-32 was determined for 20 samples. Sixteen samples were analyzed for the unstable isotopes of uranium; 13 samples were analyzed for radium-226; and the ratio of radium-228 to radium-226 was determined for 13 samples.*

## INTRODUCTION

The Michigan basin Regional Aquifer-System Analysis (RASA) study area is contained entirely within the Michigan basin and covers approximately 29,000 $mi^2$ (square miles) of the Lower Peninsula of Michigan (fig. 1). The boundary of the study area has been defined as the contact between the Coldwater Shale and the overlying Marshall Sandstone (fig. 2). The area is underlain by consolidated sedimentary rocks and unconsolidated sediments of Mississippian age and younger, including the Berea Sandstone, Coldwater Shale, Marshall Sandstone, Michigan Formation, Bayport Limestone, Saginaw Formation, Grand River Formation, and glacial deposits. These sedimentary deposits are their stratigraphic relations are shown in figure 3.

### Purpose and Scope

This report provides data from physical and chemical analyses of 476 ground-water samples collected from 459 wells in the Michigan basin. Ground-water samples were collected from wells tapping the aforementioned sedimentary deposits from May 1986 through July 1989.


Figure 1.--Michigan basin Regional Aquifer-System Analysis study area.

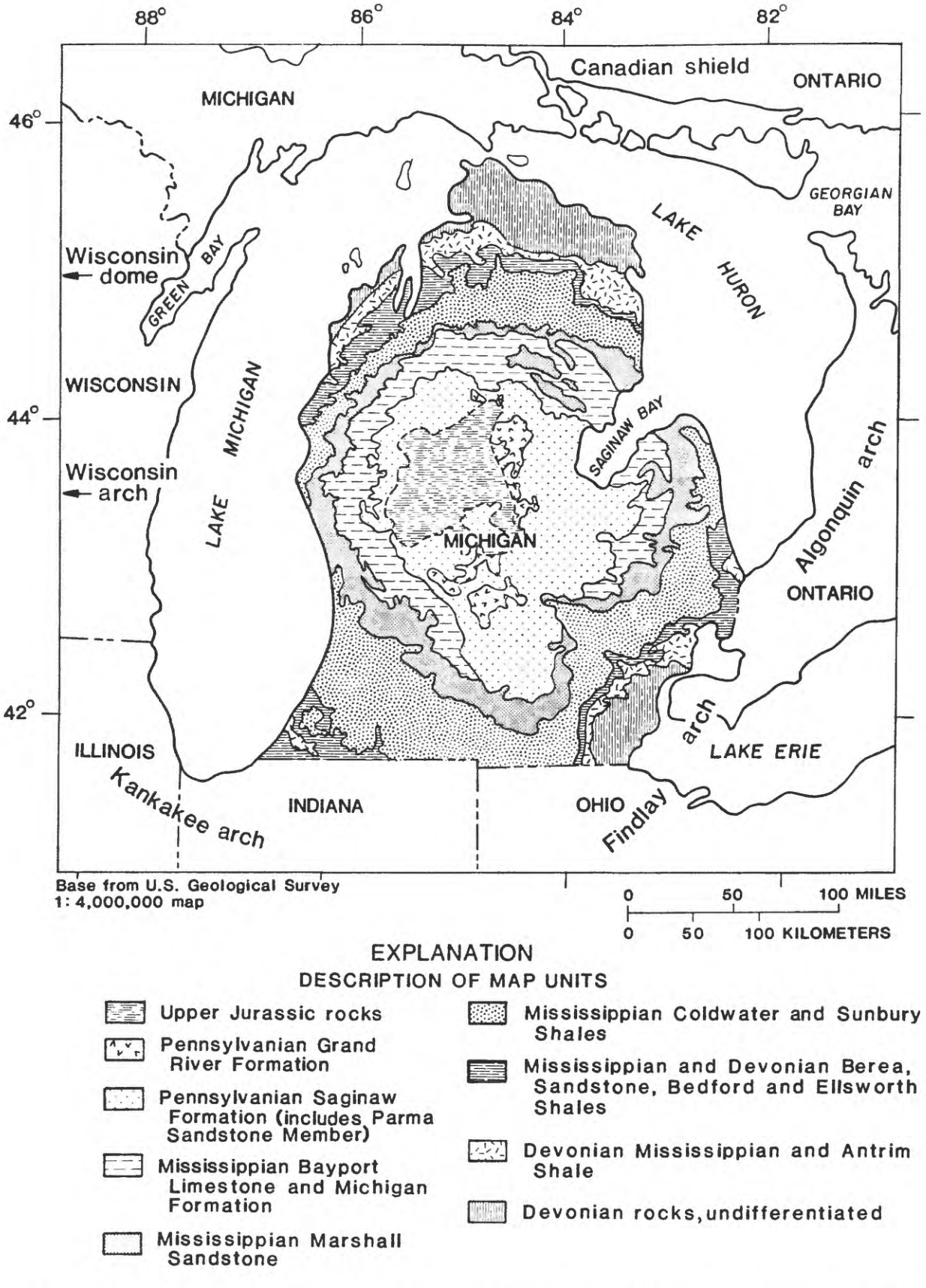


Figure 2.--Geology of the Lower Peninsula of Michigan. (Modified from H.M. Martin, 1955, fig. 11.)

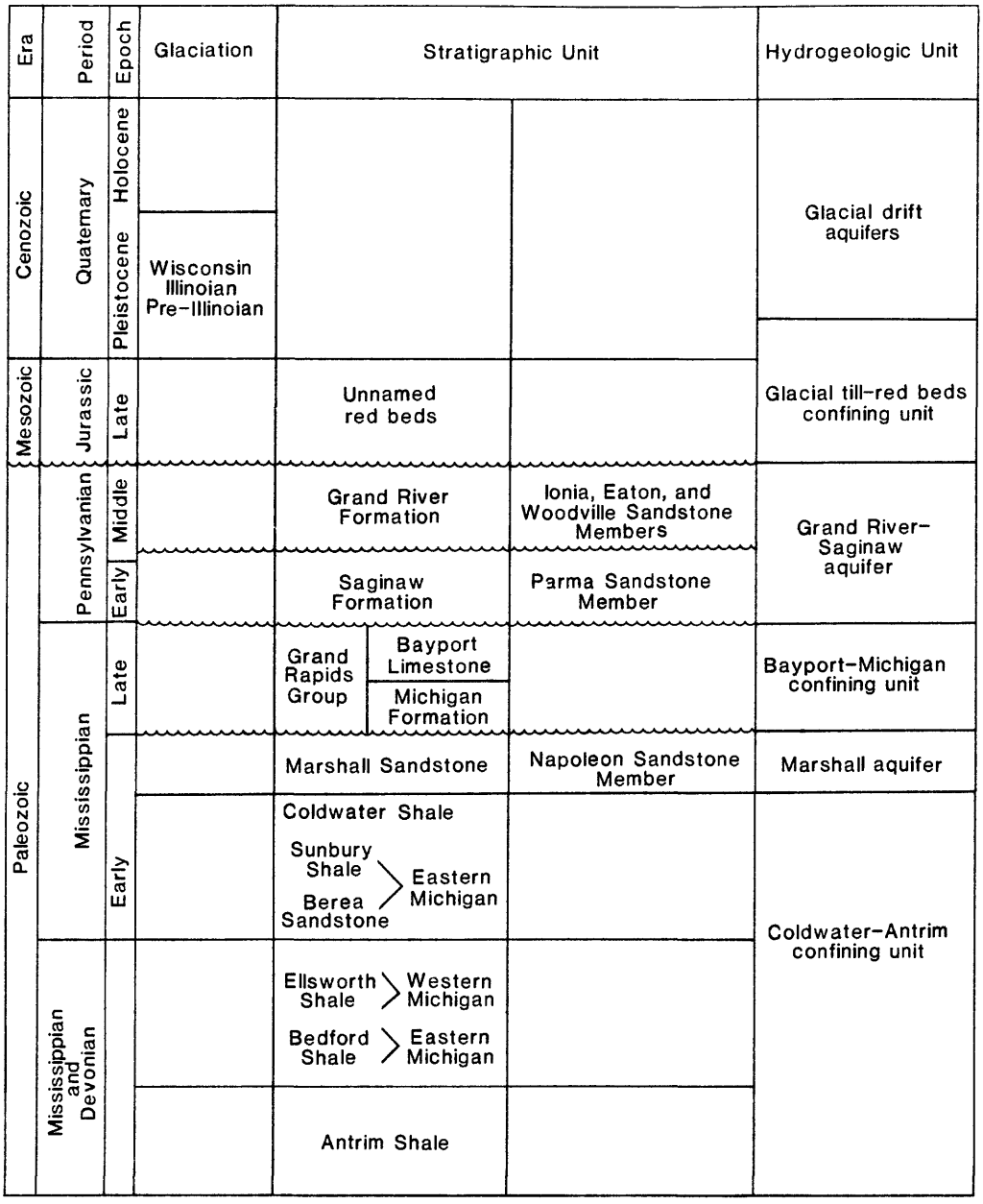


Figure 3.--Stratigraphic column of the study area. (Modified from Michigan Department of Conservation, 1964.)

## Acknowledgments

The authors thank the Michigan Department of Natural Resources for providing access to water-well logs and other geologic data, and all municipalities and individuals who allowed access to wells and provided additional well information.

## METHODS OF DATA COLLECTION AND ANALYSIS

Sites for ground-water sampling were selected on the basis of well location, depth, open interval, pumping equipment, aquifer type, and lithology. Most ground-water samples were collected from domestic and municipal wells for which detailed driller's logs were available.

### Measurement and Analysis at the Well Site

At each site, specific conductance, pH, and temperature of ground water were measured and concentrations of dissolved oxygen, alkalinity, sulfide, total iron, and ferrous iron were determined (tables 2 through 47). Before measurements were made and samples were collected, wells were pumped until temperature and specific conductance remained constant. The wellhead was inspected to ensure that chemical treatments such as chlorine, phosphate, or fluoride were not introduced into raw-water samples. The methods and equipment used for these measurements and analyses are listed in table 1.

Table 1.--Methods of measuring and analyzing ground water at the well site

| Property or constituent | Measurement or analytical method |
|---|---|
| Temperature, in degrees Celsius | Recorded during specific-conductance measurement by use of thermistor in specific-conductance probe. Probe calibrated with a certified mercury thermometer (Wood, 1976, p. 10). |
| Specific conductance, in microsiemens per centimeter at 25 degrees Celsius | Specific-conductance meter calibrated with standards obtained from U.S. Geological Survey (USGS) National Water Quality Laboratory. Results were temperature corrected by use of the following correction factor, where temperature (T) is measured in degrees Celsius: $$\text{correction factor} = \frac{1}{1 + [0.2(T-25)]}$$ |

Table 1.--Methods of measuring and analyzing ground water at the well site--Continued

| Property or constituent | Measurement or analytical method |
|---|---|
| pH | pH meter calibrated with two standard solutions (pH 4.00 and 7.00). Sample water kept at its original temperature during measurement by means of a water bath. |
| Alkalinity (bicarbonate), in milligrams per liter | Potentiometric titration with 0.01639N $H_2SO_4$ through end inflection points. Centroid of the inflection point was graphically determined (Stumm and Morgan, 1981). Sample water kept at it's original temperature during measurement by means of a water bath. |
| Dissolved oxygen, in milligrams per liter | Azide modification of Winkler method used (Hach Chemical Co., 1987)[a]. Sample kept from exposure to the atmosphere during collection. The sample bottle was filled by submerging it in a water bath of sample water, filling the bottle from a hose connected to the well pump, and capping the bottle while it was still submerged. |
| Ferrous iron ($Fe^{2+}$), in micrograms per liter | 1, 10-phenanthroline method used (Hach Chemical Co., 1987). Sample kept from exposure to atmosphere before analysis by collecting it from the well's discharge line with a syringe. |
| Total iron (Fe), in micrograms per liter | Ferrozine method used (Hach Chemical Co., 1987). |
| Sulfide ($S^{2-}$), in milligrams per liter | Methylene blue method used (Hach Chemical Co., 1987). Sample kept from exposure to atmosphere before analysis by collecting it from the well's discharge line with a syringe. |

[a] Use of firm and trade names in this report is for identification only and does not constitute endorsement by the U.S. Geological Survey.

## Sample Preparation for Major and Minor Elements

Ground-water samples were analyzed for 8 major and 18 minor inorganic constituents. The samples were filtered through a membrane (Geotech filter) using a pore size of 0.45 $\mu$m (micrometer). Discharge from the well pump was diverted into the filter through a continuous flow line, which minimized exposure of the sampled water to the atmosphere. Water samples were preserved according to methods described in Brown and others (1970) and Skougstad and others (1978). Samples were analyzed by the U.S. Geological Survey National Water Quality Laboratory.

## Sample Preparation for Stable and Radioactive Isotopes

Ground-water samples were analyzed for the stable isotopes of oxygen, hydrogen, carbon, and sulfur. Samples from several wells were also analyzed for the radioactive isotopes of carbon, hydrogen, uranium, radium-226, and radium-228/226.

### Delta Oxygen-18 and Deuterium

Delta oxygen-18 values were determined for 433 samples and delta deuterium ratios were determined for 408 samples. Unfiltered ground-water samples were collected in 0.12-L (liter) glass bottles and preserved with mercuric chloride tablets. A small volume of air was left in the bottle to allow for expansion during shipping to the USGS Stable Isotope Laboratory. A modified technique of Epstein and Mayeda (1953) was used to analyze for oxygen isotopes. A semiautomatic deuterium mass spectrometer was used to analyze for deuterium. The zinc-water reaction techniques of Kendall and Coplen (1985) were used for the analysis. Delta oxygen and deuterium are expressed as the relative difference in parts per thousand (per mil) between the ratio in a sample and the ratio in a standard (Standard Mean Ocean Water, SMOW). Analytical results for delta oxygen and deuterium are plus or minus 0.15 and 2.0 per mil, respectively, with a probability range of 0.68.

### Delta Carbon-13

Delta carbon-13 values were determined for 140 samples. Samples were collected by filling a 1-L glass bottle to about 90-percent capacity with unfiltered ground water. Fifty milliliter (mL) of ammoniacal strontium chloride reagent was added to precipitate the carbonate as strontium carbonate for laboratory analysis. The bottle was then capped and sealed with electrical tape.

The ammoniacal strontium chloride reagent was made by dissolving 453 g (grams) of reagent-grade strontium chloride hexahydrate ($SrCl_2 \cdot 6H_2O$) with 1,812 g of reagent-grade concentrated amonium hydroxide ($NH_4OH$). The solution was allowed to remain undisturbed for 2 days before the clear solution was decanted into a glass reagent bottle for use in the field (L.N. Plummer, U.S. Geological Survey, oral commun., 1987).

Samples were sent to Global Geochemistry Corporation for analysis. The laboratory filtered the strontium carbonate precipitate, reacted the carbonate with 100 percent phosphoric acid for 16 hours, and collected 4 $cm^3$ (cubic centimeters) of gas to be analyzed by a mass spectrometer. Analytical results for delta carbon-13 is plus or minus 0.5 per mil with a probability range of 0.68. The standard used for calibration was National Bureau of Standards number 20.

### Delta Sulfur-34

Delta sulfur-34 values were determined for 20 samples. A 10-L unfiltered water sample was collected at each site for the purpose of precipitating all of the sulfur as barium sulfate. This was done by acidifying the sample with hydrochloric acid to a pH of 2 to 3 and adding an excess amount of barium chloride. After the precipitate settled over a period of several hours, it was decanted with the use of a peristaltic pump into four 1-L glass bottles. They were then shipped to the Global Geochemical Corporation where the samples were further prepared for analysis at the University of Calgary. The reporting level is plus or minus 0.2 per mil. The standard reference used for calculation as the zero point is troilite of the Canyon Diablo iron meteorite.

### Carbon-14

The percentage of active carbon-14 was determined for 19 samples by the analysis of a strontium carbonate precipitated from the ground water. The precipitate was formed in a 250-L inverted pyramid-shaped stainless-steel tank under a nitrogen-gas atmosphere to prevent contamination by atmospheric carbon dioxide gas. At the bottom of the tank was attached a 2-L sample bottle to collect the precipitate. The pH of the water sample in the tank was raised with the addition of a sodium hydroxide solution, thus converting bicarbonate species to carbonate species. A strontium chloride solution was then added to form the strontium carbonate precipitate. The sodium hydroxide and strontium chloride solutions were also prepared in a nitrogen-gas atmosphere (L.N. Plummer, U.S. Geological Survey, oral commun., 1987).

The sample of precipitate was sent to Krueger Laboratory, where the precipitate was reacted with potassium permaganate, to minimize sulfur interference, then cryogenically frozen. Radiometric measurement was made by use of a flow-proportioned counter for 1,300 minutes per sample. Error summation included the sum of errors from background carbon, a standard, and the counter. The reporting level is plus or minus 0.7 percent of active carbon reported.

### Tritium

Tritium concentration was determined for 21 samples. At each site 1-L of unfiltered sample water was collected in a glass bottle for tritium analysis. No beta-particle emitters such as watches with luminous dials, were near the samples during collection. Tritium was analyzed at the U.S.

Geological Survey National Water Quality Laboratory, by the gas counting enrichment method with a level of detection of 2.5 pCi/L.

### Uranium, Radium-226, and Radium-228/226

Uranium concentration was determined for 16 samples, radium-226 concentration for 13 samples, and radium-228/226 concentration for 13 samples. Four, 1-L plastic bottles were filled with unfiltered sample water and sent to the U.S. Geological National Water Quality Laboratory for analysis. The reported detection limit for uranium, radium-226, and radium-228/226 is 0.01 $\mu$g/L, 0.02 pCi/L, and 1.0 pCi/L, respectively.

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# PHYSICAL AND CHEMICAL CHARACTERISTICS FOR GROUND WATER, BY COUNTY

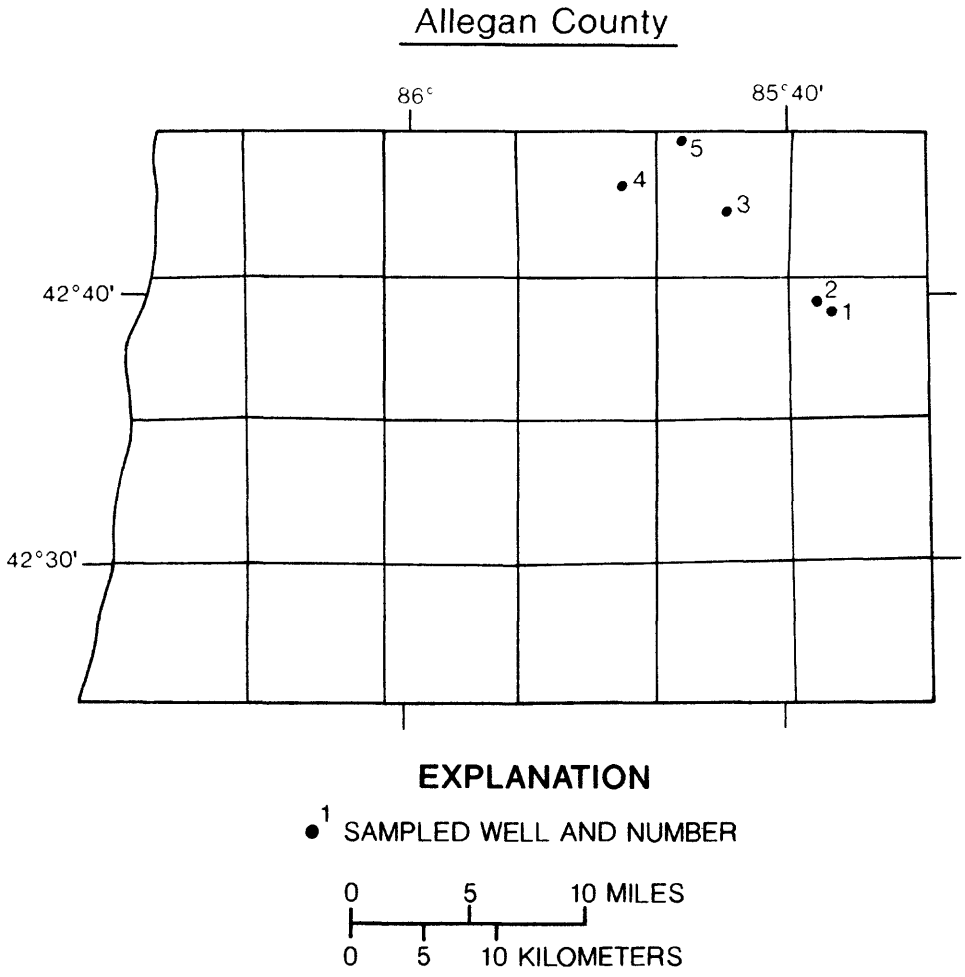


Table 2.--Physical and chemical characteristics for ground water in Allegan County

[Analyses by U.S. Geological Survey. Geologic unit: 112SDGV, sand and gravel; 337MRSL, Marshall Sandstone. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 42°39'50"N | 85°38'00"W | 5-27-87 | 112SDGV | 131 | 621 | 7.15 | 11.0 | 4.1 |
| 2 | 42°40'18"N | 85°38'54"W | 5-27-87 | 337MRSL | 251 | 563 | 7.39 | 12.0 | .3 |
| 3 | 42°43'32"N | 85°43'33"W | 5-27-87 | 337MRSL | 100 | 621 | 7.65 | 13.0 | .1 |

Table 2.--Physical and chemical characteristics for ground water in Allegan County--Continued

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 4 | 42°44'25"N | 85°47'00"W | 8-25-86 | 337MRSL | 200 | 547 | 7.30 | 12.5 | 2.1 |
| 5 | 42°46'04"N | 85°45'56"W | 6-27-88 | 337MRSL | 330 | 551 | 7.61 | 11.5 | .1 |

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 82 | 28 | 5.9 | 1.2 | 264 | -- | 33 | 15 | 0.20 | 0.060 |
| 2 | 77 | 28 | 4.2 | 1.0 | 250 | -- | 33 | 13 | .20 | .043 |
| 3 | 62 | 25 | 32 | 2.4 | 250 | -- | 21 | 36 | .50 | .11 |
| 4 | 75 | 30 | 3.8 | .90 | 306 | <0.5 | 24 | .90 | .20 | .038 |
| 5 | 80 | 31 | 3.2 | .80 | 324 | <.02 | 28 | .80 | .30 | .019 |

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, nitrite, dissolved (mg/L as N) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 12 | 347 | -- | -- | -- | <10 | <1 | 86 | 30 | 5 |
| 2 | 16 | 326 | -- | -- | -- | <10 | 3 | 160 | <10 | 320 |
| 3 | 16 | 342 | -- | -- | -- | <10 | <1 | 48 | 130 | 710 |
| 4 | 16 | 318 | <0.010 | <0.100 | 0.070 | <10 | 3 | -- | 10 | 910 |
| 5 | 14 | 324 | -- | -- | -- | <10 | 1 | 80 | 10 | 870 |

| Well number | Iron, ferrous, dissolved (µg/L as Fe) | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | H-2/H-1 stable isotope ratio, (per mil) | O-18/O-16 stable isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|---|---|---|---|---|
| 1 | <20 | 14 | 17 | 98 | 20 | -66.5 | -10.10 | 0.8 |
| 2 | 320 | 14 | 53 | 160 | 23 | -67.5 | -10.30 | .9 |
| 3 | 680 | 21 | 330 | 2,800 | 39 | -65.5 | -9.80 | 1.1 |
| 4 | -- | 10 | 24 | 110 | 430 | -68.0 | -10.50 | .5 |
| 5 | 800 | 12 | 27 | 110 | 53 | -- | -10.85 | 1.9 |

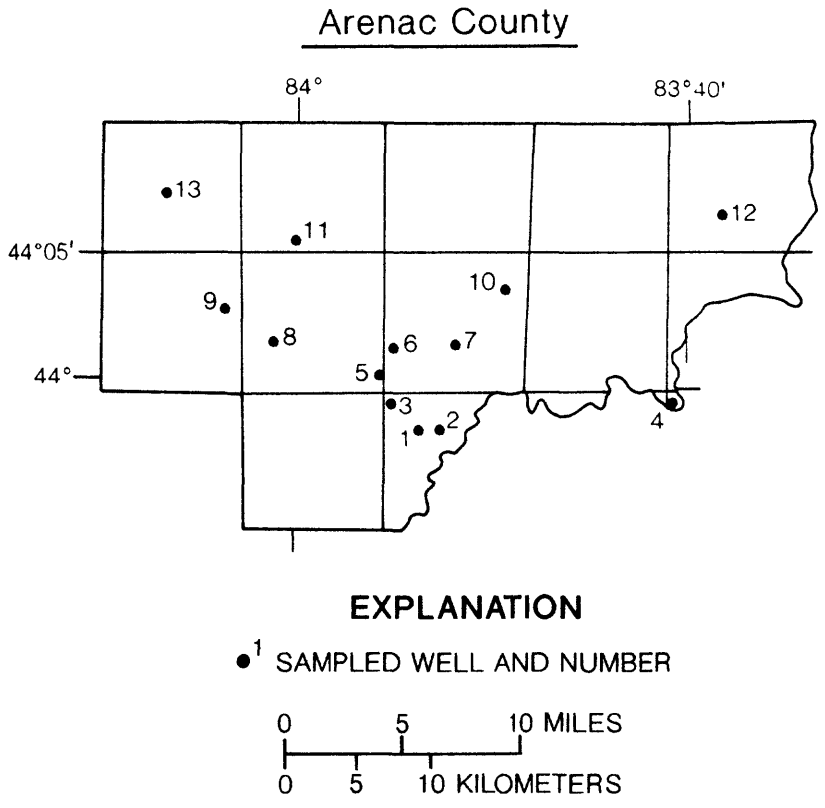


Table 3.--Physical and chemical characteristics for ground water in Arenac County

[Analyses by U.S. Geological Survey. Geologic unit: 112SDGV, sand and gravel; 324SGNW, Saginaw Formation; 333MCGN, Michigan Formation; 337MRSL, Marshall Sandstone. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter; pCi/L, picocuries per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 43°58'59"N | 83°54'17"W | 7-27-88 | 337MRSL | 320 | 3,060 | 7.41 | 11.0 | 0.2 |
| 2 | 43°59'00"N | 83°53'17"W | 7-23-86 | 324SGNW | 133 | 2,220 | 7.29 | 10.5 | 6.7 |

Table 3.--Physical and chemical characteristics for ground water in Arenac County--Continued

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 43°59'51"N | 83°55'38"W | 7-07-88 | 333MCGN | 115 | 2,430 | 7.22 | 12.0 | 0.2 |
| 4 | 44°00'00"N | 83°40'44"W | 7-23-86 | 337MRSL | 257 | 1,710 | 7.26 | 11.5 | .5 |
| 5 | 44°00'53"N | 83°56'10"W | 6-01-88 | 333MCGN | 225 | 1,520 | 7.66 | 12.5 | 0 |
| 6 | 44°01'57"N | 83°55'30"W | 6-01-88 | 324SGNW | 80 | 546 | 7.33 | 11.0 | .1 |
| 7 | 44°02'08"N | 83°52'26"W | 6-01-88 | 324SGNW | 106 | 1,390 | 7.52 | 11.0 | 0 |
| 8 | 44°02'14"N | 84°01'38"W | 9-11-86 | 112SDGV | 44 | 698 | 7.10 | 10.5 | 7.9 |
| 9 | 44°03'28"N | 84°04'05"W | 9-11-86 | 112SDGV | 55 | 328 | 7.66 | 10.5 | 1.2 |
| 10 | 44°04'08"N | 83°50'05"W | 7-28-86 | 337MRSL | 300 | 1,080 | 7.24 | 11.5 | .9 |
| 11 | 44°05'55"N | 84°00'28"W | 7-23-86 | 333MCGN | 432 | 1,100 | 7.30 | 10.5 | 1.1 |
| 12 | 44°06'52"N | 83°39'04"W | 7-27-88 | 337MRSL | 470 | 2,710 | 7.04 | 11.0 | 0 |
| 13 | 44°07'38"N | 84°07'05"W | 7-28-86 | 112SDGV | 90 | 528 | 7.80 | 10.5 | 1.3 |

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 75 | 18 | 550 | 6.9 | 259 | <0.02 | 230 | 770 | 0.50 | 0.39 |
| 2 | 150 | 35 | 370 | 9.5 | 191 | <.5 | 590 | 500 | .90 | 1.2 |
| 3 | 140 | 41 | 330 | 9.0 | 248 | -- | 270 | 530 | .40 | 1.4 |
| 4 | 110 | 13 | 230 | 4.2 | 272 | <.5 | 150 | 330 | .60 | .75 |
| 5 | 43 | 9.5 | 290 | 4.6 | 312 | .07 | 130 | 280 | .70 | .82 |
| 6 | 55 | 20 | 41 | 2.1 | 283 | .025 | 36 | 18 | .60 | .062 |
| 7 | 95 | 29 | 190 | 5.7 | 257 | .03 | 550 | 32 | .70 | .079 |
| 8 | 95 | 22 | 27 | 2.7 | 313 | <.5 | 29 | 36 | .10 | .070 |
| 9 | 40 | 15 | 16 | 1.1 | 195 | <.5 | 3.4 | .90 | .60 | <.010 |
| 10 | 150 | 28 | 65 | 3.5 | 242 | <.5 | 310 | 88 | .50 | .25 |
| 11 | 120 | 23 | 77 | 2.8 | 292 | <.5 | 270 | 30 | .60 | .070 |
| 12 | 390 | 36 | 450 | 5.6 | 166 | <.02 | 1,000 | 670 | .40 | 1.4 |
| 13 | 57 | 21 | 36 | 1.5 | 209 | <.5 | 150 | 3.3 | .70 | .034 |

Table 3.--Physical and chemical characteristics for ground water in Arenac County--Continued

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, nitrite, dissolved (mg/L as N) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Copper, dissolved (µg/L as Cu) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 8.0 | 1,800 | -- | -- | -- | <10 | <1 | <100 | 600 | -- |
| 2 | 6.2 | 1,820 | -- | 0.120 | 1.20 | <10 | <1 | -- | 3,200 | -- |
| 3 | 6.6 | 1,520 | -- | -- | -- | <10 | <1 | <100 | 1,600 | 1 |
| 4 | 11 | 1,020 | -- | .180 | .590 | <10 | <1 | -- | 580 | -- |
| 5 | 6.7 | 929 | -- | -- | -- | <10 | <1 | 17 | 600 | <1 |
| 6 | 14 | 325 | -- | -- | -- | <10 | 2 | 95 | 280 | <1 |
| 7 | 8.0 | 1,040 | -- | -- | -- | <10 | <1 | 9 | 1,300 | 1 |
| 8 | 9.5 | 408 | <0.010 | 1.50 | .030 | 10 | <1 | -- | 40 | -- |
| 9 | 15 | 208 | <.010 | <.100 | .230 | <10 | 5 | -- | 50 | -- |
| 10 | 12 | 838 | -- | <.100 | .470 | <10 | <1 | -- | 340 | -- |
| 11 | 11 | 672 | -- | .230 | .410 | <10 | <1 | -- | 370 | -- |
| 12 | 11 | 2,780 | -- | -- | -- | 30 | 1 | <100 | 500 | -- |
| 13 | 13 | 383 | -- | <.100 | .270 | <10 | 13 | -- | 110 | -- |

| Well number | Iron, dissolved (µg/L as Fe) | Iron, ferrous, dissolved (µg/L as Fe) | Lead, dissolved (µg/L as Pb) | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | Radium-226, dissolved, radon method (pCi/L) | Radium-228, dissolved (pCi/L as Ra-228) | Uranium, natural dissolved (µg/L as U) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 370 | -- | -- | 30 | 15 | 1,700 | 80 | -- | -- | -- |
| 2 | 340 | -- | -- | 60 | 40 | 11,000 | 50 | -- | -- | -- |
| 3 | 750 | 700 | <5 | 80 | 37 | 4,000 | 500 | -- | -- | -- |
| 4 | 650 | -- | -- | 23 | 7 | 1,300 | <3 | -- | -- | -- |
| 5 | 1,200 | 1,100 | <5 | 19 | 1 | 990 | 7 | -- | -- | -- |
| 6 | 670 | 650 | <5 | 17 | 31 | 860 | 46 | -- | -- | -- |
| 7 | 1,800 | 1,600 | 17 | 39 | 50 | 4,600 | 5 | 0.67 | <1.0 | 0.04 |
| 8 | 6 | -- | -- | 11 | 2 | 110 | 18 | -- | -- | -- |
| 9 | 470 | -- | -- | 8 | 18 | 580 | 110 | -- | -- | -- |
| 10 | 890 | -- | -- | 6 | 20 | 1,900 | 760 | -- | -- | -- |
| 11 | 1,900 | -- | -- | 19 | 21 | 2,100 | 11 | -- | -- | -- |
| 12 | 2,000 | 1,900 | -- | 20 | 56 | 2,900 | 1,900 | -- | -- | -- |
| 13 | 680 | -- | -- | <4 | 10 | 1,400 | 11 | -- | -- | -- |

Table 3.--Physical and chemical characteristics for ground water in Arenac County--Continued

| Well number | C-13/ C-12 stable-isotope ratio, (per mil) | H-2/ H-1 stable-isotope ratio, (per mil) | O-18/ O-16 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|---|
| 1 | -- | -79.0 | -11.50 | -- |
| 2 | -13.10 | -73.5 | -10.80 | 0.3 |
| 3 | -- | -- | -- | -- |
| 4 | -- | -72.0 | -10.50 | .7 |
| 5 | -- | -- | -- | -- |
| 6 | -- | -- | -- | -- |
| 7 | -- | -- | -- | -- |
| 8 | -- | -67.5 | -10.40 | 1.2 |
| 9 | -12.80 | -64.0 | -9.80 | 6.0 |
| 10 | -- | -67.5 | -10.00 | 2.1 |
| 11 | -- | -65.5 | -10.00 | 2.2 |
| 12 | -- | -- | -15.35 | -- |
| 13 | -- | -68.5 | -10.30 | 1.9 |

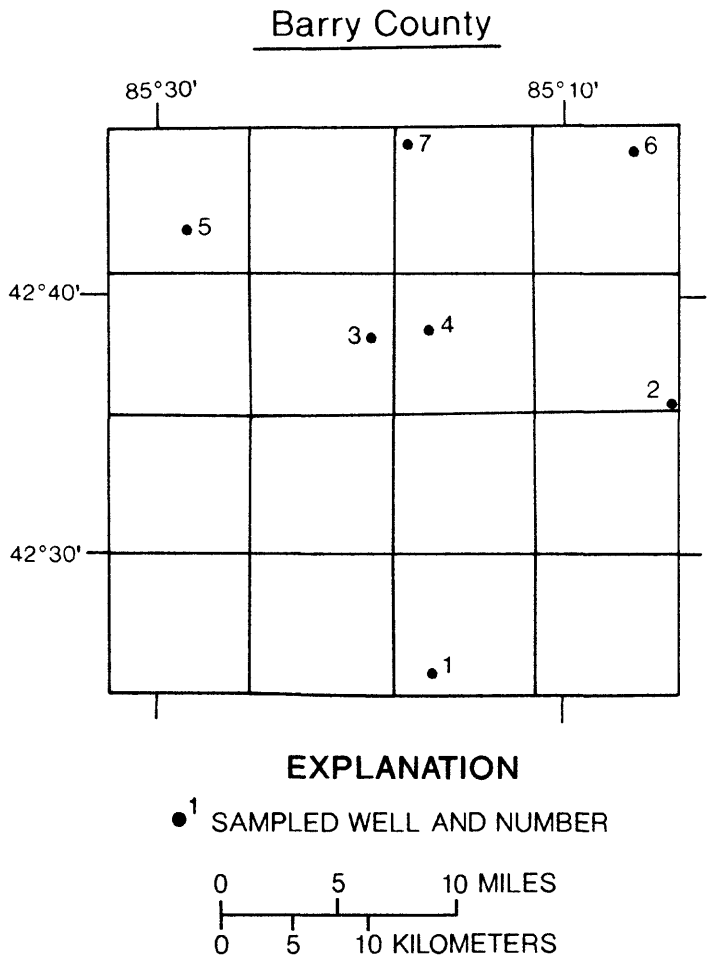


Table 4.--Physical and chemical characteristics for ground water in Barry County

[Analyses by U.S. Geological Survey. Geologic unit: 112GRVL, gravel; 112SAND, sand; 112SDGV, sand and gravel; 333MCGN, Michigan Formation; 337MRSL, Marshall Sandstone. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 42°26'29"N | 85°16'52"W | 8-07-86 | 112GRVL | 68 | 422 | 7.46 | 12.0 | 2.4 |
| 2 | 42°36'17"N | 85°05'04"W | 5-18-87 | 112GRVL | 56 | 680 | 7.19 | 14.0 | .3 |

Table 4.--Physical and chemical characteristics for ground water in Barry County--Continued

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 42°38'48"N | 85°19'59"W | 5-20-87 | 112SAND | 127 | 577 | 7.34 | 12.0 | 0.8 |
| 4 | 42°39'02"N | 85°17'15"W | 7-15-86 | 337MRSL | 339 | 535 | 7.39 | 11.0 | .3 |
| 5 | 42°42'48"N | 85°29'10"W | 7-15-86 | 112SDGV | 75 | 591 | 7.50 | 10.5 | 3.3 |
| 6 | 42°45'35"N | 85°06'58"W | 7-21-86 | 333MCGN | 290 | 769 | 7.22 | 13.0 | .4 |
| 7 | 42°46'00"N | 85°18'25"W | 7-15-86 | 112SDGV | 50 | 593 | 7.41 | 11.0 | .5 |

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 58 | 18 | 2.6 | 0.80 | 204 | <0.5 | 29 | 6.5 | 0.20 | 0.028 |
| 2 | 94 | 26 | 17 | 3.9 | 304 | -- | 33 | 28 | .20 | .035 |
| 3 | 78 | 26 | 3.9 | .60 | 210 | -- | 34 | 41 | .20 | .063 |
| 4 | 72 | 24 | 12 | 2.0 | 285 | <.5 | 17 | 6.0 | .20 | .021 |
| 5 | 83 | 28 | 5.6 | 1.0 | 252 | <.5 | 45 | 19 | <.10 | .035 |
| 6 | 110 | 36 | 7.5 | 1.1 | 324 | <.5 | 61 | 42 | .20 | .048 |
| 7 | 88 | 29 | 5.4 | 1.0 | 304 | <.5 | 48 | 6.3 | .10 | .024 |

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) | Iron, ferrous, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 13 | 240 | 0.110 | <0.010 | <10 | <1 | -- | 10 | 150 | -- |
| 2 | 15 | 400 | -- | -- | <10 | 3 | 150 | 50 | 1,300 | 1,200 |
| 3 | 17 | 287 | -- | -- | <10 | 2 | 53 | 10 | 880 | 810 |
| 4 | 17 | 314 | <.100 | .320 | <10 | <1 | -- | 70 | 530 | -- |
| 5 | 12 | 366 | 5.20 | .050 | <10 | <1 | -- | 20 | 19 | -- |
| 6 | 19 | 464 | <.100 | .110 | 20 | 3 | -- | 10 | 1,700 | -- |
| 7 | 16 | 380 | <.100 | .090 | <10 | 6 | -- | 10 | 2,100 | -- |

Table 4.--Physical and chemical characteristics for ground water in Barry County--Continued

| Well number | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | H-2/H-1 stable-isotope ratio, (per mil) | O-18/O-16 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|---|---|---|---|
| 1 | 4 | 25 | 46 | 76 | -65.0 | -9.90 | 1.2 |
| 2 | 10 | 130 | 230 | <3 | -61.5 | -9.20 | 2.8 |
| 3 | 12 | 47 | 79 | 56 | -67.0 | -10.10 | .8 |
| 4 | 12 | 17 | 1,300 | 11 | -61.5 | -9.20 | 1.1 |
| 5 | 8 | 2 | 110 | 6 | -67.0 | -10.20 | .6 |
| 6 | 12 | 45 | 140 | 14 | -64.5 | -9.70 | 1.4 |
| 7 | 9 | 46 | 360 | 13 | -66.0 | -9.90 | 1.1 |

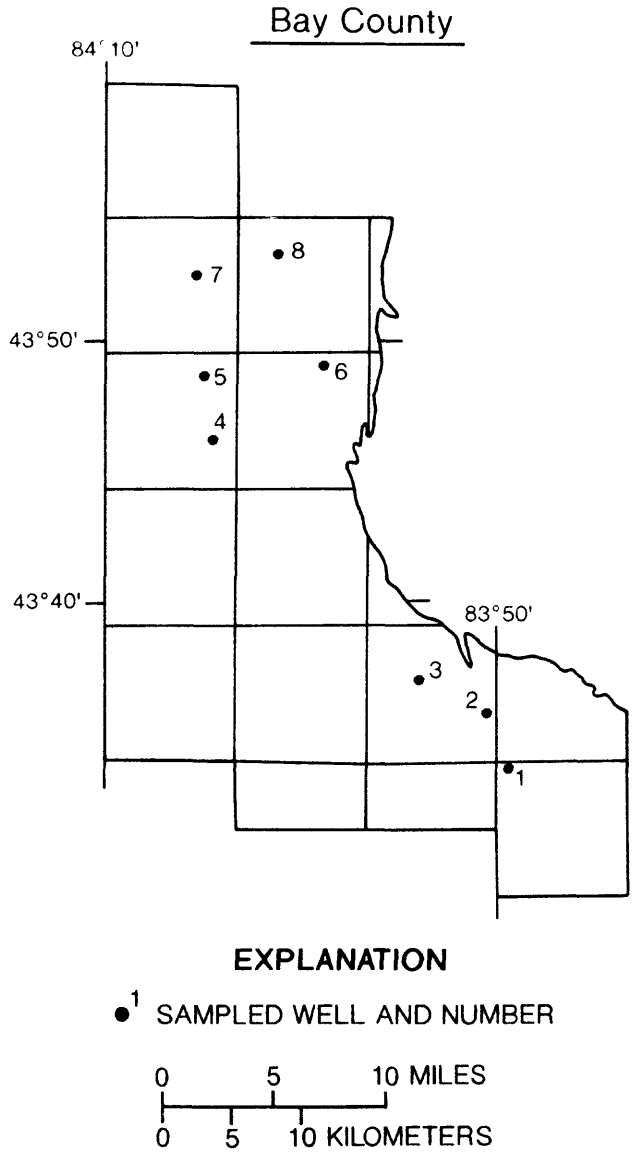


Table 5.--Physical and chemical characteristics for ground water in Bay County

[Analyses by U.S. Geological Survey. Geologic unit: 324SGNW, Saginaw Formation. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter; pCi/L, picocuries per liter. --, no analysis made, <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 43°34'16"N | 83°48'45"W | 6-30-88 | 324SGNW | 100 | 2,890 | 7.67 | 12.5 | 0.2 |
| 2 | 43°36'13"N | 83°49'59"W | 11-16-87 | 324SGNW | 95 | 3,300 | -- | 14.0 | -- |
| " | " | " | 5-26-88 | " | " | 3,370 | 8.03 | 12.0 | 0 |

Table 5.--Physical and chemical characteristics for ground water in Bay County--Continued

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 43°37'33"N | 83°53'40"W | 11-16-87 | 324SGNW | 87 | 1,800 | -- | 16.5 | -- |
| 4 | 43°46'42"N | 84°04'42"W | 7-07-88 | 324SGNW | 381 | 1,350 | 7.55 | 10.0 | 0.4 |
| 5 | 43°49'10"N | 84°05'08"W | 7-16-87 | 324SGNW | 200 | 1,090 | 7.64 | 13.0 | 0 |
| 6 | 43°49'30"N | 83°58'37"W | 11-16-87 | 324SGNW | 82 | 5,500 | -- | 15.0 | -- |
| 7 | 43°53'01"N | 84°05'28"W | 7-16-87 | 324SGNW | 150 | 928 | 7.73 | 11.5 | .4 |
| 8 | 43°53'48"N | 84°01'06"W | 7-16-87 | 324SGNW | 240 | 1,780 | 7.60 | 11.5 | 0 |

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 150 | 43 | 420 | 9.1 | 129 | -- | 660 | 520 | 0.80 | 1.1 |
| 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| " | 200 | 68 | 420 | 4.4 | 114 | 0.035 | 900 | 590 | .80 | 1.1 |
| 3 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 4 | 51 | 16 | 220 | 4.4 | 200 | -- | 100 | 270 | .30 | .82 |
| 5 | 98 | 34 | 92 | 4.4 | 206 | <.02 | 280 | 100 | .30 | .31 |
| 6 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 7 | 100 | 32 | 50 | 2.7 | 179 | <.02 | 370 | 4.2 | .60 | .018 |
| 8 | 240 | 68 | 85 | 2.9 | 137 | .07 | 920 | 36 | .50 | .11 |

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) | Iron, ferrous, dissolved (µg/L as Fe) | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 7.5 | 1,920 | <10 | 1 | <100 | 830 | 740 | 670 | 40 | 57 |
| 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| " | 12 | 2,330 | <10 | 11 | <100 | 480 | 1,200 | 850 | 40 | 160 |
| 3 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 4 | 7.6 | 798 | <10 | <1 | 27 | 450 | 220 | 210 | 39 | 12 |
| 5 | 7.8 | 739 | <10 | <1 | 12 | 440 | 500 | 490 | 39 | 22 |
| 6 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 7 | 11 | 682 | <10 | <1 | 10 | 280 | 500 | 480 | 24 | 36 |
| 8 | 13 | 1,530 | 10 | <1 | 44 | 120 | 1,700 | 1,600 | 38 | 97 |

Table 5.--Physical and chemical characteristics for ground water in Bay County--Continued

| Well number | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | Tritium, total (pCi/L) | C-13/ C-12 stable-isotope ratio, (per mil) | Carbon-14 (percent modern) | H-2/ H-1 stable-isotope ratio, (per mil) | O-18/ O-16 stable-isotope ratio, (per mil) | S-34/ S-32 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 4,900 | 400 | -- | -- | -- | -- | -14.30 | -- | 3.4 |
| 2 | -- | -- | -- | -- | -- | -89.5 | -12.70 | -- | -- |
| " | 4,800 | 140 | <2.5 | -13.00 | <1.5 | -- | -- | 15.80 | 2.0 |
| 3 | -- | -- | -- | -- | -- | -99.5 | -13.90 | -- | -- |
| 4 | 810 | 7 | -- | -- | -- | -- | -15.15 | -- | 1.1 |
| 5 | 1,400 | 380 | -- | -12.70 | -- | -109.5 | -15.70 | -- | 2.1 |
| 6 | -- | -- | -- | -- | -- | -103.0 | -14.60 | -- | -- |
| 7 | 2,400 | 460 | -- | -- | -- | -65.0 | -9.60 | -- | 2.7 |
| 8 | 4,200 | 290 | -- | -10.70 | -- | -78.0 | -11.10 | -- | 3.7 |

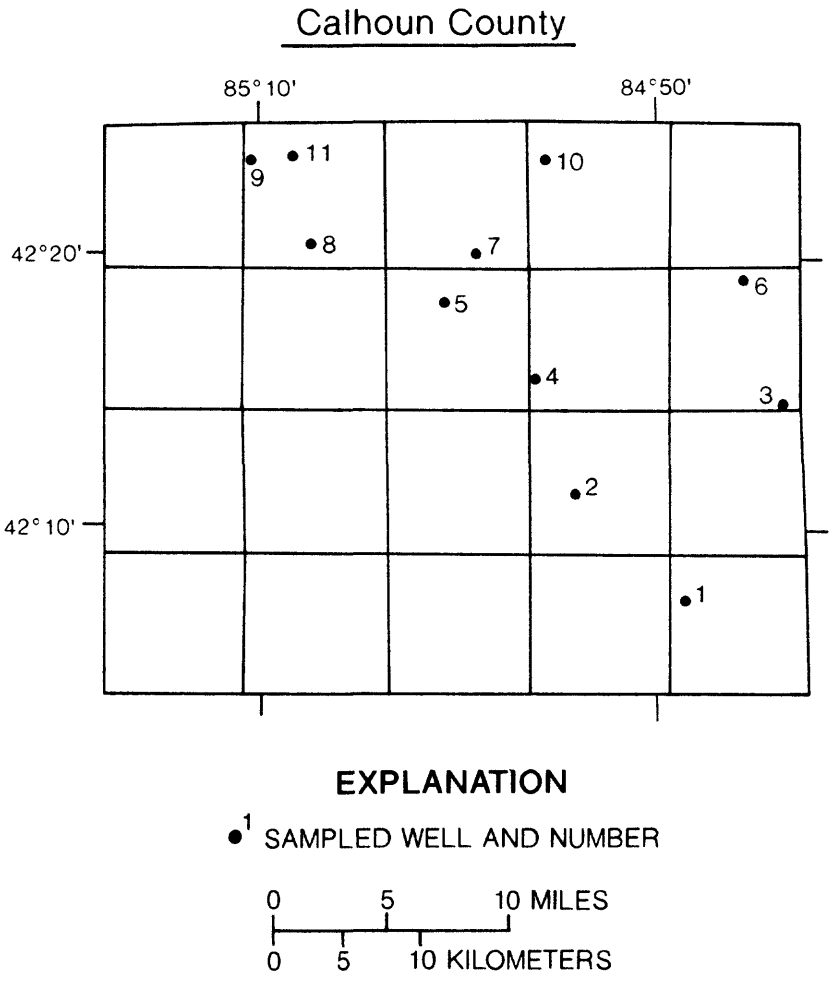


Table 6.--Physical and chemical characteristics for ground water in Calhoun County

[Analyses by U.S. Geological Survey. Geologic unit: 112SAND, sand; 112SDGV, sand and gravel; 324SGNW, Saginaw Formation; 337MRSL, Marshall Sandstone. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter; pCi/L, picocuries per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 42°08'11"N | 84°49'08"W | 7-09-86 | 337MRSL | 144 | 618 | 7.23 | 11.0 | 1.0 |
| 2 | 42°12'09"N | 84°54'37"W | 6-27-88 | 337MRSL | 330 | 578 | 7.33 | 12.0 | .4 |

Table 6.--Physical and chemical characteristics for ground water in Calhoun County--Continued

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 42°15'16"N | 84°44'15"W | 7-14-86 | 337MRSL | 254 | 630 | 7.32 | 12.0 | 0.3 |
| 4 | 42°16'15"N | 84°56'50"W | 7-22-86 | 337MRSL | 100 | 550 | 7.24 | 11.0 | .2 |
| " | " | " | 5-10-88 | " | " | 527 | -- | 11.5 | -- |
| 5 | 42°19'08"N | 85°01'24"W | 7-22-86 | 112SAND | 102 | 823 | 7.10 | 12.0 | .2 |
| 6 | 42°19'59"N | 84°46'27"W | 7-22-86 | 112SDGV | 52 | 440 | 7.37 | 12.5 | .1 |
| 7 | 42°20'51"N | 84°59'48"W | 7-22-86 | 112SDGV | 54 | 801 | 7.24 | 14.0 | 1.0 |
| 8 | 42°21'12"N | 85°07'56"W | 5-15-87 | 337MRSL | 149 | 561 | 7.43 | 12.0 | 1.1 |
| 9 | 42°24'15"N | 85°10'57"W | 6-27-88 | 337MRSL | 140 | 594 | 7.55 | 13.0 | .3 |
| 10 | 42°24'25"N | 84°56'23"W | 5-12-87 | 324SGNW | 60 | 749 | 7.32 | 11.0 | .1 |
| 11 | 42°24'25"N | 85°08'53"W | 5-15-87 | 112SAND | 106 | 645 | 7.23 | 11.0 | 1.3 |

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 73 | 24 | 38 | 2.0 | 290 | <0.5 | 4.5 | 48 | 0.20 | 0.15 |
| 2 | 81 | 23 | 15 | 1.1 | 288 | -- | 17 | 21 | .30 | .059 |
| 3 | 95 | 27 | 7.8 | 1.2 | 270 | <.5 | 41 | 27 | .20 | .057 |
| 4 | 79 | 22 | 5.8 | .90 | 221 | <.5 | 61 | 24 | .10 | .040 |
| " | -- | -- | -- | -- | -- | .02 | -- | -- | -- | -- |
| 5 | 92 | 31 | 36 | 2.3 | 394 | <.5 | 60 | 84 | .20 | .033 |
| 6 | 67 | 18 | 3.1 | .60 | 326 | <.5 | 24 | 4.8 | .20 | .017 |
| 7 | 130 | 37 | 9.2 | 1.7 | 262 | <.5 | 110 | 20 | .10 | .054 |
| 8 | 78 | 23 | 8.0 | .90 | 241 | -- | 43 | 20 | .10 | .10 |
| 9 | 92 | 28 | 4.3 | .90 | 270 | <.02 | 66 | 8.0 | .30 | <.010 |
| 10 | 110 | 31 | 9.5 | 2.3 | 300 | -- | 69 | 34 | .20 | .090 |
| 11 | 85 | 28 | 6.2 | .80 | 311 | -- | 54 | 16 | .10 | .045 |

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) | Iron, ferrous, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 17 | 367 | <0.100 | 0.210 | <10 | 3 | -- | 110 | 480 | -- |
| 2 | 15 | 351 | -- | -- | <10 | <1 | 110 | 50 | 2,200 | 1,900 |

Table 6.--Physical and chemical characteristics for ground water in Calhoun County--Continued

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) | Iron, ferrous, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 14 | 387 | <0.100 | 0.070 | <10 | 2 | -- | 20 | 700 | -- |
| 4 | 13 | 343 | <.100 | .050 | <10 | 1 | -- | 10 | 610 | -- |
| " | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 5 | 13 | 546 | 2.40 | .110 | <10 | <1 | -- | 30 | 14 | -- |
| 6 | 16 | 270 | <.100 | .100 | <10 | 7 | -- | <10 | 2,100 | -- |
| 7 | 12 | 573 | <.100 | .070 | <10 | 1 | -- | 20 | 1,900 | -- |
| 8 | 14 | 324 | -- | -- | <10 | 2 | 140 | 10 | 490 | -- |
| 9 | 12 | 361 | -- | -- | <10 | 1 | 120 | <10 | 23 | <20 |
| 10 | 14 | 460 | -- | -- | <10 | 2 | 85 | 60 | 1,300 | 1,100 |
| 11 | 16 | 353 | -- | -- | <10 | <1 | 240 | 10 | 63 | <20 |

| Well number | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | Tritium, total (pCi/L) | C-13/C-12 stable-isotope ratio, (per mil) | Carbon-14 (percent modern) | H-2/H-1 stable-isotope ratio, (per mil) | O-18/O-16 stable-isotope ratio, (per mil) | S-34/S-32 stable-isotope ratio, (per mil) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 12 | 22 | 320 | 8 | -- | -- | -- | -58.0 | -9.10 | -- |
| 2 | 12 | 48 | 140 | <3 | -- | -- | -- | -- | -9.45 | -- |
| 3 | 8 | 46 | 110 | 5 | -- | -- | -- | -63.5 | -9.80 | -- |
| 4 | 10 | 62 | 79 | 6 | -- | -- | -- | -63.5 | -9.60 | -- |
| " | -- | -- | -- | -- | 75 | -11.60 | 60.9 | -- | -- | 6.52 |
| 5 | 9 | 310 | 120 | 47 | -- | -- | -- | -62.0 | -9.70 | -- |
| 6 | 7 | 37 | 68 | 73 | -- | -12.40 | -- | -64.0 | -9.70 | -- |
| 7 | 11 | 170 | 110 | 190 | -- | -- | -- | -64.0 | -9.70 | -- |
| 8 | 11 | 69 | 120 | 19 | -- | -12.90 | -- | -63.0 | -9.70 | -- |
| 9 | 13 | 15 | 77 | 7 | -- | -- | -- | -- | -10.15 | -- |
| 10 | 20 | 44 | 340 | 25 | -- | -- | -- | -60.5 | -9.40 | -- |
| 11 | 11 | 40 | 90 | 290 | -- | -11.60 | -- | -63.5 | -9.80 | -- |

Table 6.--Physical and chemical characteristics for ground water in Calhoun County--Continued

| Well number | Carbon, organic, dissolved (mg/L as C) |
|---|---|
| 1 | 0.8 |
| 2 | 6.0 |
| 3 | .5 |
| 4 | .9 |
| " | -- |
| 5 | 1.0 |
| 6 | 2.1 |
| 7 | 1.0 |
| 8 | 1.1 |
| 9 | 2.2 |
| 10 | 1.6 |
| 11 | .9 |

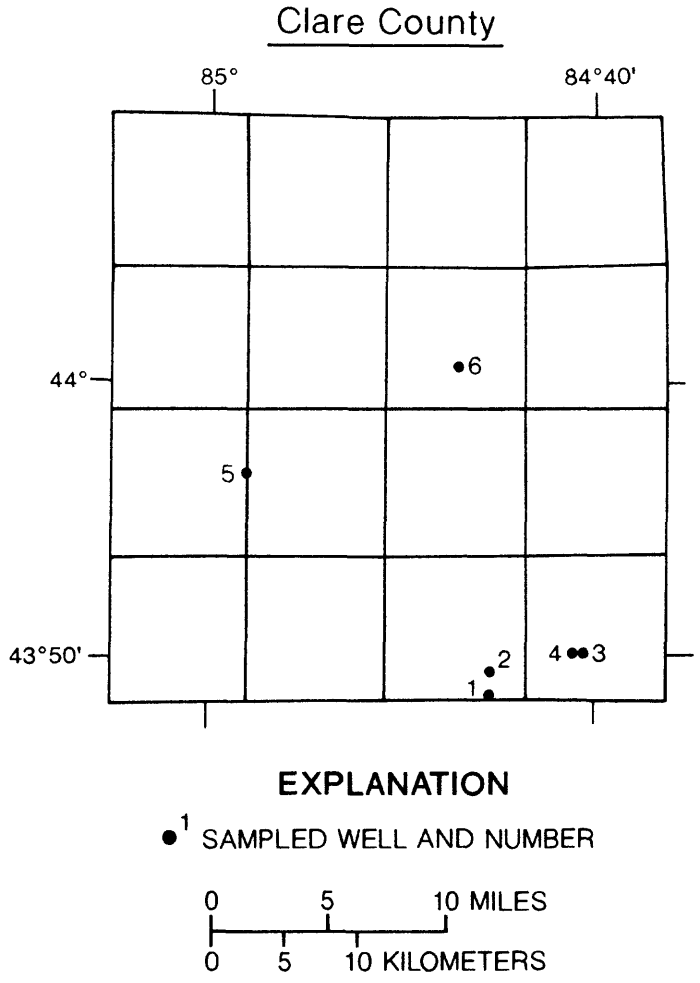


Table 7.--Physical and chemical characteristics for ground water in Clare County

[Analyses by U.S. Geological Survey. Geologic unit: 112SAND, sand; 112SDGV, sand and gravel; 324SGNW, Saginaw Formation. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 43°49'03"N | 84°46'06"W | 8-04-86 | 112SDGV | 89 | 1,010 | 7.26 | 10.5 | 0 |
| 2 | 43°50'22"N | 84°46'06"W | 6-24-87 | 112SDGV | 163 | 398 | 7.77 | 11.0 | 0 |
| 3 | 43°51'04"N | 84°41'10"W | 7-02-87 | 324SGNW | 728 | 37,500 | 7.05 | 10.0 | 0 |

Table 7.--Physical and chemical characteristics for ground water in Clare County--Continued

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 4 | 43°51'04"N | 84°41'11"W | 7-09-87 | 112SAND | 63 | -- | -- | -- | -- |
| 5 | 43°57'30"N | 84°58'46"W | 6-24-87 | 112SAND | 68 | 347 | 7.71 | 10.5 | 4.7 |
| 6 | 44°01'18"N | 84°47'48"W | 8-04-86 | 112SDGV | 212 | 340 | 7.39 | 9.5 | .8 |

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 140 | 35 | 31 | 2.3 | 346 | <0.5 | 270 | 41 | 0.30 | 0.21 |
| 2 | 33 | 15 | 36 | 1.5 | 200 | .05 | 32 | .90 | .90 | <.010 |
| 3 | 910 | 250 | 7,700 | 53 | 165 | .04 | 1,400 | 13,000 | .30 | 26 |
| 4 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 5 | 53 | 16 | 2.2 | .50 | 314 | -- | 18 | 1.2 | .10 | <.010 |
| 6 | 48 | 15 | 3.0 | .60 | 181 | <.5 | 11 | 2.2 | <.10 | .026 |

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 13 | 715 | <0.100 | 0.240 | <10 | 3 | -- | 70 | 1,400 |
| 2 | 12 | 241 | -- | -- | <10 | 13 | 100 | 150 | 240 |
| 3 | 11 | 24,300 | -- | -- | <10 | 1 | 200 | 2,200 | 5,600 |
| 4 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 5 | 9.8 | 209 | -- | -- | <10 | <1 | 13 | <10 | 6 |
| 6 | 12 | 189 | <.100 | .050 | <10 | 1 | -- | <10 | 250 |

Table 7.--Physical and chemical characteristics for ground water in Clare County--Continued

| Well number | Iron, ferrous, dissolved (µg/L as Fe) | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | C-13/ C-12 stable-isotope ratio, (per mil) | H-2/ H-1 stable-isotope ratio, (per mil) | O-18/ O-16 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | -- | 14 | 120 | 1,100 | 13 | -13.50 | -69.0 | -10.20 | 3.0 |
| 2 | 200 | 10 | 20 | 990 | 310 | -- | -69.5 | -10.30 | 4.8 |
| 3 | 3,800 | 140 | 270 | 8,600 | 90 | -13.00 | -66.0 | -9.80 | .8 |
| 4 | -- | -- | -- | -- | -- | -- | -66.0 | -9.95 | -- |
| 5 | <20 | 7 | 1 | 44 | 17 | -- | -72.5 | -10.80 | 8.2 |
| 6 | -- | <4 | 26 | 47 | 15 | -- | -74.5 | -10.90 | .8 |

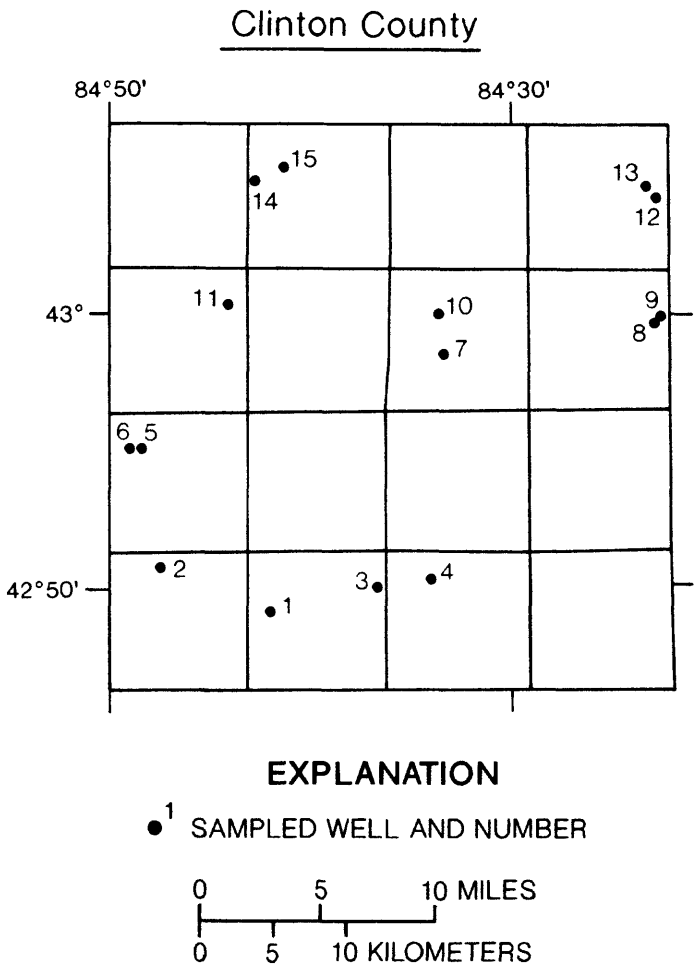


Table 8.--Physical and chemical characteristics for ground water in Clinton County

[Analyses by U.S. Geological Survey. Geologic unit: 112GRVL, gravel; 112SDCL, sand and clay; 112SDGV, sand and gravel; 324SGNW, Saginaw Formation. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 42°49'37"N | 84°42'14"W | 4-30-87 | 324SGNW | 200 | 660 | 7.14 | 11.0 | 0.1 |
| 2 | 42°51'15"N | 84°47'55"W | 8-06-86 | 324SGNW | 305 | 557 | 7.39 | 11.5 | .7 |

Table 8.--Physical and chemical characteristics for ground water in Clinton County--Continued

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 42°50'32"N | 84°36'56"W | 8-06-86 | 324SGNW | 155 | 505 | 7.49 | 11.0 | 1.5 |
| 4 | 42°50'48"N | 84°34'10"W | 7-07-86 | 324SGNW | 462 | 556 | 7.21 | 11.5 | .2 |
| 5 | 42°55'45"N | 84°49'02"W | 8-06-86 | 112GRVL | 95 | 904 | 7.11 | 12.0 | .1 |
| 6 | 42°55'45"N | 84°49'05"W | 5-11-87 | 324SGNW | 355 | 642 | 7.61 | 12.0 | .2 |
| 7 | 42°59'11"N | 84°33'34"W | 7-07-86 | 112SDGV | 170 | 456 | 7.51 | 12.5 | .3 |
| 8 | 43°00'17"N | 84°22'47"W | 5-08-87 | 112SDGV | 46 | 617 | 7.78 | 12.5 | 7.4 |
| 9 | 43°00'22"N | 84°22'26"W | 5-08-87 | 324SGNW | 345 | 627 | 7.27 | 12.0 | .4 |
| 10 | 43°00'39"N | 84°33'41"W | 7-07-86 | 324SGNW | 501 | 610 | 7.30 | 12.0 | .3 |
| 11 | 43°00'56"N | 84°44'25"W | 5-11-87 | 112GRVL | 150 | 893 | 7.51 | 11.0 | .2 |
| 12 | 43°04'56"N | 84°22'50"W | 5-08-87 | 112SDGV | 79 | 825 | 7.51 | 11.0 | .8 |
| 13 | 43°05'18"N | 84°23'16"W | 5-08-87 | 324SGNW | 400 | 1,110 | 7.43 | 12.5 | 1.4 |
| 14 | 43°05'40"N | 84°43'06"W | 6-13-88 | 324SGNW | 410 | 588 | 7.30 | 13.5 | .1 |
| 15 | 43°06'04"N | 84°41'35"W | 5-18-87 | 112SDCL | 177 | 554 | 7.62 | 11.5 | 4.0 |

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 85 | 33 | 6.8 | 1.8 | 520 | -- | 2.3 | 1.1 | 0.60 | 0.029 |
| 2 | 69 | 32 | 13 | 2.2 | 316 | <0.5 | 8.4 | 1.2 | .60 | .013 |
| 3 | 62 | 24 | 20 | 1.6 | 283 | <.5 | 4.8 | 1.3 | .70 | .014 |
| 4 | 71 | 26 | 11 | 2.6 | 297 | <.5 | 17 | 2.6 | .40 | .026 |
| 5 | 120 | 43 | 11 | 1.8 | 358 | <.5 | 120 | 20 | .20 | .073 |
| 6 | 78 | 32 | 12 | 1.8 | 362 | -- | 10 | 1.5 | .50 | .033 |
| 7 | 38 | 25 | 33 | 2.2 | 229 | <.5 | 17 | 6.3 | 1.2 | .028 |
| 8 | 72 | 25 | 26 | 2.5 | 254 | -- | 58 | 15 | .30 | .080 |
| 9 | 73 | 25 | 27 | 2.4 | 281 | -- | 52 | 15 | .30 | .093 |
| 10 | 59 | 29 | 41 | 2.2 | 293 | <.5 | 42 | 13 | .50 | .088 |
| 11 | 70 | 49 | 45 | 2.6 | 423 | -- | 67 | 3.8 | .70 | .078 |
| 12 | 87 | 33 | 25 | 2.1 | 291 | -- | 74 | 40 | .70 | .14 |
| 13 | 110 | 27 | 79 | 5.8 | 260 | -- | 99 | 160 | .40 | .61 |
| 14 | 95 | 32 | 3.9 | .90 | 308 | <.02 | 68 | 3.9 | .30 | .042 |
| 15 | 72 | 22 | 4.9 | .70 | 222 | -- | 30 | 7.8 | .20 | .037 |

Table 8.--Physical and chemical characteristics for ground water in Clinton County--Continued

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 13 | 360 | -- | -- | <10 | <1 | 110 | 60 | 660 |
| 2 | 18 | 316 | <0.100 | 0.270 | <10 | 6 | -- | 70 | 530 |
| 3 | 17 | 281 | <.100 | .250 | <10 | <1 | -- | 130 | 230 |
| 4 | 9.3 | 324 | <.100 | .290 | <10 | <1 | -- | 210 | 430 |
| 5 | 15 | 553 | <.100 | .070 | <10 | 1 | -- | 30 | 4,100 |
| 6 | 15 | 344 | -- | -- | <10 | <1 | 120 | 100 | 560 |
| 7 | 17 | 266 | <.100 | .360 | <10 | 15 | -- | 190 | 250 |
| 8 | 10 | 364 | -- | -- | 10 | <1 | 72 | 210 | 21 |
| 9 | 11 | 363 | -- | -- | <10 | 1 | 75 | 210 | 430 |
| 10 | 12 | 374 | <.100 | .240 | <10 | <1 | -- | 360 | 280 |
| 11 | 19 | 508 | -- | -- | <10 | 17 | 67 | 310 | 930 |
| 12 | 16 | 451 | -- | -- | <10 | 6 | 110 | 90 | 900 |
| 13 | 8.8 | 689 | -- | -- | <10 | 1 | 38 | 470 | 570 |
| 14 | 14 | 382 | -- | -- | <10 | <1 | 42 | <10 | 420 |
| 15 | 12 | 301 | -- | -- | <10 | <1 | 58 | 20 | 7 |

| Well number | Iron, ferrous, dissolved (µg/L as Fe) | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | C-13/C-12 stable-isotope ratio, (per mil) | H-2/H-1 stable-isotope ratio, (per mil) | O-18/O-16 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 600 | 37 | 15 | 460 | 54 | -- | -64.0 | -9.50 | 1.5 |
| 2 | -- | 18 | 10 | 820 | 660 | -- | -60.0 | -9.30 | 1.5 |
| 3 | -- | 16 | 190 | 710 | 610 | -- | -62.0 | -9.50 | 1.6 |
| 4 | -- | 30 | 15 | 890 | 12 | -- | -57.5 | -8.70 | 1.4 |
| 5 | -- | 9 | 91 | 240 | 24 | -- | -63.0 | -9.80 | 1.6 |
| 6 | 400 | 20 | 16 | 550 | 31 | -- | -61.5 | -9.40 | 1.7 |
| 7 | -- | 14 | 10 | 1,400 | 17 | -- | -65.0 | -9.90 | .9 |
| 8 | -- | 33 | 3 | 1,100 | 26 | -12.10 | -66.5 | -9.70 | 1.1 |
| 9 | 400 | 31 | 17 | 1,200 | 15 | -12.90 | -67.0 | -9.60 | 1.1 |
| 10 | -- | 32 | 14 | 810 | 11 | -14.20 | -62.0 | -9.50 | 1.0 |
| 11 | 850 | 28 | 16 | 1,500 | 25 | -- | -56.0 | -8.70 | 1.4 |
| 12 | -- | 24 | 61 | 1,300 | 12 | -- | -66.5 | -9.90 | 1.4 |
| 13 | 550 | 58 | 14 | 3,000 | 12 | -13.40 | -83.5 | -12.00 | .7 |
| 14 | -- | 13 | 68 | 91 | 11 | -- | -66.0 | -9.85 | 1.4 |
| 15 | <20 | 12 | <1 | 130 | 9 | -- | -67.5 | -10.20 | .7 |

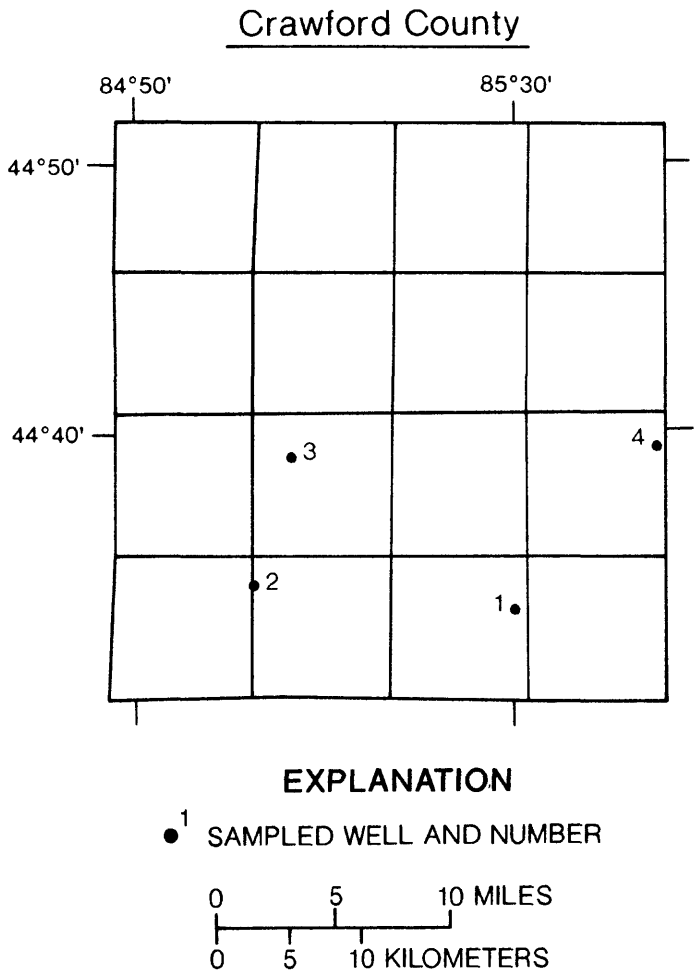


Table 9.--Physical and chemical characteristics for ground water in Crawford County

[Analyses by U.S. Geological Survey. Geologic unit: 112SAND, sand; 112SDGV, sand and gravel; 337MRSL, Marshall Sandstone. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 44°34'06"N | 84°30'30"W | 6-27-89 | 337MRSL | 480[a] | 3,110 | 6.95 | 12.0 | 0.2 |
| 2 | 44°35'23"N | 84°44'18"W | 7-14-87 | 112SDGV | 122 | 334 | 7.67 | 10.0 | 10.5 |
| 3 | 44°40'00"N | 84°42'16"W | 8-27-86 | 112SDGV | 210 | 338 | 7.67 | 9.0 | 5.7 |
| 4 | 44°40'12"N | 84°23'23"W | 7-15-87 | 112SAND | 122 | 304 | 7.95 | 10.0 | .4 |

Table 9.--Physical and chemical characteristics for ground water in Crawford County--Continued

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 180 | 39 | 390 | 8.0 | 158 | <0.02 | 250 | 730 | 0.40 | 2.4 |
| 2 | 60 | 11 | 1.2 | .40 | 181 | -- | 11 | 1.1 | <.10 | .012 |
| 3 | 48 | 12 | 4.0 | .60 | 168 | <.5 | 4.8 | 5.3 | <.10 | .052 |
| 4 | 35 | 12 | 16 | .80 | 181 | .02 | 7.7 | 3.2 | .30 | .012 |

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, nitrite, dissolved (mg/L as N) | Nitrogen, $NO_2$+$NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Copper, dissolved (µg/L as Cu) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 11 | 1,930 | -- | -- | -- | <10 | <1 | <100 | 350 | 2 |
| 2 | 8.0 | 200 | -- | -- | -- | <10 | <1 | 9 | 20 | -- |
| 3 | 11 | 181 | <0.010 | 0.310 | <0.010 | <10 | <1 | -- | 10 | -- |
| 4 | 13 | 177 | -- | -- | -- | <10 | 8 | 19 | 30 | -- |

| Well number | Iron, dissolved (µg/L as Fe) | Iron, ferrous, dissolved (µg/L as Fe) | Lead, dissolved (µg/L as Pb) | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | C-13/ C-12 stable-isotope ratio, (per mil) | H-2/ H-1 stable-isotope ratio, (per mil) | O-18/ O-16 stable-isotope ratio, (per mil) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 860 | -- | 1 | 30 | 68 | 3,600 | 80 | -16.70 | -92.5 | -13.15 |
| 2 | <3 | <20 | -- | 7 | <1 | 39 | 150 | -- | -83.5 | -12.40 |
| 3 | <3 | -- | -- | 5 | <1 | 72 | 7 | -- | -79.0 | -12.00 |
| 4 | 58 | 20 | -- | <4 | 15 | 250 | 200 | -- | -77.0 | -11.50 |

Table 9.--Physical and chemical characteristics for ground water in Crawford County--Continued

| Well number | S-34/S-32 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|
| 1 | 24.90 | -- |
| 2 | -- | 1.2 |
| 3 | -- | .4 |
| 4 | -- | 1.4 |

[a] Depth represents top of sampled interval.

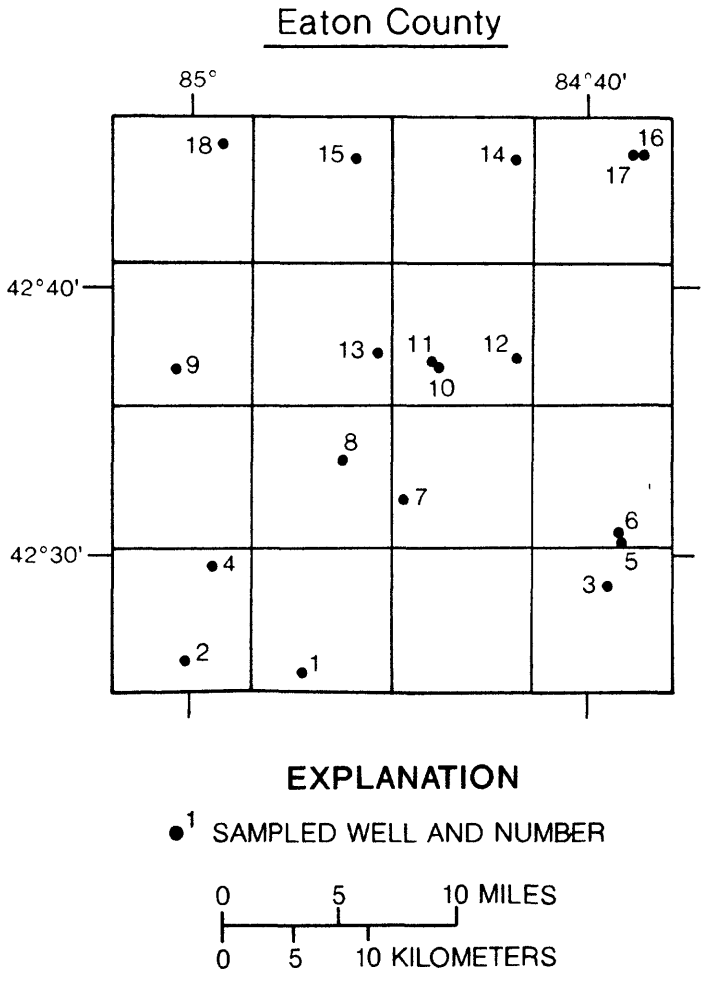


Table 10.--Physical and chemical characteristics for ground water in Eaton County

[Analyses by U.S. Geological Survey. Geologic unit: 112GRVL, gravel; 112SDGV, sand and gravel; 112SDCL, sand and clay; 324SGNW, Saginaw Formation; 333MCGN, Michigan Formation; 337MRSL, Marshall Sandstone. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter; pCi/L, picocuries per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 42°26'24"N | 84°55'10"W | 7-10-86 | 324SGNW | 230 | 1,360 | 6.99 | 11.5 | 1.3 |
| 2 | 42°26'53"N | 85°00'58"W | 8-07-86 | 333MCGN | 280 | 1,400 | 7.33 | 11.0 | .6 |

Table 10.--Physical and chemical characteristics for ground water in Eaton County--Continued

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 42°28'32"N | 84°39'44"W | 6-16-88 | 337MRSL | 410 | 1,060 | 7.47 | 13.0 | 0 |
| 4 | 42°30'11"N | 84°59'42"W | 5-12-87 | 333MCGN | 160 | 643 | 7.45 | 13.0 | .2 |
| 5 | 42°31'03"N | 84°39'02"W | 7-10-86 | 324SGNW | 280 | 911 | 7.26 | 10.5 | .6 |
| 6 | 42°31'27"N | 84°39'12"W | 7-10-86 | 112SDGV | 69 | 816 | 7.15 | 10.0 | .1 |
| 7 | 42°32'44"N | 84°50'05"W | 7-08-86 | 112GRVL | 113 | 581 | 7.30 | 10.0 | .4 |
| 8 | 42°34'07"N | 84°53'10"W | 5-11-88 | 324SGNW | 100 | 568 | -- | 11.5 | -- |
| " | " | " | 5-12-87 | " | " | 593 | 7.63 | 11.5 | .3 |
| 9 | 42°37'30"N | 85°01'35"W | 7-10-86 | 112SDCL | 183 | 661 | 7.47 | 10.5 | .7 |
| 10 | 42°37'35"N | 84°48'28"W | 6-29-88 | 324SGNW | 120 | 672 | 7.55 | 12.0 | .3 |
| 11 | 42°37'37"N | 84°48'37"W | 6-27-88 | 337MRSL | 556[a] | 6,830 | 7.41 | 12.5 | 0 |
| " | " | " | " | " | 486[a] | 5,810 | 7.45 | 12.5 | .2 |
| 12 | 42°37'49"N | 84°44'26"W | 7-08-86 | 324SGNW | 200 | 1,100 | 6.90 | 11.5 | .1 |
| 13 | 42°38'02"N | 84°51'23"W | 6-07-88 | 337MRSL | 500 | 1,720 | 7.66 | 12.0 | .4 |
| 14 | 42°45'06"N | 84°44'29"W | 7-07-86 | 324SGNW | 360 | 634 | 7.26 | 12.0 | .8 |
| 15 | 42°45'07"N | 84°52'36"W | 6-20-88 | 333MCGN | 535 | 546 | 7.42 | 13.5 | .6 |
| 16 | 42°45'19"N | 84°38'24"W | 7-07-86 | 324SGNW | 440 | 821 | 7.09 | 11.0 | 1.0 |
| 17 | 42°45'19"N | 84°38'29"W | 6-15-87 | 324SGNW | 441 | 870 | 7.12 | 12.0 | 4.0 |
| 18 | 42°45'39"N | 84°59'12"W | 7-21-86 | 112SDGV | 175 | 606 | 7.32 | 11.0 | .6 |

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 170 | 50 | 77 | 3.7 | 394 | <0.5 | 120 | 230 | 0.20 | 0.16 |
| 2 | 68 | 24 | 210 | 6.3 | 314 | <.5 | 89 | 240 | .30 | .90 |
| 3 | 82 | 28 | 110 | 13 | 291 | .02 | 99 | 150 | .30 | .46 |
| 4 | 84 | 31 | 8.9 | 4.7 | 350 | -- | 19 | 1.3 | .40 | .045 |
| 5 | 150 | 30 | 12 | 3.9 | 271 | <.5 | 260 | 17 | .20 | .032 |
| 6 | 130 | 31 | 18 | 2.7 | 352 | <.5 | 98 | 39 | .30 | .075 |
| 7 | 86 | 21 | 7.3 | 2.2 | 254 | <.5 | 58 | 20 | .10 | .031 |
| 8 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| " | 82 | 28 | 5.4 | 1.0 | 282 | -- | 34 | 5.7 | .30 | .042 |
| 9 | 92 | 34 | 6.8 | 1.2 | 347 | <.5 | 36 | 7.2 | .20 | .038 |
| 10 | 98 | 37 | 7.7 | 3.1 | 381 | <.02 | 8.0 | 1.2 | .50 | .021 |
| 11 | 220 | 62 | 1,200 | 17 | 191 | <.02 | 350 | 2,000 | .50 | 9.6 |
| " | 190 | 50 | 980 | 15 | 192 | <.02 | 380 | 1,600 | .50 | 7.3 |

Table 10.--Physical and chemical characteristics for ground water in Eaton County--Continued

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 12 | 160 | 51 | 28 | 2.5 | 455 | <0.5 | 160 | 72 | 0.10 | 0.17 |
| 13 | 70 | 20 | 310 | 6.9 | 391 | <.02 | 630 | 58 | 1.2 | .25 |
| 14 | 78 | 27 | 20 | 2.3 | 320 | <.5 | 32 | 9.6 | .40 | .065 |
| 15 | 50 | 23 | 55 | 3.1 | 356 | <.02 | 6.8 | 1.9 | .60 | .018 |
| 16 | 110 | 35 | 17 | 1.2 | 352 | <.5 | 63 | 33 | .30 | .19 |
| 17 | 110 | 38 | 16 | 1.3 | 398 | -- | 80 | 29 | .30 | .095 |
| 18 | 87 | 30 | 6.0 | 1.1 | 321 | <.5 | 33 | 7.5 | .30 | <.010 |

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) | Iron, ferrous, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 15 | 965 | <0.100 | 0.160 | <10 | <1 | -- | 80 | 1,800 | -- |
| 2 | 9.5 | 805 | <.100 | .550 | <10 | 2 | -- | 790 | 400 | -- |
| 3 | 7.1 | 655 | -- | -- | 20 | <1 | 29 | 1,700 | 890 | 890 |
| 4 | 14 | 369 | -- | -- | <10 | <1 | 130 | 360 | 2,600 | 1,700 |
| 5 | 9.3 | 665 | <.100 | .200 | <10 | <1 | -- | 360 | 590 | -- |
| 6 | 11 | 569 | <.100 | .280 | 10 | 2 | -- | 60 | 2,800 | -- |
| 7 | 9.3 | 370 | .210 | .060 | <10 | <1 | -- | 20 | 71 | -- |
| 8 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| " | 18 | 348 | -- | -- | <10 | 7 | 100 | 10 | 400 | 300 |
| 9 | 19 | 397 | <.100 | .220 | <10 | 3 | -- | 20 | 1,100 | -- |
| 10 | 5.0 | 405 | -- | -- | <10 | <1 | 150 | 70 | 550 | 520 |
| 11 | 7.9 | 4,500 | -- | -- | <10 | 5 | <100 | 2,200 | 1,600 | 1,100 |
| " | 8.4 | 3,630 | -- | -- | <10 | 5 | <100 | 2,100 | 1,400 | 1,100 |
| 12 | 15 | 809 | <.100 | .130 | <10 | 2 | -- | 30 | 2,000 | -- |
| 13 | 8.9 | 1,400 | -- | -- | <10 | 4 | 41 | 4,400 | 340 | 170 |
| 14 | 13 | 372 | <.100 | .190 | <10 | 1 | -- | 240 | 440 | -- |
| 15 | 13 | 331 | -- | -- | <10 | 5 | 170 | 550 | 700 | -- |
| 16 | 17 | 511 | <.100 | .220 | <10 | 3 | -- | 40 | 1,100 | -- |
| 17 | 18 | 500 | -- | -- | <10 | 3 | 130 | 30 | 1,100 | 1,000 |
| 18 | 19 | 357 | <.100 | .130 | 10 | 10 | -- | 20 | 1,200 | -- |

Table 10.--Physical and chemical characteristics for ground water in Eaton County--Continued

| Well number | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | Tritium, total (pCi/L) | Radium-226, dissolved, radon method (pCi/L) | Radium-228, dissolved (pCi/L as Ra-228) | Uranium, natural dissolved (µg/L as U) | C-13/C-12 stable-isotope ratio, (per mil) | Carbon-14 (percent modern) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 16 | 140 | 240 | 19 | -- | -- | -- | -- | -14.10 | -- |
| 2 | 33 | 11 | 1,800 | 31 | -- | -- | -- | -- | -- | -- |
| 3 | 39 | 23 | 3,500 | 26 | -- | -- | -- | -- | -- | -- |
| 4 | 24 | 28 | 1,100 | 55 | -- | -- | -- | -- | -- | -- |
| 5 | 20 | 110 | 1,900 | 11 | -- | -- | -- | -- | -- | -- |
| 6 | 12 | 260 | 200 | 26 | -- | -- | -- | -- | -13.90 | -- |
| 7 | 11 | 350 | 120 | 19 | -- | -- | -- | -- | -12.60 | -- |
| 8 | -- | -- | -- | -- | 4.5 | -- | -- | -- | -12.50 | 60.2 |
| " | 17 | 98 | 120 | 80 | -- | -- | -- | -- | -- | -- |
| 9 | 14 | 32 | 620 | 20 | -- | -- | -- | -- | -- | -- |
| 10 | 34 | 15 | 400 | 8 | <2.5 | 0.97 | 1.3 | 0.01 | -13.50 | 65.9 |
| 11 | 100 | 50 | 7,200 | 130 | <2.5 | 4.5 | 11 | .16 | -14.10 | 1.4 |
| " | 90 | 48 | 6,200 | 100 | <2.5 | 4.3 | 8.3 | .03 | -13.80 | 2.6 |
| 12 | 15 | 77 | 160 | 12 | -- | -- | -- | -- | -12.60 | -- |
| 13 | 55 | 10 | 830 | 44 | -- | -- | -- | -- | -- | -- |
| 14 | 25 | 13 | 420 | 13 | -- | -- | -- | -- | -- | -- |
| 15 | 20 | 9 | 850 | 490 | -- | -- | -- | -- | -- | -- |
| 16 | 18 | 41 | 230 | 20 | -- | -- | -- | -- | -13.20 | -- |
| 17 | 21 | 53 | 220 | 16 | -- | -- | -- | -- | -- | -- |
| 18 | 11 | 25 | 150 | 9 | -- | -- | -- | -- | -13.80 | -- |

| Well number | H-2/H-1 stable-isotope ratio, (per mil) | O-18/O-16 stable-isotope ratio, (per mil) | S-34/S-32 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|---|
| 1 | -61.5 | -9.50 | -- | 1.5 |
| 2 | -56.0 | -8.80 | -- | 1.3 |
| 3 | -- | -9.25 | -- | 1.1 |
| 4 | -60.5 | -9.20 | -- | 1.4 |
| 5 | -64.5 | -9.80 | -- | 1.5 |
| 6 | -59.0 | -9.10 | -- | 12 |
| 7 | -61.0 | -9.30 | -- | 5.3 |
| 8 | -- | -- | -2.70 | -- |
| " | -62.5 | -9.50 | -- | 1.3 |
| 9 | -61.5 | -9.50 | -- | 1.3 |

Table 10.--Physical and chemical characteristics for ground water in Eaton County--Continued

| Well number | H-2/ H-1 stable-isotope ratio, (per mil) | O-18/ O-16 stable-isotope ratio, (per mil) | S-34/ S-32 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|---|
| 10 | -55.9 | -8.90 | 6.10 | 4.4 |
| 11 | -53.5 | -8.20 | 20.20 | 1.7 |
| " | -54.0 | -8.15 | 19.90 | 2.8 |
| 12 | -61.5 | -9.50 | -- | 1.7 |
| 13 | -- | -8.80 | -- | 1.4 |
| 14 | -60.0 | -9.40 | -- | 1.2 |
| 15 | -- | -8.90 | -- | 1.2 |
| 16 | -61.5 | -9.40 | -- | 1.8 |
| 17 | -63.0 | -9.50 | -- | 2.6 |
| 18 | -61.0 | -9.30 | -- | 2.6 |

[a] Depth represents top of sampled interval.

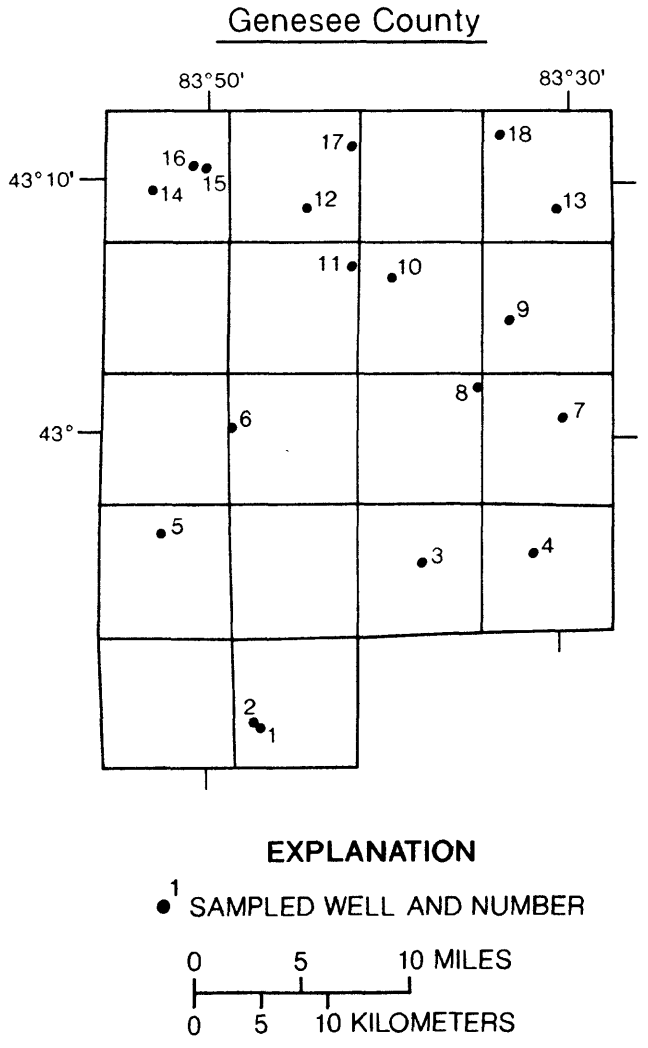


Table 11.--Physical and chemical characteristics for ground water in Genesee County

[Analyses by U.S. Geological Survey. Geologic unit: 112GRVL, gravel; 112SDGV, sand and gravel; 324SGNW, Saginaw Formation; 333MCGN, Michigan Formation; 337MRSL, Marshall Sandstone. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter; pCi/L, picocuries per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 42°49'00"N | 83°47'02"W | 6-02-87 | 112SDGV | 96 | 574 | 7.27 | 12.5 | 0.2 |
| 2 | 42°49'06"N | 83°47'15"W | 6-02-87 | 324SGNW | 187 | 518 | 7.47 | 12.5 | .3 |

Table 11.--Physical and chemical characteristics for ground water in Genesee County--Continued

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 42°55'41"N | 83°37'30"W | 8-28-86 | 324SGNW | 307 | 1,120 | 7.16 | 11.5 | 0.8 |
| 4 | 42°56'11"N | 83°32'02"W | 6-02-87 | 324SGNW | 162 | 567 | 7.39 | 12.5 | .1 |
| 5 | 42°56'42"N | 83°52'46"W | 8-19-87 | 324SGNW | 175 | 11,300 | 7.70 | 11.0 | .9 |
| 6 | 43°01'03"N | 83°49'03"W | 6-15-88 | 324SGNW | 305 | 1,480 | 8.66 | 13.0 | .2 |
| 7 | 43°01'41"N | 83°30'28"W | 8-14-86 | 333MCGN | 278 | 959 | 7.55 | 10.5 | .8 |
| 8 | 43°02'50"N | 83°35'10"W | 7-07-87 | 324SGNW | 180 | 1,410 | 7.94 | 12.5 | .4 |
| 9 | 43°05'28"N | 83°33'33"W | 6-03-87 | 112SDGV | 110 | 530 | 7.40 | 12.0 | 0 |
| 10 | 43°07'10"N | 83°40'08"W | 6-23-88 | 324SGNW | 320 | 537 | 7.73 | 12.0 | .4 |
| 11 | 43°07'30"N | 83°42'25"W | 5-18-88 | 324SGNW | 292 | 1,360 | 8.33 | 17.0 | .3 |
| 12 | 43°09'53"N | 83°45'00"W | 7-07-87 | 112GRVL | 140 | 370 | 7.80 | 13.0 | 0 |
| 13 | 43°10'00"N | 83°31'05"W | 8-14-86 | 324SGNW | 415 | 680 | 7.45 | 11.0 | 3.2 |
| 14 | 43°10'25"N | 83°53'32"W | 5-07-87 | 112SDGV | 77 | 605 | 7.54 | 12.0 | 1.0 |
| 15 | 43°11'27"N | 83°50'40"W | 6-30-88 | 324SGNW | 140 | 406 | 7.93 | 15.5 | .3 |
| 16 | 43°11'30"N | 83°51'16"W | 6-07-88 | 337MRSL | 484[a] | 151,000 | 6.96 | 26.0 | 0 |
| " | " | " | " | 324SGNW | 333[a] | 165,000 | 6.88 | 16.0 | 0 |
| " | " | " | " | " | 209[a] | 43,700 | 7.09 | 15.0 | 0 |
| 17 | 43°12'27"N | 83°42'33"W | 7-07-87 | 324SGNW | 182 | 309 | 8.03 | 12.0 | .4 |
| 18 | 43°12'50"N | 83°34'18"W | 8-14-86 | 112SDGV | 114 | 512 | 7.55 | 15.0 | .6 |

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 76 | 30 | 20 | 1.7 | 298 | -- | 24 | 29 | 0.60 | 0.044 |
| 2 | 72 | 30 | 11 | 1.8 | 288 | 0.05 | 26 | 13 | .50 | .025 |
| 3 | 85 | 34 | 96 | 2.4 | 363 | <.5 | 48 | 150 | .60 | .25 |
| 4 | 70 | 30 | 18 | 2.3 | 330 | <.02 | 10 | 22 | .90 | .042 |
| 5 | 34 | 15 | 2,500 | 13 | 604 | <.02 | 63 | 3,700 | .70 | 15 |
| 6 | .69 | .23 | 300 | 1.0 | 427 | -- | 110 | 110 | 1.9 | .22 |
| 7 | 61 | 20 | 110 | 2.5 | 333 | <.5 | 27 | 130 | .70 | .18 |
| 8 | 20 | 7.2 | 290 | 3.2 | 288 | -- | 100 | 260 | 2.2 | .45 |
| 9 | 62 | 27 | 21 | 1.1 | 278 | .04 | 15 | 10 | .80 | .030 |
| 10 | 28 | 13 | 83 | 1.7 | 253 | <.02 | 45 | 12 | 1.6 | .069 |
| 11 | 52 | 11 | 210 | 2.5 | 201 | <.02 | 240 | 180 | 1.4 | .36 |
| 12 | 41 | 15 | 24 | 1.3 | 192 | -- | 4.8 | 1.2 | .80 | <.010 |
| 13 | 46 | 18 | 77 | 2.9 | 295 | <.5 | 25 | 65 | 1.0 | .12 |

Table 11.--Physical and chemical characteristics for ground water in Genesee County--Continued

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 14 | 67 | 22 | 26 | 1.6 | 260 | <0.02 | 54 | 10 | 0.40 | <0.010 |
| 15 | 34 | 13 | 42 | 1.7 | 218 | <.02 | 16 | 5.0 | .90 | .022 |
| 16 | 3,100 | 780 | 34,000 | 100 | 108 | .04 | 3,500 | 55,000 | .10 | 110 |
| " | 3,000 | 730 | 30,000 | 20 | 118 | .03 | 3,500 | 55,000 | .10 | 110 |
| " | 1,200 | 220 | 8,000 | 20 | 211 | <.02 | 1,900 | 16,000 | .50 | 30 |
| 17 | 21 | 8.6 | 40 | 1.8 | 144 | -- | 1.4 | 1.1 | 1.6 | <.010 |
| 18 | 66 | 25 | 13 | 1.5 | 336 | <.5 | 5.1 | -- | .60 | .026 |

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, nitrite, dissolved (mg/L as N) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 19 | 369 | -- | -- | -- | <10 | 19 | 94 | 60 | 1,100 |
| 2 | 19 | 329 | -- | -- | -- | <10 | 13 | 100 | 40 | 660 |
| 3 | 8.0 | 672 | <0.010 | <0.100 | 0.210 | <10 | 5 | -- | 360 | 620 |
| 4 | 16 | 334 | -- | -- | -- | <10 | 17 | 62 | 90 | 560 |
| 5 | 22 | 6,550 | -- | -- | -- | <10 | <1 | 100 | 3,500 | 1,600 |
| 6 | 6.5 | 796 | -- | -- | -- | <10 | <1 | 4 | 3,800 | 6 |
| 7 | 8.5 | 521 | -- | <.100 | .270 | <10 | 5 | -- | 450 | 300 |
| 8 | 9.1 | 842 | -- | -- | -- | 10 | 4 | 31 | 970 | 67 |
| 9 | 18 | 306 | -- | -- | -- | <10 | 14 | 150 | 130 | 600 |
| 10 | 10 | 330 | -- | -- | -- | <10 | 10 | 39 | 540 | 73 |
| 11 | 7.9 | 840 | -- | -- | -- | <10 | 1 | 180 | 1,500 | 810 |
| 12 | 15 | 225 | -- | -- | -- | <10 | 6 | 150 | 120 | 1,700 |
| 13 | 8.5 | 385 | -- | <.100 | .260 | 10 | 1 | -- | 700 | 150 |
| 14 | 16 | 345 | -- | -- | -- | <10 | 6 | 240 | 200 | 1,100 |
| 15 | 13 | 244 | -- | -- | -- | <10 | 23 | 41 | 290 | 250 |
| 16 | 120 | 98,700 | -- | -- | -- | 150 | 2 | 200 | 5,200 | 11,000 |
| " | 13 | 98,300 | -- | -- | -- | 1400 | 14 | 200 | 5,000 | 7,800 |
| " | 7.8 | 27,500 | -- | -- | -- | 110 | 3 | 100 | 2,900 | 2,500 |
| 17 | 11 | 189 | -- | -- | -- | <10 | 29 | 25 | 340 | 210 |
| 18 | 17 | 267 | -- | <.100 | .320 | <10 | 5 | -- | 110 | 1,400 |

Table 11.--Physical and chemical characteristics for ground water in Genesee County--Continued

| Well number | Iron, ferrous, dissolved (µg/L as Fe) | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | Tritium, total (pCi/L) | Radium-226, dissolved, radon method (pCi/L) | Radium-228, dissolved (pCi/L as Ra-228) | Uranium, natural dissolved (µg/L as U) | C-13/ C-12 stable-isotope ratio, (per mil) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | -- | 14 | 25 | 760 | 13 | -- | -- | -- | -- | -- |
| 2 | 620 | 12 | 24 | 430 | 27 | -- | -- | -- | -- | -- |
| 3 | -- | 25 | 18 | 2,500 | 9 | -- | -- | -- | -- | -13.70 |
| 4 | 550 | 15 | 16 | 750 | 11 | -- | -- | -- | -- | -- |
| 5 | 150 | 150 | 140 | 1,300 | 10 | -- | -- | -- | -- | -13.50 |
| 6 | <20 | 13 | 1 | 21 | 34 | -- | -- | -- | -- | -- |
| 7 | -- | 24 | 22 | 6,100 | 12 | -- | -- | -- | -- | -- |
| 8 | -- | 20 | 20 | 1,100 | 9 | -- | -- | -- | -- | -12.70 |
| 9 | 580 | 15 | 11 | 720 | 15 | -- | -- | -- | -- | -- |
| 10 | -- | 13 | 5 | 790 | 8 | -- | -- | -- | -- | -- |
| 11 | 500 | 33 | 24 | 3,000 | 31 | <2.5 | -- | -- | -- | -11.30 |
| 12 | -- | 9 | 16 | 530 | 34 | -- | -- | -- | -- | -13.40 |
| 13 | -- | 20 | 10 | 1,800 | 5 | -- | -- | -- | -- | -13.10 |
| 14 | 950 | 10 | 360 | 850 | 52 | -- | -- | -- | -- | -- |
| 15 | -- | 12 | 18 | 840 | 5 | <2.5 | 0.59 | <1.0 | 0.06 | -13.70 |
| 16 | 7,500 | 1,400 | -- | 63,000 | 610 | -- | 140 | 150 | .26 | -19.10 |
| " | 5,400 | 1,400 | 340 | 58,000 | 1,800 | -- | 140 | 160 | .40 | -18.30 |
| " | 400 | 340 | 290 | 21,000 | 200 | <2.5 | -- | -- | -- | -12.90 |
| 17 | -- | 13 | 26 | 410 | 14 | -- | -- | -- | -- | -16.70 |
| 18 | -- | 12 | 19 | 530 | 34 | -- | -- | -- | <.40 | -- |

| Well number | Carbon-14 (percent modern) | H-2/ H-1 stable-isotope ratio, (per mil) | O-18/ O-16 stable-isotope ratio, (per mil) | S-34/ S-32 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|---|---|
| 1 | -- | -61.5 | -8.80 | -- | 1.4 |
| 2 | -- | -66.0 | -9.90 | -- | 1.2 |
| 3 | -- | -64.5 | -9.90 | -- | .6 |
| 4 | -- | -69.5 | -10.10 | -- | .7 |
| 5 | -- | -88.5 | -12.70 | -- | 4.1 |
| 6 | -- | -- | -11.20 | -- | .9 |
| 7 | -- | -64.0 | -9.30 | -- | 1.0 |
| 8 | -- | -63.5 | -9.20 | -- | 1.0 |
| 9 | -- | -68.5 | -10.00 | -- | 1.1 |
| 10 | -- | -- | -10.40 | -- | 1.8 |

Table 11.--Physical and chemical characteristics for ground water in Genesee County--Continued

| Well number | Carbon-14 (percent modern) | H-2/H-1 stable-isotope ratio, (per mil) | O-18/O-16 stable-isotope ratio, (per mil) | S-34/S-32 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|---|---|
| 11 | 19.6 | -66.5 | -9.80 | 28.70 | 1.0 |
| 12 | -- | -67.0 | -9.80 | -- | 1.6 |
| 13 | -- | -76.5 | -11.60 | -- | 1.6 |
| 14 | -- | -63.0 | -9.30 | -- | 4.5 |
| 15 | 29.8 | -63.4 | -9.35 | 26.30 | 4.0 |
| 16 | -- | -51.5 | -7.75 | 16.70 | -- |
| " | -- | -53.5 | -7.85 | 17.40 | -- |
| " | <2.9 | -70.4 | -10.55 | 15.90 | -- |
| 17 | -- | -65.0 | -9.70 | -- | 2.2 |
| 18 | -- | -65.5 | -9.80 | -- | 2.1 |

[a] Depth represents top of sampled interval.

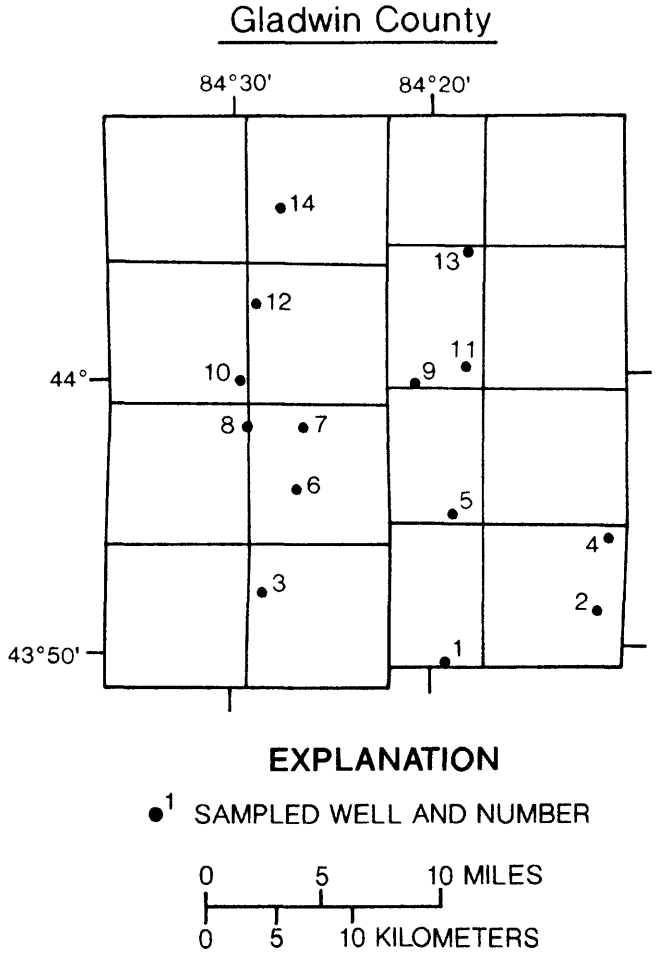


Table 12.--Physical and chemical characteristics for ground water in Gladwin County

[Analyses by U.S. Geological Survey. Geologic unit: 112SAND, sand; 112SDGV, sand and gravel; 324SGNW, Saginaw Formation. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 43°49'45"N | 84°19'28"W | 9-10-86 | 112SDGV | 132 | 944 | 7.76 | 11.0 | 1.5 |
| 2 | 43°52'11"N | 84°11'42"W | 9-10-86 | 324SGNW | 202 | 852 | 7.90 | 11.0 | 2.4 |
| 3 | 43°52'54"N | 84°28'47"W | 8-06-86 | 112SDGV | 89 | 887 | 7.20 | 10.0 | 2.6 |

Table 12.--Physical and chemical characteristics for ground water in Gladwin County--Continued

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 4 | 43°54'49"N | 84°11'14"W | 9-10-86 | 112SDGV | 133 | 918 | 7.70 | 11.5 | 1.4 |
| 5 | 43°55'41"N | 84°19'09"W | 9-10-86 | 324SGNW | 235 | 2,140 | 7.60 | 10.0 | 1.0 |
| 6 | 43°56'39"N | 84°27'10"W | 7-07-88 | 324SGNW | 540 | 3,080 | 7.10 | 12.0 | 0 |
| 7 | 43°58'49"N | 84°26'48"W | 8-20-86 | 112SAND | 58 | 1,580 | 7.65 | 11.0 | .8 |
| 8 | 43°58'52"N | 84°29'34"W | 8-04-86 | 324SGNW | 577 | 892 | 7.31 | 9.5 | 1.7 |
| 9 | 44°00'28"N | 84°21'02"W | 9-11-86 | 324SGNW | 300 | 640 | -- | 10.5 | .8 |
| 10 | 44°00'34"N | 84°30'00"W | 8-25-86 | 112SDGV | 95 | 465 | 7.23 | 10.5 | 1.2 |
| 11 | 44°01'06"N | 84°18'29"W | 9-11-86 | 112SDGV | 75 | 218 | -- | 9.0 | 1.9 |
| 12 | 44°03'22"N | 84°29'11"W | 8-25-86 | 112SDGV | 79 | 250 | 7.60 | 9.0 | 4.0 |
| 13 | 44°05'15"N | 84°18'24"W | 6-29-88 | 324SGNW | 465 | 2,630 | 7.39 | 11.0 | .1 |
| 14 | 44°06'50"N | 84°28'00"W | 8-25-86 | 112SDGV | 57 | 400 | 7.60 | 9.5 | 1.2 |

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 60 | 22 | 110 | 2.3 | 141 | <0.5 | 160 | 140 | 1.0 | 0.31 |
| 2 | 33 | 13 | 150 | 5.8 | 165 | <.5 | 290 | 8.1 | .70 | .039 |
| 3 | 130 | 33 | 110 | 2.9 | 313 | <.5 | 190 | 180 | .30 | .37 |
| 4 | 90 | 28 | 72 | 2.1 | 192 | <.5 | 360 | 1.9 | 1.2 | <.010 |
| 5 | 150 | 40 | 380 | 5.8 | 150 | <.5 | 1,200 | 31 | .60 | .65 |
| 6 | 150 | 37 | 520 | 7.1 | 173 | .04 | 1,000 | 370 | .60 | .78 |
| 7 | 240 | 66 | 53 | 3.6 | 104 | .02 | 790 | 6.5 | .40 | .026 |
| 8 | 110 | 23 | 54 | 3.6 | 251 | <.5 | 320 | 12 | .60 | .076 |
| 9 | 57 | 16 | 59 | 3.1 | 171 | <.5 | 140 | 29 | .40 | .061 |
| 10 | 82 | 31 | 140 | 1.9 | 343 | <.5 | 55 | 7.7 | .30 | .018 |
| 11 | 29 | 7.0 | 4.4 | .70 | 142 | <.5 | 17 | 1.8 | .20 | <.010 |
| 12 | 58 | 29 | 24 | 1.8 | 249 | <.5 | 79 | 1.0 | .60 | .020 |
| 13 | 310 | 68 | 240 | 10 | 182 | <.02 | 1,500 | 44 | .50 | .13 |
| 14 | 56 | 16 | 8.2 | 1.1 | 214 | <.5 | 19 | 1.2 | .30 | .017 |

Table 12.--Physical and chemical characteristics for ground water in Gladwin County--Continued

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, nitrite, dissolved (mg/L as N) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 12 | 600 | <0.010 | <0.100 | 0.580 | <10 | 6 | -- | 230 | 390 |
| 2 | 6.6 | 788 | <.010 | <.100 | .910 | <10 | <1 | -- | 2,100 | 46 |
| 3 | 11 | 835 | -- | .620 | .250 | <10 | 2 | -- | 240 | 510 |
| 4 | 13 | 676 | <.010 | <.100 | .450 | <10 | 2 | -- | 280 | 1,000 |
| 5 | 9.5 | 1,820 | <.010 | <.100 | 1.10 | <10 | <1 | -- | 540 | 770 |
| 6 | 6.7 | 2,180 | -- | -- | -- | <10 | <1 | <100 | 970 | 1,600 |
| 7 | 14 | 1,420 | -- | <.100 | .920 | <10 | 8 | -- | 290 | 1,400 |
| 8 | 8.4 | 648 | -- | <.100 | .490 | <10 | <1 | -- | 340 | 500 |
| 9 | 7.5 | 416 | <.010 | <.100 | .400 | <10 | <1 | -- | 360 | 310 |
| 10 | 12 | 360 | .090 | <.100 | .810 | <10 | 2 | 47 | 60 | 46 |
| 11 | 12 | 145 | <.010 | <.100 | .060 | <10 | <1 | -- | <10 | 44 |
| 12 | 15 | 375 | .010 | <.100 | <.050 | <10 | 16 | 36 | 80 | 580 |
| 13 | 7.1 | 2,390 | -- | -- | -- | <10 | <1 | <100 | 1,800 | 3,800 |
| 14 | 11 | 232 | .090 | <.100 | <.050 | <10 | 5 | 89 | 40 | 650 |

| Well number | Iron, ferrous, dissolved (µg/L as Fe) | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | C-13/C-12 stable-isotope ratio, (per mil) | H-2/H-1 stable-isotope ratio, (per mil) | O-18/O-16 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | -- | 18 | 14 | 1,900 | 170 | -- | -64.5 | -10.10 | 1.6 |
| 2 | -- | 53 | 35 | 560 | 160 | -- | -102.5 | -14.40 | .3 |
| 3 | -- | 17 | 66 | 1,400 | 9 | -- | -65.0 | -9.50 | 1.8 |
| 4 | -- | 18 | 19 | 2,100 | 17 | -- | -61.5 | -9.70 | 2.5 |
| 5 | -- | 40 | 50 | 4,300 | 190 | -- | -79.5 | -11.70 | .8 |
| 6 | 1,300 | 50 | 30 | 5,400 | 20 | -- | -71.5 | -10.60 | .7 |
| 7 | -- | 31 | 64 | 3,700 | 94 | -- | -71.5 | -10.60 | 1.0 |
| 8 | -- | 27 | 24 | 2,100 | 10 | -- | -85.0 | -12.30 | .9 |
| 9 | -- | 22 | 13 | 1,400 | 43 | -11.50 | -74.0 | -10.85 | .2 |
| 10 | -- | 9 | 130 | 610 | 36 | -- | -66.5 | -10.00 | 1.2 |
| 11 | -- | 5 | 27 | 190 | 64 | -11.90 | -70.5 | -10.35 | 2.0 |
| 12 | -- | 9 | 9 | 1,100 | 27 | -- | -67.5 | -10.10 | 1.5 |
| 13 | 3,800 | 40 | 89 | 7,100 | 70 | -- | -- | -13.10 | 3.0 |
| 14 | -- | 6 | 32 | 320 | 37 | -- | -70.0 | -10.40 | 1.5 |

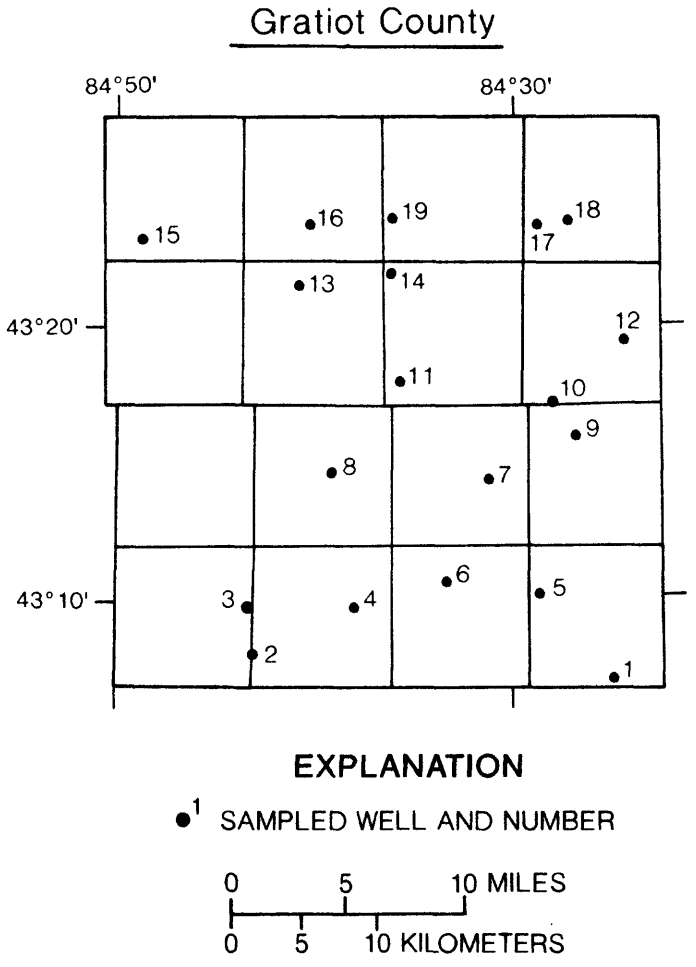


Table 13.--Physical and chemical characteristics for ground water in Gratiot County

[Analyses by U.S. Geological Survey. Geologic unit: 112GRVL, gravel; 112SAND, sand; 112SDGV, sand and gravel; 321GDRV, Grand River Formation; 324SGNW, Saginaw Formation. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/l) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 43°07'55"N | 84°25'03"W | 7-30-86 | 324SGNW | 203 | 783 | 7.24 | 12.0 | 0 |
| 2 | 43°08'51"N | 84°43'40"W | 6-14-88 | 321GDRV | 420 | 1,360 | 7.68 | 13.5 | 0 |

Table 13.--Physical and chemical characteristics for ground water in Gratiot County--Continued

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/l) |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 43°10'29"N | 84°43'46"W | 7-24-86 | 112SDGV | 70 | 658 | 7.31 | 12.0 | 1.2 |
| 4 | 43°10'32"N | 84°38'26"W | 8-19-86 | 112SDGV | 114 | 495 | 7.40 | 10.5 | .5 |
| 5 | 43°11'06"N | 84°28'55"W | 5-11-87 | 324SGNW | 305 | 1,550 | 7.26 | 12.0 | .4 |
| 6 | 43°11'26"N | 84°33'39"W | 7-29-86 | 324SGNW | 383 | 1,910 | 7.91 | 11.0 | .6 |
| 7 | 43°15'13"N | 84°31'26"W | 8-19-86 | 112SDGV | 127 | 1,390 | 7.38 | 11.0 | .1 |
| 8 | 43°15'23"N | 84°39'35"W | 8-19-86 | 112SDGV | 182 | 303 | 8.25 | 12.5 | 1.3 |
| 9 | 43°16'49"N | 84°26'54"W | 7-24-86 | 324SGNW | 200 | 818 | 7.40 | 11.5 | 2.3 |
| 10 | 43°18'02"N | 84°28'10"W | 8-19-86 | 324SGNW | 403 | 552 | 7.59 | 11.0 | .9 |
| 11 | 43°18'49"N | 84°36'10"W | 7-29-86 | 324SGNW | 605 | 576 | 7.63 | 12.0 | .8 |
| 12 | 43°20'22"N | 84°24'34"W | 8-21-86 | 112SDGV | 83 | 495 | 7.70 | 11.0 | 1.2 |
| 13 | 43°22'19"N | 84°41'16"W | 7-30-86 | 112SAND | 105 | 755 | 7.42 | 11.5 | 0 |
| 14 | 43°22'42"N | 84°36'33"W | 7-30-86 | 324SGNW | 565 | 1,920 | 6.82 | 11.5 | .3 |
| 15 | 43°24'01"N | 84°49'22"W | 6-14-88 | 324SGNW | 554 | 1,040 | 7.70 | 13.5 | 0 |
| 16 | 43°24'30"N | 84°40'45"W | 8-21-86 | 112SAND | 44 | 532 | 7.38 | 12.0 | .9 |
| 17 | 43°24'33"N | 84°28'59"W | 7-29-86 | 324SGNW | 480 | 1,110 | 7.41 | 11.5 | .9 |
| 18 | 43°24'41"N | 84°27'25"W | 7-29-86 | 112GRVL | 158 | 533 | 7.51 | 16.5 | 2.1 |
| 19 | 43°24'45"N | 84°36'28"W | 8-21-86 | 112SDGV | 219 | 931 | 7.50 | 11.0 | .3 |

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 80 | 27 | 70 | 3.0 | 286 | <0.5 | 110 | 75 | 0.60 | 0.40 |
| 2 | 140 | 34 | 130 | 3.3 | 199 | .02 | 420 | 150 | .30 | .50 |
| 3 | 97 | 32 | 20 | 1.1 | 281 | <.5 | 85 | 51 | .40 | .045 |
| 4 | 65 | 26 | 12 | 1.3 | 337 | <.5 | 8.3 | .90 | .40 | .013 |
| 5 | 120 | 29 | 160 | 2.2 | 197 | -- | 330 | 190 | .50 | .26 |
| 6 | 190 | 45 | 190 | 4.0 | 230 | <.5 | 370 | 370 | .30 | .98 |
| 7 | 260 | 38 | 57 | 1.9 | 173 | <.5 | 740 | 3.0 | .60 | .043 |
| 8 | 15 | 9.7 | 45 | 1.5 | 175 | <.5 | 6.9 | 2.9 | 1.0 | .027 |
| 9 | 96 | 21 | 66 | 1.5 | 278 | <.5 | 190 | 50 | .60 | .068 |
| 10 | 49 | 19 | 50 | 1.4 | 281 | <.5 | 60 | 8.9 | .60 | .033 |
| 11 | 62 | 23 | 33 | 1.6 | 324 | <.5 | 59 | 9.6 | .60 | <.010 |
| 12 | 43 | 20 | 44 | 1.8 | 240 | <.5 | 59 | 4.5 | .80 | <.010 |
| 13 | 110 | 27 | 23 | 1.7 | 288 | <.5 | 150 | 4.9 | .40 | .024 |
| 14 | 190 | 54 | 140 | 5.1 | 581 | <.5 | 99 | 280 | <.10 | .33 |

Table 13.--Physical and chemical characteristics for ground water in Gratiot County--Continued

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 15 | 140 | 29 | 79 | 2.2 | 239 | <0.02 | 360 | 34 | 0.40 | 0.090 |
| 16 | 74 | 25 | 7.4 | 1.3 | 315 | <.5 | 19 | 5.6 | .70 | .032 |
| 17 | 140 | 32 | 60 | 1.9 | 195 | <.5 | 400 | 33 | .20 | .098 |
| 18 | 64 | 24 | 25 | 1.4 | 325 | <.5 | 32 | 4.2 | .70 | .022 |
| 19 | 110 | 29 | 61 | 1.7 | 227 | <.5 | 240 | 51 | .40 | .12 |

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) | Iron, ferrous, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 11 | 598 | <0.100 | 0.260 | <10 | 3 | -- | 590 | 700 | -- |
| 2 | 8.9 | 1,020 | -- | -- | <10 | <1 | 10 | 340 | 2,000 | 2,000 |
| 3 | 18 | 470 | .100 | .170 | <10 | 13 | -- | 20 | 950 | -- |
| 4 | 19 | 294 | <.100 | .190 | <10 | 14 | -- | 50 | 530 | -- |
| 5 | 14 | 987 | -- | -- | <10 | 3 | 14 | 260 | 600 | -- |
| 6 | 9.1 | 1,330 | <.100 | .460 | <10 | <1 | -- | 340 | 3,100 | -- |
| 7 | 17 | 1,310 | <.100 | .500 | <10 | 5 | -- | 180 | 3,000 | -- |
| 8 | 11 | 194 | <.100 | .310 | <10 | 9 | -- | 180 | 41 | -- |
| 9 | 13 | 538 | <.100 | .360 | <10 | <1 | -- | 80 | 290 | -- |
| 10 | 14 | 338 | <.100 | .280 | <10 | 4 | -- | 170 | 540 | -- |
| 11 | 16 | 350 | <.100 | .350 | 10 | 6 | -- | 100 | 580 | -- |
| 12 | 16 | 325 | <.100 | .530 | <10 | 4 | -- | 190 | 670 | -- |
| 13 | 16 | 499 | <.100 | .430 | <10 | 4 | -- | 100 | 1,700 | -- |
| 14 | 14 | 1,180 | 3.70 | .100 | <10 | <1 | -- | 130 | 320 | -- |
| 15 | 17 | 815 | -- | -- | <10 | 2 | 37 | 300 | 2,100 | 1,800 |
| 16 | 20 | -- | <.100 | .150 | <10 | 12 | -- | 30 | 790 | -- |
| 17 | 12 | 814 | <.100 | .360 | 20 | <1 | -- | 180 | 760 | -- |
| 18 | 18 | 325 | <.100 | .350 | <10 | 14 | -- | 100 | 730 | -- |
| 19 | 15 | 624 | <.100 | .420 | <10 | <1 | -- | 170 | 790 | -- |

Table 13.--Physical and chemical characteristics for ground water in Gratiot County--Continued

| Well number | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | Uranium, natural dissolved (µg/L as U) | C-13/ C-12 stable-isotope ratio, (per mil) | H-2/ H-1 stable-isotope ratio, (per mil) | O-18/ O-16 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 41 | 13 | 1,500 | 58 | -- | -- | -83.0 | -12.00 | 0.9 |
| 2 | 50 | 43 | 2,100 | <3 | -- | -- | -67.0 | -9.75 | 1.3 |
| 3 | 11 | 21 | 230 | 260 | -- | -- | -66.0 | -10.10 | 2.1 |
| 4 | 13 | 96 | 500 | 92 | -- | -- | -64.5 | -9.80 | 1.2 |
| 5 | 41 | 22 | 780 | 7 | -- | -13.40 | -75.5 | -11.00 | 1.5 |
| 6 | 50 | 60 | 1,600 | 40 | -- | -- | -80.0 | -11.80 | 1.4 |
| 7 | 31 | 67 | 1,300 | 30 | -- | -13.10 | -- | -- | 2.5 |
| 8 | 6 | 6 | 450 | 94 | -- | -12.40 | -65.0 | -9.90 | 3.0 |
| 9 | 23 | 10 | 630 | 320 | <0.40 | -- | -70.5 | -10.40 | 1.6 |
| 10 | 24 | 15 | 520 | 130 | -- | -- | -- | -- | 1.8 |
| 11 | 13 | 21 | 710 | 26 | -- | -- | -- | -- | 3.6 |
| 12 | 12 | 14 | 950 | 41 | -- | -- | -62.0 | -9.50 | 2.7 |
| 13 | 12 | 44 | 960 | 25 | -- | -13.50 | -65.0 | -9.80 | 1.2 |
| 14 | 15 | 190 | 820 | 310 | -- | -15.00 | -68.0 | -10.10 | 3.7 |
| 15 | 29 | 42 | 1,400 | 390 | -- | -- | -65.0 | -9.90 | 1.3 |
| 16 | 12 | 10 | 480 | 19 | -- | -13.30 | -64.5 | -9.60 | 1.2 |
| 17 | 36 | 15 | 1,800 | 45 | -- | -- | -71.5 | -10.60 | .9 |
| 18 | 13 | 10 | 870 | 50 | -- | -14.00 | -63.5 | -9.60 | 2.0 |
| 19 | 20 | 54 | 1,100 | 15 | -- | -- | -66.0 | -9.95 | 1.4 |

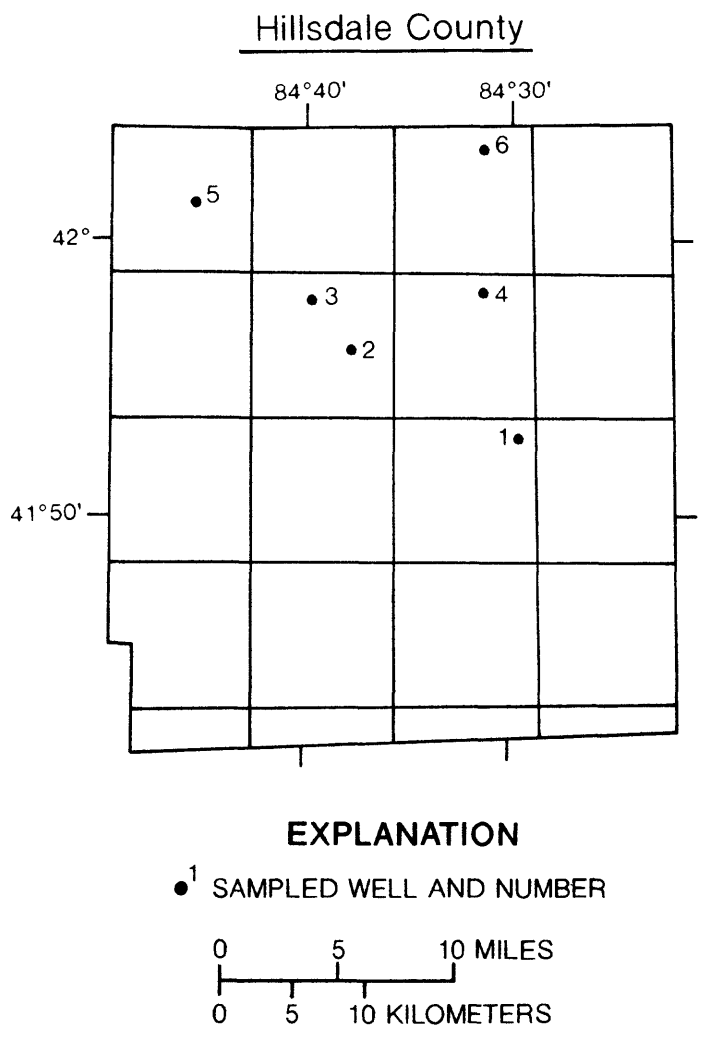


Table 14.--Physical and chemical characteristics for ground water in Hillsdale County

[Analyses by U.S. Geological Survey. Geologic unit: 112SDGV, sand and gravel; 337MRSL, Marshall Sandstone. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geo - logic unit | Depth of well, total (feet) | Spe- cific con- duct- ance (µS/cm) | pH (stand- ard units) | Temper- ature water (°C) | Oxygen, dis- solved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 41°53'29"N | 84°29'45"W | 5-14-87 | 112SDGV | 128 | 572 | 7.56 | 11.5 | 0 |
| 2 | 41°56'40"N | 84°37'58"W | 5-14-87 | 112SDGV | 83 | 560 | 7.39 | 13.0 | .2 |
| 3 | 41°58'24"N | 84°39'49"W | 7-09-86 | 112SDGV | 80 | 721 | -- | 11.0 | .1 |

Table 14.--Physical and chemical characteristics for ground water in Hillsdale County--Continued

| Well number | Latitude | Longitude | Date | Geo - logic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 4 | 41°58'43"N | 84°31'34"W | 5-14-87 | 337MRSL | 115 | 560 | 7.26 | 13.0 | 0.1 |
| 5 | 42°01'57"N | 84°45'41"W | 7-09-86 | 112SDGV | 63 | 609 | 7.20 | 10.5 | 1.0 |
| 6 | 42°03'53"N | 84°31'28"W | 6-16-88 | 337MRSL | 120 | 556 | 7.59 | 11.0 | 0 |

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 73 | 24 | 8.2 | 1.0 | 277 | 0.04 | 28 | 1.2 | 0.70 | 0.030 |
| 2 | 77 | 19 | 11 | 1.2 | 199 | -- | 66 | 21 | .10 | .040 |
| 3 | 120 | 34 | 12 | 1.5 | 392 | <.5 | 59 | 22 | .20 | .054 |
| 4 | 79 | 21 | 2.7 | .70 | 217 | -- | 56 | 7.2 | .20 | .053 |
| 5 | 100 | 28 | 5.5 | 1.5 | 268 | <.5 | 82 | 18 | .10 | .033 |
| 6 | 87 | 26 | 3.6 | .70 | 289 | .02 | 40 | 12 | .20 | .037 |

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) | Iron, ferrous, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 17 | 321 | -- | -- | <10 | 18 | 320 | 30 | 2,400 | 2,200 |
| 2 | 9.4 | 332 | -- | -- | <10 | 2 | 85 | 40 | 1,400 | 1,300 |
| 3 | 13 | 486 | <0.100 | 0.080 | <10 | 4 | -- | 30 | 1,100 | -- |
| 4 | 16 | 327 | -- | -- | <10 | 10 | 230 | <10 | 3,100 | 2,200 |
| 5 | 9.7 | 417 | 2.10 | .050 | <10 | <1 | -- | <10 | 89 | -- |
| 6 | 9.1 | 311 | -- | -- | <10 | 1 | 11 | <10 | 120 | 90 |

Table 14.--Physical and chemical characteristics for ground water in Hillsdale County--Continued

| Well number | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | C-13/ C-12 stable-isotope ratio, (per mil) | H-2/ H-1 stable-isotope ratio, (per mil) | O-18/ O-16 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|---|---|---|---|---|
| 1 | 14 | 23 | 4,800 | 57 | -- | -61.0 | -9.20 | 1.6 |
| 2 | 10 | 76 | 110 | 38 | -- | -60.0 | -8.90 | 1.5 |
| 3 | 12 | 120 | 190 | 13 | -- | -60.5 | -9.30 | 1.1 |
| 4 | 10 | 36 | 130 | 17 | -- | -62.0 | -9.50 | 1.5 |
| 5 | 9 | 35 | 98 | 8 | -11.30 | -58.5 | -9.40 | 1.2 |
| 6 | 9 | 55 | 120 | 26 | -- | -- | -9.45 | .8 |

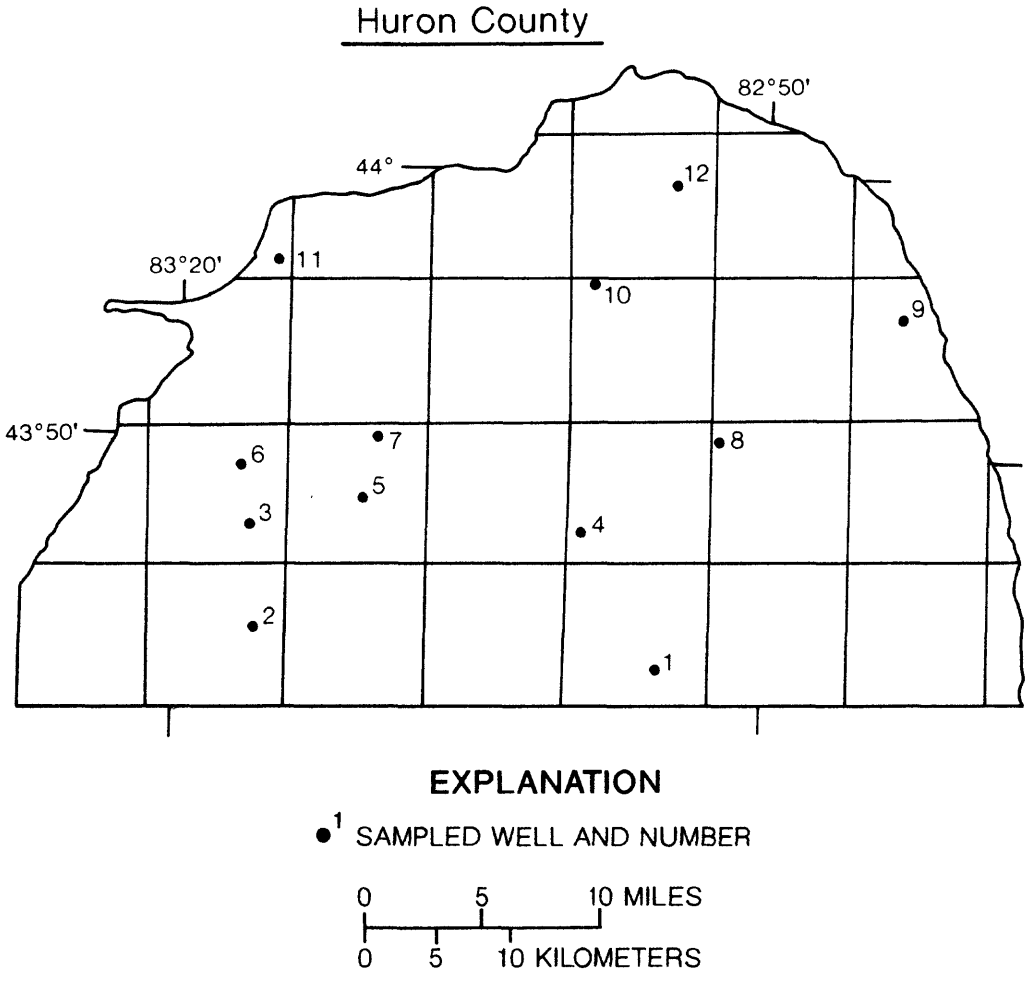


Table 15.--Physical and chemical characteristics for ground water in Huron County

[Analyses by U.S. Geological Survey. Geologic unit: 333MCGN, Michigan Formation; 337MRSL, Marshall Sandstone. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 43°42'44"N | 82°55'34"W | 6-10-87 | 337MRSL | 380 | 650 | 7.48 | 11.5 | 0.2 |
| 2 | 43°43'40"N | 83°16'15"W | 6-08-87 | 337MRSL | 225 | 852 | 7.62 | 11.0 | .3 |
| 3 | 43°47'31"N | 83°16'40"W | 6-22-88 | 337MRSL | 260 | 844 | 7.48 | 12.0 | .3 |

Table 15.--Physical and chemical characteristics for ground water in Huron County--Continued

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 4 | 43°47'40"N | 82°59'44"W | 8-11-86 | 337MRSL | 252 | 495 | 7.40 | 9.5 | 6.5 |
| 5 | 43°48'40"N | 83°10'53"W | 6-04-87 | 333MCGN | 175 | 542 | 7.38 | 11.0 | .4 |
| 6 | 43°49'38"N | 83°17'17"W | 8-12-86 | 333MCGN | 230 | 1,530 | 7.42 | 10.0 | 1.2 |
| 7 | 43°50'49"N | 83°10'19"W | 6-22-88 | 337MRSL | 216 | 509 | 7.54 | 12.5 | .1 |
| 8 | 43°51'08"N | 82°52'55"W | 6-10-87 | 337MRSL | 82 | 605 | 7.44 | 11.5 | .5 |
| 9 | 43°55'40"N | 82°43'37"W | 8-11-86 | 337MRSL | 100 | 6,780 | 7.56 | 12.0 | 1 |
| 10 | 43°56'33"N | 82°59'33"W | 8-12-86 | 333MCGN | 115 | 508 | 7.50 | 13.0 | 1.1 |
| 11 | 43°57'10"N | 83°15'45"W | 8-12-86 | 337MRSL | 237 | 911 | 7.52 | 10.5 | .5 |
| 12 | 44°00'19"N | 82°55'37"W | 8-12-86 | 337MRSL | 44 | 529 | 7.37 | 12.0 | 1.7 |

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 67 | 24 | 44 | 2.4 | 248 | -- | 30 | 57 | 0.60 | 0.078 |
| 2 | 78 | 21 | 140 | 2.9 | 268 | -- | 90 | 190 | .70 | .25 |
| 3 | 90 | 22 | 95 | 2.4 | 274 | <0.02 | 86 | 110 | .80 | .16 |
| 4 | -- | -- | -- | -- | 235 | <.5 | -- | -- | -- | .033 |
| 5 | 73 | 23 | 24 | 1.9 | 334 | -- | 23 | 3.2 | .40 | .012 |
| 6 | 110 | 21 | 190 | 3.3 | 274 | <.5 | 200 | 230 | .80 | .36 |
| 7 | 63 | 18 | 32 | 1.7 | 286 | <.02 | 28 | 7.6 | .60 | .021 |
| 8 | 65 | 19 | 57 | 2.0 | 278 | -- | 18 | 65 | .80 | .11 |
| 9 | 130 | 57 | 1,300 | 11 | 138 | <.5 | 330 | 2,400 | 1.0 | 2.5 |
| 10 | 71 | 18 | 17 | 1.7 | 245 | <.5 | 36 | 6.0 | .50 | <.010 |
| 11 | 78 | 19 | 92 | 1.8 | 232 | <.5 | 140 | 84 | .70 | .11 |
| 12 | 89 | 21 | 2.1 | .70 | 219 | <.5 | 76 | 5.0 | .10 | <.010 |

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) | Iron, ferrous, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 14 | 385 | -- | -- | <10 | 33 | 140 | 170 | 290 | 290 |
| 2 | 12 | 676 | -- | -- | <10 | 6 | 31 | 450 | 530 | 530 |

Table 15.--Physical and chemical characteristics for ground water in Huron County--Continued

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) | Iron, ferrous, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 12 | 580 | -- | -- | <10 | 1 | 29 | 420 | 420 | 380 |
| 4 | -- | -- | <0.100 | 0.140 | -- | 3 | -- | 250 | -- | -- |
| 5 | 13 | 335 | -- | -- | <10 | <1 | 120 | 290 | 300 | 250 |
| 6 | 11 | 925 | <.100 | .270 | <10 | <1 | -- | 670 | 460 | -- |
| 7 | 12 | 310 | -- | -- | <10 | 1 | 91 | 270 | 220 | 210 |
| 8 | 15 | 396 | -- | -- | <10 | 9 | 160 | 100 | 820 | -- |
| 9 | 7.3 | 4,600 | <.100 | 1.10 | -- | 4 | -- | 1,500 | 610 | -- |
| 10 | 12 | 273 | <.100 | .230 | <10 | 1 | -- | 180 | 200 | -- |
| 11 | 11 | 556 | <.100 | .180 | <10 | 2 | -- | 450 | 440 | -- |
| 12 | 9.3 | 326 | <.100 | .060 | <10 | 4 | -- | 10 | 1,500 | -- |

| Well number | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | C-13/C-12 stable-isotope ratio, (per mil) | H-2/H-1 stable-isotope ratio, (per mil) | O-18/O-16 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|---|---|---|---|---|
| 1 | 25 | 35 | 740 | 11 | -- | -70.0 | -10.30 | 2.3 |
| 2 | 25 | 14 | 1,800 | 8 | -- | -68.5 | -10.20 | 1.4 |
| 3 | 20 | 10 | 1,500 | 35 | -- | -- | -10.25 | 1.3 |
| 4 | -- | -- | -- | <10 | -- | -68.0 | -10.40 | 2.0 |
| 5 | 20 | 11 | 940 | 10 | -- | -66.0 | -9.20 | 2.1 |
| 6 | 27 | 9 | 1,900 | 53 | -13.50 | -67.0 | -10.30 | 1.4 |
| 7 | 16 | 8 | 740 | 14 | -- | -- | -9.70 | 1.6 |
| 8 | 19 | 28 | 590 | 13 | -- | -74.0 | -11.10 | 1.3 |
| 9 | 110 | 110 | 5,400 | 20 | -15.10 | -69.0 | -10.40 | .6 |
| 10 | 17 | 23 | 960 | 13 | -- | -66.5 | -10.20 | 2.5 |
| 11 | 24 | 10 | 1,100 | 21 | -13.00 | -79.0 | -11.60 | 1.4 |
| 12 | 9 | 310 | 65 | 160 | -14.80 | -69.5 | -10.60 | 2.9 |

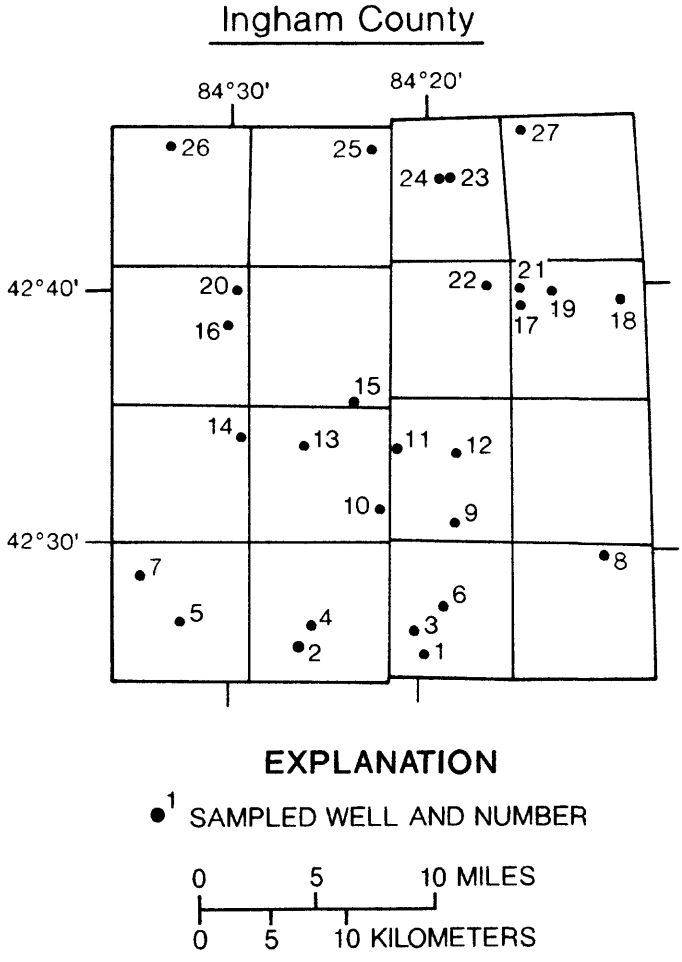


Table 16.--Physical and chemical characteristics for ground water in Ingham County

[Analyses by U.S. Geological Survey. Geologic unit: 112GRVL, gravel; 112SDGV, sand and gravel; 324SGNW, Saginaw Formation; 333MCGN, Michigan Formation; 337MRSL, Marshall Sandstone. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter; pCi/L, picocuries per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 42°26'46"N | 84°20'40"W | 5-25-88 | 324SGNW | 150 | 877 | 7.03 | 12.0 | -- |
| 2 | 42°27'00"N | 84°27'00"W | 6-26-86 | 324SGNW | 178 | 867 | -- | 11.0 | 1.3 |

Table 16.--Physical and chemical characteristics for ground water in Ingham County--Continued

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 42°27'42"N | 84°21'04"W | 5-25-88 | 324SGNW | 207 | 492 | 7.37 | 11.5 | 0 |
| 4 | 42°27'51"N | 84°26'20"W | 6-26-86 | 112SDGV | 54 | 747 | -- | 12.5 | .6 |
| 5 | 42°28'02"N | 84°32'58"W | 7-14-88 | 324SGNW | 660 | 5,900 | 7.26 | 14.0 | 0 |
| 6 | 42°28'34"N | 84°19'36"W | 5-26-88 | 324SGNW | 100 | 792 | 7.44 | 13.0 | 0 |
| 7 | 42°29'42"N | 84°35'00"W | 6-30-86 | 324SGNW | 110 | 491 | -- | 11.5 | .3 |
| 8 | 42°30'31"N | 84°11'23"W | 6-21-88 | 337MRSL | 315 | 449 | 7.43 | 13.0 | .1 |
| 9 | 42°31'43"N | 84°19'03"W | 5-19-87 | 324SGNW | 100 | 468 | 7.60 | 12.0 | .4 |
| 10 | 42°32'14"N | 84°22'45"W | 6-26-86 | 112SDGV | 61 | 464 | 7.05 | 12.0 | .7 |
| 11 | 42°32'15"N | 84°21'57"W | 6-26-86 | 324SGNW | 125 | 409 | 7.09 | 10.5 | .8 |
| 12 | 42°34'26"N | 84°19'00"W | 7-14-88 | 333MCGN | 765 | 7,990 | 7.26 | 15.5 | 0 |
| 13 | 42°34'41"N | 84°26'43"W | 7-21-86 | 324SGNW | 218 | 555 | 7.27 | 12.5 | .8 |
| 14 | 42°34'58"N | 84°29'46"W | 6-25-86 | 324SGNW | 170 | 512 | 7.59 | 12.0 | 1.5 |
| 15 | 42°36'08"N | 84°24'13"W | 3-10-87 | 324SGNW | 250 | 2,340 | 7.83 | 10.0 | 0 |
| 16 | 42°39'21"N | 84°30'31"W | 6-23-86 | 324SGNW | 78 | 629 | 7.16 | 12.0 | 1.5 |
| 17 | 42°39'32"N | 84°15'56"W | 5-24-88 | 324SGNW | 175 | 562 | 7.48 | 11.5 | .7 |
| 18 | 42°40'02"N | 84°14'00"W | 5-04-87 | 324SGNW | 201 | 720 | 7.22 | 11.0 | 0 |
| 19 | 42°40'26"N | 84°14'07"W | 6-06-88 | 324SGNW | 182 | 660 | 7.96 | 13.0 | .6 |
| 20 | 42°40'29"N | 84°30'09"W | 6-20-86 | 324SGNW | 160 | 589 | 7.47 | 11.0 | 1.6 |
| 21 | 42°40'30"N | 84°15'44"W | 5-24-88 | 324SGNW | 175 | 525 | 7.48 | 12.5 | .5 |
| 22 | 42°40'40"N | 84°17'29"W | 6-26-86 | 324SGNW | 220 | 600 | 7.55 | 10.5 | .2 |
| 23 | 42°44'40"N | 84°19'20"W | 6-27-86 | 324SGNW | 375 | 505 | 7.58 | 12.0 | 1 |
| 24 | 42°44'40"N | 84°19'21"W | 6-27-86 | 112GRVL | 36 | 461 | 6.70 | 13.5 | .5 |
| 25 | 42°45'33"N | 84°23'24"W | 6-24-86 | 112SDGV | 36 | 414 | 7.71 | 11.0 | 1.2 |
| 26 | 42°45'49"N | 84°33'58"W | 6-30-86 | 324SGNW | 490 | 652 | 7.25 | 12.0 | .3 |
| 27 | 42°46'30"N | 84°15'45"W | 6-15-88 | 337MRSL | 418 | 1,070 | 8.10 | 14.0 | 0 |

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 140 | 47 | 11 | 1.0 | 370 | <0.02 | 71 | 71 | 0.30 | 0.065 |
| 2 | 160 | 24 | 5.3 | 1.6 | 308 | <.5 | 220 | 3.8 | .30 | <.010 |
| 3 | 89 | 17 | 5.7 | 2.6 | 293 | <.02 | 51 | .90 | .50 | .012 |
| 4 | 110 | 37 | 7.4 | .70 | 424 | <.5 | 59 | 26 | .10 | .049 |
| 5 | 310 | 77 | 820 | 30 | 241 | .07 | 230 | 1,600 | .30 | 11 |

Table 16.--Physical and chemical characteristics for ground water in Ingham County--Continued

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 99 | 30 | 42 | 1.0 | 264 | 0.8 | 54 | 120 | 0.20 | 0.38 |
| 7 | 80 | 22 | 3.5 | .80 | 220 | <.5 | 42 | 5.0 | .10 | <.010 |
| 8 | 68 | 14 | 12 | 4.7 | 221 | <.02 | 47 | 1.2 | .70 | .015 |
| 9 | 64 | 19 | 6.3 | .90 | 224 | -- | 18 | 8.1 | .20 | <.010 |
| 10 | 72 | 22 | 4.8 | .80 | 274 | <.5 | 19 | 1.2 | .30 | .013 |
| 11 | 65 | 17 | 3.9 | .80 | 246 | <.5 | 4.1 | .80 | .20 | <.010 |
| 12 | 490 | 120 | 1,400 | 13 | 149 | .02 | 460 | 2,900 | .50 | 17 |
| 13 | 87 | 26 | 10 | 1.6 | 300 | <.5 | 28 | 15 | .30 | .010 |
| 14 | 80 | 26 | 3.1 | .90 | 302 | <.5 | 14 | 1.2 | .20 | <.010 |
| 15 | 10 | 4.2 | 550 | 5.2 | 755 | <.5 | 58 | 320 | 1.1 | 3.2 |
| 16 | 99 | 31 | 5.7 | 1.1 | 320 | <.5 | 60 | 12 | .20 | -- |
| 17 | 71 | 24 | 33 | 5.6 | 347 | <.02 | <.20 | .90 | .30 | .017 |
| 18 | 100 | 33 | 12 | 2.1 | 414 | -- | 57 | 28 | .30 | .056 |
| 19 | 12 | 57 | 160 | 4.2 | 445 | <.02 | 7.5 | 9.4 | .90 | .022 |
| 20 | 77 | 26 | 3.7 | 1.6 | 312 | <.5 | 5.9 | 1.7 | .40 | <.010 |
| 21 | 77 | 28 | 11 | 7.1 | 335 | <.02 | 7.3 | 1.4 | .50 | .016 |
| 22 | 43 | 15 | 76 | 3.7 | 322 | <.5 | 19 | 4.3 | .40 | .028 |
| 23 | 12 | 3.6 | 130 | 2.7 | 372 | <.5 | .20 | 2.3 | 1.1 | .013 |
| 24 | 74 | 20 | 3.4 | 1.0 | 304 | <.5 | 22 | 9.4 | .20 | <.010 |
| 25 | 57 | 19 | 6.2 | 1.3 | 231 | <.5 | 19 | 1.0 | .40 | -- |
| 26 | 86 | 26 | 13 | 2.2 | 300 | <.5 | 26 | 20 | .40 | .028 |
| 27 | 10 | 3.2 | 230 | 2.5 | 504 | <.02 | 43 | 50 | 1.2 | .12 |

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Copper, dissolved (µg/L as Cu) | Iron, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 16 | 578 | -- | -- | <10 | 2 | 91 | 10 | <1 | 660 |
| 2 | 13 | 618 | <0.100 | 0.250 | <10 | <1 | -- | 60 | -- | 690 |
| 3 | 11 | 325 | -- | -- | <10 | <1 | 47 | 320 | <1 | 1,700 |
| 4 | 15 | 487 | <.100 | .040 | <10 | 1 | -- | <10 | -- | 1,800 |
| 5 | 9.2 | 3,620 | -- | -- | <10 | <1 | <100 | 1,800 | -- | 860 |
| 6 | 16 | 520 | -- | -- | <10 | 2 | 140 | 10 | <1 | 2,400 |
| 7 | 15 | 315 | <.100 | .150 | <10 | 3 | -- | 20 | -- | 3,300 |
| 8 | 6.7 | 274 | -- | -- | <10 | 4 | 110 | 1,900 | -- | 360 |

Table 16.--Physical and chemical characteristics for ground water in Ingham County--Continued

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Copper, dissolved (µg/L as Cu) | Iron, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 9 | 16 | 281 | -- | -- | <10 | 2 | 110 | 20 | -- | 850 |
| 10 | 17 | 288 | <0.100 | 0.200 | <10 | 1 | -- | 30 | -- | 1,500 |
| 11 | 15 | 255 | <.100 | .430 | <10 | 6 | -- | 20 | -- | 360 |
| 12 | 9.7 | 5,750 | -- | -- | 10 | <1 | 200 | 1,100 | -- | 2,300 |
| 13 | 14 | 364 | <.100 | .230 | <10 | <1 | -- | 80 | -- | 290 |
| 14 | 16 | 298 | <.100 | .090 | <10 | 2 | -- | 20 | -- | 700 |
| 15 | 6.8 | 1,440 | -- | -- | <10 | <1 | 200 | 6,400 | -- | 80 |
| 16 | 16 | 426 | -- | -- | <10 | 4 | -- | 10 | -- | 2,100 |
| 17 | 14 | 627 | -- | -- | <10 | <1 | 24 | 810 | <1 | 25 |
| 18 | 18 | 438 | -- | -- | <10 | 8 | 200 | 90 | -- | 770 |
| 19 | 7.1 | 463 | -- | -- | <10 | <1 | 500 | 2,500 | <1 | 69 |
| 20 | 13 | 306 | -- | -- | <10 | 2 | -- | 60 | -- | 710 |
| 21 | 8.0 | 332 | -- | -- | <10 | <1 | 260 | 670 | <1 | 750 |
| 22 | 9.3 | 360 | <.100 | .270 | <10 | <1 | -- | 1,100 | -- | 370 |
| 23 | 6.9 | 384 | <.100 | .210 | <10 | <1 | -- | 2,500 | -- | 32 |
| 24 | 15 | 300 | <.100 | .100 | <10 | 2 | -- | 20 | -- | 2,500 |
| 25 | 17 | 249 | -- | -- | <10 | 22 | -- | 40 | -- | 660 |
| 26 | 12 | 356 | -- | .240 | <10 | <1 | -- | 170 | -- | 510 |
| 27 | 6.9 | 621 | -- | -- | <10 | <1 | 120 | 2,300 | -- | 67 |

| Well number | Iron, ferrous, dissolved (µg/L as Fe) | Lead, dissolved (µg/L as Pb) | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | Radium-226, dissolved, radon method (pCi/L) | Radium-228, dissolved (pCi/L as Ra-228) | Uranium, natural dissolved (µg/L as U) | C-13/C-12 stable-isotope ratio, (per mil) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 510 | <5 | 20 | 160 | 150 | 47 | 0.64 | <1.0 | 0.41 | -- |
| 2 | -- | -- | 17 | 24 | 3,200 | 14 | -- | -- | -- | -- |
| 3 | 1,400 | <5 | 14 | 22 | 2,200 | 10 | -- | -- | -- | -- |
| 4 | -- | -- | 11 | 88 | 100 | 63 | -- | -- | -- | -- |
| 5 | 800 | -- | 170 | 45 | 11,000 | 50 | -- | -- | -- | -- |
| 6 | 1,700 | <5 | 13 | 75 | 140 | 37 | -- | -- | -- | -- |
| 7 | -- | -- | 9 | 24 | 120 | 140 | -- | -- | -- | -- |
| 8 | 310 | -- | 12 | 17 | 2,500 | 49 | -- | -- | -- | -- |
| 9 | 700 | -- | 12 | 19 | 180 | 95 | -- | -- | -- | -- |
| 10 | -- | -- | 11 | 24 | 190 | 150 | -- | -- | -- | -- |

Table 16.--Physical and chemical characteristics for ground water in Ingham County--Continued

| Well number | Iron, ferrous, dissolved (µg/L as Fe) | Lead, dissolved (µg/L as Pb) | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | Radium-226, dissolved, radon method (pCi/L) | Radium-228, dissolved (pCi/L as Ra-228) | Uranium, natural dissolved (µg/L as U) | C-13/C-12 stable-isotope ratio, (per mil) |
|---|---|---|---|---|---|---|---|---|---|---|
| 11 | -- | -- | 10 | 6 | 170 | 17 | -- | -- | -- | -- |
| 12 | -- | -- | 90 | 100 | 23,000 | 110 | -- | -- | -- | -- |
| 13 | -- | -- | 15 | 22 | 260 | <3 | -- | -- | -- | -- |
| 14 | -- | -- | 10 | 23 | 86 | 15 | -- | -- | -- | -- |
| 15 | -- | -- | 60 | 240 | 330 | 20 | -- | -- | -- | -11.20 |
| 16 | -- | -- | 10 | 35 | 100 | 25 | -- | -- | -- | -- |
| 17 | -- | <5 | 41 | 5 | 1,500 | 10 | 0.71 | 1.5 | <0.01 | -- |
| 18 | 600 | -- | 5 | 15 | 320 | 8 | -- | -- | -- | -- |
| 19 | 60 | <5 | 23 | 2 | 390 | 25 | -- | -- | -- | -- |
| 20 | -- | -- | 17 | 17 | 520 | 32 | -- | -- | -- | -- |
| 21 | 710 | <5 | 41 | 16 | 1,400 | 150 | -- | -- | -- | -- |
| 22 | -- | -- | 34 | 5 | 950 | 10 | -- | -- | -- | -- |
| 23 | -- | -- | 23 | 7 | 220 | 32 | -- | -- | -- | -- |
| 24 | -- | -- | 10 | 97 | 89 | 130 | -- | -- | -- | -12.70 |
| 25 | -- | -- | 8 | 11 | 520 | 55 | -- | -- | -- | -11.90 |
| 26 | -- | -- | 24 | 24 | 750 | 20 | -- | -- | -- | -- |
| 27 | 40 | -- | 17 | 4 | 310 | 22 | -- | -- | -- | -- |

| Well number | H-2/H-1 stable-isotope ratio, (per mil) | O-18/O-16 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|
| 1 | -- | -- | -- |
| 2 | -62.5 | -9.50 | 2.0 |
| 3 | -- | -- | -- |
| 4 | -62.5 | -9.80 | 1.0 |
| 5 | -54.0 | -8.20 | .8 |
| 6 | -- | -- | -- |
| 7 | -63.0 | -9.70 | 3.7 |
| 8 | -- | -9.70 | .7 |
| 9 | -63.5 | -9.70 | 2.2 |
| 10 | -64.0 | -9.70 | 11 |
| 11 | -- | -- | 4.9 |
| 12 | -54.5 | -8.35 | 1.1 |

Table 16.--Physical and chemical characteristics for ground water in Ingham County--Continued

| Well number | H-2/ H-1 stable-isotope ratio, (per mil) | O-18/ O-16 stable-isotope ratio, (per mil) | Carbon, organic, dis-solved (mg/L as C) |
|---|---|---|---|
| 13 | -62.0 | -9.60 | 1.8 |
| 14 | -62.5 | -9.70 | 2.5 |
| 15 | -58.5 | -8.80 | .8 |
| 16 | -60.5 | -9.10 | 2.4 |
| 17 | -- | -- | -- |
| 18 | -63.5 | -9.70 | 1.6 |
| 19 | -- | -- | -- |
| 20 | -58.5 | -9.20 | 2.0 |
| 21 | -- | -- | -- |
| 22 | -59.0 | -9.30 | 1.2 |
| 23 | -60.0 | -9.10 | .7 |
| 24 | -60.0 | -8.90 | 3.8 |
| 25 | -66.0 | -9.80 | 1.6 |
| 26 | -61.5 | -9.20 | 1.9 |
| 27 | -- | -9.95 | .7 |

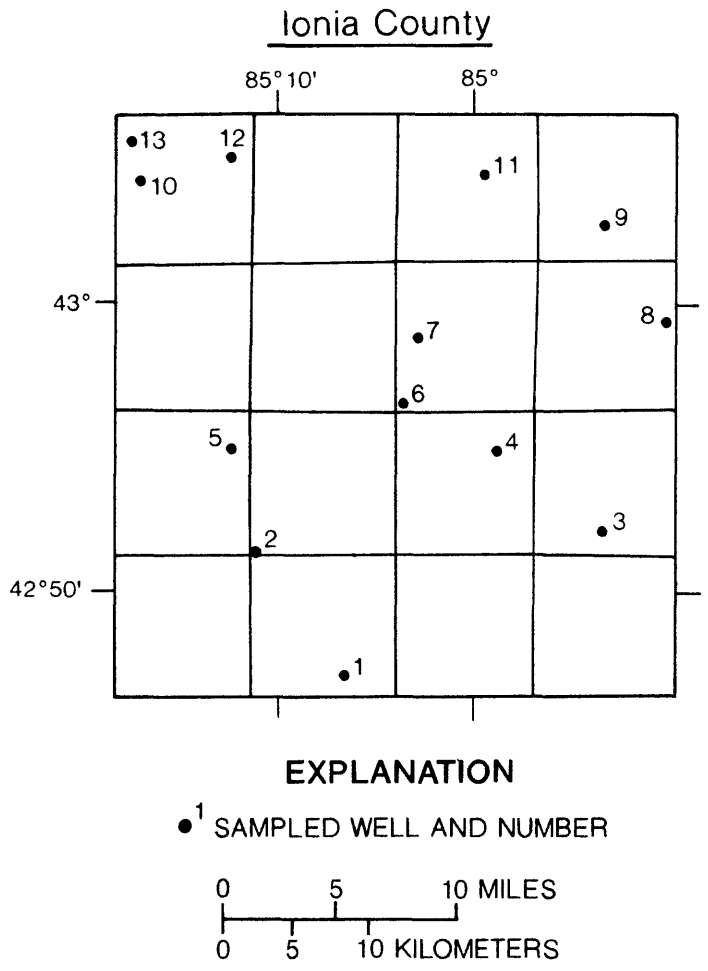


Table 17.--Physical and chemical characteristics for ground water in Ionia County

[Analyses by U.S. Geological Survey. Geologic unit: 112CLAY, clay; 112GRVL, gravel; 112SAND, sand; 112SDGV, sand and gravel; 321GDRV, Grand River Formation; 324PARM, Parma Sandstone; 324SGNW, Saginaw Formation; 333MCGN, Michigan Formation. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 42°47'26"N | 85°07'15"W | 7-21-86 | 112SDGV | 96 | 564 | 7.37 | 11.0 | 0.1 |
| 2 | 42°51'44"N | 85°11'54"W | 6-09-88 | 333MCGN | 560 | 2,600 | 7.32 | 11.5 | 0 |

Table 17.--Physical and chemical characteristics for ground water in Ionia County--Continued

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 42°52'36"N | 84°54'15"W | 5-12-86 | 324PARM | 645 | 22,400 | 7.08 | 13.5 | 0 |
| 4 | 42°55'30"N | 84°59'42"W | 5-18-87 | 324SGNW | 245 | 601 | 7.47 | 11.0 | .2 |
| 5 | 42°55'33"N | 85°13'10"W | 5-28-87 | 112SDGV | 118 | 464 | 7.21 | 11.0 | 4.2 |
| 6 | 42°57'18"N | 85°04'31"W | 7-20-88 | 333MCGN | 453 | 691 | 7.19 | 14.0 | 0 |
| 7 | 42°59'30"N | 85°03'45"W | 7-24-86 | 112SDGV | 150 | 617 | 7.24 | 9.5 | .1 |
| 8 | 43°00'11"N | 84°51'03"W | 7-02-86 | 321GDRV | 485 | 551 | 7.39 | 13.0 | .4 |
| 9 | 43°03'43"N | 84°54'10"W | 6-17-88 | 324SGNW | 450 | 774 | 7.53 | 13.5 | 1.2 |
| 10 | 43°05'16"N | 85°17'51"W | 5-28-87 | 112SAND | 222 | 479 | 7.47 | 12.0 | 1.9 |
| 11 | 43°05'28"N | 85°00'17"W | 7-20-88 | 333MCGN | 478 | 2,700 | 7.45 | 12.0 | .4 |
| 12 | 43°06'08"N | 85°13'10"W | 5-28-87 | 112GRVL | 180 | 478 | 7.48 | 11.0 | .4 |
| 13 | 43°06'37"N | 85°18'16"W | 6-09-88 | 112CLAY | 462 | 540 | 7.52 | 12.0 | 4.0 |

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 82 | 29 | 7.3 | 1.1 | 308 | <0.5 | 28 | 6.7 | 0.30 | 0.018 |
| 2 | 510 | 30 | 190 | 11 | 325 | .05 | 1,300 | 170 | .60 | .90 |
| 3 | 1,200 | 240 | 5,400 | 69 | 107 | -- | 1,900 | 11,000 | .40 | 53 |
| 4 | 73 | 29 | 9.4 | 1.0 | 314 | .025 | 11 | 1.1 | .40 | .012 |
| 5 | 69 | 24 | 4.4 | .60 | 304 | -- | 33 | 4.7 | .20 | .021 |
| 6 | 120 | 32 | 29 | 3.2 | 379 | .13 | 190 | 8.1 | .40 | .038 |
| 7 | 91 | 27 | 5.8 | 1.6 | 273 | <.5 | 58 | 22 | .20 | .042 |
| 8 | 76 | 29 | 16 | 1.9 | 333 | <.5 | 5.9 | 9.3 | .50 | .060 |
| 9 | 120 | 37 | 40 | 3.4 | 367 | <.02 | 160 | 21 | .40 | .11 |
| 10 | 70 | 23 | 9.5 | .80 | 268 | -- | <5.0 | 1.3 | .40 | <.010 |
| 11 | 530 | 97 | 91 | 5.6 | 143 | <.02 | 1,800 | 42 | .90 | .17 |
| 12 | 69 | 21 | 9.5 | .60 | 212 | -- | 33 | 19 | .10 | .089 |
| 13 | 74 | 27 | 8.2 | 1.2 | 240 | -- | 32 | 17 | .20 | .097 |

Table 17.--Physical and chemical characteristics for ground water in Ionia County--Continued

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) | Iron, ferrous, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 17 | 346 | <0.100 | 0.130 | 10 | 5 | -- | 20 | 1,100 | -- |
| 2 | 12 | 2,410 | -- | -- | <10 | 1 | <100 | 1,100 | 1,600 | -- |
| 3 | 6.6 | 19,400 | -- | -- | 20 | <1 | -- | 6,800 | 3,400 | -- |
| 4 | 18 | 320 | -- | -- | <10 | 3 | 120 | 50 | 890 | 850 |
| 5 | 13 | 280 | -- | -- | <10 | <1 | 38 | 20 | 6 | <20 |
| 6 | 9.8 | 583 | -- | -- | <10 | <1 | 17 | 210 | 6,300 | 2,800 |
| 7 | 10 | 356 | <.100 | .060 | <10 | 1 | -- | 20 | 910 | -- |
| 8 | 17 | 338 | <.100 | .310 | 10 | <1 | -- | 60 | 780 | -- |
| 9 | 12 | 590 | -- | -- | <10 | <1 | 19 | 140 | 3,200 | 2,400 |
| 10 | 20 | 286 | -- | -- | <10 | <1 | 90 | 40 | 990 | 750 |
| 11 | 21 | 2,820 | -- | -- | <10 | 3 | <100 | 710 | 860 | -- |
| 12 | 14 | 286 | -- | -- | <10 | 1 | 38 | 20 | 260 | 250 |
| 13 | 12 | 341 | -- | -- | <10 | <1 | 25 | 20 | 21 | <20 |

| Well number | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | H-2/H-1 stable-isotope ratio, (per mil) | O-18/O-16 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|---|---|---|---|
| 1 | 11 | 55 | 190 | 9 | -60.5 | -9.50 | 1.2 |
| 2 | 50 | 19 | 4400 | 700 | -- | -9.15 | 1.1 |
| 3 | 500 | 320 | 27,000 | 70 | -54.0 | -8.00 | -- |
| 4 | 16 | 25 | 420 | 24 | -61.5 | -9.30 | 1.6 |
| 5 | 6 | 1 | 110 | <3 | -65.5 | -10.10 | .9 |
| 6 | 29 | 56 | 1,600 | 8 | -- | -- | -- |
| 7 | 9 | 100 | 80 | 15 | -66.0 | -10.10 | 1.7 |
| 8 | 18 | 29 | 610 | 17 | -60.0 | -9.30 | 2.2 |
| 9 | 36 | 67 | 1,500 | 16 | -- | -- | 1.4 |
| 10 | 6 | 57 | 540 | 28 | -67.0 | -10.20 | 1.4 |
| 11 | 80 | 90 | 8,600 | 1,800 | -- | -- | -- |
| 12 | 5 | 47 | 110 | <3 | -66.0 | -10.10 | .8 |
| 13 | 6 | <1 | 61 | 110 | -- | -10.10 | 1.0 |

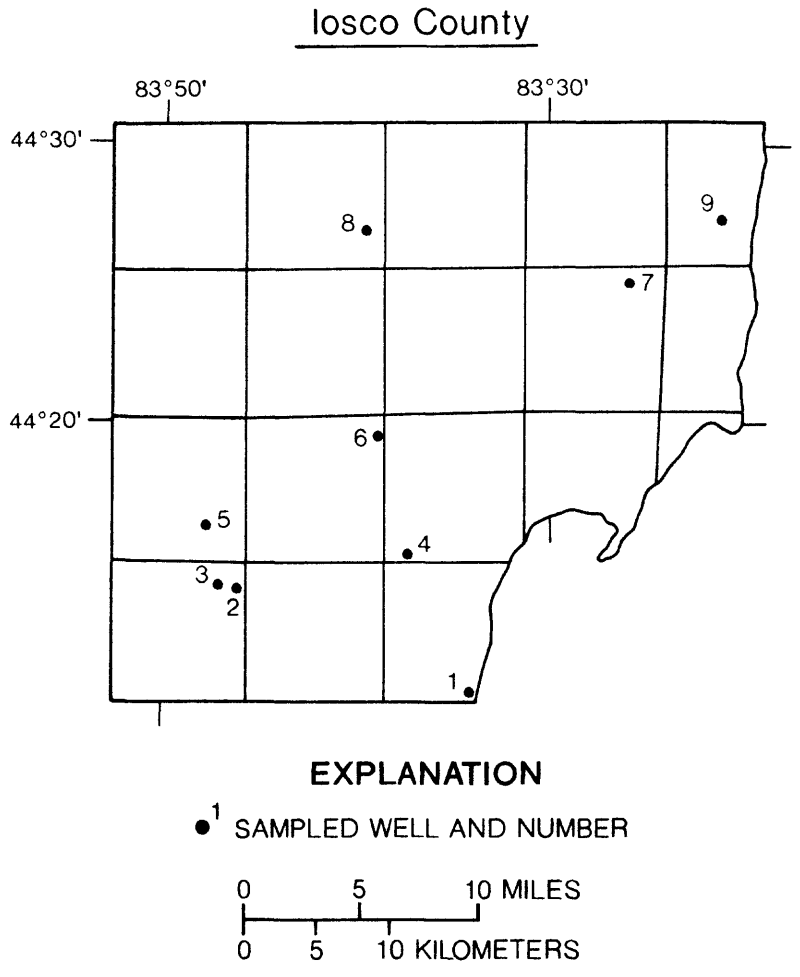


Table 18.--Physical and chemical characteristics for ground water in Iosco County

[Analyses by U.S. Geological Survey. Geologic unit: 112SAND, sand; 333MCGN, Michigan Formation; 337MRSL, Marshall Sandstone. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter; pCi/L, picocuries per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 44°10'35"N | 83°33'40"W | 7-16-87 | 333MCGN | 450 | 2,560 | 7.49 | 14.0 | 0.3 |
| 2 | 44°14'30"N | 83°46'55"W | 8-05-86 | 333MCGN | 43 | 633 | 7.30 | 11.0 | 7.4 |

Table 18.--Physical and chemical characteristics for ground water in Iosco County--Continued

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 44°14'35"N | 83°48'05"W | 8-05-86 | 333MCGN | 290 | 1,500 | 7.47 | 10.0 | 0.7 |
| 4 | 44°15'48"N | 83°38'08"W | 7-07-88 | 337MRSL | 340 | 2,620 | 7.21 | 10.5 | .3 |
| 5 | 44°16'39"N | 83°48'38"W | 7-27-88 | 337MRSL | 397 | 1,340 | 7.35 | 11.5 | 0 |
| 6 | 44°20'00"N | 83°39'40"W | 7-16-87 | 337MRSL | 295 | 402 | 7.89 | 12.0 | 0 |
| 7 | 44°25'30"N | 83°26'42"W | 7-15-87 | 112SAND | 92 | 309 | 8.45 | 10.0 | .5 |
| 8 | 44°27'20"N | 83°40'24"W | 7-15-87 | 337MRSL | 110 | 1,440 | 8.08 | 10.0 | .4 |
| 9 | 44°27'44"N | 83°21'51"W | 5-19-86 | 337MRSL | 190 | -- | -- | -- | -- |
| " | " | " | " | " | " | 7,150 | 7.70 | 10.0 | -- |

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 120 | 14 | 390 | 3.6 | 254 | 0.02 | 250 | 570 | 0.60 | 0.76 |
| 2 | 100 | 22 | 11 | 1.1 | 362 | <.5 | 56 | 36 | .10 | .038 |
| 3 | 110 | 14 | 180 | 3.0 | 164 | <.5 | 160 | 270 | .40 | .65 |
| 4 | 240 | 42 | 310 | 3.9 | 146 | <.02 | 660 | 480 | .50 | .99 |
| 5 | 110 | 16 | 170 | 2.6 | 181 | <.02 | 250 | 210 | .40 | .48 |
| 6 | 42 | 13 | 34 | 2.0 | 165 | .025 | 88 | 2.3 | .90 | .015 |
| 7 | 31 | 11 | 16 | .70 | 147 | .02 | 2.5 | 24 | .60 | .055 |
| 8 | 55 | 17 | 220 | 2.9 | 255 | .02 | 98 | 310 | .50 | 1.3 |
| 9 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| " | 170 | 82 | 1,200 | 8.7 | -- | -- | 56 | 2,500 | .80 | -- |

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) | Iron, ferrous, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 9.9 | 1,460 | -- | -- | <10 | <1 | 100 | 460 | 430 | 430 |
| 2 | 6.9 | 400 | 0.130 | 0.050 | <10 | <1 | -- | 60 | 16 | -- |
| 3 | 14 | 883 | <.100 | .550 | <10 | <1 | -- | 180 | 450 | -- |
| 4 | 11 | 1,840 | -- | -- | <10 | 2 | <100 | 530 | 1,000 | 1,000 |
| 5 | 12 | 874 | -- | -- | 10 | <1 | 12 | 200 | 810 | -- |
| 6 | 12 | 273 | -- | -- | <10 | 1 | 32 | 270 | 780 | 710 |

Table 18.--Physical and chemical characteristics for ground water in Iosco County--Continued

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) | Iron, ferrous, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 7 | 12 | 174 | -- | -- | <10 | <1 | 19 | 20 | 210 | 200 |
| 8 | 9.9 | 820 | -- | -- | <10 | <2 | 51 | 520 | 23 | -- |
| 9 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| " | 8.3 | 4,180 | <0.100 | 1.80 | -- | -- | -- | -- | 810 | -- |

| Well number | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | Tritium, total (pCi/L) | C-13/C-12 stable-isotope ratio, (per mil) | H-2/H-1 stable-isotope ratio, (per mil) | O-18/O-16 stable-isotope ratio, (per mil) | Carbon, organic dissolved (mg/L as C) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 20 | 12 | 1,200 | 300 | -- | -12.60 | -99.5 | -14.20 | 1.4 |
| 2 | 7 | 1 | 330 | 65 | -- | -- | -79.0 | -11.50 | 1.9 |
| 3 | 15 | 20 | 990 | 130 | -- | -13.50 | -79.0 | -11.90 | 1.1 |
| 4 | 30 | 25 | 3 | 840 | -- | -- | -- | -12.10 | .8 |
| 5 | 13 | 19 | 1,100 | 98 | -- | -- | -- | -11.75 | -- |
| 6 | 9 | 22 | 560 | 190 | -- | -- | -70.5 | -10.40 | 1.8 |
| 7 | <4 | 11 | 370 | 44 | -- | -13.80 | -75.5 | -11.20 | 1.6 |
| 8 | <24 | 110 | 1,600 | 4 | -- | -10.50 | -76.0 | -11.20 | 1.4 |
| 9 | -- | -- | -- | -- | -- | -- | -119.5 | -17.00 | -- |
| " | -- | 150 | -- | -- | <200 | -- | -- | -- | 1.1 |

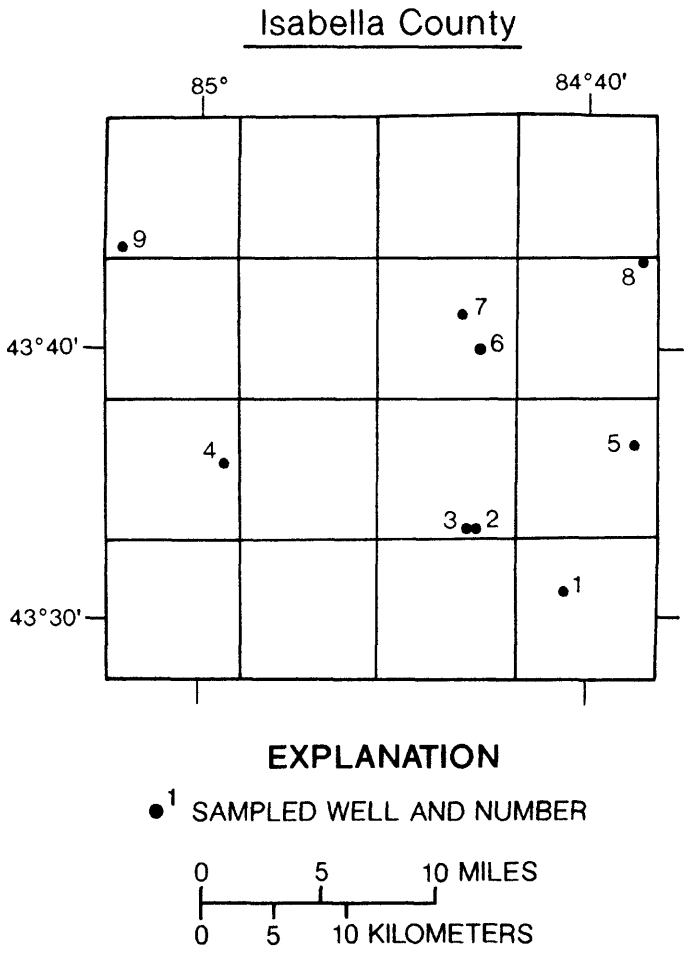


Table 19.--Physical and chemical characteristics for ground water in Isabella County

[Analyses by U.S. Geological Survey. Geologic unit: 112GRVL, gravel; 112SAND, sand; 112SDGV, sand and gravel; 321GDRV, Grand River Formation; 324SGNW, Saginaw Formation. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter; pCi/L, picocuries per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 43°31'46"N | 84°41'33"W | 6-22-87 | 112GRVL | 151 | 493 | 7.44 | 11.0 | 0 |
| 2 | 43°34'07"N | 84°46'05"W | 8-04-86 | 321GDRV | 504 | 755 | 7.43 | 12.5 | 1.5 |

Table 19.--Physical and chemical characteristics for ground water in Isabella County--Continued

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 43°34'07"N | 84°46'06"W | 8-04-86 | 112SDGV | 102 | 675 | 7.29 | 11.0 | 0.3 |
| 4 | 43°36'32"N | 84°59'18"W | 6-22-87 | 112SDGV | 199 | 359 | 7.66 | 12.0 | -- |
| 5 | 43°37'14"N | 84°37'57"W | 6-03-87 | 324SGNW | 525 | 9,620 | 6.82 | 17.0 | 10.4 |
| 6 | 43°40'47"N | 84°46'02"W | 5-25-88 | 324SGNW | 575 | 3,720 | 7.42 | 16.0 | 0 |
| 7 | 43°42'00"N | 84°47'02"W | 6-22-87 | 112SAND | 153 | 1,310 | 7.60 | 14.0 | 0 |
| 8 | 43°43'58"N | 84°37'33"W | 6-29-88 | 321GDRV | 430 | 5,560 | 7.42 | 11.0 | 0 |
| 9 | 43°44'30"N | 85°04'38"W | 6-22-87 | 112SAND | 137 | 352 | 7.77 | 12.0 | 0 |

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 72 | 23 | 8.9 | 1.3 | 450 | 0.03 | 8.6 | 0.80 | 0.40 | <0.010 |
| 2 | 84 | 27 | 35 | 1.9 | 261 | <.5 | 100 | 25 | .40 | .10 |
| 3 | 96 | 31 | 14 | 1.6 | 304 | <.5 | 68 | 23 | .30 | .14 |
| 4 | 56 | 16 | 2.3 | .70 | 356 | <.02 | 20 | 3.1 | .10 | <.010 |
| 5 | 490 | 94 | 1,100 | 20 | 200 | -- | 450 | 2,600 | .30 | 9.1 |
| 6 | 220 | 46 | 630 | 12 | 121 | .03 | 1,600 | 330 | .40 | .74 |
| 7 | 150 | 45 | 74 | 2.7 | 160 | -- | 510 | 44 | .40 | .13 |
| 8 | 460 | 94 | 670 | 5.0 | 152 | .02 | 1,200 | 1,100 | .40 | 3.5 |
| 9 | 47 | 15 | 9.0 | .90 | 186 | .05 | 6.8 | .70 | .20 | <.010 |

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) | Iron, ferrous, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 18 | 293 | -- | -- | <10 | 8 | 79 | 20 | 1,300 | 1,100 |
| 2 | 16 | 457 | <0.100 | 0.310 | <10 | 1 | -- | 80 | 300 | -- |
| 3 | 16 | 441 | <.100 | .250 | <10 | 7 | -- | 40 | 1,400 | -- |
| 4 | 13 | 218 | -- | -- | <10 | 3 | 21 | <10 | 140 | 120 |
| 5 | 7.5 | 5,130 | -- | -- | <10 | <1 | <100 | 630 | 1,700 | -- |
| 6 | 18 | 2,920 | -- | -- | <10 | <1 | <100 | 1,600 | 3,200 | 910 |
| 7 | 14 | 978 | -- | -- | <10 | 2 | 22 | 170 | 710 | -- |
| 8 | 14 | 3,880 | -- | -- | <10 | <1 | <100 | 220 | 2,800 | 2,400 |
| 9 | 14 | 200 | -- | -- | <10 | 6 | 49 | 20 | 750 | 680 |

Table 19.--Physical and chemical characteristics for ground water in Isabella County--Continued

| Well number | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | Tritium, total (pCi/L) | C-13/C-12 stable-isotope ratio, (per mil) | Carbon-14 (percent modern) | H-2/H-1 stable-isotope ratio, (per mil) | O-18/O-16 stable-isotope ratio, (per mil) | S-34/S-32 stable-isotope ratio, (per mil) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 11 | 36 | 390 | 8 | -- | -- | -- | -65.5 | -9.90 | -- |
| 2 | 15 | 9 | 990 | 9 | -- | -13.90 | -- | -65.5 | -9.90 | -- |
| 3 | 9 | 51 | 470 | 16 | -- | -13.00 | -- | -66.0 | -10.00 | -- |
| 4 | 9 | 35 | 51 | 75 | -- | -- | -- | -69.0 | -10.30 | -- |
| 5 | 340 | 77 | 13,000 | 20 | -- | -11.30 | -- | -68.0 | -10.30 | -- |
| 6 | 120 | 31 | 1,900 | 20 | <2.5 | -9.60 | <1.4 | -80.9 | -11.60 | 15.40 |
| 7 | 31 | 73 | 2,900 | 11 | -- | -12.60 | -- | -67.5 | -10.30 | -- |
| 8 | 50 | 140 | 7,300 | 1,500 | -- | -- | -- | -70.5 | -10.40 | -- |
| 9 | 9 | 26 | 220 | 37 | -- | -12.30 | -- | -69.0 | -10.50 | -- |

| Well number | Carbon, organic, dissolved (mg/L as C) |
|---|---|
| 1 | 4.3 |
| 2 | 1.4 |
| 3 | 2.3 |
| 4 | 4.2 |
| 5 | .7 |
| 6 | .7 |
| 7 | 3.7 |
| 8 | 2.9 |
| 9 | 3.7 |

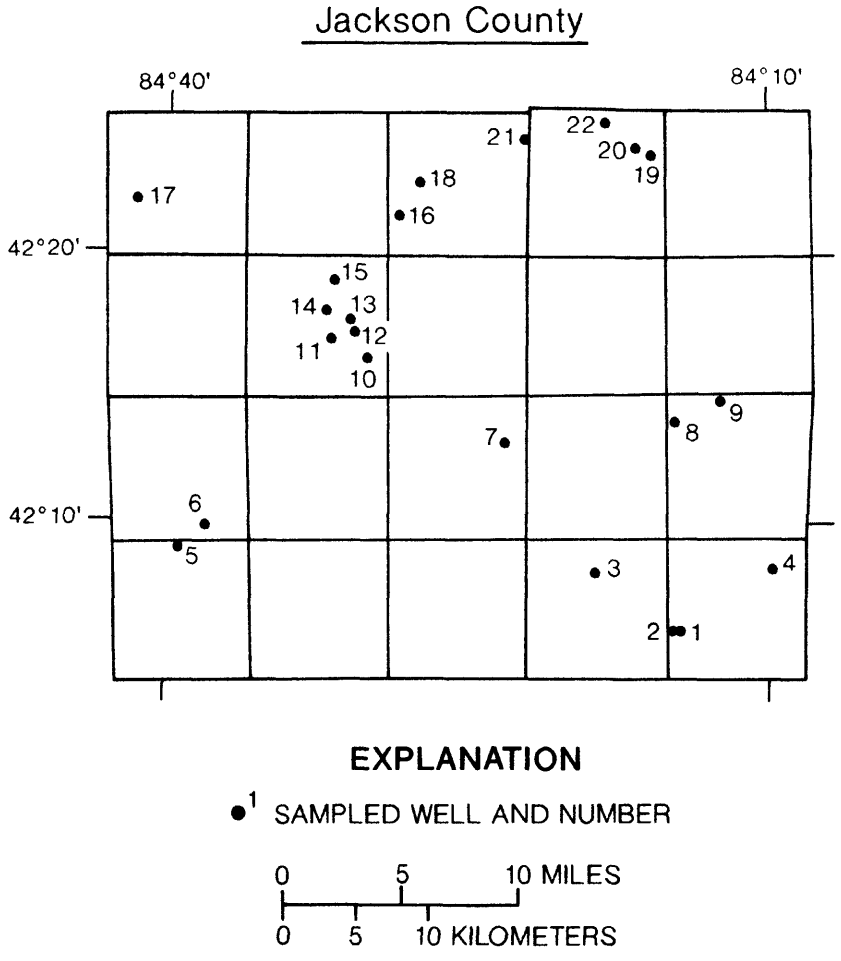


Table 20.--Physical and chemical characteristics for ground water in Jackson County

[Analyses by U.S. Geological Survey. Geologic unit: 112GRVL, gravel; 112SAND, sand; 112SDGV, sand and gravel; 324SGNW, Saginaw Formation; 337MRSL, Marshall Sandstone. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter; pCi/L, picocuries per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 42°06'40"N | 84°14'48"W | 5-21-87 | 337MRSL | 40 | 764 | 7.08 | 11.0 | 0.5 |
| 2 | 42°06'40"N | 84°14'49"W | 5-21-87 | 337MRSL | 131 | 707 | 6.75 | 12.0 | .7 |

Table 20.--Physical and chemical characteristics for ground water in Jackson County--Continued

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 42°08'46"N | 84°19'00"W | 5-13-87 | 337MRSL | 65 | 1,010 | 7.66 | 11.0 | 0 |
| 4 | 42°08'47"N | 84°10'06"W | 5-13-87 | 337MRSL | 72 | 593 | 7.59 | 12.0 | .2 |
| 5 | 42°09'48"N | 84°39'50"W | 7-14-86 | 112SAND | 54 | 495 | 7.33 | 15.5 | 2.3 |
| 6 | 42°10'29"N | 84°38'23"W | 7-14-86 | 337MRSL | 100 | 559 | 7.11 | 11.0 | 2.8 |
| " | " | " | " | " | " | -- | -- | -- | -- |
| 7 | 42°13'34"N | 84°23'09"W | 7-09-86 | 337MRSL | 385 | 858 | 7.24 | 11.0 | 1.7 |
| 8 | 42°14'23"N | 84°15'01"W | 7-31-86 | 324SGNW | 104 | 451 | 7.45 | 12.0 | 1.0 |
| 9 | 42°15'05"N | 84°12'48"W | 5-13-87 | 337MRSL | 78 | 904 | 7.03 | 11.0 | .1 |
| 10 | 42°16'39"N | 84°30'26"W | 6-06-88 | 324SGNW | 170 | 540 | 7.34 | 12.0 | 0 |
| 11 | 42°17'20"N | 84°32'15"W | 5-26-88 | 324SGNW | 110 | 533 | 7.37 | 13.0 | .5 |
| 12 | 42°17'34"N | 84°31'01"W | 6-06-88 | 324SGNW | 100 | 554 | 7.32 | 12.0 | 0 |
| 13 | 42°18'01"N | 84°31'14"W | 5-27-88 | 324SGNW | 140 | 525 | 7.44 | 12.5 | 0 |
| 14 | 42°18'24"N | 84°32'24"W | 5-27-88 | 324SGNW | 175 | 681 | 7.32 | 11.0 | .1 |
| 15 | 42°19'30"N | 84°32'02"W | 5-26-88 | 324SGNW | 125 | 535 | 7.40 | 13.0 | 0 |
| 16 | 42°21'59"N | 84°28'50"W | 7-31-86 | 112SDGV | 95 | 636 | 7.18 | 11.5 | .6 |
| 17 | 42°22'38"N | 84°42'01"W | 7-14-86 | 324SGNW | 245 | 1,010 | 7.05 | 11.0 | .1 |
| 18 | 42°23'10"N | 84°27'43"W | 5-12-87 | 324SGNW | 145 | 531 | 7.33 | 13.0 | .1 |
| 19 | 42°24'11"N | 84°16'13"W | 7-31-86 | 112SDGV | 37 | 590 | 7.30 | 13.0 | 1.9 |
| 20 | 42°24'30"N | 84°17'05"W | 7-31-86 | 324SGNW | 213 | 1,020 | 6.91 | 13.0 | .3 |
| 21 | 42°24'52"N | 84°22'29"W | 7-31-86 | 112GRVL | 44 | 515 | 7.33 | 12.0 | 1.4 |
| 22 | 42°25'24"N | 84°18'33"W | 6-21-88 | 337MRSL | 393 | 675 | 7.20 | 12.0 | 0 |

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 110 | 27 | 17 | 1.6 | 302 | -- | 49 | 33 | 0.30 | 0.070 |
| 2 | 98 | 25 | 130 | 1.5 | 309 | 0.03 | 56 | 35 | .40 | .021 |
| 3 | 95 | 27 | 58 | 1.4 | 211 | .06 | 53 | 150 | .20 | .077 |
| 4 | 77 | 30 | 1.7 | 0.80 | 230 | -- | 53 | 6.7 | .10 | .028 |
| 5 | 100 | 27 | 8.7 | 1.0 | 294 | <.5 | 41 | 13 | .20 | .072 |
| 6 | 86 | 20 | 5.9 | 1.0 | 245 | <.5 | 23 | 14 | .20 | .037 |
| " | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 7 | 120 | 32 | 48 | 3.0 | 300 | <.5 | 120 | 71 | .20 | .12 |
| 8 | 69 | 18 | 4.1 | 1.1 | 294 | <.5 | 27 | 3.9 | .20 | .028 |
| 9 | 100 | 28 | 31 | 1.8 | 270 | -- | 72 | 67 | .20 | .052 |

Table 20.--Physical and chemical characteristics for ground water in Jackson County--Continued

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 10 | 83 | 28 | 4.9 | 3.2 | 383 | <0.02 | 22 | 6.6 | 0.40 | <0.010 |
| 11 | 80 | 25 | 3.5 | 5.0 | 304 | <.02 | 27 | 2.4 | .30 | .025 |
| 12 | 90 | 23 | 6.3 | 1.7 | 302 | <.02 | 56 | 3.6 | .30 | .026 |
| 13 | 55 | 25 | 38 | 7.8 | 353 | .08 | 6.2 | 4.2 | .40 | .036 |
| 14 | 110 | 31 | 4.9 | 2.4 | 337 | <.02 | 81 | 17 | .30 | .045 |
| 15 | 86 | 23 | 5.2 | 0.90 | 253 | .03 | 56 | 15 | .30 | .030 |
| 16 | 100 | 28 | 3.7 | 1.0 | 294 | <.5 | 69 | 12 | .10 | .047 |
| 17 | 140 | 42 | 34 | 2.8 | 416 | <.5 | 90 | 83 | .20 | .11 |
| 18 | 80 | 23 | 2.6 | 1.0 | 275 | .06 | 38 | 2.1 | .20 | .039 |
| 19 | 85 | 28 | 15 | 1.4 | 327 | <.5 | 59 | 19 | .20 | .029 |
| 20 | 180 | 34 | 17 | 4.6 | 295 | <.5 | 360 | 5.7 | .30 | .022 |
| 21 | 81 | 24 | 4.5 | 0.80 | 229 | <.5 | 68 | 10 | .10 | .033 |
| 22 | 120 | 32 | 5.6 | 1.5 | 341 | <.02 | 85 | 3.7 | .20 | .021 |

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Copper, dissolved (µg/L as Cu) | Iron, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 16 | 442 | -- | -- | <10 | 9 | 150 | 50 | -- | 1,100 |
| 2 | 16 | 831 | -- | -- | 50 | 16 | 100 | 50 | -- | 990 |
| 3 | 15 | 531 | -- | -- | <10 | 4 | 250 | <10 | -- | 2,100 |
| 4 | 8.6 | 330 | -- | -- | <10 | <1 | 33 | 10 | -- | 980 |
| 5 | 14 | 383 | 0.710 | 0.050 | <10 | <1 | -- | 10 | -- | 270 |
| 6 | 14 | 317 | 1.60 | .070 | <10 | 1 | -- | 20 | -- | 74 |
| " | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 7 | 15 | 594 | <.100 | .220 | <10 | 3 | -- | 200 | -- | 790 |
| 8 | 15 | 257 | <.100 | .100 | <10 | 12 | -- | 30 | -- | 630 |
| 9 | 13 | 520 | -- | -- | <10 | 4 | 190 | 50 | -- | 1,200 |
| 10 | 16 | 336 | -- | -- | <10 | 1 | 130 | 130 | <1 | 700 |
| 11 | 12 | 279 | -- | -- | <10 | <1 | 81 | 440 | 1 | 540 |
| 12 | 14 | 363 | -- | -- | <10 | 2 | 86 | 90 | 1 | 2,600 |
| 13 | 8.7 | 321 | -- | -- | <10 | <1 | 340 | 1,000 | 1 | 440 |
| 14 | 12 | 426 | -- | -- | <10 | <1 | 210 | 70 | 1 | 890 |
| 15 | 14 | 343 | -- | -- | <10 | 1 | 9 | 10 | <1 | 820 |
| 16 | 15 | 409 | <.100 | .060 | <10 | 2 | -- | 10 | -- | 1,300 |

Table 20.--Physical and chemical characteristics for ground water in Jackson County--Continued

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Copper, dissolved (µg/L as Cu) | Iron, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 17 | 16 | 662 | <0.100 | 0.110 | <10 | 2 | -- | 50 | -- | 1,000 |
| 18 | 15 | 332 | -- | -- | <10 | 4 | 99 | 20 | -- | 1,100 |
| 19 | 16 | 370 | <.100 | .080 | <10 | 4 | -- | 40 | -- | 470 |
| 20 | 9.3 | 803 | <.100 | .430 | <10 | <1 | -- | 500 | -- | 750 |
| 21 | 12 | 343 | <.100 | .040 | <10 | 1 | -- | <10 | -- | 920 |
| 22 | 20 | 470 | -- | -- | 20 | 4 | 230 | 50 | -- | 690 |

| Well number | Iron, ferrous, dissolved (µg/L as Fe) | Lead, dissolved (µg/L as Pb) | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | Radium-226, dissolved, radon method (pCi/L) | Radium-228, dissolved (pCi/L as Ra-228) | Uranium, natural dissolved (µg/L as U) | C-13/C-12 stable-isotope ratio, (per mil) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1,000 | -- | 20 | 91 | 740 | 6 | -- | -- | -- | -12.30 |
| 2 | <20 | -- | 17 | 120 | 1,200 | 37 | -- | -- | -- | -11.50 |
| 3 | 2,000 | -- | 14 | 70 | 180 | 15 | -- | -- | -- | -11.50 |
| 4 | 1,100 | -- | 12 | 150 | 84 | 7 | -- | -- | -- | -- |
| 5 | -- | -- | 7 | 33 | 90 | 84 | -- | -- | -- | -- |
| 6 | -- | -- | 8 | 64 | 92 | 15 | -- | -- | -- | -- |
| " | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 7 | -- | -- | 15 | 36 | 1,000 | 18 | -- | -- | -- | -- |
| 8 | -- | -- | 7 | 9 | 300 | 29 | -- | -- | -- | -- |
| 9 | 1,100 | -- | 13 | 33 | 400 | 9 | -- | -- | -- | -- |
| 10 | 700 | <5 | 18 | 27 | 490 | 3 | -- | -- | -- | -- |
| 11 | -- | 6 | 30 | 15 | 350 | 120 | 0.48 | 1.2 | <0.01 | -- |
| 12 | 1,700 | <5 | 12 | 100 | 230 | <3 | -- | -- | -- | -- |
| 13 | 440 | <5 | 19 | 8 | 1,100 | <3 | -- | -- | -- | -- |
| 14 | 830 | <5 | 19 | 52 | 290 | 7 | -- | -- | -- | -- |
| 15 | -- | <5 | 10 | 30 | 87 | <3 | -- | -- | -- | -- |
| 16 | -- | -- | 10 | 49 | 110 | 6 | -- | -- | -- | -- |
| 17 | -- | -- | 16 | 150 | 150 | <3 | -- | -- | -- | -12.10 |
| 18 | 1,000 | -- | 13 | 48 | 110 | 12 | -- | -- | -- | -- |
| 19 | -- | -- | 10 | 34 | 160 | 9 | -- | -- | -- | -12.30 |
| 20 | -- | -- | 22 | 24 | 5,500 | 53 | -- | -- | -- | -13.90 |
| 21 | -- | -- | 7 | 46 | 73 | 60 | -- | -- | -- | -10.80 |
| 22 | 690 | -- | 17 | 17 | 440 | 19 | -- | -- | -- | -- |

Table 20.--Physical and chemical characteristics for ground water in Jackson County--Continued

| Well number | H-2/ H-1 stable-isotope ratio, (per mil) | O-18/ O-16 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|
| 1 | -- | -- | 1.2 |
| 2 | -61.5 | -9.40 | 1.4 |
| 3 | -- | -- | 1.2 |
| 4 | -63.5 | -9.60 | .5 |
| 5 | -64.5 | -10.00 | .5 |
| 6 | -62.0 | -9.40 | 1.8 |
| " | -61.5 | -9.40 | -- |
| 7 | -59.5 | -9.20 | 2.0 |
| 8 | -65.0 | -10.00 | 1.0 |
| 9 | -65.0 | -9.90 | .9 |
| 10 | -- | -- | -- |
| 11 | -- | -- | -- |
| 12 | -- | -- | -- |
| 13 | -- | -- | -- |
| 14 | -- | -- | -- |
| 15 | -- | -- | -- |
| 16 | -64.0 | -9.80 | 1.3 |
| 17 | -64.0 | -9.70 | .8 |
| 18 | -64.0 | -9.70 | .8 |
| 19 | -68.0 | -10.10 | .7 |
| 20 | -59.5 | -9.20 | 1.6 |
| 21 | -65.5 | -10.20 | .9 |
| 22 | -- | -10.00 | 1.0 |

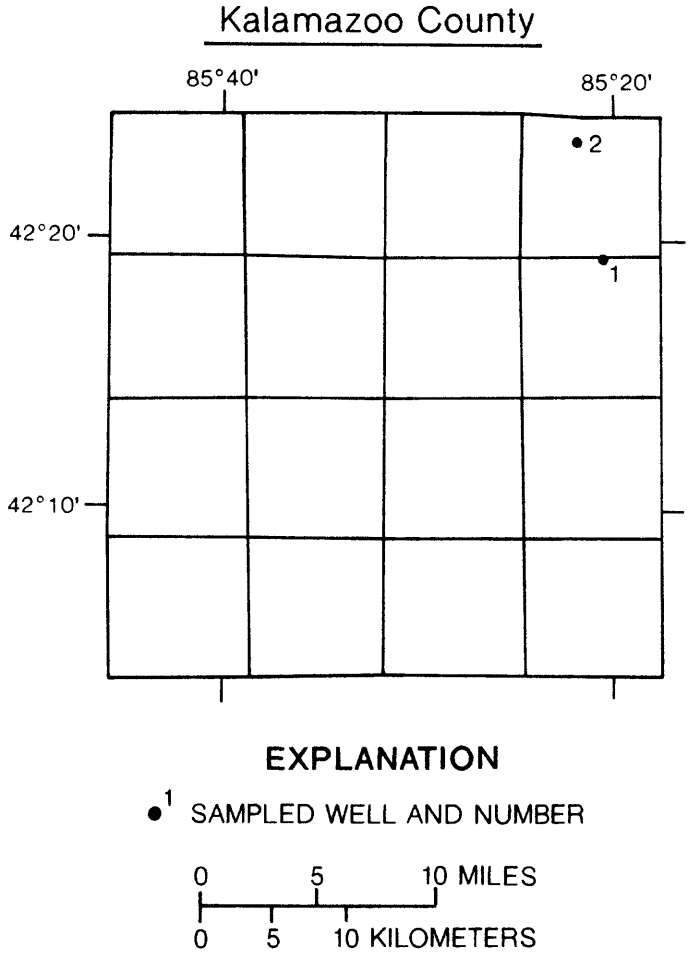


Table 21.--Physical and chemical characteristics for ground water in Kalamazoo County

[Analyses by U.S. Geologcial Survey. Geologic unit: 112SDGV, sand and gravel. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 42°20'15"N | 85°20'55"W | 5-15-87 | 112SDGV | 151 | 551 | 7.45 | 12.0 | 0.6 |
| 2 | 42°24'34"N | 85°22'21"W | 6-27-88 | 112SDGV | 238 | 570 | 7.53 | 11.0 | 3.3 |

Table 21.--Physical and chemical characteristics for ground water in Kalamazoo County--Continued

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 77 | 22 | 8.2 | 1.2 | 249 | -- | 23 | 15 | 0.10 | 0.031 |
| 2 | 88 | 25 | 6.9 | 1.7 | 264 | <0.02 | 31 | 10 | .30 | .017 |

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) | Iron, ferrous, dissolved (µg/L as Fe) | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 15 | 313 | 10 | 1 | 290 | 20 | 390 | 300 | 10 | 580 |
| 2 | 12 | 328 | <10 | <1 | 74 | 20 | 20 | <20 | 12 | 5 |

| Well number | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | H-2/H-1 stable-isotope ratio, (per mil) | O-18/O-16 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|---|---|
| 1 | 120 | 16 | -58.0 | -8.80 | 1.9 |
| 2 | 120 | 5 | -- | -10.05 | 2.5 |

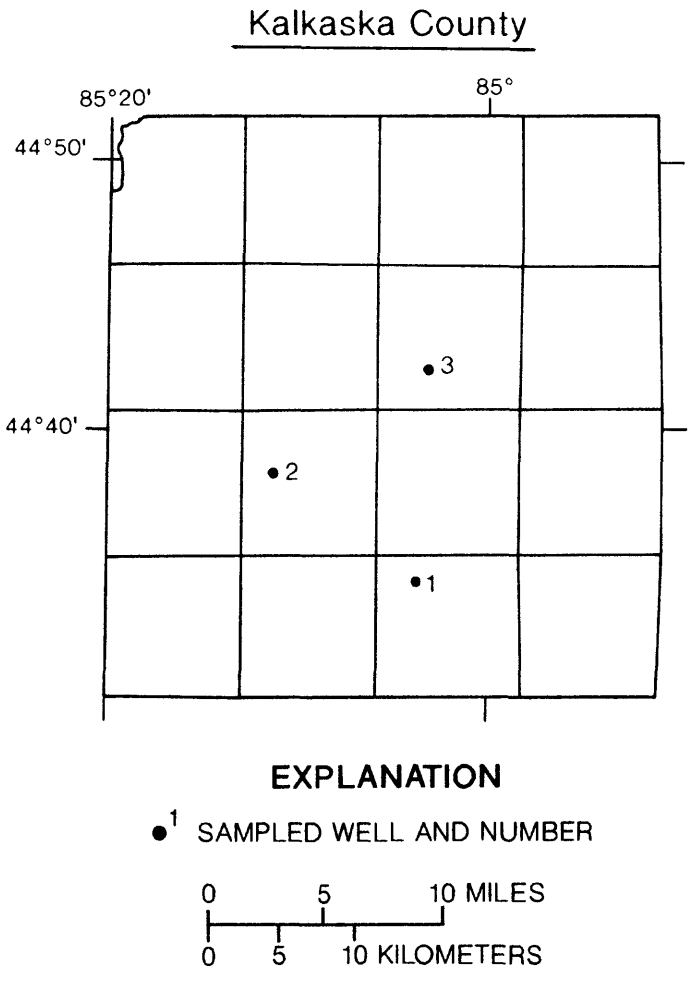


Table 22.--Physical and chemical characteristics for ground water in Kalkaska County

[Analyses by U.S. Gelogical Survey. Geologic unit: 112SAND, sand. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geo-logic unit | Depth of well, total (feet) | Spe-cific con-duct-ance (µS/cm) | pH (stand-ard units) | Temper-ature water (°C) | Oxygen, dis-solved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 44°35'27"N | 85°04'10"W | 7-14-87 | 112SAND | 117 | 614 | 7.62 | 11.5 | 0.2 |
| 2 | 44°39'18"N | 85°11'40"W | 8-21-86 | 112SAND | 89 | 418 | 7.40 | 11.0 | -- |
| 3 | 44°42'58"N | 85°03'35"W | 8-27-86 | 112SAND | 89 | 292 | 7.56 | 10.5 | -- |

Table 22.--Physical and chemical characteristics for ground water in Kalkaska County--Continued

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 96 | 20 | 14 | 1.2 | 170 | 0.02 | 180 | 10 | 0.20 | 0.029 |
| 2 | 65 | 14 | 3.6 | 1.0 | 166 | <.5 | 42 | 10 | <.10 | .011 |
| 3 | 41 | 8.5 | 6.7 | .40 | 124 | <.5 | 9.0 | 10 | <.10 | .022 |

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, nitrite, dissolved (mg/L as N) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 15 | 448 | -- | -- | -- | <10 | <1 | 19 | 70 | 860 |
| 2 | 7.1 | 256 | -- | 3.30 | 0.010 | <10 | <1 | -- | 10 | 6 |
| 3 | 5.9 | 160 | <0.010 | .800 | <.010 | <10 | <1 | -- | <10 | 3 |

| Well number | Iron, ferrous, dissolved (µg/L as Fe) | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | H-2/H-1 stable-isotope ratio, (per mil) | O-18/O-16 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|---|---|---|---|---|
| 1 | 780 | 14 | 56 | 1,500 | 96 | -80.5 | -11.90 | 1.2 |
| 2 | -- | 6 | <1 | 49 | 190 | -81.5 | -12.00 | 1.4 |
| 3 | -- | 4 | <1 | 27 | 12 | -83.5 | -12.40 | .8 |

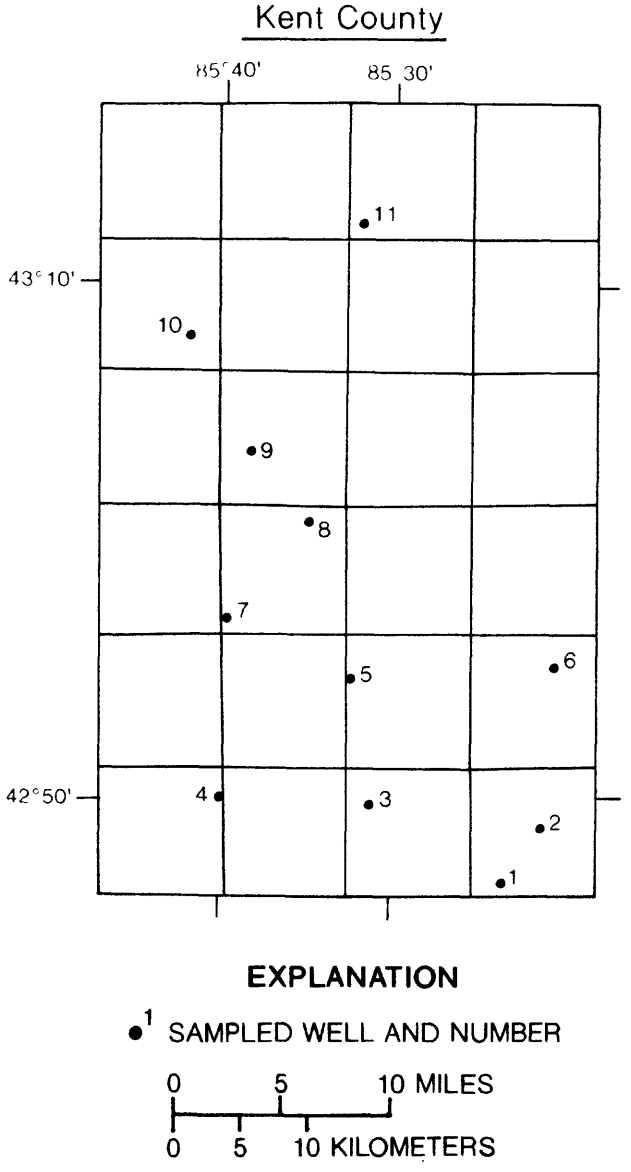


Table 23.--Physical and chemical characteristics for ground water in Kent County

[Analyses by U.S. Geological Survey. Geologic unit: 112SDGV, sand and gravel; 333BPRT, Bayport Limestone; 333MCGN, Michigan Formation; 337MRSL, Marshall Sandstone. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 42°47'04"N | 85°24'29"W | 7-23-86 | 337MRSL | 250 | 990 | 7.33 | 13.0 | 1.4 |
| 2 | 42°49'17"N | 85°22'12"W | 7-23-86 | 112SDGV | 155 | 578 | 7.44 | 13.0 | 2.0 |

Table 23.--Physical and chemical characteristics for ground water in Kent County--Continued

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 42°50'07"N | 85°32'05"W | 11-10-87 | 337MRSL | 325 | 588 | -- | 12.0 | -- |
| 4 | 42°50'29"N | 85°40'33"W | 11-10-87 | 337MRSL | 238 | 800 | -- | 14.5 | -- |
| 5 | 42°55'10"N | 85°33'10"W | 6-30-87 | 337MRSL | 425 | 1,740 | 7.20 | 12.0 | 0 |
| 6 | 42°55'37"N | 85°21'30"W | 5-20-87 | 112SDGV | 113 | 599 | 7.44 | 11.0 | 3.3 |
| 7 | 42°57'34"N | 85°40'20"W | 5-13-87 | 333MCGN | 149 | 10,100 | 7.08 | 11.0 | -- |
| " | " | " | 5-14-87 | 337MRSL | 220 | 6,560 | 7.01 | 11.5 | 1.2 |
| 8 | 43°01'24"N | 85°35'42"W | 8-25-86 | 333BPRT | 288 | 379 | 7.70 | 11.5 | 1.2 |
| 9 | 43°04'08"N | 85°39'00"W | 6-30-87 | 333MCGN | 260 | 1,060 | 7.01 | 14.0 | .3 |
| 10 | 43°08'50"N | 85°42'38"W | 6-25-87 | 112SDGV | 111 | 501 | 7.56 | 12.0 | .6 |
| 11 | 43°13'14"N | 85°32'44"W | 7-23-86 | 112SDGV | 167 | 476 | 7.68 | 11.0 | .8 |

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.0 | 0.14 | 220 | 0.30 | 268 | <0.5 | 220 | 1.1 | 0.30 | <0.010 |
| 2 | 71 | 31 | 17 | 1.3 | 326 | <.5 | 15 | 2.0 | .40 | .018 |
| 3 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 4 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 5 | 230 | 23 | 120 | 5.5 | 190 | -- | 570 | 160 | .30 | .65 |
| 6 | 85 | 25 | 6.8 | 1.0 | 238 | -- | 62 | 17 | .30 | .040 |
| 7 | 660 | 110 | 1,200 | 18 | -- | -- | 1,300 | 2,900 | .40 | 13 |
| " | 520 | 85 | 860 | 12 | 200 | -- | 900 | 1,700 | .40 | 7.2 |
| 8 | .20 | .01 | 88 | .10 | 294 | <.5 | 8.9 | 7.4 | .50 | .021 |
| 9 | 1.6 | .63 | 260 | .70 | 298 | .02 | 280 | 1.2 | .20 | .011 |
| 10 | 71 | 28 | 5.4 | 1.0 | 236 | -- | 37 | 7.9 | .20 | .022 |
| 11 | 71 | 19 | 9.9 | 1.0 | 206 | <.5 | 74 | 2.7 | .40 | <.010 |

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, nitrite, dissolved (mg/L as N) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 18 | 629 | -- | <0.100 | 0.030 | <10 | <1 | -- | 70 | 12 |
| 2 | 20 | 331 | -- | <.100 | .150 | <10 | 5 | -- | 40 | 1,400 |

Table 23.--Physical and chemical characteristics for ground water in Kent County--Continued

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, nitrite, dissolved (mg/L as N) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 4 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 5 | 12 | 1,310 | -- | -- | -- | <10 | 1 | 6 | 490 | 8 |
| 6 | 12 | 359 | -- | -- | -- | <10 | <1 | 27 | 30 | 6 |
| 7 | 11 | 6,830 | -- | -- | -- | <10 | 4 | <100 | 950 | 1,800 |
| " | 13 | 4,330 | -- | -- | -- | <10 | 2 | <100 | 810 | 4,300 |
| 8 | 14 | 243 | <0.010 | <0.100 | <0.010 | <10 | <1 | -- | 60 | <3 |
| 9 | 18 | 716 | -- | -- | -- | <10 | 2 | <2 | 60 | 18 |
| 10 | 13 | 301 | -- | -- | -- | <10 | <1 | 40 | 20 | 620 |
| 11 | 16 | 299 | -- | <.100 | .210 | <10 | 7 | -- | 40 | 360 |

| Well number | Iron, ferrous, dissolved (µg/L as Fe) | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | C-13/C-12 stable-isotope ratio, (per mil) | H-2/H-1 stable-isotope ratio, (per mil) | O-18/O-16 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | -- | <4 | 1 | 13 | 34 | -- | -62.0 | -9.50 | 2.2 |
| 2 | -- | 13 | 62 | 330 | 41 | -- | -64.0 | -9.80 | 1.5 |
| 3 | -- | -- | -- | -- | -- | -- | -64.5 | -9.75 | -- |
| 4 | -- | -- | -- | -- | -- | -- | -63.5 | -9.60 | -- |
| 5 | -- | 48 | 120 | 5,700 | 17 | -13.70 | -63.5 | -9.70 | 1.1 |
| 6 | <20 | 13 | <1 | 540 | 35 | -- | -67.0 | -10.00 | .8 |
| 7 | -- | 160 | 180 | 16,000 | 70 | -13.10 | -63.0 | -9.60 | .6 |
| " | -- | 110 | 140 | 13,000 | 50 | -12.60 | -62.5 | -9.70 | .7 |
| 8 | -- | <4 | <1 | 1 | 11 | -- | -66.0 | -10.30 | .6 |
| 9 | 100 | 15 | <1 | 17 | 58 | -12.80 | -66.5 | -10.00 | 1.0 |
| 10 | 600 | 14 | 65 | 290 | 16 | -- | -67.5 | -10.20 | .9 |
| 11 | -- | 10 | 30 | 490 | 7 | -- | -64.0 | -10.10 | 1.9 |

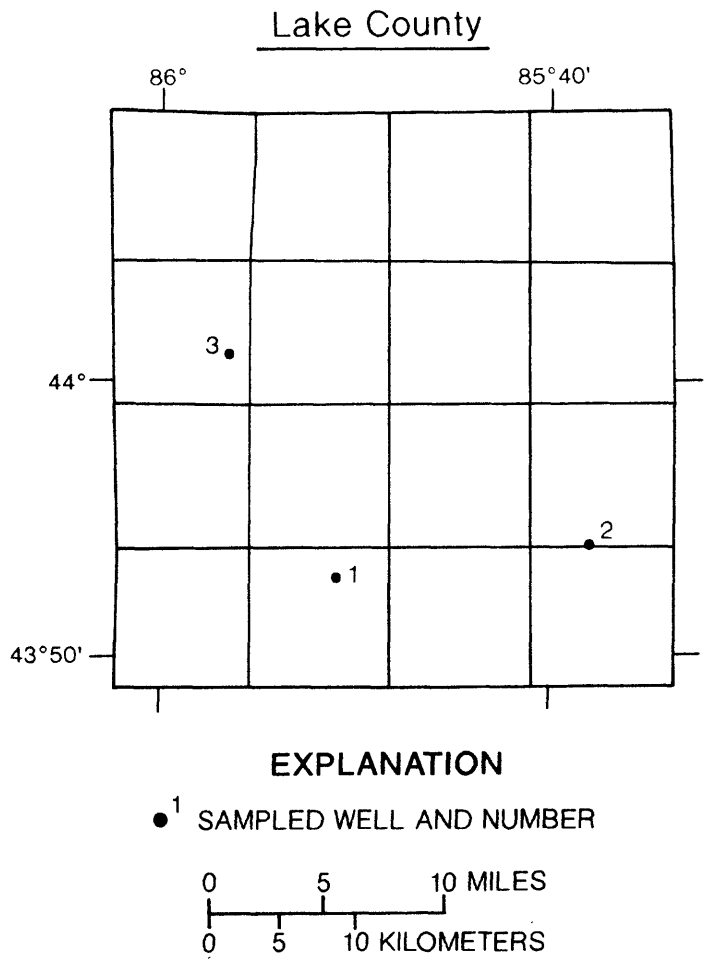


Table 24.--Physical and chemical characteristics for ground water in Lake County

[Analyses by U.S. Geological Survey. Geologic unit: 112SAND, sand; 337MRSL, Marshall Sandstone; 333MCGN, Michigan Formation. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 43°53'20"N | 85°51'30"W | 7-09-87 | 112SAND | 185 | 369 | 7.66 | 11.0 | 4.6 |
| 2 | 43°54'30"N | 85°38'30"W | 8-20-86 | 112SAND | 245 | 351 | 7.72 | 10.5 | .2 |
| 3 | 44°01'25"N | 85°56'40"W | 6-24-89 | 337MRSL | 569[a] | 104,000 | 6.43 | 13.5 | 0 |
| " | " | " | 6-29-89 | 333MCGN | 449[a] | 2,650 | 6.81 | 13.0 | 0 |

Table 24.--Physical and chemical characteristics for ground water in Lake County--Continued

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 43 | 14 | 16 | 0.70 | 206 | -- | 22 | 34 | <0.10 | 0.13 |
| 2 | 47 | 16 | 5.3 | .90 | 202 | <0.5 | 4.8 | 1.2 | .20 | <.010 |
| 3 | 3,700 | 880 | 20,000 | 180 | 140 | .045 | 1,900 | 44,000 | .20 | 130 |
| " | 580 | 48 | 82 | 3.6 | 127 | .025 | 1,600 | 4.4 | 1.1 | .15 |

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Copper, dissolved (µg/L as Cu) | Iron, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 7.9 | 224 | -- | -- | <10 | 1 | 16 | 40 | -- | 3 |
| 2 | 14 | 211 | <0.100 | 0.110 | <10 | 4 | -- | 10 | -- | 770 |
| 3 | 7.5 | 81,400 | -- | -- | 10 | <1 | 200 | 5,600 | <2 | 12,000 |
| " | 17 | 2,520 | -- | -- | <10 | 1 | <100 | 350 | 5 | 2,100 |

| Well number | Iron, ferrous, dissolved (µg/L as Fe) | Lead, dissolved (µg/L as Pb) | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | C-13/C-12 stable-isotope ratio, (per mil) | H-2/H-1 stable-isotope ratio, (per mil) | O-18/O-16 stable-isotope ratio, (per mil) | S-34/S-32 stable-isotope ratio, (per mil) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | -- | -- | <4 | 1 | 94 | 21 | -- | -73.0 | -10.80 | -- |
| 2 | -- | -- | 6 | 27 | 92 | 710 | -- | -67.5 | -10.30 | -- |
| 3 | 9,000 | 8 | 700 | 450 | 80,000 | 1,200 | -26.70 | -78.0 | -10.35 | 25.40 |
| " | 2,000 | <1 | 30 | 33 | 12,000 | 60 | -10.80 | -76.0 | -11.20 | 20.00 |

| Well number | Carbon, organic, dissolved (mg/L as C) |
|---|---|
| 1 | 0.9 |
| 2 | 4.4 |
| 3 | -- |
| " | -- |

[a] Depth represents top of sampled interval.

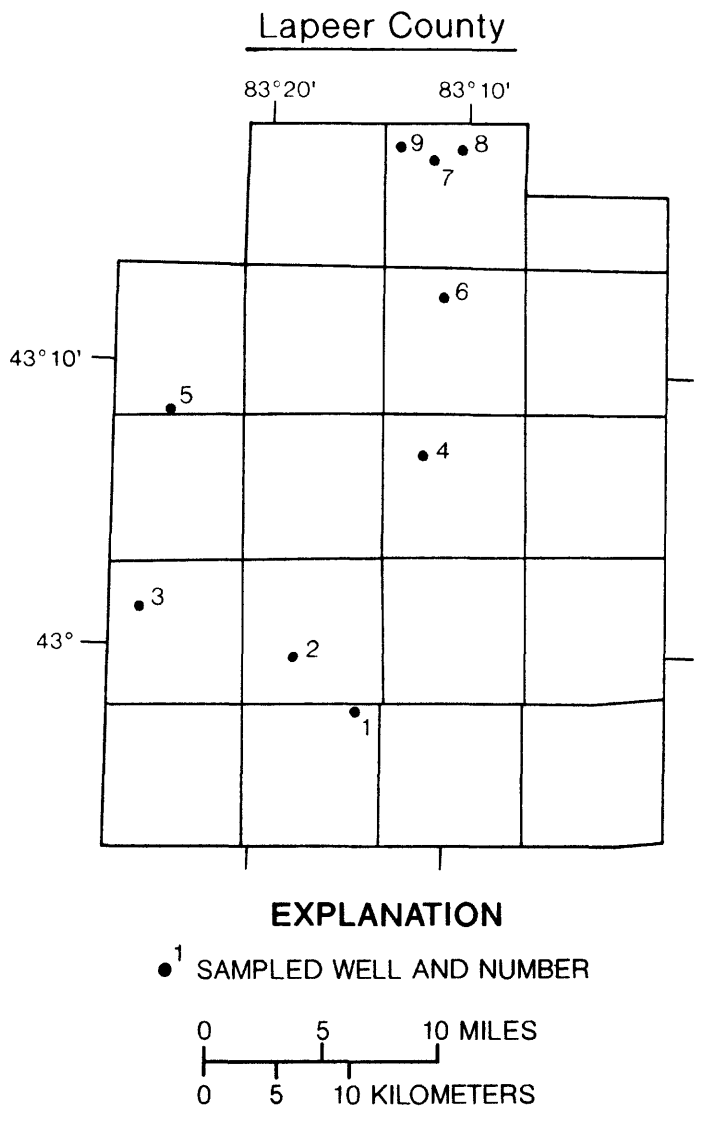


Table 25.--Physical and chemical characteristics for ground water in Lapeer County

[Analyses by U.S. Geological Survey. Geologic unit: 112SDGV, sand and gravel; 333MCGN, Michigan Formation; 337MRSL, Marshall Sandstone. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 42°58'16"N | 83°15'19"W | 8-28-86 | 337MRSL | 220 | 498 | 7.20 | 11.0 | 1.7 |
| 2 | 43°00'27"N | 83°18'05"W | 6-03-87 | 337MRSL | 132 | 631 | 7.49 | 11.5 | .4 |

Table 25.--Physical and chemical characteristics for ground water in Lapeer County--Continued

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 43°02'08"N | 83°25'55"W | 6-03-87 | 112SDGV | 111 | 728 | 7.28 | 12.0 | 0 |
| 4 | 43°07'59"N | 83°12'02"W | 7-28-88 | 337MRSL | 360 | 375 | 7.44 | 11.0 | 0 |
| 5 | 43°09'13"N | 83°24'46"W | 7-16-86 | 333MCGN | 280 | 1,390 | 7.79 | 14.0 | 1.1 |
| 6 | 43°13'47"N | 83°11'13"W | 7-16-86 | 337MRSL | 250 | 945 | 7.38 | 12.0 | .5 |
| 7 | 43°18'43"N | 83°12'00"W | 7-16-86 | 333MCGN | 160 | 400 | 7.90 | 12.0 | .4 |
| 8 | 43°19'09"N | 83°10'40"W | 7-16-86 | 337MRSL | 400 | 790 | 7.58 | 11.5 | .9 |
| 9 | 43°19'10"N | 83°13'43"W | 7-16-86 | 112SDGV | 80 | 412 | 7.89 | 11.0 | 1.1 |

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 59 | 28 | 13 | 1.6 | 258 | <0.5 | 14 | 2.0 | 0.70 | 0.020 |
| 2 | 90 | 30 | 8.7 | 2.8 | 250 | -- | 78 | 20 | .10 | .089 |
| 3 | 110 | 41 | 7.0 | 1.2 | 348 | .05 | 71 | 3.2 | .30 | .024 |
| 4 | 39 | 16 | 26 | 3.2 | 232 | .03 | 5.6 | .90 | 1.3 | .024 |
| 5 | 46 | 13 | 230 | 3.2 | 257 | <.5 | 73 | 270 | 1.2 | .52 |
| 6 | 82 | 33 | 81 | 2.4 | 326 | <.5 | 48 | 140 | .70 | .095 |
| 7 | 27 | 12 | 51 | 2.0 | 197 | <.5 | 28 | 2.9 | 1.6 | .018 |
| 8 | 52 | 18 | 95 | 2.1 | 277 | <.5 | 35 | 93 | .80 | .064 |
| 9 | 37 | 21 | 31 | 1.7 | 239 | <.5 | 10 | 1.1 | 1.3 | .016 |

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, nitrite, dissolved (mg/L as N) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 14 | 488 | <0.010 | <0.100 | 0.110 | <10 | 23 | -- | 80 | 780 |
| 2 | 9.8 | 398 | -- | -- | -- | <10 | <1 | 62 | 30 | 11 |
| 3 | 18 | 477 | -- | -- | -- | <10 | 14 | 160 | 30 | 2,600 |
| 4 | 7.7 | 216 | -- | -- | -- | <10 | 7 | 140 | 380 | 1,100 |
| 5 | 7.6 | 781 | -- | <.100 | .330 | <10 | <1 | -- | 770 | 1,100 |
| 6 | 9.1 | 582 | -- | <.100 | .240 | <10 | 9 | -- | 340 | 540 |
| 7 | 10 | 243 | -- | <.100 | .150 | <10 | 8 | -- | 390 | 140 |
| 8 | 8.2 | 470 | -- | <.100 | .170 | <10 | 1 | -- | 610 | 270 |
| 9 | 15 | 241 | -- | <.100 | .240 | <10 | 29 | -- | 260 | 500 |

Table 25.--Physical and chemical characteristics for ground water in Lapeer County--Continued

| Well number | Iron, ferrous, dissolved (µg/L as Fe) | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | C-13/ C-12 stable-isotope ratio, (per mil) | H-2/ H-1 stable-isotope ratio, (per mil) | O-18/ O-16 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | -- | 14 | 31 | 510 | 15 | -- | -69.5 | -10.20 | 0.6 |
| 2 | <20 | 15 | 120 | 130 | 27 | -- | -65.5 | -9.80 | 1.3 |
| 3 | 2,400 | 20 | 57 | 330 | 14 | -- | -65.5 | -9.70 | 2.1 |
| 4 | 520 | 16 | 14 | 930 | 62 | -- | -- | -9.60 | -- |
| 5 | -- | 30 | 20 | 2,100 | 3 | -12.30 | -90.5 | -13.50 | .5 |
| 6 | -- | 27 | 14 | 2,900 | 14 | -- | -64.0 | -9.80 | .7 |
| 7 | -- | 15 | 11 | 460 | 10 | -- | -64.5 | -9.90 | 1.1 |
| 8 | -- | 21 | 11 | 880 | 10 | -- | -64.5 | -9.60 | 1.1 |
| 9 | -- | 17 | 8 | 930 | 29 | -10.90 | -62.5 | -9.70 | 1.0 |

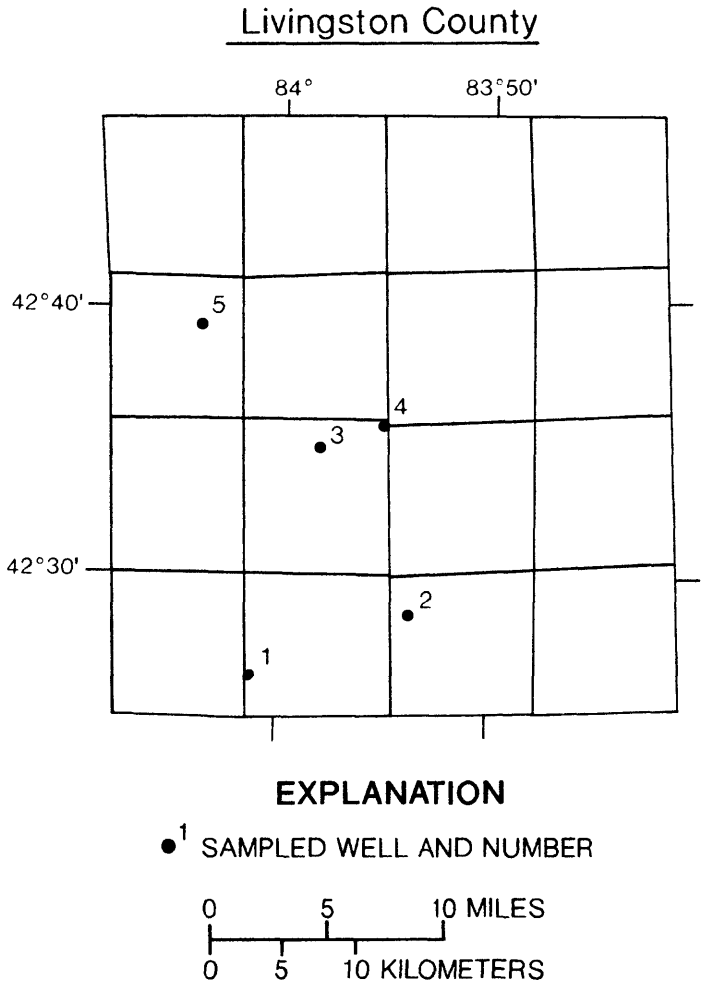


Table 26.--Physical and chemical characteristics for ground water in Livingston County

[Analyses by U.S. Geological Survey. Geologic unit: 112SAND, sand; 337BERE, Berea Sandstone; 337CLDR, Coldwater Shale; 337MRSL, Marshall Sandstone. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter. --, no analysis made; <, less than. Alkainity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 42°27'21"N | 84°01'50"W | 6-21-88 | 337CLDR | 219 | 425 | 7.53 | 13.0 | 0 |
| 2 | 42°29'32"N | 83°53'50"W | 8-20-87 | 337CLDR | 253 | 526 | 7.43 | 10.0 | .0 |

Table 26.--Physical and chemical characteristics for ground water in Livingston County--Continued

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 42°35'30"N | 83°58'22"W | 5-19-87 | 337BERE | 450 | 858 | 7.43 | 11.5 | 0.2 |
| 4 | 42°36'28"N | 83°55'15"W | 5-19-87 | 112SAND | 92 | 846 | 7.38 | 12.0 | 1.9 |
| 5 | 42°39'55"N | 84°04'29"W | 8-13-86 | 337MRSL | 400 | 973 | 7.38 | 10.5 | 1.6 |

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 61 | 20 | 8.5 | 0.90 | 257 | 0.02 | 11 | 0.80 | 0.40 | <0.010 |
| 2 | 78 | 23 | 12 | 2.0 | 287 | .03 | 5.2 | 8.9 | .30 | .016 |
| 3 | 69 | 24 | 63 | 3.8 | 286 | .01 | 19 | 74 | .40 | .17 |
| 4 | 68 | 23 | 61 | 4.0 | 284 | -- | 17 | 71 | .40 | .16 |
| 5 | 76 | 24 | 89 | 4.9 | 327 | <.5 | 25 | 140 | .50 | .40 |

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) | Iron, ferrous, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 15 | 249 | -- | -- | 10 | 4 | 180 | 40 | 790 | 450 |
| 2 | 12 | 292 | -- | -- | <10 | 2 | 230 | 100 | 880 | 780 |
| 3 | 9.0 | 454 | -- | -- | 10 | <1 | 160 | 250 | 450 | 450 |
| 4 | 9.1 | 422 | -- | -- | <10 | <1 | 140 | 250 | 320 | 300 |
| 5 | 7.6 | 504 | <0.100 | 0.300 | <10 | <1 | -- | 450 | 450 | -- |

| Well number | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | C-13/ C-12 stable-isotope rati, (per mil) | H-2/ H-1 stable-isotope ratio, (per mil) | O-18/ O-16 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|---|---|---|---|---|
| 1 | 11 | 53 | 400 | 34 | -- | -- | -9.75 | 1.8 |
| 2 | 4 | 32 | 580 | 18 | -12.00 | -62.0 | -9.20 | 2.0 |
| 3 | 19 | 19 | 2,300 | 13 | -- | -62.0 | -9.10 | .8 |
| 4 | 20 | 30 | 2,400 | 7 | -- | -60.5 | -9.00 | 1.2 |
| 5 | 24 | 16 | 4,700 | 8 | -- | -56.5 | -8.60 | 1.4 |

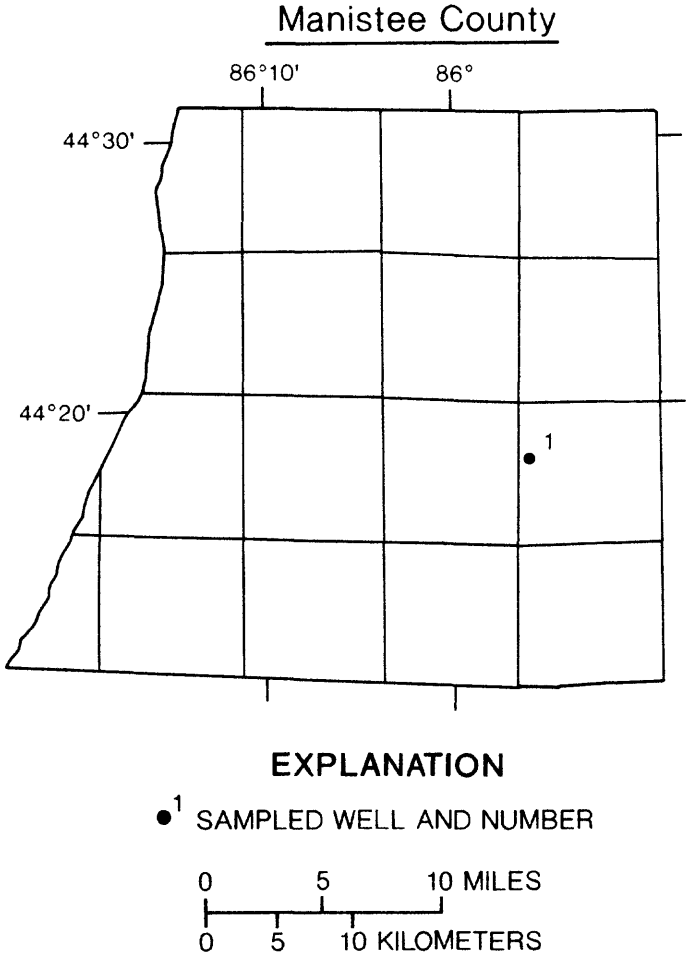


Table 27.--Physical and chemical characteristics for ground water in Manistee County

[Analyses by U.S. Geological Survey. Geologic unit: 112SAND, sand. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 44°18'40"N | 85°56'30"W | 7-13-87 | 112SAND | 168 | 438 | 7.62 | 11.5 | 8.3 |

Table 27.--Physical and chemical characteristics for ground water in Manistee County--Continued

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) | Silica, dissolved (mg/L as $SiO_2$) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 58 | 25 | 1.9 | 0.70 | 264 | 26 | 6.3 | <0.10 | 0.021 | 10 |

| Well number | Solids, residue at 180 °C, dissolved (mg/L) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 269 | <10 | 1 | <100 | 10 | 6 | <10 | <1 | 46 | 300 |

| Well number | H-2/H-1 stable-isotope ratio, (per mil) | O-18/O-16 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|
| 1 | -81.5 | -12.20 | 1.1 |

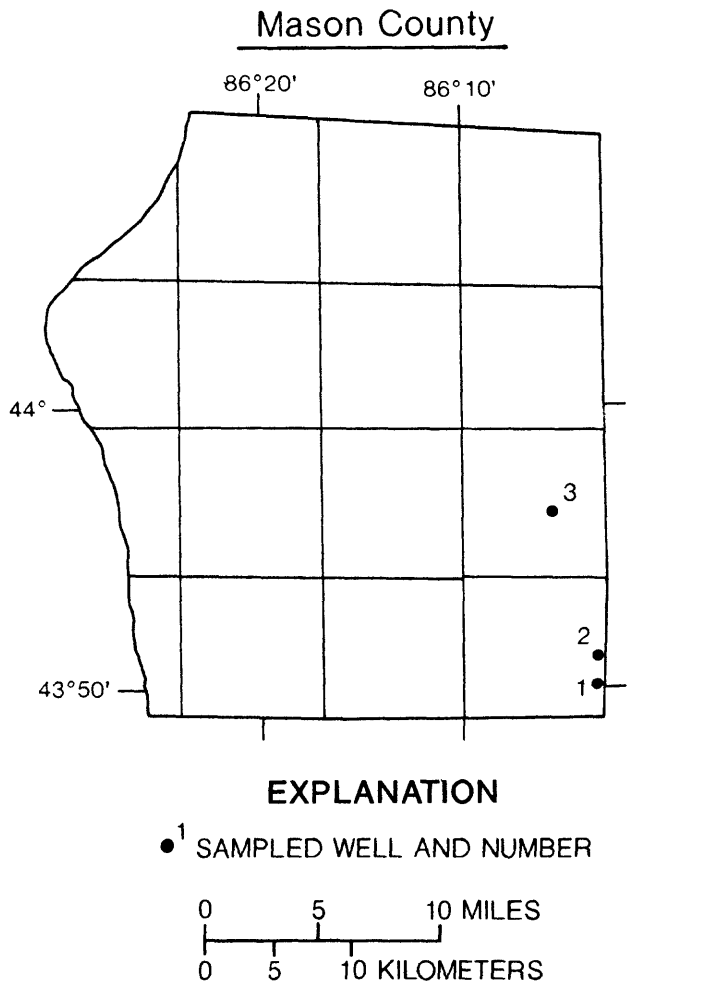


Table 28.--Physical and chemical characteristics for ground water in Mason County

[Analyses by U.S. Geological Survey. Geologic unit: 112SAND, sand; 112SDGV, sand and gravel. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 43°50'46"N | 86°02'56"W | 7-08-87 | 112SAND | 90 | 485 | 7.56 | 12.0 | 0.1 |
| 2 | 43°51'44"N | 86°02'20"W | 7-08-87 | 112SDGV | 300 | 265 | 7.90 | 12.0 | .6 |
| 3 | 43°56'54"N | 86°05'30"W | 8-20-86 | 112SDGV | 118 | 1430 | 8.03 | 11.0 | 1.3 |

Table 28.--Physical and chemical characteristics for ground water in Mason County--Continued

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) | Silica, dissolved (mg/L as $SiO_2$) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 71 | 25 | 3.2 | 0.90 | 313 | 6.6 | 1.3 | 0.10 | 0.030 | 15 |
| 2 | 40 | 11 | 3.6 | .70 | 151 | .60 | .50 | .20 | <.010 | 15 |
| 3 | 64 | 25 | 200 | 3.2 | 277 | 18 | 320 | .40 | 3.1 | 15 |

| Well number | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) | Iron, ferrous, dissolved (µg/L as Fe) | Lithium, dissolved (µg/L as Li) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 285 | -- | -- | <10 | <1 | 52 | <10 | <3 | -- | <4 |
| 2 | 158 | -- | -- | <10 | 4 | 32 | <10 | 170 | 150 | <4 |
| 3 | 810 | <0.100 | 1.70 | 20 | <1 | -- | 330 | 110 | -- | 17 |

| Well number | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | C-13/C-12 stable-isotope ratio, (per mil) | H-2/H-1 stable-isotope ratio, (per mil) | O-18/O-16 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|---|---|---|---|
| 1 | 78 | 130 | 59 | -12.10 | -73.0 | -10.90 | 2.7 |
| 2 | 11 | 230 | 10 | -7.90 | -61.5 | -8.30 | 1.5 |
| 3 | 16 | 4,500 | 27 | -19.00 | -64.0 | -9.40 | 3.0 |

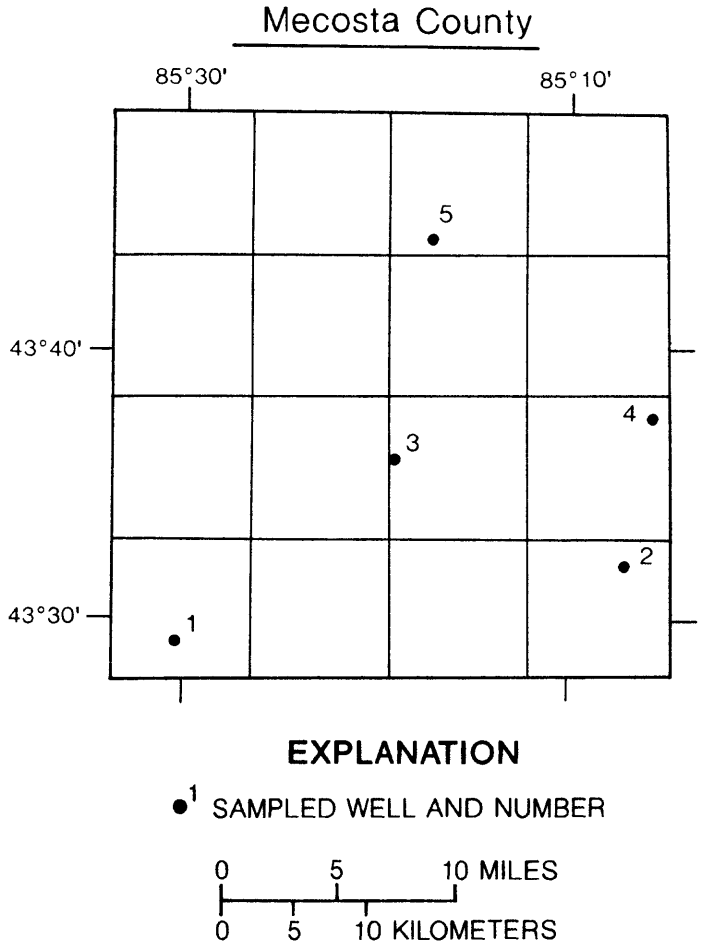


Table 29.--Physical and chemical characteristics for ground water in Mecosta County

[Analyses by U.S. Geological Survey. Geologic unit: 112GRVL, gravel; 112SAND, sand; 112SDGV, sand and gravel. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 43°29'56"N | 85°30'50"W | 6-18-87 | 112SAND | 120 | 383 | 8.06 | 17.0 | 1.6 |
| 2 | 43°32'44"N | 85°07'47"W | 6-23-87 | 112GRVL | 110 | 500 | 7.50 | 11.0 | 0 |
| 3 | 43°36'32"N | 85°19'40"W | 6-23-87 | 112GRVL | 162 | 331 | 7.89 | 12.0 | 8.5 |

Table 29.--Physical and chemical characteristics for ground water in Mecosta County--Continued

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 4 | 43°38'03"N | 85°06'23"W | 8-19-86 | 112SDGV | 210 | 449 | 7.30 | 11.5 | 2.1 |
| 5 | 43°44'41"N | 85°17'41"W | 7-09-87 | 112SAND | 140 | 347 | 7.70 | 12.5 | 4.0 |

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 45 | 9.4 | 21 | 1.7 | 220 | 0.32 | 13 | 63 | <0.10 | 0.47 |
| 2 | 76 | 26 | 6.4 | .80 | 272 | .08 | 20 | 4.2 | .20 | .019 |
| 3 | 52 | 16 | 1.8 | .40 | 176 | -- | 16 | 3.5 | <.10 | .011 |
| 4 | 68 | 22 | 2.5 | .80 | 232 | <.5 | 36 | 2.5 | .10 | .020 |
| 5 | 49 | 18 | 4.4 | .60 | 287 | -- | 10 | 3.3 | .20 | <.010 |

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) | Iron, ferrous, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 8.4 | 224 | -- | -- | 20 | <1 | 14 | 40 | 19 | <20 |
| 2 | 18 | 309 | -- | -- | <10 | 4 | 43 | 10 | 790 | 750 |
| 3 | 9.7 | 201 | -- | -- | <10 | <1 | 16 | <10 | 6 | <20 |
| 4 | 8.2 | 259 | <0.100 | 0.030 | <10 | <1 | -- | <10 | 1,300 | -- |
| 5 | 13 | 201 | -- | -- | <10 | <1 | 25 | 10 | 1,100 | -- |

| Well number | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | H-2/H-1 stable-isotope ratio, (per mil) | O-18/O-16 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|---|---|---|---|
| 1 | 4 | 1 | 690 | 68 | -61.5 | -9.00 | 3.3 |
| 2 | 10 | 16 | 140 | 110 | -67.0 | -10.10 | 4.6 |
| 3 | 8 | <1 | 40 | 360 | -71.0 | -10.60 | 3.8 |
| 4 | 7 | 54 | 59 | 45 | -69.0 | -10.60 | 1.1 |
| 5 | <4 | 37 | 110 | 400 | -69.5 | -10.00 | 1.9 |

## Midland County

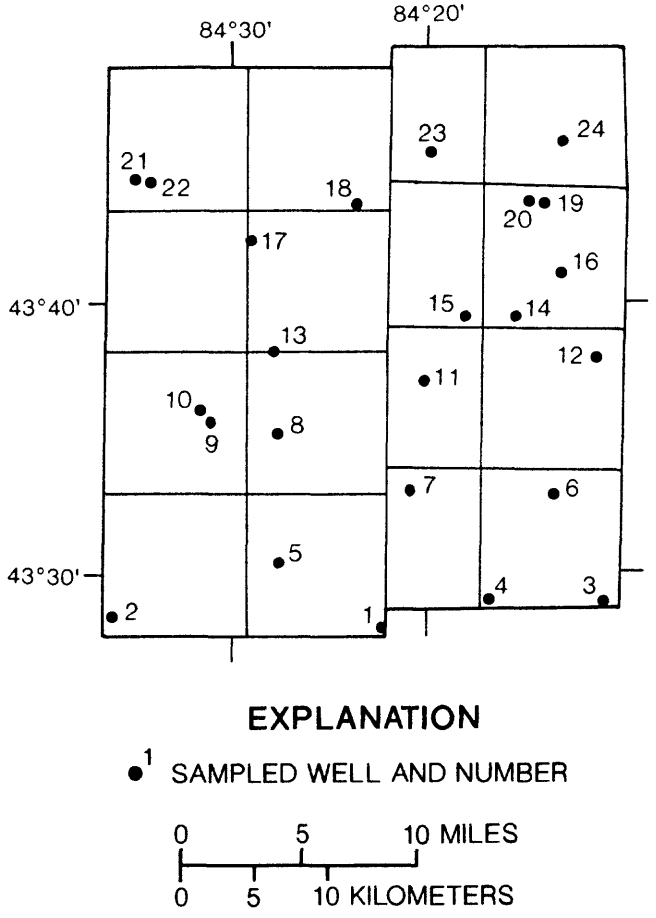


Table 30.--Physical and chemical characteristics for ground water in Midland County

[Analyses by U.S. Geological Survey. Geologic unit: 112SAND, sand; 112SDGV, sand and gravel; 324SGNW, Saginaw Formation; 337MRSL, Marshall Sandstone. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter; pCi/L, picocuries per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 43°27'58"N | 84°22'34"W | 7-21-86 | 324SGNW | 290 | 493 | 7.45 | 10.5 | 1.5 |
| 2 | 43°29'06"N | 84°36'26"W | 8-27-86 | 112SAND | 124 | 884 | 7.40 | 10.5 | 4.3 |

Table 30.--Physical and chemical characteristics for ground water in Midland County--Continued

| Well number | Latitude | Longitude | Date | Geo-logic unit | Depth of well, total (feet) | Spe-cific con-duct-ance (µS/cm) | pH (stand-ard units) | Temper-ature water (°C) | Oxygen, dis-solved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 43°29'08"N | 84°11'27"W | 6-02-88 | 324SGNW | 432 | 3,770 | 8.12 | 12.0 | 0 |
| 4 | 43°29'11"N | 84°17'29"W | 8-27-86 | 112SAND | 51 | 440 | 7.52 | 11.0 | .5 |
| 5 | 43°31'06"N | 84°27'59"W | 8-27-86 | 112SAND | 80 | 415 | 7.97 | 12.0 | 6.0 |
| 6 | 43°33'40"N | 84°14'07"W | 9-03-86 | 112SDGV | 82 | 281 | 7.68 | 9.5 | .9 |
| 7 | 43°33'43"N | 84°21'23"W | 11-16-87 | 324SGNW | 350 | 1,200 | -- | 14.0 | -- |
| 8 | 43°35'50"N | 84°28'06"W | 7-31-86 | 112SAND | 25 | 884 | 6.90 | 13.5 | 1.2 |
| 9 | 43°36'41"N | 84°31'42"W | 5-25-88 | 324SGNW | 470 | 4,250 | -- | 12.0 | -- |
| " | " | " | 7-21-86 | " | " | 3,470 | 7.23 | 11.5 | 3.8 |
| 10 | 43°36'46"N | 84°31'58"W | 6-03-87 | 324SGNW | 528 | 8,480 | 6.83 | 13.5 | 8.2 |
| 11 | 43°37'49"N | 84°20'35"W | 9-21-86 | 112SAND | 165 | 325 | 7.65 | 11.5 | .9 |
| 12 | 43°38'43"N | 84°11'48"W | 9-03-86 | 324SGNW | 435 | 4,660 | 7.67 | 11.5 | 1 |
| 13 | 43°38'50"N | 84°28'08"W | 9-04-86 | 324SGNW | 400 | 4,360 | 7.27 | 11.5 | 1 |
| 14 | 43°40'12"N | 84°11'55"W | 9-24-87 | 337MRSL | 1,296 | 201,000 | 5.26 | 17.0 | 0 |
| 15 | 43°40'12"N | 84°18'33"W | 8-04-86 | 112SAND | 70 | 4,790 | 7.73 | 11.0 | 1.5 |
| 16 | 43°41'52"N | 84°13'37"W | 9-16-86 | 324SGNW | 408 | 745 | 8.50 | 11.0 | 1.6 |
| 17 | 43°42'58"N | 84°29'28"W | 7-31-86 | 324SGNW | 241 | 1,130 | 7.58 | 11.0 | 0 |
| 18 | 43°44'04"N | 84°24'09"W | 9-16-86 | 324SGNW | 335 | 3,000 | 7.50 | 10.5 | 1.1 |
| 19 | 43°44'31"N | 84°14'46"W | 6-29-88 | 324SGNW | 480 | 5,530 | 7.63 | 12.0 | .3 |
| 20 | 43°44'31"N | 84°15'19"W | 7-28-86 | 112SAND | 140 | 1,310 | 7.67 | 13.5 | .2 |
| 21 | 43°45'18"N | 84°35'25"W | 7-31-86 | 324SGNW | 555 | 450 | 7.48 | 12.0 | 1.1 |
| 22 | 43°45'22"N | 84°34'30"W | 7-31-86 | 112SDGV | 97 | 505 | 7.43 | 10.5 | .7 |
| 23 | 43°46'19"N | 84°20'20"W | 9-04-86 | 112SDGV | 120 | 2,700 | 7.54 | 11.5 | 1.8 |
| " | " | " | 9-16-86 | " | " | 2,150 | 7.60 | 12.0 | .3 |
| 24 | 43°46'40"N | 84°13'35"W | 7-28-86 | 324SGNW | 335 | 1,340 | 7.59 | 12.0 | 1.5 |

| Well number | Calcium, dis-solved (mg/L as Ca) | Magne-sium, dis-solved (mg/L as Mg) | Sodium, dis-solved (mg/L as Na) | Potas-sium, dis-solved (mg/L as K) | Alka-linity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dis-solved (mg/L as $SO_4$) | Chlo-ride, dis-solved (mg/L as Cl) | Fluo-ride, dis-solved (mg/L as F) | Bromide, dis-solved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 59 | 22 | 22 | 1.5 | 298 | <.5 | 8.6 | 1.4 | .50 | <0.010 |
| 2 | 110 | 32 | 43 | 2.0 | 262 | <.5 | 190 | 37 | .50 | .14 |
| 3 | 76 | 13 | 760 | 7.2 | 247 | .12 | 290 | 990 | .40 | 1.5 |
| 4 | 58 | 21 | 17 | 1.7 | 271 | <.5 | 14 | 2.8 | .50 | .016 |
| 5 | 31 | 14 | 48 | .70 | 152 | <.5 | 98 | 3.9 | .60 | .040 |

Table 30.--Physical and chemical characteristics for ground water in Midland County--Continued

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 42 | 9.7 | 2.0 | 0.70 | 141 | <0.5 | 21 | 4.5 | 0.20 | <0.010 |
| 7 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 8 | 150 | 19 | 19 | 7.7 | 365 | <.5 | 100 | 58 | .20 | .32 |
| 9 | -- | -- | -- | -- | -- | .03 | -- | -- | -- | -- |
| " | 170 | 36 | 500 | 5.7 | 160 | <.5 | 370 | 880 | .30 | 2.1 |
| 10 | 190 | 46 | 110 | 4.4 | 180 | -- | 610 | 120 | .10 | .50 |
| 11 | 51 | 19 | 39 | 1.7 | 218 | <.5 | 68 | 6.3 | .90 | .018 |
| 12 | 5.0 | 4.0 | 1,600 | 8.8 | 314 | <.5 | 250 | 2,100 | .40 | .019 |
| 13 | 240 | 60 | 880 | 8.2 | 142 | .5 | 750 | 1,500 | .30 | .012 |
| 14 | 31,000 | 7,300 | 78,000 | 750 | 12 | .5 | 200 | 190,000 | <.10 | 1,200 |
| 15 | 4.0 | 4.0 | 1,500 | 6.3 | 213 | <.5 | 290 | 2,100 | .50 | 3.6 |
| 16 | 19 | 6.8 | 150 | 2.7 | 179 | <.5 | 210 | 26 | 1.0 | .11 |
| 17 | 92 | 18 | 190 | 4.1 | 221 | <.5 | 270 | 200 | .30 | .44 |
| 18 | 180 | 30 | 800 | 14 | 181 | <0.5 | 280 | 1,400 | 0.40 | 2.6 |
| 19 | 170 | 49 | 930 | 10 | 127 | <.02 | 400 | 1,400 | .40 | 3.9 |
| 20 | 130 | 39 | 110 | 2.8 | 194 | <.5 | 610 | 12 | 1.0 | .17 |
| 21 | 72 | 21 | 5.4 | 1.0 | 292 | <.5 | 3.7 | 1.4 | .20 | <.010 |
| 22 | 80 | 22 | 13 | .90 | 220 | <.5 | 32 | 46 | .10 | .18 |
| 23 | 400 | 120 | 200 | 4.5 | 152 | <.5 | 1,900 | 58 | .90 | .23 |
| " | 430 | 130 | 200 | 4.6 | 64 | <.5 | 1,800 | 47 | .80 | .18 |
| 24 | 110 | 32 | 180 | 6.8 | 205 | <.5 | 540 | 70 | .40 | .17 |

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, nitrite, dissolved (mg/L as N) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 16 | 286 | -- | <.100 | .360 | <10 | 1 | -- | 80 | 1,000 |
| 2 | 17 | 572 | <.010 | .400 | .390 | <10 | <1 | -- | 100 | 290 |
| 3 | 8.3 | 2,260 | -- | -- | -- | <10 | <1 | <100 | 700 | 1,800 |
| 4 | 16 | 227 | <.010 | <.100 | .260 | <10 | 4 | -- | 70 | 890 |
| 5 | 12 | 286 | <.010 | <.100 | .530 | <10 | <1 | -- | 140 | 84 |
| 6 | 19 | 184 | <.010 | <.100 | .230 | <10 | <1 | -- | <10 | 840 |
| 7 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 8 | 9.2 | 533 | -- | .630 | .090 | 20 | <1 | -- | 70 | 11 |

Table 30.--Physical and chemical characteristics for ground water in Midland County--Continued

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, nitrite, dissolved (mg/L as N) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 9 | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1,000 |
| " | 7.3 | 2,140 | -- | 0.580 | 0.500 | <10 | <1 | -- | 400 | 620 |
| 10 | 9.6 | 1,250 | -- | -- | -- | 10 | <1 | 8 | 430 | 720 |
| 11 | 14 | 395 | <0.010 | <.100 | .520 | <10 | 1 | -- | 180 | 760 |
| 12 | 7.6 | -- | <.010 | <.100 | 1.20 | <10 | <1 | -- | 1,200 | 30 |
| 13 | 8.4 | 3,250 | <.010 | <.100 | 1.30 | 10 | <1 | -- | 530 | 1,200 |
| 14 | -- | 297,000 | -- | -- | -- | 770 | <1 | 2,300 | 2,300 | 100,000 |
| 15 | 11 | 3,890 | -- | <.100 | 1.50 | <10 | <1 | -- | 930 | 70 |
| 16 | 8.8 | 640 | <.010 | <.100 | .460 | <10 | <1 | -- | 490 | 840 |
| 17 | 11 | 894 | -- | <.100 | .600 | <10 | <1 | -- | 550 | 1,600 |
| 18 | 6.2 | 3,450 | <0.010 | <0.100 | 1.50 | <10 | <1 | -- | 1,800 | 2,300 |
| 19 | 7.4 | 3,290 | -- | -- | -- | <10 | <1 | <100 | 820 | 960 |
| 20 | 13 | 1,030 | -- | <.100 | 1.20 | <10 | 7 | -- | 290 | 960 |
| 21 | 17 | 282 | -- | <.100 | .120 | <10 | 2 | -- | 20 | 1,200 |
| 22 | 14 | 348 | -- | .800 | .060 | <10 | 3 | -- | 20 | 25 |
| 23 | 11 | 2,600 | <.010 | <.100 | .990 | 10 | 5 | -- | 350 | 1,600 |
| " | 11 | 2,800 | <.010 | <.100 | -- | <10 | 7 | -- | 330 | 1,500 |
| 24 | 7.1 | 1,060 | -- | <.100 | .810 | <10 | <1 | -- | 860 | 790 |

| Well number | Iron, ferrous, dissolved (µg/L as Fe) | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | Tritium, total (pCi/L) | C-13/C-12 stable-isotope ratio, (per mil) | Carbon-14 (percent modern) | H-2/H-1 stable-isotope ratio, (per mil) | O-18/O-16 stable-isotope ratio, (per mil) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | -- | 12 | 14 | 740 | 90 | -- | -- | -- | -59.5 | -8.90 |
| 2 | -- | 16 | 380 | 1,400 | 68 | -- | -- | -- | -65.0 | -9.60 |
| 3 | -- | 80 | 46 | 1,200 | <10 | <2.5 | -10.50 | <1.1 | -99.5 | -14.25 |
| 4 | -- | 8 | 19 | 720 | 13 | -- | -14.20 | -- | -60.5 | -9.00 |
| 5 | -- | 7 | 6 | 890 | 64 | -- | -- | -- | -76.5 | -11.30 |
| 6 | -- | 10 | 29 | 81 | 33 | -- | -- | -- | -66.5 | -10.00 |
| 7 | -- | -- | -- | -- | -- | -- | -- | -- | -93.5 | -13.30 |
| 8 | -- | 9 | 93 | 710 | 22 | -- | -16.10 | -- | -56.5 | -8.70 |
| 9 | 850 | -- | -- | -- | -- | <2.5 | -10.70 | 6.2 | -- | -- |
| " | -- | 80 | 40 | 3,700 | 170 | -- | -11.50 | -- | -71.5 | -10.50 |

Table 30.--Physical and chemical characteristics for ground water in Midland County--Continued

| Well number | Iron, ferrous, dissolved (µg/L as Fe) | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | Tritium, total (pCi/L) | C-13/ C-12 stable-isotope ratio, (per mil) | Carbon-14 (percent modern) | H-2/ H-1 stable-isotope ratio, (per mil) | O-18/ O-16 stable-isotope ratio, (per mil) |
|---|---|---|---|---|---|---|---|---|---|---|
| 10 | -- | 59 | 55 | 3,400 | 16 | -- | -10.80 | -- | -72.5 | -10.60 |
| 11 | -- | 14 | 11 | 1,200 | 88 | -- | -- | -- | -98.0 | -14.00 |
| 12 | -- | 110 | <10 | 60 | 90 | -- | -- | -- | -99.5 | -14.20 |
| 13 | -- | 110 | 50 | 3,900 | 90 | -- | -- | -- | -85.0 | -12.20 |
| 14 | 95,000 | 2,600 | 15,000 | 350,000 | 930 | -- | -18.80 | -- | -29.5 | -1.85 |
| 15 | -- | 70 | <10 | 70 | 20 | -- | -- | -- | -72.0 | -10.60 |
| 16 | -- | 27 | 10 | 360 | 10 | -- | -- | -- | -87.0 | -12.50 |
| 17 | -- | 56 | 29 | 950 | 11 | -- | -- | -- | -77.0 | -11.20 |
| 18 | -- | 160 | 50 | 4,600 | 210 | -- | -- | -- | -67.5 | -10.00 |
| 19 | 900 | 100 | 17 | 3,000 | 20 | -- | -- | -- | -84.0 | -12.05 |
| 20 | -- | 5 | 34 | 3,000 | 370 | -- | -- | -- | -82.5 | -11.90 |
| 21 | -- | 10 | 50 | 150 | 31 | -- | -13.60 | -- | -66.0 | -9.80 |
| 22 | -- | 9 | 66 | 110 | 9 | -- | -- | -- | -67.5 | -9.90 |
| 23 | -- | 20 | 130 | 8,900 | 80 | -- | -- | -- | -97.0 | -13.90 |
| " | -- | 20 | 150 | 8,800 | 70 | -- | -- | -- | -63.0 | -9.35 |
| 24 | -- | 37 | 44 | 2,000 | 270 | -- | -- | -- | -89.0 | -12.70 |

| Well number | S-34/ S-32 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|
| 1 | -- | 3.3 |
| 2 | -- | 1.1 |
| 3 | 15.40 | .8 |
| 4 | -- | 2.7 |
| 5 | -- | 1.4 |
| 6 | -- | 6.0 |
| 7 | -- | -- |
| 8 | -- | 10 |
| 9 | 15.10 | -- |
| " | -- | .7 |
| 10 | -- | 1.0 |
| 11 | -- | -- |
| 12 | -- | .3 |

Table 30.--Physical and chemical characteristics for ground water in Midland County--Continued

| Well number | S-34/ S-32 stable-isotope ratio, (per mil) | Carbon, organic, dis-solved (mg/L as C) |
|---|---|---|
| 13 | -- | .5 |
| 14 | -- | 0.6 |
| 15 | -- | .6 |
| 16 | -- | 1.5 |
| 17 | -- | 1.2 |
| 18 | -- | 0.2 |
| 19 | -- | 2.9 |
| 20 | -- | 3.0 |
| 21 | -- | 2.3 |
| 22 | -- | 1.7 |
| 23 | -- | 2.0 |
| " | -- | 1.4 |
| 24 | -- | 1.3 |

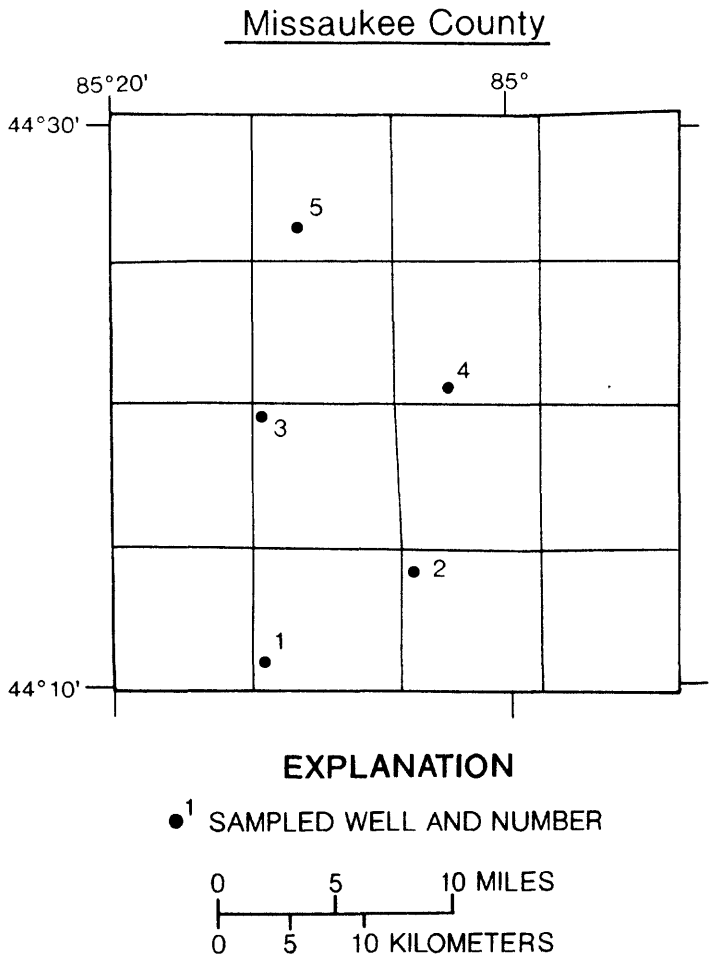


Table 31.--Physical and chemical characteristics for ground water in Missaukee County

[Analyses by U.S. Geological Survey. Geologic unit: 112SAND, sand; 112SDGV, sand and gravel. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 44°11'27"N | 85°12'45"W | 7-13-87 | 112SDGV | 90 | 427 | 7.53 | 11.0 | 6.2 |
| 2 | 44°14'38"N | 85°05'16"W | 7-14-87 | 112SAND | 180 | 274 | 7.87 | 12.0 | 2.6 |
| 3 | 44°20'20"N | 85°12'58"W | 7-13-87 | 112SAND | 93 | 379 | 7.49 | 11.5 | 1.0 |

Table 31.--Physical and chemical characteristics for ground water in Missaukee County--Continued

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 4 | 44°21'19"N | 85°03'23"W | 8-26-86 | 112SAND | 309 | 254 | 7.69 | 9.0 | -- |
| 5 | 44°27'13"N | 85°10'58"W | 7-14-87 | 112SAND | 253 | 290 | 7.92 | 9.5 | 8.0 |

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 71 | 19 | 3.6 | 1.1 | 211 | -- | 16 | 8.9 | <0.10 | 0.026 |
| 2 | 42 | 12 | 3.2 | .60 | 179 | -- | 3.9 | 1.0 | <.10 | .012 |
| 3 | 54 | 10 | 13 | 2.9 | 250 | -- | 7.8 | 21 | <.10 | .013 |
| 4 | 38 | 9.0 | 1.0 | .40 | 125 | <0.5 | 8.0 | .50 | <.10 | .010 |
| 5 | 48 | 13 | 1.8 | .50 | 168 | -- | 9.8 | .70 | <.10 | .012 |

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, nitrite, dissolved (mg/L as N) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 11 | 254 | -- | -- | -- | <10 | <1 | <100 | 10 | 8 |
| 2 | 11 | 162 | -- | -- | -- | <10 | 6 | 12 | <10 | 10 |
| 3 | 6.2 | 239 | -- | -- | -- | <10 | <1 | <100 | 20 | 240 |
| 4 | 7.7 | 140 | <0.010 | 0.950 | <0.010 | <10 | <1 | -- | <10 | <3 |
| 5 | 10 | 173 | -- | -- | -- | <10 | 13 | 9 | <10 | 7 |

| Well number | Iron, ferrous, dissolved (µg/L as Fe) | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | H-2/H-1 stable-isotope ratio, (per mil) | O-18/O-16 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|---|---|---|---|---|
| 1 | -- | <10 | <1 | 52 | 20 | -77.0 | -11.40 | 1.2 |
| 2 | <20 | 4 | 6 | 50 | 130 | -74.5 | -11.10 | 1.0 |
| 3 | 240 | <10 | 78 | 59 | 10 | -47.5 | -6.00 | 2.5 |
| 4 | -- | <4 | <1 | 25 | 330 | -- | -- | .7 |
| 5 | <20 | 7 | 5 | 44 | 270 | -82.5 | -12.00 | 1.2 |

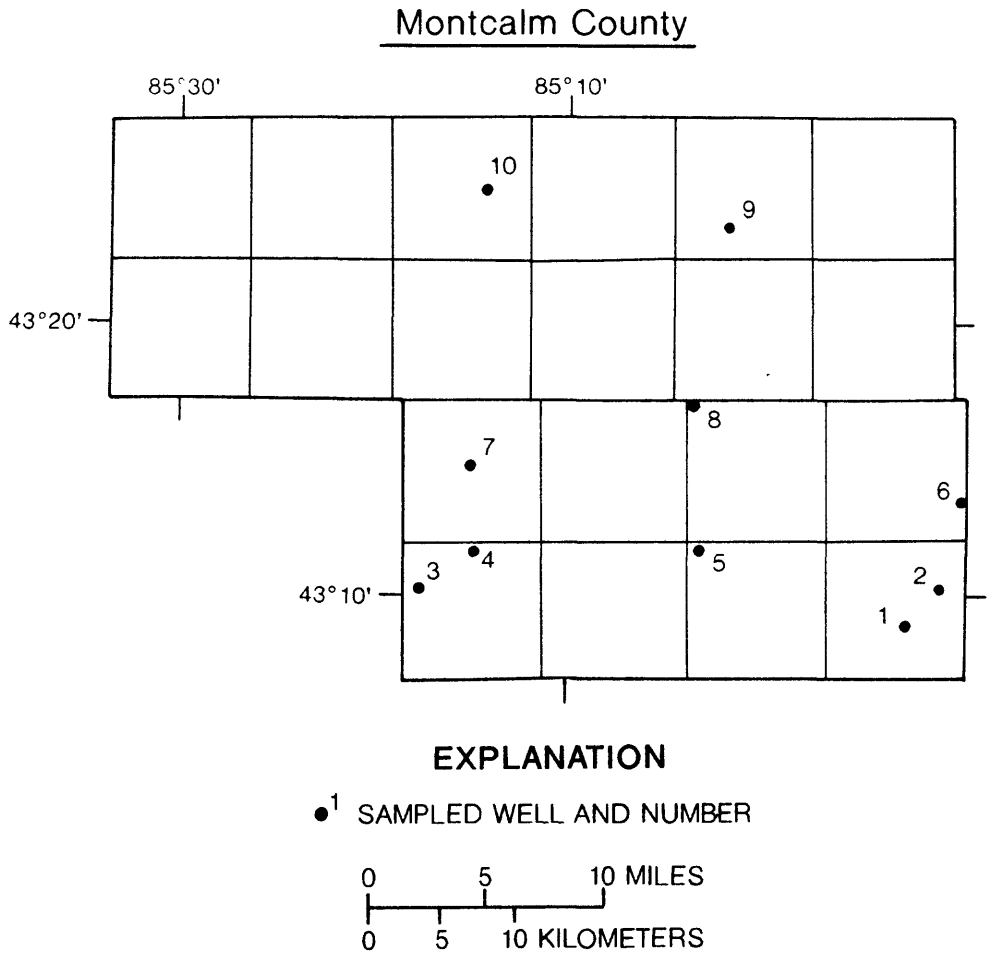


Table 32.--Physical and chemical characteristics for ground water in Montcalm County

[Analyses by U.S. Geological Survey. Geologic unit: 112SAND, sand; 112SDGV, sand and gravel; 324SGNW, Saginaw Formation. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 43°09'37"N | 84°53'42"W | 7-24-86 | 324SGNW | 360 | 765 | 7.44 | 12.0 | 1.8 |
| 2 | 43°11'04"N | 84°51'53"W | 12-08-87 | 324SGNW | 361 | 3,220 | 7.38 | 10.0 | 0 |
| 3 | 43°11'05"N | 85°18'30"W | 6-17-87 | 112SAND | 200 | 612 | 7.50 | 13.0 | 6.3 |

Table 32.--Physical and chemical characteristics for ground water in Montcalm County--Continued

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 4 | 43°12'24"N | 85°15'50"W | 7-24-86 | 324SGNW | 500 | 4,050 | 7.25 | 12.0 | 0.5 |
| 5 | 43°12'28"N | 85°04'15"W | 8-19-86 | 112SDGV | 150 | 719 | 7.20 | 10.0 | .5 |
| 6 | 43°14'16"N | 84°50'11"W | 6-29-88 | 324SGNW | 417 | 1,920 | 7.43 | 12.0 | .2 |
| 7 | 43°15'38"N | 85°15'54"W | 6-17-87 | 112SAND | 233 | 632 | 7.71 | 12.0 | .3 |
| 8 | 43°17'47"N | 85°04'30"W | 6-17-87 | 112SAND | 167 | 491 | 7.66 | 11.5 | .5 |
| 9 | 43°24'22"N | 85°02'43"W | 8-19-86 | 112SDGV | 97 | 527 | 7.20 | 11.5 | 6.7 |
| 10 | 43°25'56"N | 85°15'06"W | 6-18-87 | 112SDGV | 122 | 456 | 7.43 | 11.0 | .9 |

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 99 | 28 | 29 | 2.1 | 278 | <0.5 | 150 | 14 | 0.60 | 0.038 |
| 2 | 500 | 62 | 240 | 5.7 | 123 | .07 | 1,400 | 320 | .50 | -- |
| 3 | 87 | 31 | 4.7 | .80 | 232 | -- | 57 | 25 | .10 | .053 |
| 4 | 550 | 90 | 280 | 12 | 111 | <.5 | 1,800 | 190 | .80 | 1.3 |
| 5 | 92 | 27 | 24 | 1.4 | 288 | <.5 | 30 | 65 | .20 | .041 |
| 6 | 2.5 | .5 | 460 | 1.2 | 203 | -- | 730 | 90 | .60 | .33 |
| 7 | 81 | 22 | 34 | 1.3 | 386 | -- | 110 | 13 | .30 | .024 |
| 8 | 71 | 23 | 4.1 | .70 | 408 | -- | 26 | 17 | .10 | .065 |
| 9 | 73 | 24 | 9.5 | 1.4 | 241 | <.5 | 25 | 17 | .10 | .027 |
| 10 | 68 | 21 | 4.0 | .60 | 225 | -- | 24 | 9.3 | .10 | .042 |

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) | Iron, ferrous, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 16 | 493 | <0.100 | 0.610 | <10 | <1 | -- | 100 | 2,200 | -- |
| 2 | 13 | 2,780 | -- | -- | 10 | <1 | <100 | 450 | 6,500 | 6,500 |
| 3 | 11 | 415 | -- | -- | <10 | <1 | 26 | <10 | 13 | <20 |
| 4 | 15 | 3,440 | <.100 | 2.20 | 10 | 2 | -- | 680 | 2,500 | -- |
| 5 | 17 | 436 | <.100 | .400 | <10 | <1 | -- | 20 | 1,900 | -- |
| 6 | 7.8 | 1,360 | -- | -- | <10 | <1 | <100 | 440 | 12 | -- |
| 7 | 17 | 431 | -- | -- | <10 | <1 | 27 | 60 | 1,100 | 1,100 |

Table 32.--Physical and chemical characteristics for ground water in Montcalm County--Continued

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) | Iron, ferrous, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 8 | 14 | 296 | -- | -- | <10 | 1 | 34 | <10 | 380 | 250 |
| 9 | 11 | 277 | 3.50 | 0.040 | <10 | <1 | -- | 50 | 5 | -- |
| 10 | 11 | 269 | -- | -- | 30 | <1 | 34 | 20 | 140 | 140 |

| Well number | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | C-13/ C-12 stable-isotope ratio, (per mil) | H-2/ H-1 stable-isotope ratio, (per mil) | O-18/ O-16 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|---|---|---|---|---|
| 1 | 20 | 29 | 1,100 | 25 | -15.70 | -64.5 | -9.50 | 1.8 |
| 2 | 80 | 100 | 4,900 | 190 | -12.80 | -70.0 | -10.35 | 1.2 |
| 3 | 7 | 5 | 65 | 200 | -- | -66.0 | -10.10 | 2.2 |
| 4 | 120 | 90 | 7,000 | 990 | -14.00 | -70.5 | -10.00 | 1.2 |
| 5 | 9 | 35 | 170 | 19 | -- | -63.0 | -9.60 | 2.8 |
| 6 | <10 | <1 | 45 | <10 | -- | -- | -9.55 | 4.1 |
| 7 | 11 | 51 | 1,000 | 7 | -- | -64.0 | -9.80 | 2.6 |
| 8 | 7 | 46 | 80 | 21 | -- | -67.5 | -10.20 | 2.2 |
| 9 | 6 | 1 | 62 | 9 | -- | -68.0 | -10.50 | 1.0 |
| 10 | 6 | 16 | 65 | 12 | -- | -67.5 | -10.20 | 4.4 |

## Muskegon County

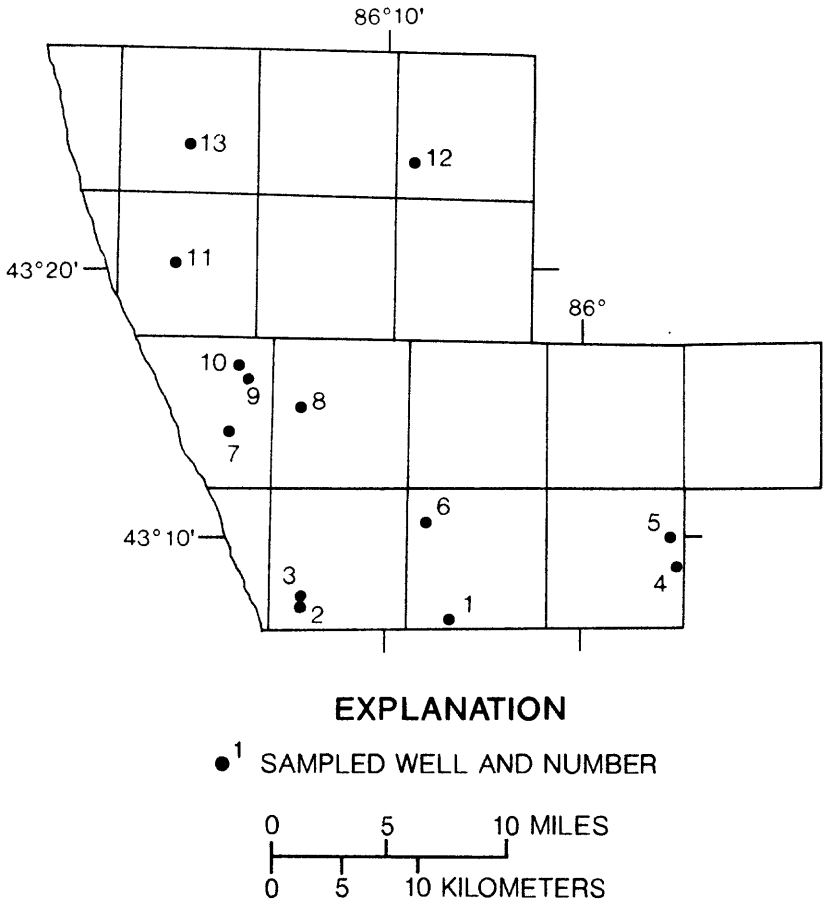


Table 33.--Physical and chemical characteristics for ground water in Muskegon County

[Analyses by U.S. Geological Survey. Geologic unit: 112SAND, sand; 333MCGN, Michigan Formation; 337MRSL, Marshall Sandstone. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter; pCi/L, picocuries per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 43°07'57"N | 86°07'00"W | 6-25-87 | 337MRSL | 195 | 3,290 | 7.69 | 16.0 | 0.7 |
| 2 | 43°08'27"N | 86°14'47"W | 7-02-86 | 112SAND | 25 | 439 | 7.35 | 12.5 | 0 |

Table 33.--Physical and chemical characteristics for ground water in Muskegon County--Continued

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 43°08'40"N | 86°14'41"W | 7-02-86 | 337MRSL | 225 | 1,950 | 7.69 | 16.0 | 0.3 |
| 4 | 43°09'58"N | 85°54'30"W | 7-01-86 | 112SAND | 154 | 413 | 7.81 | 16.0 | .9 |
| 5 | 43°10'55"N | 85°55'35"W | 7-01-86 | 112SAND | 164 | 687 | 7.61 | 11.0 | .5 |
| 6 | 43°11'30"N | 86°08'12"W | 6-25-87 | 112SAND | 28 | 230 | 8.30 | 13.5 | 3.5 |
| 7 | 43°14'45"N | 86°18'26"W | 7-08-87 | 337MRSL | 238 | 1,620 | 7.79 | 12.5 | 0 |
| " | " | " | 5-12-88 | " | " | 1,700 | -- | 12.5 | -- |
| 8 | 43°15'47"N | 86°14'34"W | 6-28-88 | 337MRSL | 204 | 3,780 | 7.54 | 13.5 | 0 |
| 9 | 43°16'44"N | 86°17'35"W | 6-25-87 | 337MRSL | 254 | 1,220 | 7.85 | 14.0 | .6 |
| 10 | 43°16'49"N | 86°17'50"W | 6-25-87 | 337MRSL | 262 | 1,160 | 7.84 | 11.5 | .1 |
| 11 | 43°20'58"N | 86°21'21"W | 7-20-88 | 337MRSL | 275 | 2,070 | 7.81 | 12.0 | 0 |
| 12 | 43°24'38"N | 86°09'00"W | 6-21-88 | 337MRSL | 501[a] | 54,900 | 6.68 | 16.0 | -- |
| " | " | " | " | " | 427[a] | 666 | 7.88 | 18.0 | -- |
| " | " | " | " | " | " | 984 | 7.47 | 18.0 | -- |
| " | " | " | 6-18-88 | " | 442[a] | 24,000 | 6.79 | 13.5 | -- |
| " | " | " | " | 333MCGN[b] | 366[a] | 1,450 | 7.90 | 13.0 | -- |
| 13 | 43°25'17"N | 86°20'36"W | 6-26-87 | 112SAND | 152 | 316 | 8.03 | 11.0 | .6 |

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 100 | 27 | 550 | 7.5 | 172 | -- | 240 | 920 | 1.1 | 4.5 |
| 2 | 55 | 15 | 16 | 1.2 | 202 | <0.5 | 36 | 24 | .10 | .020 |
| 3 | 72 | 30 | 320 | 6.5 | 166 | <.5 | 92 | 510 | .50 | 2.9 |
| 4 | 35 | 16 | 38 | 1.1 | 190 | <.5 | 41 | 3.6 | .70 | <.010 |
| 5 | 75 | 30 | 49 | 2.2 | 347 | .7 | 57 | 12 | .40 | .021 |
| 6 | 29 | 7.5 | 7.6 | 1.3 | 80 | -- | 19 | 12 | .10 | .013 |
| 7 | 73 | 26 | 230 | 5.2 | 203 | .06 | 64 | 440 | .50 | 2.4 |
| " | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 8 | 180 | 64 | 490 | 9.6 | 159 | <.02 | 130 | 1,100 | .50 | 6.8 |
| 9 | 47 | 18 | 160 | 4.5 | 198 | -- | 22 | 270 | .70 | 1.2 |
| 10 | 44 | 17 | 160 | 4.0 | 190 | <.02 | 14 | 260 | .70 | 1.2 |
| 11 | 90 | 30 | 310 | 4.7 | 198 | <.02 | 75 | 580 | .40 | 3.6 |
| 12 | 3,400 | 960 | 10,000 | 10 | 232 | .02 | 1,900 | 25,000 | .20 | 150 |
| " | 45 | 13 | 110 | 3.9 | 214 | .02 | 87 | 72 | .90 | .38 |
| " | 36 | 16 | 150 | 4.2 | 236 | -- | 66 | 140 | 2.3 | .81 |

Table 33.--Physical and chemical characteristics for ground water in Muskegon County--Continued

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 12 | 1,400 | 350 | 4,000 | 54 | 157 | 0.04 | 1,500 | 8,600 | 0.40 | 56 |
| " | 140 | 19 | 240 | 8.7 | 202 | .04 | 650 | 83 | 1.0 | .64 |
| 13 | 31 | 12 | 22 | .70 | 174 | .02 | 8.7 | 19 | .40 | .13 |

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) | Iron, ferrous, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 9.7 | 1,970 | -- | -- | 40 | 1 | <100 | 1,800 | 680 | 600 |
| 2 | 14 | 301 | <0.100 | 0.380 | 20 | <1 | -- | 30 | 2,700 | -- |
| 3 | 9.5 | 1,180 | <.100 | 1.00 | <10 | 4 | -- | 1,200 | 2,300 | -- |
| 4 | 17 | 265 | <.100 | .830 | <10 | <1 | -- | 200 | 130 | -- |
| 5 | 17 | 450 | <.100 | 1.90 | <10 | <1 | -- | 220 | 500 | -- |
| 6 | 7.6 | 145 | -- | -- | <10 | <1 | 19 | 30 | 6 | <20 |
| 7 | 11 | 953 | -- | -- | <10 | 3 | 41 | 910 | 1,300 | 1,100 |
| " | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 8 | 10 | 2,320 | -- | -- | <10 | 3 | <100 | 1,500 | 2,100 | -- |
| 9 | 10 | 640 | -- | -- | <10 | 2 | 110 | 660 | 200 | 170 |
| 10 | 10 | 613 | -- | -- | <10 | 2 | 240 | 560 | 1,000 | 950 |
| 11 | 12 | 1,290 | -- | -- | <10 | <1 | <100 | 930 | 1,600 | 1,600 |
| 12 | 6.2 | 45,600 | -- | -- | 50 | <1 | 200 | 6,300 | 22,000 | 1,000 |
| " | 10 | 472 | -- | -- | <10 | <1 | 750 | 710 | 190 | -- |
| " | 10 | 554 | -- | -- | <10 | <1 | 530 | 630 | 11 | -- |
| " | 8.3 | 17,000 | -- | -- | 10 | <1 | <100 | 4,600 | 5,400 | 2,700 |
| " | 7.4 | 1,240 | -- | -- | <10 | 3 | 310 | 2,100 | 1,400 | 70 |
| 13 | 14 | 189 | -- | -- | <10 | <1 | 38 | 80 | 210 | 200 |

| Well number | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | Tritium, total (pCi/L) | Radium-226, dissolved, radon method (pCi/L) | Radium-228, dissolved (pCi/L as Ra-228) | Uranium, natural dissolved (µg/L as U) | C-13/C-12 stable-isotope ratio, (per mil) | Carbon-14 (percent modern) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 90 | 29 | 8,300 | 80 | -- | -- | -- | -- | -18.70 | -- |
| 2 | 6 | 61 | 200 | 17 | -- | -- | -- | -- | -12.10 | -- |

Table 33.--Physical and chemical characteristics for ground water in Muskegon County--Continued

| Well number | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | Tritium, total (pCi/L) | Radium-226, dissolved, radon method (pCi/L) | Radium-228, dissolved (pCi/L as Ra-228) | Uranium, natural dissolved (µg/L as U) | C-13/C-12 stable-isotope ratio, (per mil) | Carbon-14 (percent modern) |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 60 | 70 | 2,600 | 220 | -- | -- | -- | -- | -13.20 | -- |
| 4 | 10 | 8 | 1,000 | 17 | -- | -- | -- | -- | -- | -- |
| 5 | 11 | 31 | 1,600 | 21 | -- | -- | -- | -- | -17.90 | -- |
| 6 | 6 | <1 | 44 | 17 | -- | -- | -- | -- | -11.70 | -- |
| 7 | 41 | 41 | 2,000 | 17 | -- | -- | -- | -- | -15.70 | -- |
| " | -- | -- | -- | -- | <2.5 | -- | -- | -- | -- | 4.0 |
| 8 | 100 | 89 | 5,900 | 20 | -- | -- | -- | -- | -- | -- |
| 9 | 35 | 21 | 1,600 | 700 | -- | -- | -- | -- | -18.60 | -- |
| 10 | 30 | 24 | 1,500 | 74 | -- | -- | -- | -- | -18.90 | -- |
| 11 | 40 | 52 | 6,800 | 90 | -- | -- | -- | -- | -- | -- |
| 12 | 1,200 | 1,700 | 75,000 | 1,000 | -- | -- | -- | -- | -- | -- |
| " | 18 | 34 | 1,100 | 14 | 1.6 | 0.18 | <1.0 | 0.17 | -10.90 | 12.2 |
| " | 21 | <1 | 1,300 | 3 | <2.5 | .16 | <1.0 | .13 | -10.60 | -- |
| " | 450 | 540 | 32,000 | 230 | <2.5 | -- | -- | .43 | -14.70 | 13.9 |
| " | 57 | 58 | 2,200 | 180 | <2.5 | .05 | <1.0 | .26 | -12.50 | 10.0 |
| 13 | 8 | 15 | 600 | 17 | -- | -- | -- | -- | -- | -- |

| Well number | H-2/H-1 stable-isotope ratio, (per mil) | O-18/O-16 stable-isotope ratio, (per mil) | S-34/S-32 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|---|
| 1 | -78.0 | -11.60 | -- | 1.0 |
| 2 | -65.0 | -10.20 | -- | 11 |
| 3 | -110.0 | -15.80 | -- | 3.5 |
| 4 | -67.5 | -10.30 | -- | 2.0 |
| 5 | -62.0 | -9.70 | -- | 3.6 |
| 6 | -67.5 | -10.50 | -- | 1.5 |
| 7 | -95.9 | -13.40 | -- | 1.6 |
| " | -- | -- | 30.70 | -- |
| 8 | -98.0 | -13.85 | -- | 2.5 |
| 9 | -83.5 | -12.40 | -- | 2.4 |
| 10 | -80.5 | -11.60 | -- | 2.2 |
| 11 | -- | -14.00 | -- | -- |
| 12 | -91.0 | -12.80 | -- | -- |

Table 33.--Physical and chemical characteristics for ground water in Muskegon County--Continued

| Well number | H-2/ H-1 stable-isotope ratio, (per mil) | O-18/ O-16 stable-isotope ratio, (per mil) | S-34/ S-32 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|---|
| 12 | -68.5 | -10.40 | 19.80 | -- |
| " | -68.5 | -10.45 | 20.10 | -- |
| " | -76.5 | -11.25 | 19.50 | -- |
| " | 69.0 | -10.35 | 20.40 | -- |
| 13 | -74.5 | -11.30 | -- | 0.9 |

[a] Depth represents top of sampled interval.

[b] Composite sample from the Jurassic "Red Beds" and the Michigan Formation.

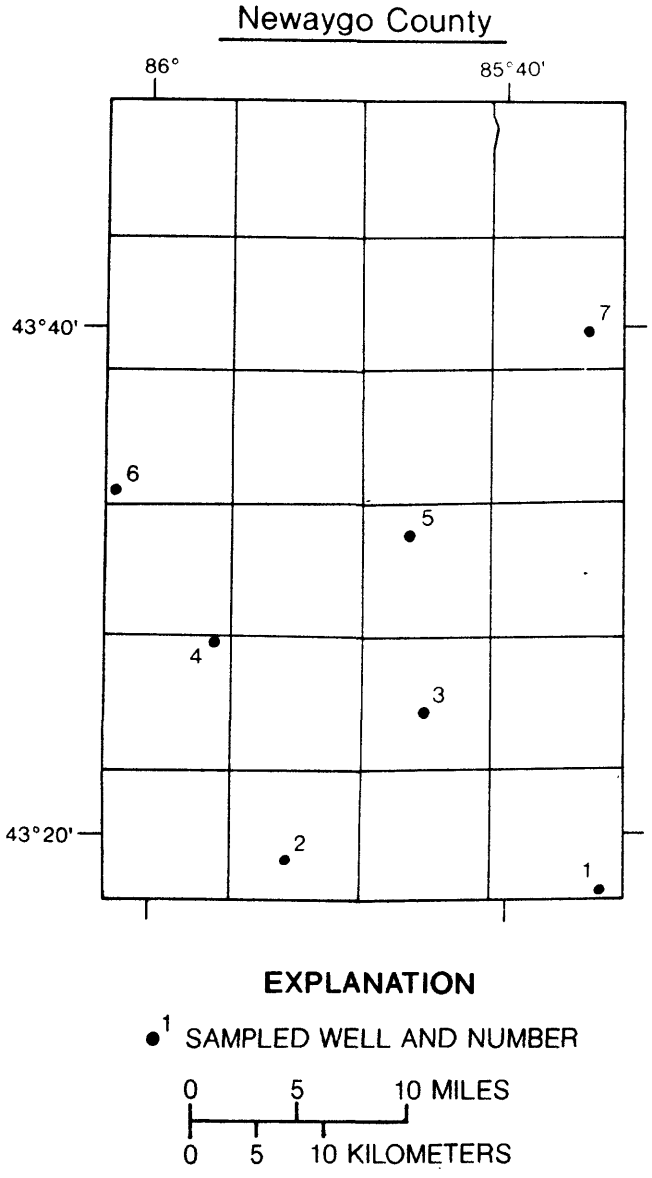


Table 34.--Physical and chemical characteristics for ground water in Newaygo County

[Analyses by U.S. Geological Survey. Geologic unit: 112SAND, sand; 112SDGV, sand and gravel; 324SGNW, Saginaw Formation. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 43°18'30"N | 85°35'20"W | 6-18-87 | 112SAND | 216 | 326 | 7.90 | 12.0 | 8.4 |
| 2 | 43°19'43"N | 85°52'36"W | 7-08-87 | 112SAND | 233 | 541 | 7.86 | 12.0 | 0 |
| 3 | 43°25'24"N | 85°45'07"W | 7-29-86 | 324SGNW | 321 | 637 | 7.44 | 11.0 | .6 |

Table 34.--Physical and chemical characteristics for ground water in Newaygo County--Continued

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 4 | 43°28'11"N | 85°56'44"W | 7-29-86 | 112SAND | 108 | 576 | 7.25 | 10.5 | 2.1 |
| 5 | 43°32'50"N | 85°45'50"W | 8-20-86 | 112SDGV | 94 | 403 | 7.50 | 11.0 | 1.9 |
| 6 | 43°34'08"N | 86°02'10"W | 7-08-87 | 112SAND | 137 | 612 | 7.45 | 12.0 | .5 |
| 7 | 43°40'25"N | 85°36'05"W | 6-23-87 | 112SAND | 209 | 309 | 7.91 | 12.0 | 9.6 |

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 44 | 16 | 1.9 | 0.40 | 376 | <0.02 | 13 | 1.0 | 0.10 | <0.010 |
| 2 | 66 | 26 | 22 | 1.8 | 392 | .03 | 3.2 | 1.4 | .50 | <.010 |
| 3 | 110 | 17 | 17 | 1.5 | 189 | <.5 | 160 | 11 | .80 | .047 |
| 4 | 82 | 30 | 7.3 | .90 | 288 | <.5 | 34 | 12 | .20 | .050 |
| 5 | 51 | 18 | 8.5 | 1.0 | 186 | <.5 | 24 | 10 | .20 | .048 |
| 6 | 85 | 28 | 17 | 1.5 | 310 | -- | 66 | 22 | .30 | .050 |
| 7 | 42 | 17 | 1.5 | .40 | 212 | -- | 14 | 1.1 | <.10 | <.010 |

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) | Iron, ferrous, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 10 | 174 | -- | -- | <10 | <1 | 18 | 20 | 5 | -- |
| 2 | 17 | 322 | -- | -- | 30 | <1 | 140 | 150 | 3,400 | 1,900 |
| 3 | 13 | 443 | <0.100 | 0.370 | <10 | <1 | -- | 170 | 810 | -- |
| 4 | 14 | 351 | .980 | .060 | <10 | <1 | -- | 10 | 61 | -- |
| 5 | 11 | 237 | .270 | .140 | <10 | 2 | -- | 20 | 410 | -- |
| 6 | 14 | 393 | -- | -- | <10 | <1 | 63 | 60 | 380 | -- |
| 7 | 8.1 | 202 | -- | -- | <10 | <1 | 17 | 10 | 4 | <20 |

Table 34.--Physical and chemical characteristics for ground water in Newaygo County--Continued

| Well number | Lithium dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | H-2/H-1 stable-isotope ratio, (per mil) | O-18/O-16 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|---|---|---|---|
| 1 | 5 | <1 | 36 | 130 | -67.5 | -10.30 | 2.1 |
| 2 | <4 | 47 | 1,800 | 19 | -68.0 | -10.10 | 2.9 |
| 3 | 17 | 10 | 900 | 9 | -61.5 | -9.20 | 1.1 |
| 4 | 11 | 62 | 99 | 45 | -67.5 | -10.30 | 1.4 |
| 5 | 6 | 38 | 190 | 8 | -67.0 | -10.20 | 1.1 |
| 6 | <4 | 57 | 590 | 15 | -69.0 | -10.50 | 1.7 |
| 7 | 6 | <1 | 47 | 73 | -72.5 | -11.00 | 4.2 |

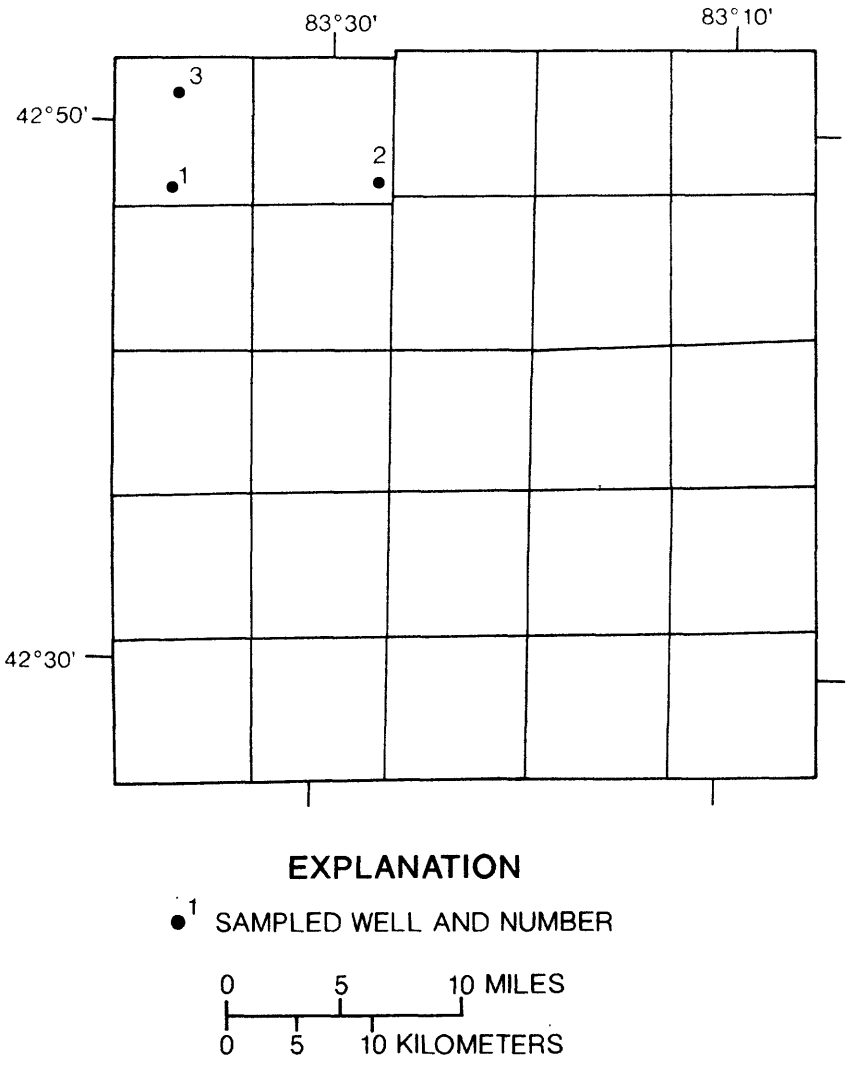


Table 35.--Physical and chemical characteristics for ground water in Oakland County

[Analyses by U.S. Geological Survey. Geologic unit: 112SDGV, sand and gravel; 337MRSL, Marshall Sandstone. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 42°48'09"N | 83°38'19"W | 7-30-86 | 337MRSL | 207 | 870 | 7.35 | 11.5 | 0.9 |
| 2 | 42°48'32"N | 83°27'57"W | 7-30-86 | 112SDGV | 54 | 258 | 7.84 | 14.5 | 5.3 |
| 3 | 42°51'37"N | 83°38'05"W | 7-30-86 | 337MRSL | 300 | 553 | 7.32 | 11.0 | 1 |

Table 35.--Physical and chemical characteristics for ground water in Oakland County--Continued

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 81 | 30 | 58 | 1.8 | 309 | <0.5 | 43 | 79 | 0.60 | 0.088 |
| 2 | 38 | 11 | 1.7 | .50 | 123 | <.5 | 16 | 1.4 | <.10 | .011 |
| 3 | 79 | 31 | 8.5 | 1.5 | 333 | <.5 | 13 | 1.2 | .50 | .041 |

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 14 | 474 | <0.100 | 0.200 | <10 | 17 | 110 | 610 | 18 | 16 |
| 2 | 10 | 163 | .600 | .030 | <10 | <1 | 10 | 7 | 6 | 3 |
| 3 | 21 | 345 | <.100 | .130 | <10 | 39 | 40 | 680 | 16 | 10 |

| Well number | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | C-13/C-12 stable-isotope ratio, (per mil) | H-2/H-1 stable-isotope ratio, (per mil) | O-18/O-16 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|---|---|---|
| 1 | 1,200 | 12 | -- | -66.0 | -9.90 | 1.4 |
| 2 | 39 | 10 | -11.50 | -71.5 | -10.60 | .8 |
| 3 | 250 | 9 | -13.20 | -66.5 | -10.10 | 1.1 |

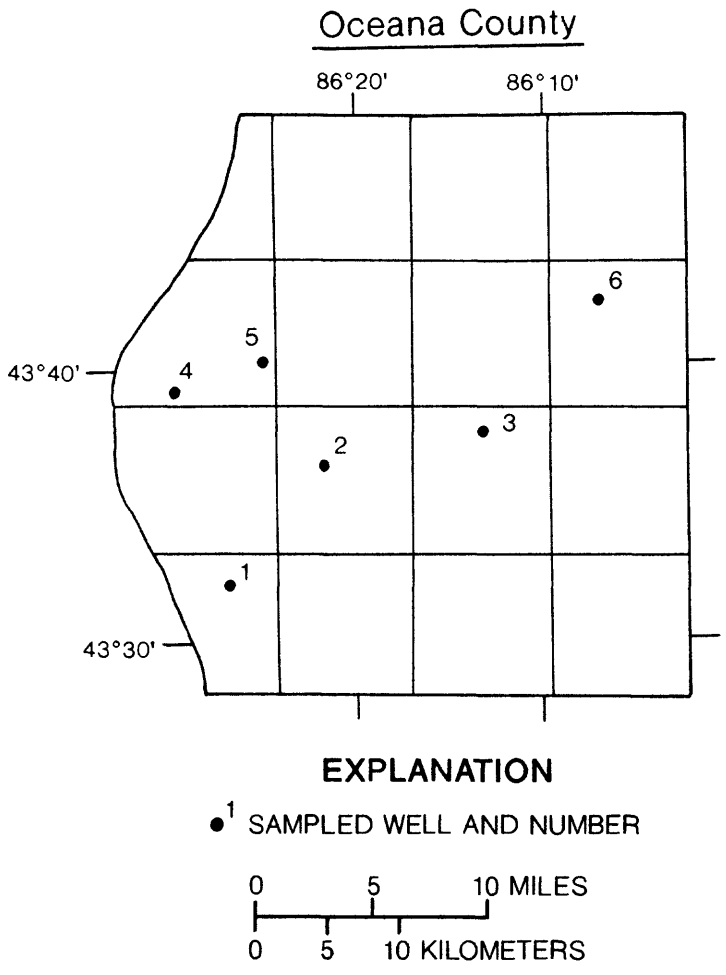


Table 36.--Physical and chemical characteristics for ground water in Oceana County

[Analyses by U.S. Geological Survey. Geologic unit: 112SAND, sand; 112SDGV, sand and gravel. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 43°32'45"N | 86°26'52"W | 7-28-86 | 112SAND | 106 | 270 | 7.99 | 10.5 | 7.8 |
| 2 | 43°37'00"N | 86°21'54"W | 7-28-86 | 112SDGV | 220 | 347 | 7.81 | 9.5 | 2.3 |
| 3 | 43°38'08"N | 86°13'30"W | 6-26-87 | 112SAND | 98 | 315 | 7.66 | 12.0 | 8.5 |

Table 36.--Physical and chemical characteristics for ground water in Oceana County--Continued

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 4 | 43°39'40"N | 86°29'40"W | 6-26-87 | 112SAND | 254 | 314 | 7.80 | 14.0 | 0.4 |
| 5 | 43°40'45"N | 86°25'00"W | 7-28-86 | 112SAND | 176 | 294 | 7.84 | 13.0 | 4.2 |
| 6 | 43°42'50"N | 86°07'24"W | 8-20-86 | 112SAND | 169 | 366 | 7.70 | 12.0 | .9 |

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 35 | 14 | 2.0 | 0.60 | 136 | <0.5 | 18 | 2.4 | <0.10 | 0.014 |
| 2 | 45 | 18 | 2.4 | .60 | 168 | <.5 | 20 | 1.5 | .10 | .014 |
| 3 | 42 | 16 | 2.5 | .60 | 154 | -- | 16 | 4.5 | <.10 | .010 |
| 4 | 47 | 18 | 2.5 | .60 | 187 | -- | 9.0 | .70 | .10 | <.010 |
| 5 | 35 | 14 | 2.8 | .70 | 137 | <.5 | 19 | 2.9 | .10 | .018 |
| 6 | 41 | 19 | 11 | 1.1 | 288 | <.5 | 17 | 7.4 | .50 | .018 |

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) | Iron, ferrous, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 8.9 | 157 | 0.510 | 0.020 | <10 | <1 | -- | 20 | 9 | -- |
| 2 | 10 | 190 | 1.70 | .020 | <10 | <1 | -- | <10 | 16 | -- |
| 3 | 10 | 191 | -- | -- | <10 | <1 | 11 | <10 | 6 | <20 |
| 4 | 12 | 194 | -- | -- | <10 | <1 | 32 | <10 | 260 | 260 |
| 5 | 9.6 | 165 | 2.00 | .020 | <10 | <1 | -- | 10 | 9 | -- |
| 6 | 14 | 222 | <.100 | .150 | <10 | <1 | -- | 40 | 410 | -- |

Table 36.--Physical and chemical characteristics for ground water in Oceana County--Continued

| Well number | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | H-2/H-1 stable-isotope ratio, (per mil) | O-18/O-16 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|---|---|---|---|
| 1 | <4 | 3 | 98 | 15 | -72.0 | -11.20 | 1.1 |
| 2 | <4 | 2 | 84 | 28 | -74.5 | -11.40 | .8 |
| 3 | 7 | <1 | 41 | 86 | -75.0 | -11.20 | .7 |
| 4 | 7 | 13 | 58 | 16 | -79.5 | -11.80 | .6 |
| 5 | <4 | <1 | 120 | 180 | -72.5 | -11.30 | .9 |
| 6 | 7 | 9 | 490 | 210 | -70.5 | -11.10 | .9 |

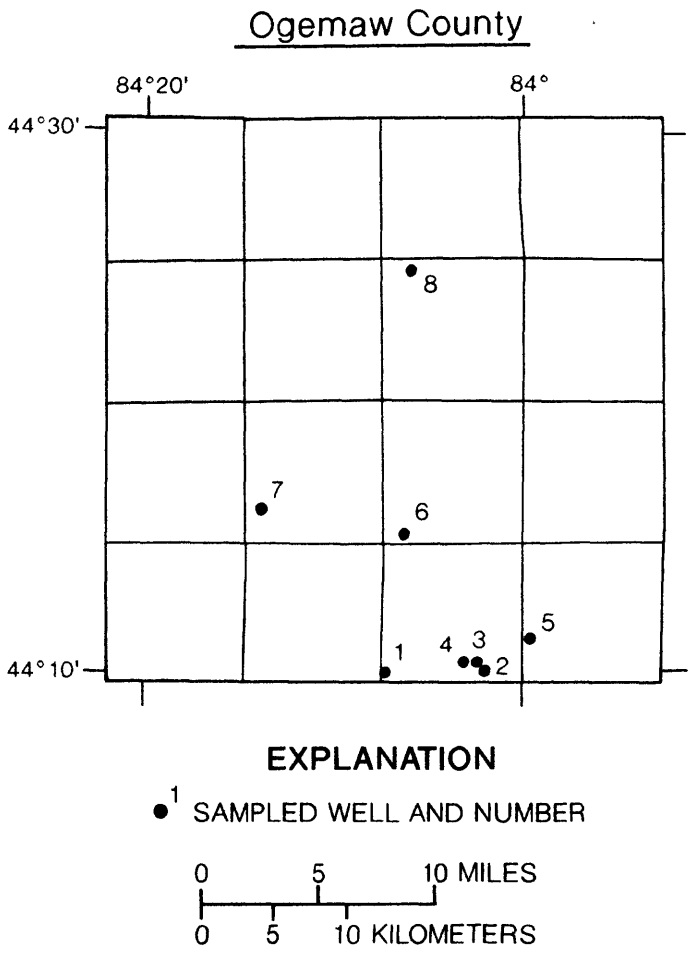


Table 37.--Physical and chemical characteristics for ground water in Ogemaw County

[Analyses by U.S. Geological Survey. Geologic unit: 112SAND, sand; 112SGVC, sand, gravel, and clay; 337CLDR, Coldwater Shale; 337MRSL, Marshall Sandstone. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 44°10'36"N | 84°07'58"W | 8-04-86 | 337MRSL | 165 | 494 | 7.80 | 13.0 | 0.4 |
| 2 | 44°10'44"N | 84°02'41"W | 7-16-87 | 337MRSL | 195 | 1,040 | 8.15 | 11.0 | 0 |

Table 37.--Physical and chemical characteristics for ground water in Ogemaw County--Continued

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 44°11'00"N | 84°03'05"W | 8-05-86 | 337CLDR | 270 | 1,930 | 7.56 | 11.0 | 0.5 |
| 4 | 44°11'00"N | 84°03'54"W | 8-04-86 | 337MRSL | 180 | 515 | 7.77 | 13.0 | .2 |
| 5 | 44°11'52"N | 84°00'26"W | 7-16-87 | 112SAND | 47 | 572 | 7.15 | 11.0 | .6 |
| 6 | 44°15'43"N | 84°07'01"W | 8-05-86 | 337MRSL | 162 | 614 | 7.50 | 12.0 | 9.3 |
| 7 | 44°16'40"N | 84°14'29"W | 8-05-86 | 112SGVC | 131 | 346 | 7.76 | 9.5 | 1.2 |
| 8 | 44°25'25"N | 84°06'43"W | 7-15-87 | 112SAND | 161 | 338 | 8.16 | 9.5 | .5 |

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 67 | 16 | 20 | 1.3 | 140 | 1.0 | 110 | 4.0 | 0.40 | <0.010 |
| 2 | 79 | 28 | 95 | 2.1 | 229 | .03 | 150 | 160 | .70 | .41 |
| 3 | 140 | 37 | 200 | 3.8 | 270 | <.5 | 350 | 290 | .70 | .69 |
| 4 | 48 | 12 | 42 | 2.0 | 165 | <.5 | 60 | 31 | .70 | .053 |
| 5 | 90 | 27 | 5.4 | .90 | 322 | -- | 17 | 2.5 | .20 | .014 |
| 6 | .80 | .10 | 140 | .20 | 201 | <.5 | 29 | 24 | .20 | .017 |
| 7 | 43 | 13 | 9.4 | .80 | 155 | <.5 | 16 | 7.0 | .20 | .036 |
| 8 | 44 | 14 | 10 | .80 | 176 | -- | 15 | 1.1 | .40 | .020 |

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) | Iron, ferrous, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 13 | 333 | <0.100 | 0.220 | <10 | 4 | -- | 70 | 590 | -- |
| 2 | 13 | 657 | -- | -- | <10 | 8 | 19 | 170 | 4,200 | 1,800 |
| 3 | 12 | 1,220 | <.100 | .620 | 10 | 16 | -- | 280 | 670 | -- |
| 4 | 13 | 307 | <.100 | .200 | <10 | 20 | -- | 110 | 170 | -- |
| 5 | 15 | 344 | -- | -- | <10 | 2 | 44 | 20 | 430 | 340 |
| 6 | 10 | 403 | 15.0 | .020 | <10 | <1 | -- | 10 | 5 | -- |
| 7 | 14 | 188 | <.100 | .130 | <10 | 10 | -- | 30 | 250 | -- |
| 8 | 14 | 192 | -- | -- | <10 | 15 | 130 | 20 | 370 | 300 |

Table 37.--Physical and chemical characteristics for ground water in Ogemaw County--Continued

| Well number | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | C-13/C-12 stable-isotope ratio, (per mil) | H-2/H-1 stable-isotope ratio, (per mil) | O-18/O-16 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|---|---|---|---|---|
| 1 | 8 | 15 | 1,200 | 400 | -- | -68.0 | -10.30 | 3.9 |
| 2 | 19 | 42 | 2,300 | 16 | -13.10 | -71.5 | -10.70 | 2.0 |
| 3 | 24 | 110 | 3,400 | 140 | -- | -72.0 | -10.50 | 1.1 |
| 4 | 9 | 61 | 1,300 | 110 | -- | -66.5 | -9.90 | 1.9 |
| 5 | 10 | 25 | 160 | 630 | -14.10 | -68.5 | -10.40 | 2.5 |
| 6 | <4 | 2 | 2 | 17 | -- | -71.5 | -10.70 | 1.6 |
| 7 | 5 | 16 | 410 | 4 | -- | -75.5 | -11.30 | .9 |
| 8 | 9 | 23 | 680 | 17 | -11.80 | -77.0 | -11.40 | 1.2 |

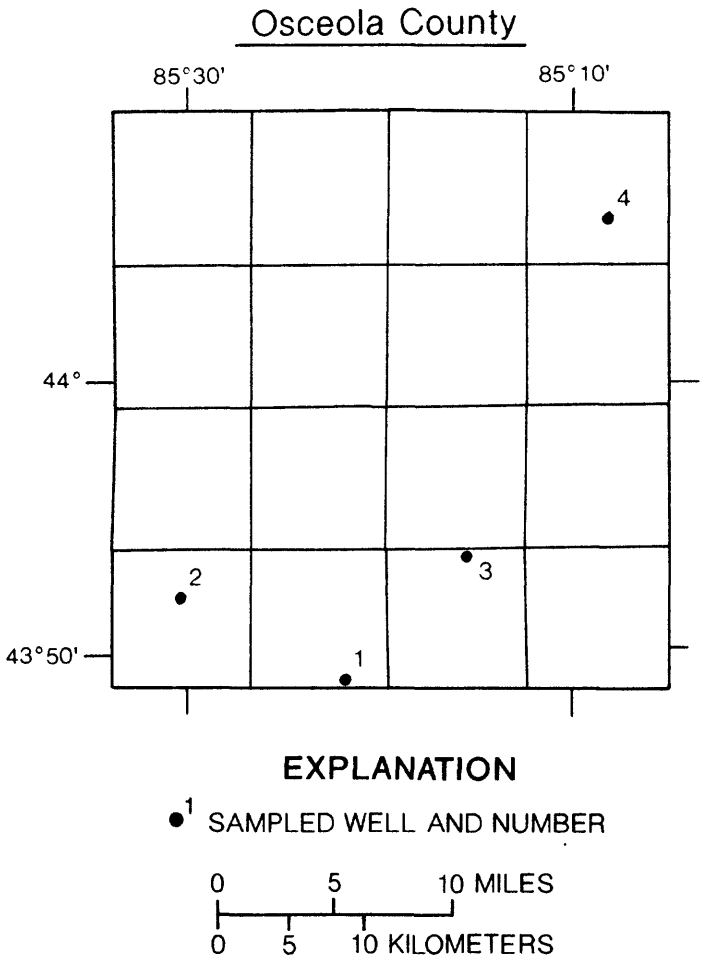


Table 38.--Physical and chemical characteristics for ground water in Osceola County

[Analyses by U.S. Geological Survey. Geologic unit: 112SAND, sand; 112SDGV, sand and gravel. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 43°49'45"N | 85°22'15"W | 7-09-87 | 112SAND | 213 | 408 | 7.57 | 13.5 | 6.6 |
| 2 | 43°52'40"N | 85°30'45"W | 7-09-87 | 112SAND | 115 | 662 | 7.07 | 11.5 | 1.4 |
| 3 | 43°54'12"N | 85°16'03"W | 8-26-86 | 112SDGV | 42 | 422 | 7.20 | 9.5 | 8.2 |
| 4 | 44°06'33"N | 85°08'48"W | 7-13-87 | 112SAND | 174 | 379 | 7.61 | 10.0 | .1 |

Table 38.--Physical and chemical characteristics for ground water in Osceola County--Continued

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 58 | 22 | 3.3 | 0.90 | 288 | -- | 16 | 2.4 | <0.10 | 0.18 |
| 2 | 67 | 24 | 48 | 1.5 | 195 | -- | 39 | 100 | .10 | .50 |
| 3 | 56 | 16 | 12 | 1.0 | 185 | <0.5 | 17 | 20 | <.10 | .079 |
| 4 | 54 | 17 | 4.9 | .70 | 220 | <.02 | 4.9 | .40 | .20 | <.010 |

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, nitrite, dissolved (mg/L as N) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 11 | 231 | -- | -- | -- | <10 | <1 | 18 | 10 | <3 |
| 2 | 11 | 412 | -- | -- | -- | <10 | 2 | 43 | 60 | 90 |
| 3 | 10 | 245 | <0.010 | 0.920 | <0.010 | <10 | <1 | -- | 20 | 7 |
| 4 | 15 | 223 | -- | -- | -- | <10 | 2 | <100 | 10 | 350 |

| Well number | Iron, ferrous, dissolved (µg/L as Fe) | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | H-2/H-1 stable-isotope ratio, (per mil) | O-18/O-16 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|---|---|---|---|---|
| 1 | -- | <4 | <1 | 83 | 740 | -71.5 | -10.70 | 0.9 |
| 2 | 30 | <4 | 36 | 140 | 14 | -70.5 | -10.70 | 1.3 |
| 3 | -- | 6 | <1 | 120 | 12 | -69.0 | -10.40 | 1.3 |
| 4 | 350 | <10 | 67 | 140 | <10 | -73.5 | -11.10 | 1.1 |

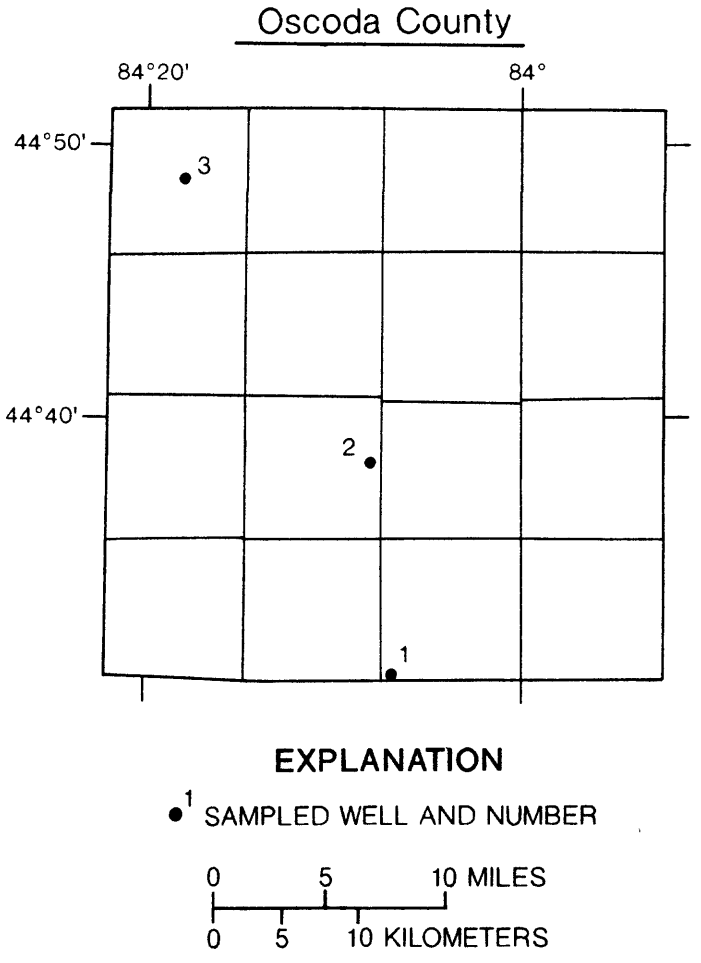


Table 39.--Physical and chemical characteristics for ground water in Oscoda County

[Analyses by U.S. Geological Survey. Geologic unit: 112GRVL, gravel; 112SAND, sand. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 44°31'10"N | 84°07'50"W | 7-15-87 | 112GRVL | 162 | 361 | 7.82 | 11.0 | 9.1 |
| 2 | 44°38'41"N | 84°08'43"W | 7-15-87 | 112SAND | 92 | 349 | 7.71 | 10.0 | 4.8 |
| 3 | 44°49'22"N | 84°18'47"W | 8-27-86 | 112SAND | 397 | 322 | 7.64 | 9.0 | .9 |

Table 39.--Physical and chemical characteristics for ground water in Oscoda County--Continued

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 57 | 14 | 3.5 | 0.70 | 188 | -- | 7.3 | 10 | <0.10 | 0.035 |
| 2 | 53 | 13 | 4.1 | .80 | 173 | -- | 15 | 3.8 | .10 | .014 |
| 3 | 39 | 13 | 11 | .70 | 170 | <0.5 | 3.2 | .90 | .20 | .020 |

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, nitrite, dissolved (mg/L as N) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 8.9 | 206 | -- | -- | -- | <10 | <1 | 27 | <10 | 4 |
| 2 | 9.0 | 202 | -- | -- | -- | 10 | <1 | 12 | 40 | 10 |
| 3 | 14 | 177 | <0.010 | <0.100 | 0.080 | <10 | 4 | -- | 20 | 20 |

| Well number | Iron, ferrous, dissolved (µg/L as Fe) | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | C-13/C-12 stable-isotope ratio, (per mil) | H-2/H-1 stable-isotope ratio, (per mil) | O-18/O-16 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | <20 | 7 | <1 | 53 | 86 | -9.80 | -53.0 | -6.50 | 1.2 |
| 2 | <20 | 6 | 4 | 57 | 790 | -12.30 | -77.5 | -11.40 | 1.7 |
| 3 | -- | 5 | 25 | 150 | 59 | -11.10 | -77.0 | -11.40 | .9 |

## Ottawa County

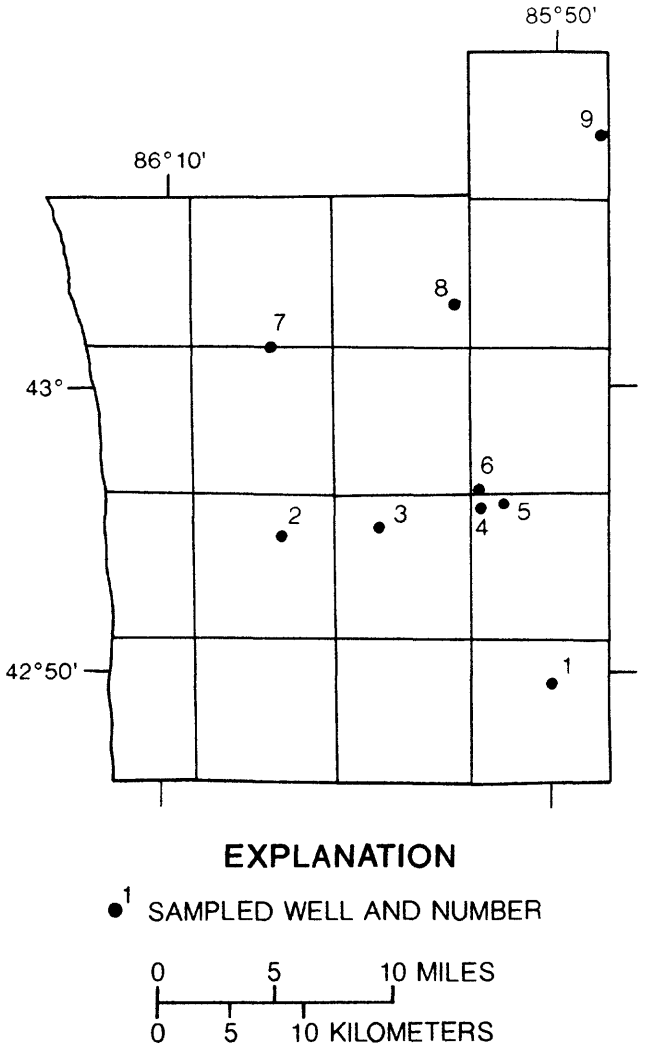


Table 40.--Physical and chemical characteristics for ground water in Ottawa County

[Analyses by U.S. Geological Survey. Geologic unit: 112SAND, sand; 337MRSL, Marshall Sandstone. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 42°50'05"N | 85°50'30"W | 6-12-87 | 337MRSL | 300 | 599 | 7.40 | 12.0 | 0 |
| 2 | 42°51'58"N | 86°04'13"W | 6-09-87 | 337MRSL | 170 | 1,920 | 7.55 | 11.5 | .5 |
| 3 | 42°55'40"N | 85°59'25"W | 6-09-87 | 337MRSL | 200 | 1,050 | 7.81 | 11.0 | .3 |

Table 40.--Physical and chemical characteristics for ground water in Ottawa County--Continued

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 4 | 42°56'21"N | 85°54'12"W | 8-25-86 | 337MRSL | 245 | 801 | 7.74 | 10.5 | 0.8 |
| 5 | 42°56'30"N | 85°53'03"W | 6-28-88 | 337MRSL | 238 | 610 | 7.84 | 16.0 | .3 |
| 6 | 42°57'01"N | 85°54'17"W | 6-28-88 | 337MRSL | 210 | 650 | 7.84 | 13.5 | .1 |
| 7 | 43°02'10"N | 86°05'07"W | 6-12-87 | 337MRSL | 172 | 2,160 | 7.66 | 12.0 | .1 |
| 8 | 43°03'44"N | 85°55'45"W | 7-01-86 | 112SAND | 130 | 1,200 | 7.02 | 12.5 | .0 |
| 9 | 43°09'50"N | 85°47'26"W | 6-25-87 | 337MRSL | 303 | 1,950 | 7.56 | 13.5 | 0 |

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 73 | 34 | 10 | 1.7 | 332 | 0.04 | 25 | 2.3 | 0.20 | 0.027 |
| 2 | 55 | 19 | 300 | 8.6 | 188 | -- | 20 | 490 | .50 | 1.7 |
| 3 | 40 | 15 | 150 | 3.4 | 172 | -- | 85 | 190 | 1.1 | .54 |
| 4 | 34 | 12 | 100 | 4.0 | 199 | <.5 | 74 | 76 | .70 | .36 |
| 5 | 36 | 13 | 100 | 3.5 | 232 | <.02 | 64 | 73 | .70 | .29 |
| 6 | 39 | 14 | 110 | 3.7 | 221 | <.02 | 79 | 79 | .60 | .32 |
| 7 | 80 | 24 | 310 | 5.7 | 302 | .06 | 30 | 580 | .80 | <.010 |
| 8 | 220 | 37 | 38 | 3.1 | 208 | <.5 | 530 | 6.2 | .50 | .027 |
| 9 | 350 | 66 | 75 | 3.1 | 150 | -- | 1,200 | 6.8 | .70 | .082 |

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, nitrite, dissolved (mg/L as N) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 17 | 354 | -- | -- | -- | <10 | 7 | 110 | 110 | 1,700 |
| 2 | 9.9 | 1,040 | -- | -- | -- | <10 | 1 | 81 | 910 | 180 |
| 3 | 12 | 603 | -- | -- | -- | <10 | 7 | 39 | 610 | 290 |
| 4 | 12 | 444 | <0.010 | <0.100 | 0.390 | <10 | 3 | -- | 610 | 250 |
| 5 | 12 | 428 | -- | -- | -- | <10 | 3 | 37 | 580 | 200 |
| 6 | 12 | 453 | -- | -- | -- | 20 | 4 | 35 | 610 | 70 |
| 7 | 11 | 1,230 | -- | -- | -- | <10 | 3 | 100 | 1,000 | 570 |
| 8 | 18 | 1,070 | -- | <.100 | .840 | <10 | 2 | -- | 300 | 1,900 |
| 9 | 15 | 1,890 | -- | -- | -- | <10 | <1 | <100 | 580 | 8,300 |

Table 40.--Physical and chemical characteristics for ground water in Ottawa County--Continued

| Well number | Iron, ferrous, dissolved (µg/L as Fe) | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | C-13/ C-12 stable-isotope ratio, (per mil) | H-2/ H-1 stable-isotope ratio, (per mil) | O-18/ O-16 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1,200 | 16 | 28 | 1,700 | 190 | -11.30 | -69.0 | -10.80 | 1.5 |
| 2 | 180 | 75 | 50 | 1,800 | 11 | -13.50 | -119.0 | -16.50 | 1.1 |
| 3 | 270 | 35 | 30 | 2,800 | 30 | -13.10 | -98.1 | -14.10 | 1.4 |
| 4 | -- | 23 | 23 | 2,300 | 130 | -- | -70.5 | -10.90 | 1.7 |
| 5 | 200 | 22 | 24 | 3,400 | 19 | -- | -- | -10.20 | 2.8 |
| 6 | 70 | 21 | 29 | 2,600 | 91 | -- | -- | -11.45 | 3.5 |
| 7 | 550 | 40 | 32 | 3,800 | <10 | -15.20 | -86.0 | -12.40 | 2.1 |
| 8 | -- | 37 | 29 | 7,900 | 22 | -16.00 | -63.0 | -9.70 | 1.1 |
| 9 | -- | 70 | 110 | 10 | 60 | -12.60 | -78.0 | -11.50 | 1.9 |

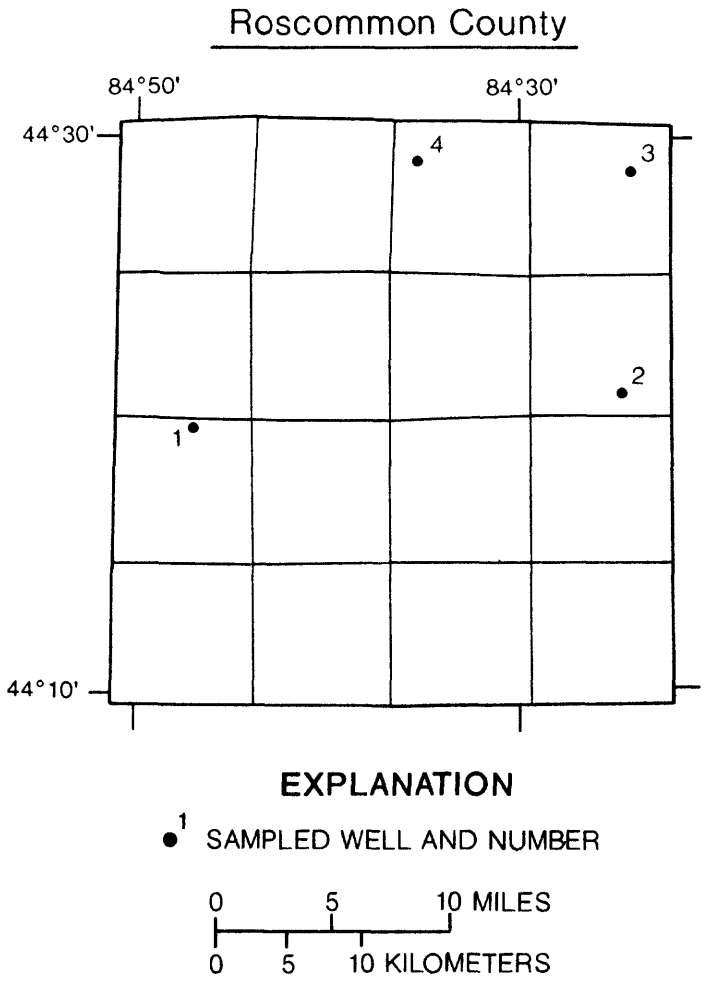


Table 41.--Physical and chemical characteristics for ground water in Roscommon County

[Analyses by U.S. Geological Survey. Geologic unit: 112SAND, sand; 112SDGV, sand and gravel. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 44°20'08"N | 84°47'38"W | 7-14-87 | 112SDGV | 253 | 397 | 7.70 | 13.0 | 0 |
| 2 | 44°21'25"N | 84°25'13"W | 7-14-87 | 112SAND | 45 | 181 | 8.58 | 10.5 | 9.7 |
| 3 | 44°29'25"N | 84°24'48"W | 7-14-87 | 112SAND | 133 | 566 | 7.38 | 12.0 | 4.0 |
| 4 | 44°29'45"N | 84°35'55"W | 8-26-86 | 112SDGV | 300 | 275 | 7.61 | 9.5 | 2.3 |

Table 41.--Physical and chemical characteristics for ground water in Roscommon County--Continued

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 63 | 17 | 3.4 | 0.70 | 257 | 0.075 | 4.6 | 0.70 | <0.10 | <0.010 |
| 2 | 26 | 6.2 | 3.4 | .40 | 62 | -- | 12 | 15 | <.10 | .015 |
| 3 | 86 | 25 | 8.4 | .70 | 147 | -- | 17 | 17 | <.10 | .12 |
| 4 | 42 | 12 | 3.3 | .50 | 150 | <.5 | 9.9 | .70 | <.10 | .013 |

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, nitrite, dissolved (mg/L as N) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 15 | 225 | -- | -- | -- | <10 | 12 | 37 | <10 | 3,500 |
| 2 | 7.9 | 107 | -- | -- | -- | <10 | <1 | 9 | 30 | 4 |
| 3 | 13 | 340 | -- | -- | -- | <10 | <1 | 32 | <10 | 9 |
| 4 | 12 | 172 | <0.010 | <0.100 | 0.010 | <10 | <1 | -- | <10 | 30 |

| Well number | Iron, ferrous, dissolved (µg/L as Fe) | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | C-13/C-12 stable-isotope ratio, (per mil) | H-2/H-1 stable-isotope ratio, (per mil) | O-18/O-16 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1,800 | 8 | 53 | 64 | 120 | -- | -72.5 | -10.70 | 5.2 |
| 2 | -- | 6 | 1 | 34 | 32 | -11.60 | -70.0 | -10.50 | 1.0 |
| 3 | -- | 9 | 1 | 66 | 84 | -- | -77.0 | -11.30 | 1.2 |
| 4 | -- | 5 | 15 | 75 | 9 | -11.50 | -79.5 | -11.70 | .5 |

# Saginaw County

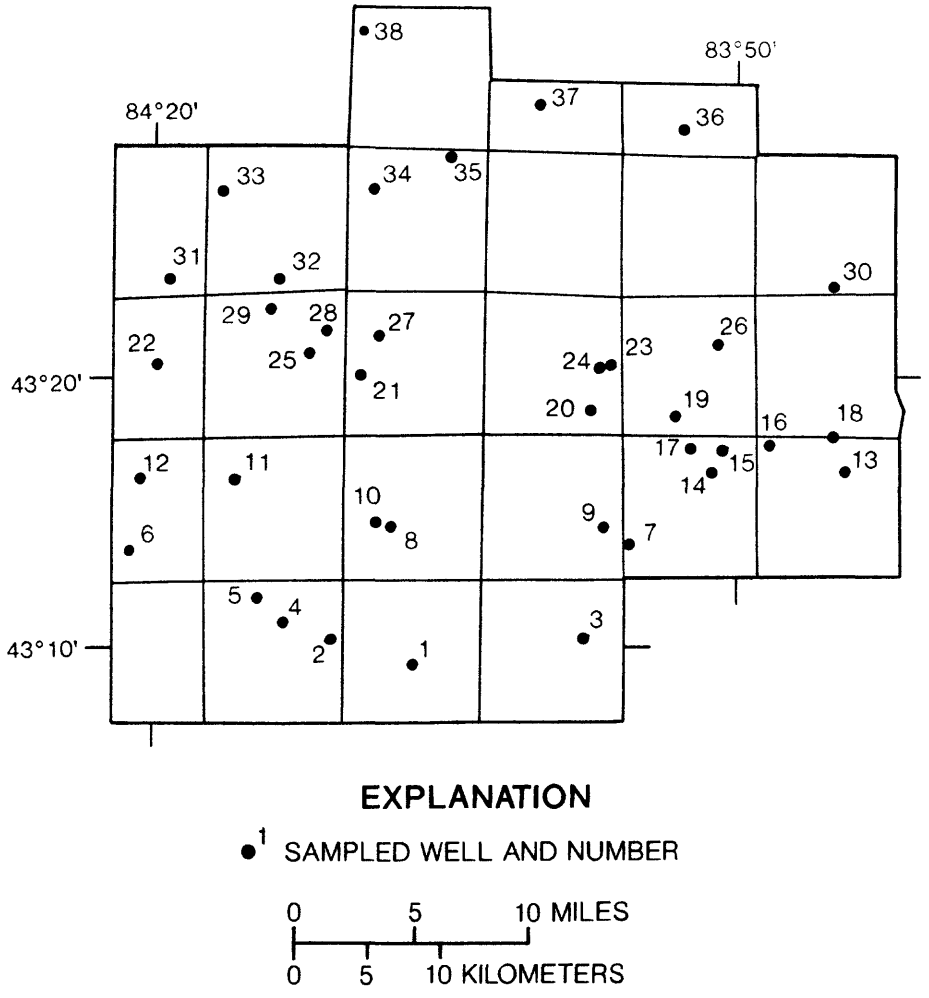


Table 42.--Physical and chemical characteristics for ground water in Saginaw County

[Analyses by U.S. Geological Survey. Geologic unit: 112GRVL, gravel; 112SAND, sand; 112SDGV, sand and gravel; 324SGNW, Saginaw Formation. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter; Pci/L, picocuries per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 43°10'30"N | 84°07'01"W | 7-02-86 | 324SGNW | 375 | 1,340 | 7.60 | 11.5 | 2.1 |
| 2 | 43°11'25"N | 84°11'18"W | 6-30-86 | 324SGNW | 200 | 670 | 7.67 | 11.0 | 1.8 |

Table 42.--Physical and chemical characteristics for ground water in Saginaw County--Continued

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 43°11'30"N | 83°58'15"W | 6-30-86 | 324SGNW | 145 | 578 | 7.40 | 11.0 | 1.1 |
| 4 | 43°12'01"N | 84°13'43"W | 12-05-87 | 324SGNW | 210 | 2,190 | -- | -- | -- |
| 5 | 43°12'52"N | 84°15'06"W | 6-25-86 | 112SAND | 75 | 1,790 | 7.54 | 11.5 | 1.6 |
| 6 | 43°14'37"N | 84°21'40"W | 7-07-86 | 112SDGV | 58 | 509 | 7.68 | 10.5 | 1.3 |
| 7 | 43°14'57"N | 83°55'59"W | 7-02-86 | 324SGNW | 140 | 543 | 7.74 | 12.0 | 4.1 |
| 8 | 43°15'32"N | 84°08'17"W | 12-05-87 | 112SAND | 51 | 1,320 | -- | -- | -- |
| 9 | 43°15'35"N | 83°57'17"W | 12-05-87 | 324SGNW | 160 | 6,020 | -- | -- | -- |
| 10 | 43°15'42"N | 84°09'01"W | 6-30-86 | 324SGNW | 175 | 1,520 | 7.65 | 11.5 | 1.2 |
| 11 | 43°17'14"N | 84°16'24"W | 7-07-86 | 324SGNW | 144 | 2,120 | 7.25 | 11.5 | 1.3 |
| 12 | 43°17'14"N | 84°21'08"W | 7-07-86 | 324SGNW | 247 | 1,250 | 7.23 | 10.0 | 1.2 |
| 13 | 43°17'37"N | 83°44'58"W | 7-16-86 | 324SGNW | 230 | 2,640 | 7.23 | 11.0 | 1.4 |
| 14 | 43°17'37"N | 83°51'41"W | 7-02-86 | 112SDGV | 53 | 12,000 | 7.50 | 12.5 | .6 |
| 15 | 43°18'22"N | 83°51'11"W | 7-02-86 | 324SGNW | 107 | 9,450 | 7.38 | 11.5 | 1.4 |
| 16 | 43°18'23"N | 83°48'42"W | 7-16-86 | 112GRVL | 70 | 1,820 | 7.29 | 14.5 | 1.3 |
| 17 | 43°18'27"N | 83°52'52"W | 12-05-87 | 324SGNW | 90 | 510 | -- | -- | -- |
| 18 | 43°18'51"N | 83°45'26"W | 7-16-86 | 324SGNW | 70 | 740 | 7.35 | 11.0 | 1.5 |
| 19 | 43°19'39"N | 83°53'42"W | 7-17-86 | 324SGNW | 90 | 1,060 | 7.74 | 12.0 | 1.7 |
| 20 | 43°19'45"N | 84°01'08"W | 7-09-86 | 112SDGV | 64 | 1,130 | 6.95 | 12.5 | 1.6 |
| 21 | 43°21'03"N | 84°09'56"W | 7-07-86 | 324SGNW | 156 | 2,610 | 8.01 | 13.5 | 6.2 |
| 22 | 43°21'27"N | 84°20'26"W | 7-10-86 | 324SGNW | 260 | 729 | 7.60 | 10.5 | 1.6 |
| 23 | 43°21'30"N | 83°57'00"W | 5-20-88 | 112SDGV | 114 | 2,660 | 8.14 | 13.0 | 0 |
| 24 | 43°21'30"N | 83°57'30"W | 12-05-87 | 112SDGV | 114 | 2,630 | -- | -- | -- |
| 25 | 43°21'50"N | 84°12'34"W | 6-23-88 | 324SGNW | 525 | 3,390 | 7.61 | 12.5 | 0 |
| 26 | 43°22'13"N | 83°51'35"W | 11-19-87 | 112SAND | 123 | 15,500 | -- | -- | -- |
| 27 | 43°22'30"N | 84°09'05"W | 12-04-87 | 324SGNW | 365 | 1,450 | -- | -- | -- |
| 28 | 43°22'40"N | 84°11'40"W | 7-09-86 | 324SGNW | 212 | 5,550 | 7.76 | 11.5 | 1.1 |
| 29 | 43°23'26"N | 84°14'36"W | 7-09-86 | 112SDGV | 71 | 505 | 7.80 | 11.0 | 1.3 |
| 30 | 43°24'25"N | 83°45'31"W | 7-16-86 | 324SGNW | 135 | 2,790 | 7.47 | 11.0 | 1.3 |
| 31 | 43°24'31"N | 84°19'48"W | 7-10-86 | 324SGNW | 290 | 673 | 7.50 | 13.0 | 2.4 |
| 32 | 43°24'37"N | 84°14'08"W | 9-08-86 | 112SDGV | 190 | 637 | 7.64 | 10.5 | .9 |
| 33 | 43°27'46"N | 84°17'10"W | 7-14-86 | 324SGNW | 307 | 1,110 | 8.15 | 11.5 | 2.3 |
| 34 | 43°27'56"N | 84°09'20"W | 7-14-86 | 112SAND | 69 | 748 | 7.90 | 12.5 | 2.1 |
| 35 | 43°29'06"N | 84°05'22"W | 6-23-88 | 324SGNW | 420 | 18,300 | 6.99 | 13.0 | .1 |
| 36 | 43°30'14"N | 83°53'17"W | 7-17-86 | 324SGNW | 230 | 4,210 | 6.73 | 12.0 | 3.7 |
| 37 | 43°31'05"N | 84°00'50"W | 7-14-86 | 324SGNW | 226 | 5,630 | 7.78 | 11.0 | 2.0 |
| 38 | 43°33'13"N | 84°09'30"W | 9-08-86 | 112SDGV | 56 | 1,120 | 7.96 | 12.5 | 1.0 |

Table 42.--Physical and chemical characteristics for ground water in Saginaw County--Continued

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 36 | 10 | 210 | 3.2 | 341 | <0.5 | 74 | 180 | 0.50 | 0.50 |
| 2 | 34 | 8.2 | 110 | 3.3 | 315 | <.5 | 23 | 43 | .50 | .20 |
| 3 | 63 | 23 | 32 | 2.2 | 334 | <.5 | 4.2 | 11 | .50 | .033 |
| 4 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 5 | 100 | 63 | 290 | 2.5 | 184 | <.5 | 160 | 560 | .50 | 2.0 |
| 6 | 49 | 13 | 44 | 1.4 | 287 | <.5 | 57 | 9.3 | .80 | .038 |
| 7 | 34 | 10 | 62 | 2.1 | 246 | <.5 | 8.0 | 57 | .80 | .11 |
| 8 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 9 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 10 | 70 | 12 | 190 | 4.0 | 270 | <.5 | 84 | 280 | .60 | .86 |
| 11 | 160 | 44 | 280 | 4.0 | 267 | <.5 | 380 | 440 | .50 | .53 |
| 12 | 180 | 29 | 61 | 1.6 | 201 | <.5 | 480 | 21 | .50 | .063 |
| 13 | 100 | 23 | 470 | 4.4 | 309 | <.5 | 170 | 670 | 1.0 | 1.3 |
| 14 | 320 | 100 | 2,100 | 8.8 | 104 | <.5 | 420 | 3,800 | .60 | 7.1 |
| 15 | 210 | 59 | 1,600 | 9.1 | 185 | <.5 | 590 | 2,700 | .60 | 5.0 |
| 16 | 87 | 18 | 280 | 2.6 | 392 | <.5 | 63 | 380 | .70 | .38 |
| 17 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 18 | 78 | 31 | 39 | 2.2 | 312 | <.5 | 62 | 37 | .50 | .068 |
| 19 | 25 | 7.3 | 180 | 1.7 | 247 | <.5 | 33 | 210 | 2.0 | .37 |
| 20 | -- | -- | -- | -- | 492 | -- | -- | -- | -- | -- |
| 21 | 18 | 5.0 | 640 | 7.5 | 312 | <.5 | 260 | 660 | .80 | 1.1 |
| 22 | 59 | 24 | 67 | 1.8 | 268 | <.5 | 82 | 67 | .60 | .11 |
| 23 | 160 | 49 | 290 | 2.5 | 143 | <.02 | 110 | 750 | .40 | 1.7 |
| 24 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 25 | 120 | 32 | 570 | 5.7 | 215 | .8 | 310 | 710 | .60 | 1.2 |
| 26 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 27 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 28 | 46 | 18 | 1,600 | 13 | 288 | <.5 | 260 | 2,200 | 1.0 | 2.8 |
| 29 | 55 | 16 | 31 | 1.8 | 241 | <.5 | 49 | 13 | .60 | <.010 |
| 30 | 130 | 30 | 660 | 5.7 | 368 | <.5 | 730 | 610 | .80 | 1.2 |
| 31 | 60 | 23 | 56 | 1.6 | 281 | <.5 | 77 | 49 | .40 | .091 |
| 32 | 48 | 18 | 67 | 2.3 | 224 | <.5 | 70 | 42 | .60 | .081 |
| 33 | 16 | 2.3 | 220 | 3.6 | 231 | <.5 | 49 | 220 | .50 | .27 |
| 34 | 37 | 25 | 94 | 1.9 | 234 | <.5 | 53 | 130 | .70 | .16 |
| 35 | 900 | 110 | 3,400 | 20 | 186 | <.02 | 1,700 | 5,800 | .30 | 9.1 |
| 36 | 64 | 24 | 880 | 13 | 295 | <.5 | 15 | 1,400 | .90 | 2.6 |

Table 42.--Physical and chemical characteristics for ground water in Saginaw County--Continued

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 37 | 76 | 40 | 1,600 | 8.8 | 279 | <0.5 | 25 | 2,400 | 0.50 | 3.9 |
| 38 | -- | -- | -- | -- | 285 | -- | -- | -- | -- | -- |

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) | Iron, ferrous, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 9.2 | 695 | <0.100 | 0.380 | <10 | <1 | -- | 850 | 140 | -- |
| 2 | 8.9 | 416 | <.100 | .310 | <10 | <1 | -- | 860 | 370 | -- |
| 3 | 12 | 327 | <.100 | .670 | <10 | <1 | -- | 220 | 230 | -- |
| 4 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 5 | 13 | 1,300 | <.100 | .830 | <10 | 8 | -- | 420 | 900 | -- |
| 6 | 14 | 312 | <.100 | .440 | <10 | 5 | -- | 180 | 480 | -- |
| 7 | 9.9 | 298 | <.100 | 1.30 | <10 | <1 | -- | 400 | 110 | -- |
| 8 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 9 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 10 | 8.8 | 777 | <.100 | .680 | <10 | 2 | -- | 670 | 480 | -- |
| 11 | 10 | 1,500 | <.100 | .570 | <10 | <1 | -- | 590 | 740 | -- |
| 12 | 14 | 959 | <.100 | .420 | 10 | <1 | -- | 80 | 960 | -- |
| 13 | 6.6 | 1,600 | <.100 | .570 | <10 | <1 | -- | 850 | 590 | -- |
| 14 | 12 | 7,230 | <.100 | 3.40 | 10 | 11 | -- | 1,100 | 2,400 | -- |
| 15 | 9.5 | 5,230 | <.100 | 2.60 | <10 | 4 | -- | 1,600 | 1,100 | -- |
| 16 | 11 | 1,060 | .100 | .360 | <10 | 2 | -- | 330 | 870 | -- |
| 17 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 18 | 18 | 454 | <.100 | .760 | <10 | 5 | -- | 160 | 1,400 | -- |
| 19 | 11 | 579 | <.100 | .360 | <10 | 18 | -- | 580 | 120 | -- |
| 20 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 21 | 6.3 | 1,630 | <.100 | .580 | <10 | <1 | -- | 2,200 | 30 | -- |
| 22 | 14 | 448 | <.100 | .460 | <10 | 6 | -- | 130 | 570 | -- |
| 23 | 14 | 1,630 | -- | -- | 20 | 12 | 100 | 720 | 1,200 | 1,100 |
| 24 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 25 | 11 | 2,020 | -- | -- | 10 | 1 | <100 | 500 | 3,900 | 2,800 |
| 26 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 27 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 28 | 6.8 | 3,870 | <.100 | .980 | <10 | <1 | -- | 4,100 | 320 | -- |

Table 42.--Physical and chemical characteristics for ground water in Saginaw County--Continued

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) | Iron, ferrous, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 29 | 17 | 313 | <0.100 | 0.480 | <10 | 4 | -- | 130 | 520 | -- |
| 30 | 6.4 | 2,370 | <.100 | 1.10 | <10 | <1 | -- | 3,900 | 280 | -- |
| 31 | 14 | 411 | <.100 | .150 | <10 | 3 | -- | 80 | 290 | -- |
| 32 | 14 | 460 | <.100 | .310 | <10 | 5 | -- | 230 | 330 | -- |
| 33 | 6.9 | 641 | <.100 | .360 | <10 | <1 | -- | 1,700 | 66 | -- |
| 34 | 12 | 448 | <.100 | .520 | <10 | 10 | -- | 240 | 280 | -- |
| 35 | 6.8 | 12,600 | -- | -- | <10 | <1 | <100 | 1,400 | 5,600 | 3,200 |
| 36 | 6.6 | 2,530 | <.100 | 2.60 | <10 | <1 | -- | 2,300 | 260 | -- |
| 37 | 9.9 | 4,210 | <.100 | 2.80 | <10 | <1 | -- | 860 | 380 | -- |
| 38 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

| Well number | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | Tritium, total (pCi/L) | C-13/C-12 stable-isotope ratio, (per mil) | Carbon-14 (percent modern) | H-2/H-1 stable-isotope ratio, (per mil) | O-18/O-16 stable-isotope ratio, (per mil) | S-34/S-32 stable-isotope ratio, (per mil) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 45 | 9 | 1,200 | 8 | -- | -- | -- | -62.0 | -9.20 | -- |
| 2 | 42 | 9 | 1,200 | 49 | -- | -- | -- | -60.0 | -9.10 | -- |
| 3 | 28 | 12 | 870 | 110 | -- | -- | -- | -58.5 | -8.80 | -- |
| 4 | -- | -- | -- | -- | -- | -- | -- | -72.0 | -10.40 | -- |
| 5 | 30 | 20 | 2,900 | 110 | -- | -13.40 | -- | -76.0 | -11.10 | -- |
| 6 | 13 | 19 | 740 | 44 | -- | -15.40 | -- | -66.5 | -10.00 | -- |
| 7 | 26 | 17 | 630 | 15 | -- | -- | -- | -62.5 | -9.20 | -- |
| 8 | -- | -- | -- | -- | -- | -- | -- | -65.0 | -9.50 | -- |
| 9 | -- | -- | -- | -- | -- | -- | -- | -86.5 | -12.50 | -- |
| 10 | 42 | 12 | 1,200 | 24 | -- | -- | -- | -65.0 | -9.70 | -- |
| 11 | <10 | 50 | 1,400 | 50 | -- | -- | -- | -94.0 | -13.40 | -- |
| 12 | 32 | 24 | 800 | 380 | -- | -13.10 | -- | -67.5 | -10.00 | -- |
| 13 | 50 | 30 | 5,500 | 50 | -- | -- | -- | -111.0 | -15.40 | -- |
| 14 | 90 | 120 | 9,200 | 120 | -- | -14.30 | -- | -82.5 | -11.90 | -- |
| 15 | 110 | 80 | 4,900 | 190 | -- | -14.80 | -- | -89.0 | -12.70 | -- |
| 16 | 22 | 120 | 970 | 46 | -- | -- | -- | -62.5 | -9.30 | -- |
| 17 | -- | -- | -- | -- | -- | -- | -- | -63.0 | -9.20 | -- |
| 18 | 18 | 23 | 1,400 | 36 | -- | -- | -- | -66.5 | -9.80 | -- |
| 19 | 17 | 11 | 690 | 62 | -- | -- | -- | -63.0 | -9.30 | -- |
| 20 | -- | -- | -- | -- | -- | -- | -- | -60.5 | -8.80 | -- |

Table 42.--Physical and chemical characteristics for ground water in Saginaw County--Continued

| Well number | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | Tritium, total (pCi/L) | C-13/ C-12 stable-isotope ratio, (per mil) | Carbon-14 (percent modern) | H-2/ H-1 stable-isotope ratio, (per mil) | O-18/ O-16 stable-isotope ratio, (per mil) | S-34/ S-32 stable-isotope ratio, (per mil) |
|---|---|---|---|---|---|---|---|---|---|---|
| 21 | 70 | 20 | 270 | 70 | -- | -- | -- | -96.0 | -13.60 | -- |
| 22 | 17 | 10 | 650 | 310 | -- | -- | -- | -65.0 | -9.70 | -- |
| 23 | 40 | 37 | 2,100 | 470 | <2.5 | -17.20 | 3.1 | -- | -- | 33.60 |
| 24 | -- | -- | -- | -- | -- | -- | -- | -95.0 | -13.40 | -- |
| 25 | 60 | 70 | 1,600 | 20 | -- | -- | -- | -88.0 | -12.60 | -- |
| 26 | -- | -- | -- | -- | -- | -- | -- | -83.9 | -11.90 | -- |
| 27 | -- | -- | -- | -- | -- | -- | -- | -79.0 | -11.40 | -- |
| 28 | 150 | 20 | 900 | 130 | -- | -7.90 | -- | -96.5 | -13.90 | -- |
| 29 | 14 | 20 | 980 | 330 | -- | -14.70 | -- | -62.0 | -9.30 | -- |
| 30 | 90 | 50 | 3,100 | 30 | -- | -- | -- | -105.0 | -15.00 | -- |
| 31 | 21 | 14 | 260 | 210 | -- | -- | -- | -65.5 | -10.00 | -- |
| 32 | 21 | 13 | 530 | 7 | -- | -- | -- | -66.9 | -10.00 | -- |
| 33 | 50 | 8 | 610 | 68 | -- | -13.60 | -- | -91.5 | -13.00 | -- |
| 34 | 9 | 8 | 1,000 | 32 | -- | -- | -- | -71.0 | -10.70 | -- |
| 35 | 260 | 270 | 21,000 | 300 | -- | -- | -- | -63.5 | -9.70 | -- |
| 36 | 70 | 30 | 1,700 | 20 | -- | -- | -- | -66.5 | -9.80 | -- |
| 37 | 60 | 20 | 1,800 | 160 | -- | -- | -- | -111.0 | -15.70 | -- |
| 38 | -- | -- | -- | -- | -- | -- | -- | -65.9 | -9.80 | -- |

| Well number | Carbon, organic, dissolved (mg/L as C) |
|---|---|
| 1 | 1.1 |
| 2 | .6 |
| 3 | 1.5 |
| 4 | -- |
| 5 | 1.6 |
| 6 | 2.2 |
| 7 | 1.8 |
| 8 | -- |
| 9 | -- |
| 10 | 1.2 |
| 11 | 1.1 |
| 12 | 1.7 |

Table 42.--Physical and chemical characteristics for ground water in Saginaw County--Continued

| Well number | Carbon, organic, dissolved (mg/L as C) |
|---|---|
| 13 | 1.0 |
| 14 | 0.3 |
| 15 | .6 |
| 16 | 6.3 |
| 17 | -- |
| 18 | 1.9 |
| 19 | 3.4 |
| 20 | -- |
| 21 | .3 |
| 22 | 1.8 |
| 23 | 2.1 |
| 24 | -- |
| 25 | 2.0 |
| 26 | -- |
| 27 | -- |
| 28 | .2 |
| 29 | 5.0 |
| 30 | 1.8 |
| 31 | 1.5 |
| 32 | 1.5 |
| 33 | .1 |
| 34 | 2.5 |
| 35 | .6 |
| 36 | .3 |
| 37 | 2.1 |
| 38 | -- |

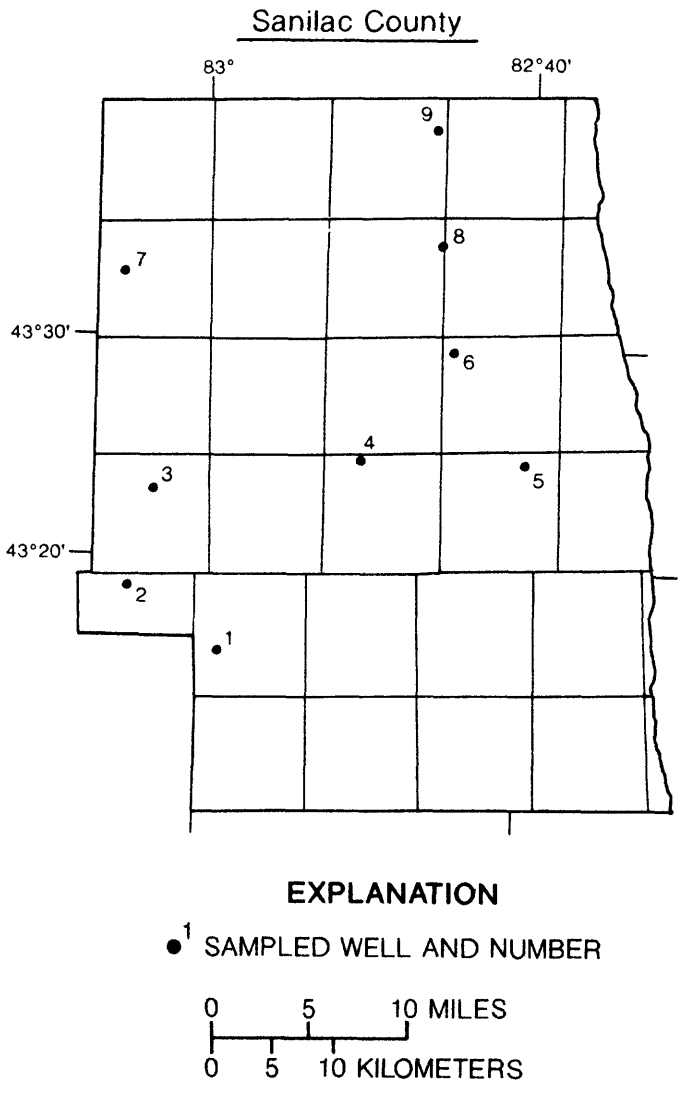


Table 43.--Physical and chemical characteristics for ground water in Sanilac County

[Analyses by U.S. Geological Survey. Geologic unit: 112SAND, sand; 112SDGV, sand and gravel; 337CLDR, Coldwater Shale; 337MRSL, Marshall Sandstone. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter. --, no analysis made; <, less than. Alkainity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 43°17'05"N | 82°58'56"W | 7-28-88 | 337CLDR | 347 | 1,980 | 7.33 | 13.0 | 0.0 |
| 2 | 43°19'50"N | 83°04'37"W | 8-11-86 | 337MRSL | 263 | 766 | 7.40 | 10.5 | 1.0 |

Table 43.--Physical and chemical characteristics for ground water in Sanilac County--Continued

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 43°24'05"N | 83°03'12"W | 6-11-87 | 337MRSL | 220 | 616 | 7.67 | 11.0 | 0.2 |
| 4 | 43°25'34"N | 82°50'32"W | 6-11-87 | 337MRSL | 168 | 1,080 | 7.38 | 11.0 | .2 |
| 5 | 43°25'35"N | 82°40'20"W | 6-11-87 | 112SDGV | 150 | 648 | 7.42 | 11.5 | 0 |
| 6 | 43°30'35"N | 82°45'00"W | 6-10-87 | 112SAND | 21 | 548 | 7.38 | 15.5 | .7 |
| 7 | 43°33'37"N | 83°05'28"W | 6-10-87 | 337MRSL | 198 | 525 | 7.52 | 11.0 | .3 |
| 8 | 43°35'12"N | 82°46'00"W | 6-10-87 | 337MRSL | 135 | 900 | 7.67 | 9.0 | .3 |
| 9 | 43°40'15"N | 82°46'30"W | 6-10-87 | 337MRSL | 145 | 532 | 7.80 | 10.0 | .3 |

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 140 | 17 | 330 | 3.5 | 173 | <0.02 | 300 | 500 | 0.60 | 0.41 |
| 2 | 49 | 20 | 82 | 2.3 | 279 | <.5 | 28 | 66 | 1.0 | .041 |
| 3 | 46 | 17 | 67 | 2.9 | 212 | -- | 55 | 60 | 1.7 | .035 |
| 4 | 86 | 22 | 120 | 2.5 | 282 | -- | 84 | 160 | .70 | .19 |
| 5 | 89 | 28 | 20 | 1.5 | 270 | <.02 | 46 | 44 | .50 | .052 |
| 6 | 82 | 21 | 7.8 | 3.7 | 210 | -- | 71 | 28 | .20 | .052 |
| 7 | 54 | 26 | 27 | 2.6 | 274 | -- | 26 | 4.4 | 1.0 | .019 |
| 8 | 57 | 13 | 120 | 2.7 | 238 | -- | 43 | 140 | .70 | .46 |
| 9 | 42 | 16 | 53 | 2.3 | 250 | -- | 17 | 23 | 1.3 | .052 |

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) | Iron, ferrous, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 7.9 | 1,440 | -- | -- | 20 | 3 | <100 | 1,500 | 450 | -- |
| 2 | 8.3 | 398 | <0.100 | 0.130 | -- | <1 | -- | 720 | 110 | -- |
| 3 | 7.6 | 377 | -- | -- | <10 | <1 | 34 | 3,100 | 230 | 230 |
| 4 | 10 | 640 | -- | -- | <10 | 2 | 55 | 520 | 430 | 400 |
| 5 | 16 | 424 | -- | -- | <10 | 13 | 260 | 50 | 1,400 | 1,100 |
| 6 | 4.5 | 377 | -- | -- | <10 | <1 | 92 | 50 | 38 | <20 |
| 7 | 13 | 304 | -- | -- | <10 | 18 | 110 | 370 | 200 | 190 |
| 8 | 8.2 | 520 | -- | -- | <10 | <1 | 57 | 570 | 460 | 440 |
| 9 | 12 | 300 | -- | -- | <10 | 11 | 110 | 360 | 240 | 220 |

Table 43.--Physical and chemical characteristics for ground water in Sanilac County--Continued

| Well number | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | C-13/ C-12 stable-isotope ratio, (per mil) | H-2/ H-1 stable-isotope ratio, (per mil) | O-18/ O-16 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|---|---|---|---|---|
| 1 | 40 | 77 | 2,500 | 630 | -- | -- | -15.15 | -- |
| 2 | 17 | 10 | 780 | 8 | -- | -62.5 | -9.70 | 0.9 |
| 3 | 27 | 8 | 670 | 28 | -- | -76.5 | -11.20 | 1.5 |
| 4 | 31 | 19 | 1,700 | 9 | -13.90 | -65.5 | -9.80 | 1.7 |
| 5 | 17 | 56 | 320 | 12 | -- | -69.0 | -10.40 | 2.5 |
| 6 | 14 | 200 | 200 | 16 | -- | -60.0 | -8.60 | 2.8 |
| 7 | 26 | 62 | 1,200 | 12 | -- | -63.0 | -9.60 | 1.5 |
| 8 | 24 | 24 | 3,400 | 6 | -- | -68.1 | -10.50 | 1.3 |
| 9 | 21 | 44 | 890 | 14 | -- | -66.5 | -10.10 | 1.7 |

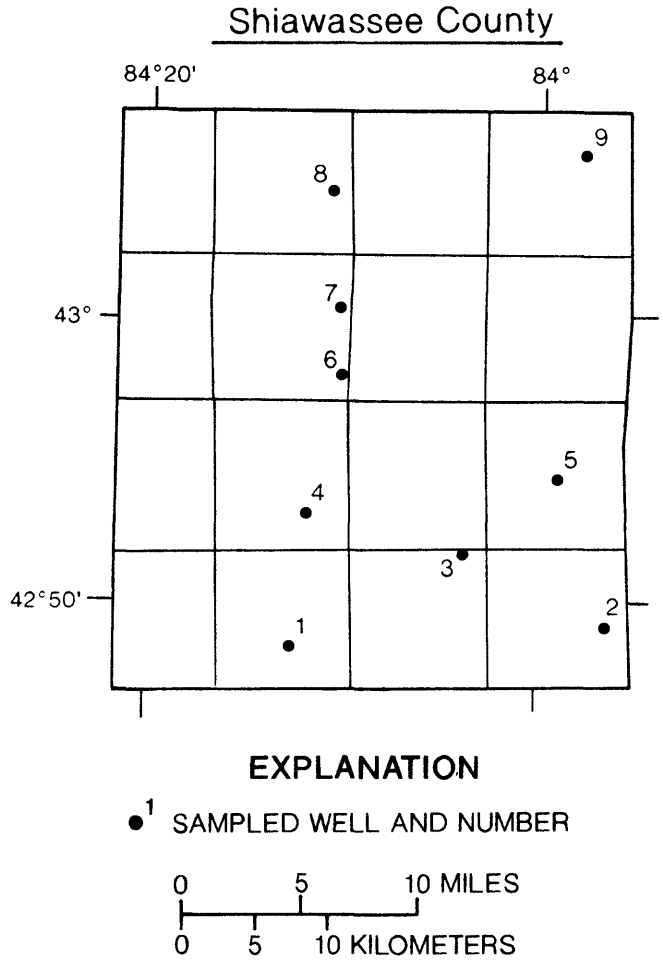


Table 44.--Physical and chemical characteristics for ground water in Shiawassee County

[Analyses by U.S. Geological Survey. Geologic unit: 112SDGV, sand and gravel; 324SGNW, Saginaw Formation; 337MRSL, Marshall Sandstone. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 42°48'47"N | 84°12'53"W | 5-05-87 | 112SDGV | 135 | 764 | 7.04 | 10.5 | 0 |
| 2 | 42°49'36"N | 83°56'43"W | 5-05-87 | 337MRSL | 175 | 1,090 | 7.48 | 11.0 | .3 |

Table 44.--Physical and chemical characteristics for ground water in Shiawassee County--Continued

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 42°52'12"N | 84°04'05"W | 5-05-87 | 112SDGV | 96 | 660 | 7.63 | 10.5 | 0.3 |
| 4 | 42°53'38"N | 84°12'15"W | 7-07-87 | 112SDGV | 62 | 781 | 7.30 | 12.5 | .2 |
| 5 | 42°55'02"N | 83°59'18"W | 7-17-86 | 112SDGV | 56 | 1,210 | 7.07 | 12.0 | .6 |
| 6 | 42°58'42"N | 84°10'30"W | 7-17-86 | 112SDGV | 145 | 788 | 7.27 | 11.5 | .9 |
| 7 | 43°01'09"N | 84°10'39"W | 7-17-86 | 324SGNW | 165 | 837 | 7.52 | 13.0 | 1.5 |
| 8 | 43°05'29"N | 84°11'10"W | 6-15-88 | 324SGNW | 402 | 3,200 | 7.94 | 14.0 | 0 |
| 9 | 43°06'57"N | 83°58'07"W | 5-07-87 | 324SGNW | 75 | 1,620 | 7.46 | 12.0 | .7 |

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 110 | 34 | 11 | 2.8 | 298 | -- | 120 | 22 | 0.20 | 0.043 |
| 2 | 73 | 34 | 96 | 2.1 | 308 | 0.05 | 34 | 150 | 8.3 | .44 |
| 3 | 65 | 29 | 27 | 1.7 | 326 | <.02 | 16 | 39 | .70 | .091 |
| 4 | 110 | 38 | 14 | 1.1 | 337 | .02 | 63 | 39 | .30 | .053 |
| 5 | 140 | 56 | 50 | 3.2 | 400 | <.5 | 170 | 100 | .70 | .14 |
| 6 | 110 | 36 | 15 | 2.3 | 330 | <.5 | 110 | 27 | .40 | .065 |
| 7 | 81 | 27 | 60 | 3.4 | 292 | <.5 | 48 | 92 | .50 | .29 |
| 8 | 50 | 15 | 540 | 4.6 | 339 | .02 | 150 | 680 | 1.1 | 2.4 |
| 9 | 96 | 46 | 160 | 3.3 | 307 | -- | 170 | 240 | .80 | .38 |

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) | Iron, ferrous, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 15 | 477 | -- | -- | <10 | 5 | 120 | 30 | 1,300 | 1,200 |
| 2 | 17 | 574 | -- | -- | 10 | 27 | 220 | 150 | 600 | 600 |
| 3 | 19 | 356 | -- | -- | <10 | 27 | 170 | 90 | 1,600 | 1,200 |
| 4 | 12 | 496 | -- | -- | 10 | <1 | 54 | 20 | 140 | -- |
| 5 | 16 | 834 | <0.100 | 0.310 | <10 | 17 | -- | 210 | 3,100 | -- |
| 6 | 15 | 539 | <.100 | .150 | <10 | 2 | -- | 90 | 2,000 | -- |
| 7 | 12 | 509 | <.100 | .310 | <10 | 3 | -- | 1,000 | 2,600 | -- |
| 8 | 7.7 | 1,630 | -- | -- | <10 | <1 | <100 | 3,100 | 270 | 210 |
| 9 | 18 | 930 | -- | -- | <10 | 16 | 51 | 460 | 1,400 | 1,200 |

Table 44.--Physical and chemical characteristics for ground water in Shiawassee County--Continued

| Well number | Lithium dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | C-13/ C-12 stable-isotope ratio, (per mil) | H-2/ H-1 stable-isotope ratio, (per mil) | O-18/ O-16 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|---|---|---|---|---|
| 1 | 11 | 83 | 350 | 12 | -- | -66.5 | -10.00 | 2.4 |
| 2 | 14 | 11 | 1,800 | 7 | -- | -62.0 | -9.30 | 2.1 |
| 3 | 9 | 14 | 1,000 | 8 | -- | -65.0 | -9.60 | 2.4 |
| 4 | 12 | 150 | 82 | 360 | -- | -70.0 | -10.60 | 1.0 |
| 5 | 25 | 180 | 800 | 13 | -12.60 | -62.0 | -9.50 | 3.0 |
| 6 | 15 | 80 | 250 | 12 | -- | -67.5 | -10.00 | 1.7 |
| 7 | 40 | 46 | 1,800 | 14 | -- | -65.0 | -9.90 | 1.2 |
| 8 | 80 | 22 | 1,700 | 10 | -- | -72.0 | -10.75 | .7 |
| 9 | 29 | 23 | 1,500 | 23 | -13.70 | -64.5 | -9.60 | 1.9 |

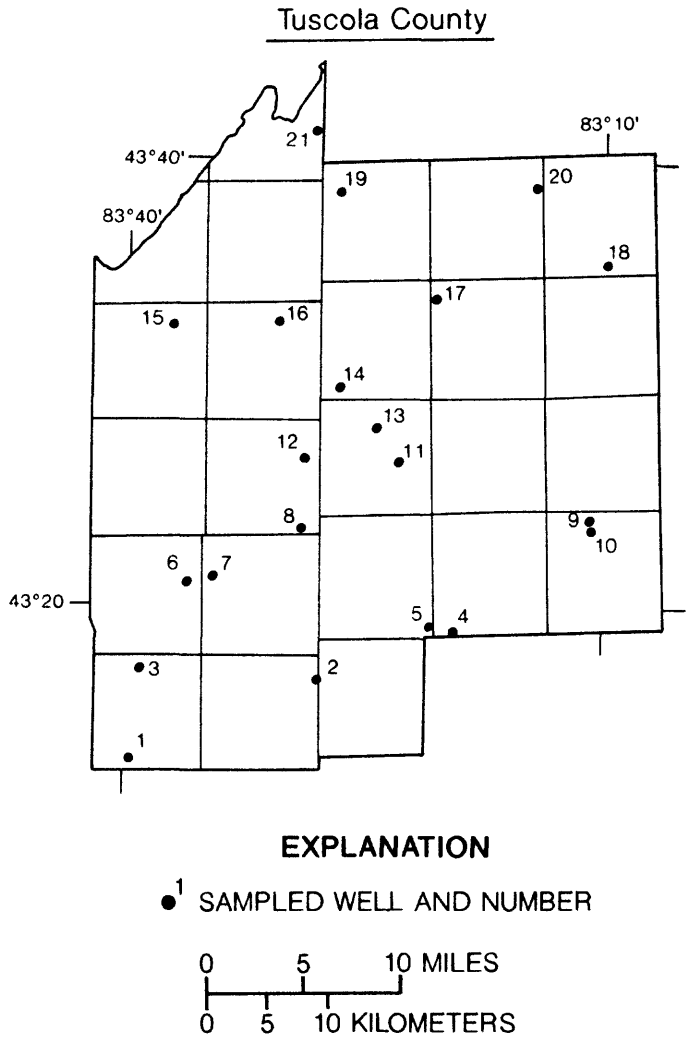


Table 45.--Physical and chemical characteristics for ground water in Tuscola County

[Analyses by U.S. Geological Survey. Geologic unit: 112SDGV, sand and gravel; 324PARM, Parma Sandstone; 324SGNW, Saginaw Formation; 333BPRT, Bayport Limestone; 333MCGN, Michigan Formation; 337MRSL, Marshall Sandstone. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 43°14'23"N | 83°39'42"W | 6-23-88 | 324SGNW | 348 | 652 | 7.79 | 12.5 | 0.5 |
| 2 | 43°17'51"N | 83°28'10"W | 8-11-86 | 324SGNW | 162 | 455 | 7.33 | 10.5 | .6 |

Table 45.--Physical and chemical characteristics for ground water in Tuscola County--Continued

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 43°18'23"N | 83°39'08"W | 8-14-86 | 324SGNW | 127 | 336 | 7.49 | 10.5 | 0.6 |
| 4 | 43°19'23"N | 83°19'40"W | 6-22-88 | 324SGNW | 466 | 510 | 7.56 | 12.0 | 0 |
| 5 | 43°20'17"N | 83°21'13"W | 8-13-86 | 333MCGN | 332 | 370 | 7.30 | 10.0 | .1 |
| 6 | 43°22'08"N | 83°36'19"W | 8-28-86 | 324SGNW | 160 | 426 | 8.00 | 11.5 | 1.0 |
| 7 | 43°22'29"N | 83°34'38"W | 8-07-86 | 324SGNW | 236 | 651 | 7.34 | 10.5 | 1.4 |
| 8 | 43°24'33"N | 83°29'25"W | 8-13-86 | 112SDGV | 74 | 262 | 7.37 | 10.5 | 1.3 |
| 9 | 43°24'34"N | 83°11'08"W | 6-11-87 | 337MRSL | 110 | 482 | 7.53 | 12.0 | .1 |
| 10 | 43°24'36"N | 83°11'08"W | 6-11-87 | 337MRSL | 191 | 492 | 7.50 | 11.0 | .1 |
| 11 | 43°27'24"N | 83°23'12"W | 8-11-86 | 112SDGV | 63 | 275 | 7.87 | 11.0 | 1.1 |
| 12 | 43°27'33"N | 83°29'03"W | 8-13-86 | 333MCGN | 416 | 449 | 8.50 | 11.0 | .3 |
| 13 | 43°28'57"N | 83°24'35"W | 8-11-86 | 112SDGV | 215 | 415 | 7.60 | 10.5 | .3 |
| 14 | 43°30'42"N | 83°26'56"W | 8-28-86 | 333MCGN | 240 | 488 | 7.71 | 10.5 | 2.9 |
| 15 | 43°33'25"N | 83°37'21"W | 8-14-86 | 324SGNW | 170 | 6,600 | 7.70 | 11.0 | .3 |
| 16 | 43°33'36"N | 83°30'49"W | 8-14-86 | 333MCGN | 365 | 2,050 | 7.84 | 11.5 | .4 |
| 17 | 43°34'37"N | 83°21'00"W | 6-22-88 | 324SGNW | 460 | 5,150 | 7.43 | 13.0 | 0 |
| 18 | 43°36'08"N | 83°10'10"W | 6-04-87 | 337MRSL | 240 | 600 | 7.58 | 15.5 | .2 |
| 19 | 43°39'13"N | 83°27'01"W | 8-18-86 | 324PARM | 180 | 803 | 7.62 | 10.5 | 1.1 |
| 20 | 43°39'30"N | 83°14'43"W | 6-08-87 | 337MRSL | 185 | 446 | 7.70 | 12.0 | .1 |
| 21 | 43°41'56"N | 83°28'20"W | 11-12-87 | 333BPRT | 175 | 1,610 | -- | 17.0 | -- |

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 17 | 4.4 | 170 | 2.1 | 352 | <0.02 | 18 | 54 | 1.1 | 0.20 |
| 2 | 71 | 27 | 5.0 | 1.2 | 335 | <.5 | 13 | 1.3 | .50 | .020 |
| 3 | 50 | 13 | 17 | 2.2 | 277 | <.5 | 2.4 | 3.2 | .60 | <.010 |
| 4 | 60 | 14 | 41 | 2.9 | 294 | .07 | 24 | 6.2 | .90 | .022 |
| 5 | 87 | 34 | 6.1 | 1.5 | 348 | <.5 | 54 | 9.4 | .80 | .023 |
| 6 | 30 | 9.9 | 88 | 1.7 | 253 | <.5 | 13 | 41 | 1.2 | .094 |
| 7 | 54 | 20 | 65 | 2.4 | 291 | <.5 | 48 | 60 | .90 | .12 |
| 8 | -- | -- | -- | -- | 301 | 1.2 | -- | -- | -- | -- |
| 9 | 52 | 23 | 29 | 2.0 | 290 | <.02 | 24 | 2.9 | 1.3 | .012 |
| 10 | 54 | 26 | 24 | 1.9 | 268 | .03 | 22 | 2.9 | .90 | <.010 |
| 11 | 38 | 15 | 24 | 1.6 | 263 | <.5 | 6.6 | 1.1 | 1.1 | <.010 |

Table 45.--Physical and chemical characteristics for ground water in Tuscola County--Continued

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 12 | 9.3 | 3.9 | 120 | 1.3 | 267 | <0.5 | 16 | 3.0 | 2.7 | <0.010 |
| 13 | 78 | 26 | 44 | 2.2 | 279 | <.5 | 170 | 7.2 | 1.1 | .023 |
| 14 | 41 | 20 | 57 | 2.4 | 193 | <.5 | 120 | 9.0 | 1.3 | .018 |
| 15 | 47 | 14 | 1,700 | 9.4 | 358 | <.5 | 170 | 2,600 | .70 | 3.8 |
| 16 | 36 | 10 | 440 | 3.7 | 214 | <.5 | 450 | 300 | 1.4 | .56 |
| 17 | 300 | 30 | 800 | 5.7 | 213 | .05 | 810 | 1,200 | 1.1 | 2.0 |
| 18 | 75 | 29 | 12 | 1.8 | 360 | .04 | 34 | 8.1 | .80 | .030 |
| 19 | 60 | 14 | 86 | 3.4 | 199 | <.5 | 210 | 40 | 1.2 | .13 |
| 20 | 45 | 17 | 31 | 2.0 | 220 | -- | 19 | 16 | 1.0 | .016 |
| 21 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, nitrite, dissolved (mg/L as N) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 6.8 | 481 | -- | -- | -- | 20 | <1 | 15 | 3,100 | 95 |
| 2 | 15 | 270 | -- | <0.100 | 0.160 | -- | 6 | -- | 40 | 2,400 |
| 3 | 12 | 218 | -- | <.100 | .930 | <10 | <1 | -- | 240 | 390 |
| 4 | 8.4 | 307 | -- | -- | -- | <10 | <1 | 93 | 2,000 | 790 |
| 5 | 17 | 375 | -- | <.100 | .080 | <10 | 11 | -- | 30 | 1,200 |
| 6 | 13 | 339 | <0.010 | <.100 | 1.20 | 20 | <1 | -- | 400 | 78 |
| 7 | 9.7 | 410 | -- | <.100 | .320 | <10 | <1 | -- | 600 | 220 |
| 8 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 9 | 12 | 296 | -- | -- | -- | <10 | 3 | 110 | 330 | 450 |
| 10 | 13 | 298 | -- | -- | -- | <10 | 6 | 140 | 240 | 740 |
| 11 | 14 | 220 | -- | <.100 | .270 | -- | 17 | -- | 330 | 350 |
| 12 | 7.4 | 339 | -- | <.100 | .130 | <10 | 1 | -- | 4,300 | 41 |
| 13 | 14 | 471 | -- | <.100 | .410 | -- | 12 | -- | 660 | 920 |
| 14 | 12 | 372 | <.010 | <.100 | .460 | <10 | 3 | -- | 690 | 200 |
| 15 | 6.2 | 4,400 | -- | <.100 | 1.30 | <10 | <1 | -- | 3,100 | 190 |
| 16 | 6.6 | 1,370 | -- | <.100 | .470 | <10 | <1 | <100 | 2,600 | 110 |
| 17 | 9.9 | 3,330 | -- | -- | -- | 10 | 1 | 100 | 930 | 5,200 |
| 18 | 16 | 333 | -- | -- | -- | <10 | 8 | 140 | 130 | <3 |
| 19 | 7.6 | 527 | -- | <.100 | .390 | <10 | <1 | -- | 930 | 390 |
| 20 | 13 | 260 | -- | -- | -- | <10 | 14 | 130 | 310 | 180 |

Table 45.--Physical and chemical characteristics for ground water in Tuscola County--Continued

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, nitrite, dissolved (mg/L as N) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 21 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

| Well number | Iron, ferrous, dissolved (µg/L as Fe) | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | C-13/C-12 stable-isotope ratio, (per mil) | H-2/H-1 stable-isotope ratio, (per mil) | O-18/O-16 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | <20 | 29 | 10 | 590 | 160 | -- | -- | -10.50 | 1.1 |
| 2 | -- | 5 | 99 | 240 | 5 | -- | -70.5 | -10.30 | -- |
| 3 | -- | 20 | 39 | 790 | 16 | -- | -61.5 | -9.30 | 5.0 |
| 4 | 750 | 33 | 18 | 1,300 | 18 | -- | -68.5 | -10.30 | 1.1 |
| 5 | -- | 13 | 23 | 230 | 10 | -- | -72.0 | -10.80 | 1.1 |
| 6 | -- | 9 | 12 | 800 | 28 | -- | -66.5 | -9.90 | 2.9 |
| 7 | -- | 16 | 15 | 1,100 | 5 | -- | -67.5 | -10.20 | 1.3 |
| 8 | -- | -- | -- | -- | -- | -- | -68.0 | -10.20 | 1.0 |
| 9 | 400 | 19 | 11 | 500 | 13 | -11.90 | -67.0 | -10.00 | 1.8 |
| 10 | 660 | 16 | 12 | 530 | 14 | -12.70 | -66.5 | -10.00 | 2.0 |
| 11 | -- | 7 | 11 | 740 | 33 | -13.60 | -64.5 | -9.60 | 3.4 |
| 12 | -- | 16 | 4 | 240 | 22 | -- | -74.0 | -10.90 | .9 |
| 13 | -- | 11 | 13 | 2,200 | 6 | -- | -69.5 | -10.30 | 1.2 |
| 14 | -- | 12 | 10 | 1,300 | 98 | -14.10 | -70.5 | -10.40 | 1.7 |
| 15 | -- | 80 | 30 | 1,500 | 90 | -- | -115.0 | -16.30 | 1.4 |
| 16 | -- | 40 | 10 | 650 | 30 | -11.30 | -108.0 | -15.20 | 1.1 |
| 17 | 3,200 | 50 | 28 | 5,500 | 30 | -- | -84.0 | -12.35 | 1.1 |
| 18 | <20 | 16 | 47 | 760 | 10 | -- | -75.0 | -10.80 | 1.0 |
| 19 | -- | 21 | 21 | 2,400 | 5 | -- | -89.5 | -12.90 | 1.1 |
| 20 | 150 | 14 | 15 | 1,200 | 9 | -13.00 | -70.5 | -10.50 | 1.3 |
| 21 | -- | -- | -- | -- | -- | -- | -110.0 | -15.45 | -- |

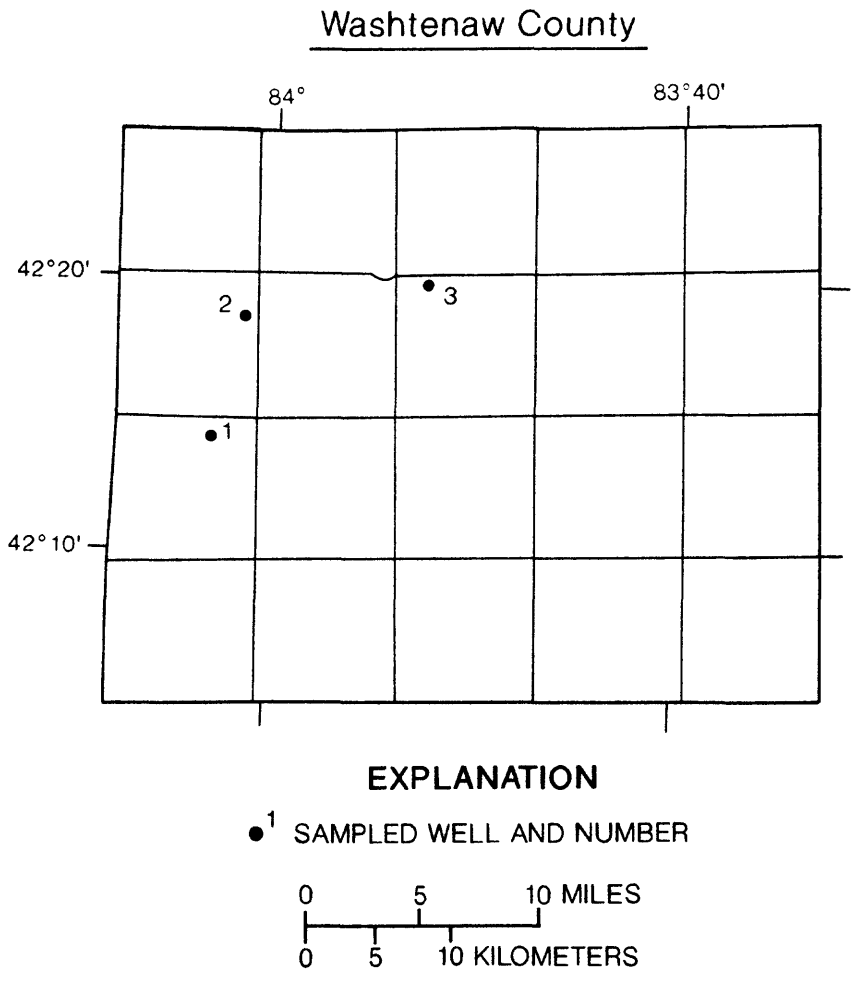


Table 46.--Physical and chemical characteristics for ground water in Washtenaw County

[Analyses by U.S. Geological Survey. Geologic unit: 112SDGV, sand and gravel; 337MRSL, Marshall Sandstone. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 42°14'38"N | 84°03'16"W | 8-13-86 | 337MRSL | 120 | 520 | 7.30 | 12.0 | 0.5 |
| 2 | 42°19'03"N | 84°01'40"W | 8-13-86 | 112SDGV | 85 | 904 | 7.20 | 11.5 | 1.8 |
| 3 | 42°20'22"N | 83°52'38"W | 5-19-87 | 337MRSL | 116 | 874 | 7.44 | 11.0 | .1 |

Table 46.--Physical and chemical characteristics for ground water in Washtenaw County--Continued

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 77 | 22 | 6.0 | 1.4 | 277 | <0.5 | 19 | 1.0 | 0.50 | 0.013 |
| 2 | 120 | 30 | 26 | 1.9 | 396 | <.5 | 68 | 60 | .30 | .16 |
| 3 | 97 | 29 | 28 | 1.2 | 296 | .08 | 55 | 50 | .30 | .18 |

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids residue at 180 °C, dissolved (mg/L) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) | Iron, ferrous, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 15 | 296 | <0.100 | 0.080 | <10 | 6 | -- | 30 | 850 | -- |
| 2 | 18 | 539 | <.100 | .300 | <10 | 1 | -- | 140 | 1,700 | -- |
| 3 | 17 | 474 | -- | -- | 10 | 4 | 310 | 50 | 1,600 | 1,200 |

| Well number | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | H-2/H-1 stable-isotope ratio, (per mil) | O-18 / O-16 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|---|---|---|---|
| 1 | 10 | 37 | 2,300 | 31 | -66.0 | -9.90 | 1.3 |
| 2 | 16 | 86 | 410 | 7 | -60.5 | -9.50 | 4.2 |
| 3 | 19 | 87 | 700 | 3 | -63.0 | -9.40 | 1.6 |

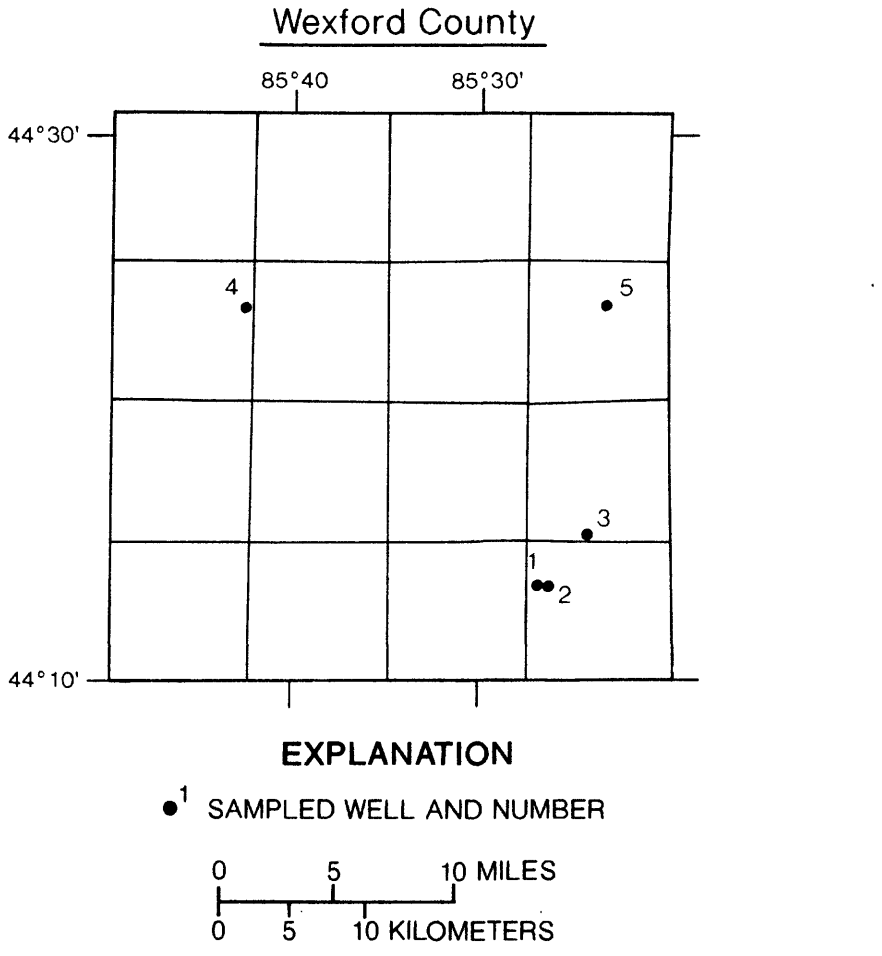


Table 47.--Physical and chemical characteristics for ground water in Wexford County

[Analyses by U.S. Geological Survey. Geologic unit: 112SAND, sand; 112SDGV, sand and gravel. Units of measure: µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter; pCi/L, picocuries per liter. --, no analysis made; <, less than. Alkalinity determined by use of the fixed-endpoint titration method on whole-water samples]

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 44°14'03"N | 85°27'12"W | 5-16-88 | 112SAND | 214 | 225 | 8.05 | 12.0 | 0 |
| 2 | 44°14'03"N | 85°27'18"W | 5-16-88 | 112SAND | 472 | 253 | 8.02 | 12.0 | .1 |
| 3 | 44°15'54"N | 85°24'56"W | 8-21-86 | 112SDGV | 290 | 512 | 7.50 | 10.0 | .3 |

Table 47.--Physical and chemical characteristics for ground water in Wexford County--Continued

| Well number | Latitude | Longitude | Date | Geologic unit | Depth of well, total (feet) | Specific conductance (µS/cm) | pH (standard units) | Temperature water (°C) | Oxygen, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 4 | 44°24'12"N | 85°42'50"W | 8-21-86 | 112SDGV | 225 | 347 | 7.69 | 8.5 | 1.4 |
| 5 | 44°24'23"N | 85°24'02"W | 7-13-87 | 112SAND | 100 | 343 | 7.60 | 11.0 | 4.4 |

| Well number | Calcium, dissolved (mg/L as Ca) | Magnesium, dissolved (mg/L as Mg) | Sodium, dissolved (mg/L as Na) | Potassium, dissolved (mg/L as K) | Alkalinity, field (mg/L as $CaCO_3$) | Sulfide, total (mg/L as S) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Bromide, dissolved (mg/L as Br) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 37 | 10 | 5.0 | 0.50 | 144 | 0.03 | 5.6 | 0.50 | 0.30 | <0.010 |
| 2 | 39 | 7.1 | 3.8 | .40 | 146 | .05 | 5.3 | .50 | .20 | <.010 |
| 3 | 67 | 15 | 16 | 1.4 | 155 | <.5 | 34 | 60 | .60 | .029 |
| 4 | 45 | 17 | 2.3 | .90 | 170 | <.5 | 18 | 1.9 | .30 | <.010 |
| 5 | 51 | 14 | 4.3 | .70 | 170 | -- | 13 | 9.8 | <.10 | .018 |

| Well number | Silica, dissolved (mg/L as $SiO_2$) | Solids, residue at 180 °C, dissolved (mg/L) | Nitrogen, $NO_2+NO_3$, dissolved (mg/L as N) | Nitrogen, ammonia, dissolved (mg/L as N) | Aluminum, dissolved (µg/L as Al) | Arsenic, dissolved (µg/L as As) | Barium, dissolved (µg/L as Ba) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) | Iron, ferrous, dissolved (µg/L as Fe) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 11 | 147 | -- | -- | <10 | 6 | 26 | 10 | 7 | -- |
| 2 | 14 | 149 | -- | -- | <10 | 2 | 33 | 20 | 600 | <20 |
| 3 | 7.0 | 312 | <0.100 | 0.180 | -- | <1 | 34 | 80 | 530 | -- |
| 4 | 9.2 | 200 | <.100 | <.010 | <10 | <1 | -- | 10 | <3 | -- |
| 5 | 9.0 | 207 | -- | -- | <10 | <1 | <100 | 20 | 97 | -- |

| Well number | Lithium, dissolved (µg/L as Li) | Manganese, dissolved (µg/L as Mn) | Strontium, dissolved (µg/L as Sr) | Zinc, dissolved (µg/L as Zn) | Tritium, total (pCi/L) | C-13/C-12 stable-isotope ratio, (per mil) | Carbon-14 (percent modern) | H-2/H-1 stable-isotope ratio, (per mil) | O-18/O-16 stable-isotope ratio, (per mil) | Carbon, organic, dissolved (mg/L as C) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 6 | 24 | 99 | 37 | <2.5 | -7.00 | 58.7 | -60.9 | -8.80 | 1.6 |
| 2 | 5 | 150 | 63 | 10 | <2.5 | -11.50 | 44.8 | -76.0 | -11.30 | 7.3 |
| 3 | 6 | 65 | 75 | 9 | -- | -- | -- | -61.5 | -8.70 | 3.2 |
| 4 | 8 | <1 | 6 | 11 | -- | -- | -- | -78.5 | -11.80 | 1.1 |
| 5 | <10 | 15 | 51 | 10 | -- | -11.70 | -- | -77.5 | -11.40 | 1.3 |