GROUND-WATER DATA FOR MICHIGAN 1986

by G. C. Huffman

U.S. GEOLOGICAL SURVEY

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UNITED STATES DEPARTMENT OF THE INTERIOR

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ABSTRACT

Water levels, locations, depths, and aquifers tapped are given for 112 observation wells. Tabulated data include extremes of water levels for calendar year 1986 and for the period of record, pumpage of most major ground-water users in the State, and water-quality data from selected wells. The largest reported user of ground-water, the city of Lansing, pumped 7.6 billion gallons from the Saginaw Formation and glacial deposits in 1986.

INTRODUCTION

Purpose and Scope

This report makes available, through 1986, the records of water levels and related data for the principal aquifers of Michigan. Data on yield of wells, pumpage, quality of water, and hydrographs of ground-water levels for the past 5 years are shown in the text. Yearly hydrographs are included to illustrate seasonal changes in water levels. Records of water levels in observation wells, records of pumpage by most major ground-water users, and water-quality data from selected wells sampled during 1986 are given in tables 1, 2, and 3. Distribution of observation wells is shown in figure 1. Location of wells sampled for water-quality data and years sampled are shown in figure 2.

Application of Data

The quantity of water available from an aquifer can be determined by analysis of records of water levels and pumpage. Water-level records showing long-term effects of pumping can be used to estimate the capacity of aquifers to meet present and future demands for water and to determine whether expansion of present supply systems for ground water is practicable.

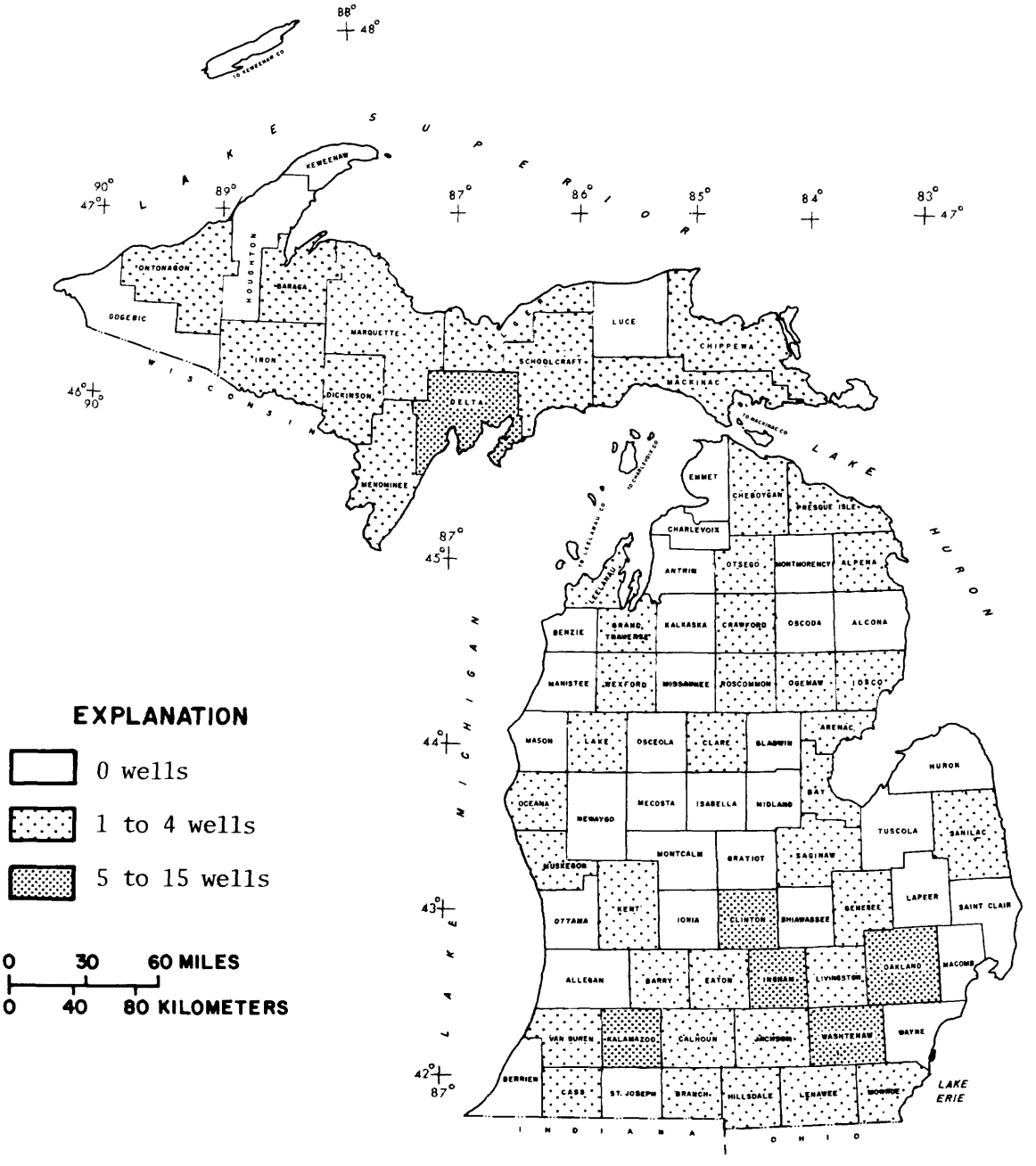


Figure 1.--Distribution of observation wells. Water levels were monitored in 112 wells in 1986.

Water levels normally fluctuate annually (fig. 5) and may exhibit long-term trends over a period of years. Should an excavation be made when the levels are low, good construction practices would allow for probable higher levels. When construction is made after several years of drought, the allowance for rising water levels should be greater. Test drilling may be needed at some sites to determine water levels. In an area where the water level is declining because of pumping, projection of future water levels indicates the depth below which well intakes should be installed.

Ground-Water Records and Reports

Tabulations of water-level measurements, hydrographs of observation wells, records of chemical quality, water-temperature measurements, well records and logs, aquifer tests, records of pumping for public and industrial supplies, and water-resources reports are on file for public inspection. They may be examined at the Geological Survey Division, Michigan Department of Natural Resources, Mason Building, Lansing, Michigan 48933; or at the U.S. Geological Survey, 6520 Mercantile Way, Suite 5, Lansing, MI 48911. Records for the Upper Peninsula are also kept on file in the State and Federal Geological Survey Offices, State Office Building, Escanaba, MI 49829.

Ground-water levels from 1935 to 1974 are reported in U.S. Geological Survey Water-Supply Papers (WSP). Records since 1975 are in U.S. Geological Survey Water-Data Reports (WDR). Annual reports, titled "Summary of Ground-Water Conditions in Michigan," were begun in 1956 to supplement the Water-Supply Paper and Water-Data Report series. The title of the report was changed to "Summary of Ground-Water Hydrological Data in Michigan," in 1967 and to "Ground-Water Data for Michigan" in 1973.

Areas covered by reports that describe ground water in Michigan are shown in figures 3 and 4. In addition, many publications dealing with ground water are listed in the selected references at the end of this report.

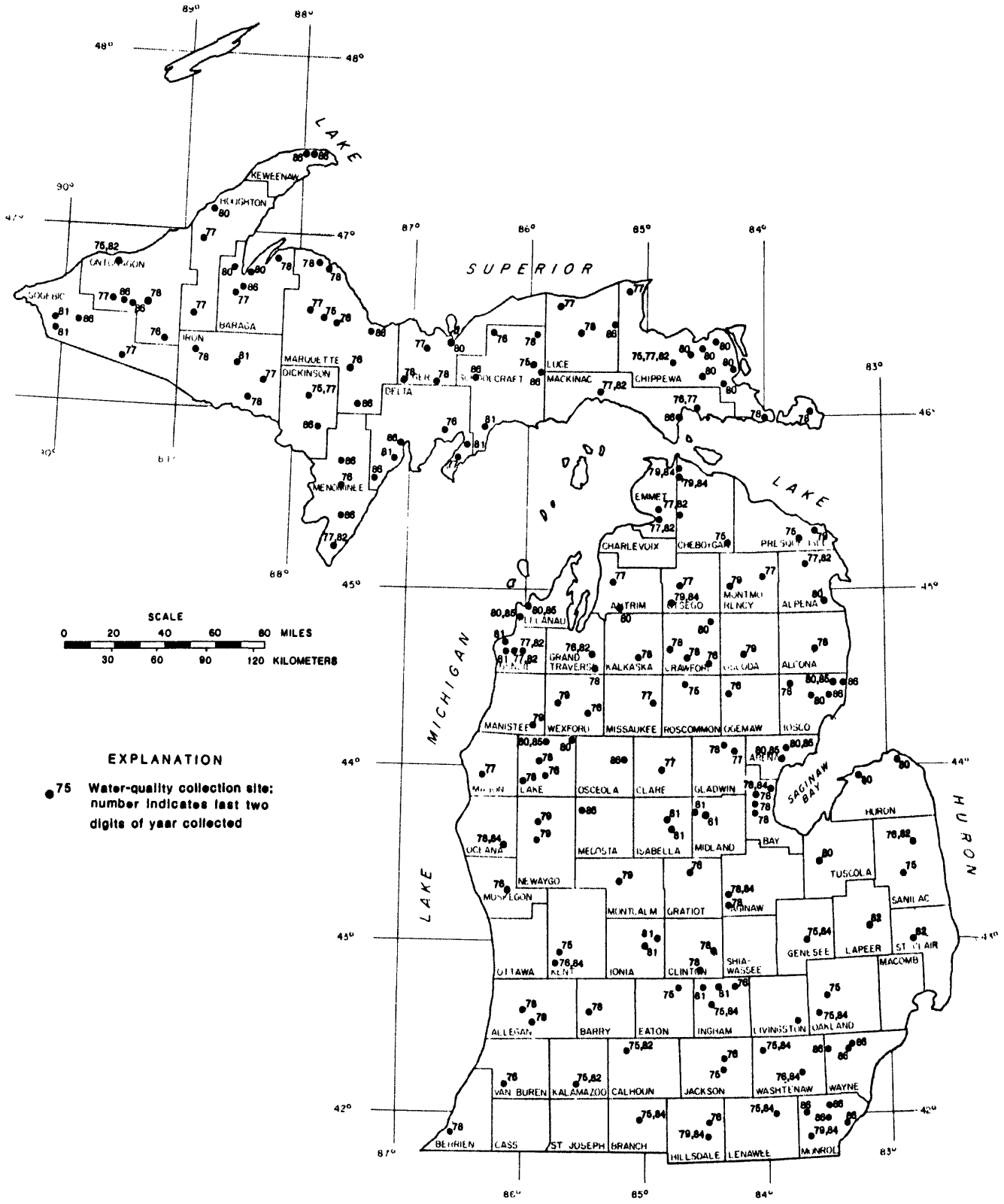
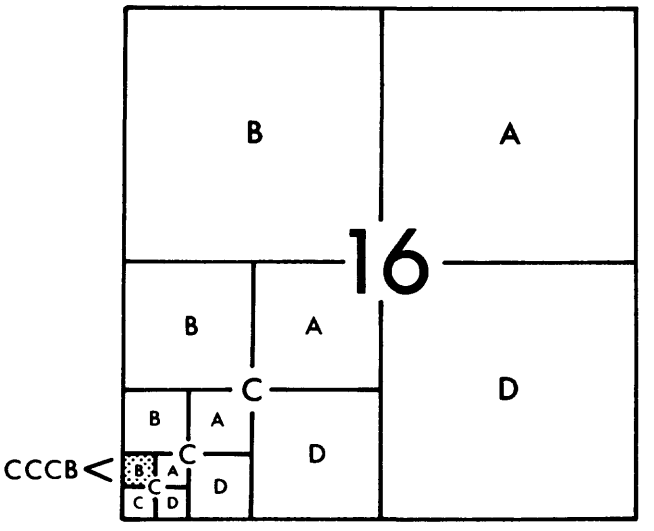


Figure 2.--Water-quality collection sites and year sample collected. (Water-quality data are given in the annual ground-water report for year in which sample was collected except data for the years 1975-76 which are in the annual report for 1977. Analyses by U.S. Geological Survey.)

Well-Numbering System

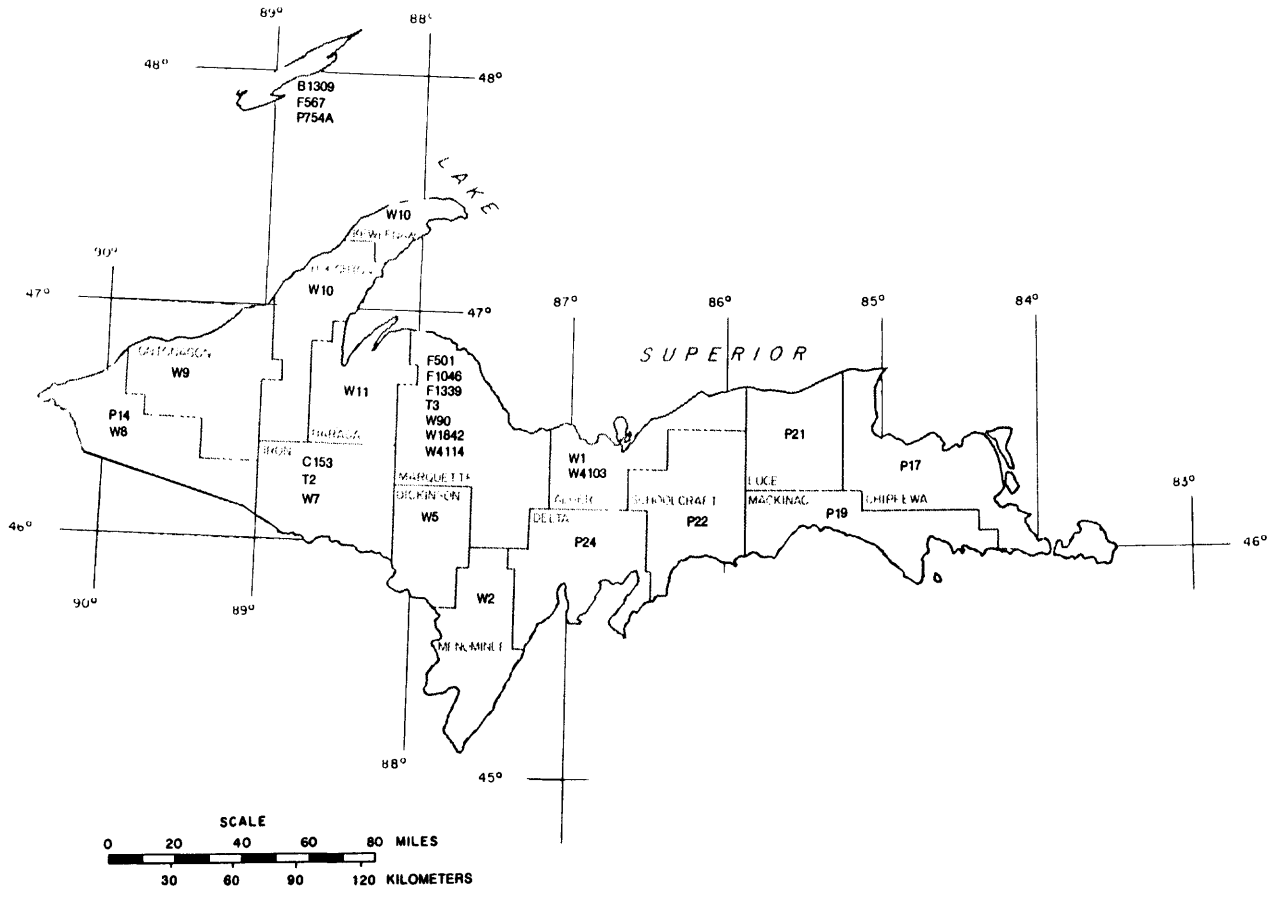
The well-numbering system for Michigan indicates the location of wells within a rectangular subdivision of land with reference to the Michigan meridian and base line. The first two segments of the well number designate township and range, the third segment of the number designates the section, and the letters A through D designate successively smaller subdivisions of the section, as shown below. Thus, a well designated as 32N 6E 16CCCB is located to the nearest 2.5 acres and is within the shaded area in section 16.



For many wells in this report, locations are only given to the nearest 40-acre tract, for example, 16CC. In the event that two or more wells are in the same tract, sequential number designation is added--for example, 16CCCB1, 16CCCB2, etc. The Michigan Geological Survey uses a similar system except that numbers are used instead of letters.

Acknowledgments

Acknowledgment is made to personnel of Federal and State agencies, county and township governments, industrial concerns, well drillers, consultants, municipalities, and public utilities, without whose cooperation the accumulation of data presented in this report would not have been possible.



EXPLANATION

C153 Symbol for reports shown on following peges

Figure 3.--Areas in the Upper Peninsula where ground-water conditions are described in published reports.

PUBLISHED REPORTS

Upper Peninsula

B1309 -- Huber, N. K., 1975, The geologic story of Isle Royale National Park: U.S. Geological Survey Bulletin 1309.

C153 -- Pettijohn, F. J., 1952, Geology of the northern Crystal Falls area, Iron County, Michigan: U.S. Geological Survey Circular 153.

F501 -- Doonan, C. J., and VanAlstine, J. L., 1982, Ground water and geology of Marquette County, Michigan: U.S. Geological Survey Open-File Report 82-501.

F567 -- Grannemann, N. G., and Twenter, F. R., 1982, Ground water for public supply at Windigo, Isle Royale National Park, Michigan: U.S. Geological Survey Open-File Report 82-567.

F1046 -- Grannemann, N. G., 1978, Water supply potential of the Lake Sally system, Marquette County, Michigan: U.S. Geological Survey Open-File Report 78-1046.

F1339 -- ____, 1979, Water resources of the Marquette Iron Range area, Marquette County, Michigan: U.S. Geological Survey Open-File Report 79-1339.

P14 -- Brown, E. A., and Stuart, W. T., 1951, Ground-water resources of the glacial deposits in the Bessemer area, Michigan: Michigan Geological Survey Progress Report 14.

P17 -- Vanlier, K. E., and Deutsch, Morris, 1958, Reconnaissance of the ground-water resources of Chippewa County, Michigan: Michigan Geological Survey Progress Report 17.

P19 -- ____, 1958, Reconnaissance of the ground-water resources of Mackinac County, Michigan: Michigan Geological Survey Progress Report 19.

P21 -- Vanlier, K. E., 1959, Reconnaissance of the ground-water resources of Luce County, Michigan: Michigan Geological Survey Progress Report 21.

P22 -- Sinclair, W. C., 1959, Reconnaissance of the ground-water resources of Schoolcraft County, Michigan: Michigan Geological Survey Progress Report 22.

P24 -- ____, 1960, Reconnaissance of the ground-water resources of Delta County, Michigan: Michigan Geological Survey Progress Report 24.

P754A -- Huber, N. K., 1973, Glacial and postglacial geologic history of Isle Royale National Park, Michigan: U.S. Geological Survey Professional Paper 754-A.

T2 -- Stuart, W. T., Theis, C. V., and Stanley, G. M., 1948, Ground-water problems in the Iron River district, Michigan: Michigan Geological Survey Technical Report 2.

T3 -- Stuart, W. T. Brown, E. A., and Rhodehamel, E. C., 1954, Ground-water investigations of the Marquette iron-mining district, Michigan: Michigan Geological Survey Technical Report 3.

W1 -- Vanlier, K. E., 1963, Reconnaissance of the ground-water resources in Alger County, Michigan: Michigan Geological Survey Water Investigation 1.

W2 -- ____, 1963, Ground water in Menominee County: Michigan Geological Survey Water Investigation 2.

W5 -- Hendrickson, G. E., and Doonan, C. J., 1966, Ground-water resources of Dickinson County, Michigan: Michigan Geological Survey Water Investigation 5.

W7 -- Doonan, C. J., Hendrickson, G. E., 1967, Ground water in Iron County, Michigan: Michigan Geological Survey Water Investigation 7.

W8 -- ____, 1968, Ground water in Gogebic County, Michigan: Michigan Geological Survey Water Investigation 8.

W9 -- ____, 1969, Ground water in Ontonagon County, Michigan: Michigan Geological Survey Water Investigation 9

W10 -- Doonan, C. J., Hendrickson, G. E.,and Byerlay, J. R., 1970, Ground water and geology of Keweenaw Peninsula, Michigan: Michigan Geological Survey Water Investigation 10.

W11 -- Doonan, C. J., and Byerlay, J. R., 1973, Ground water and geology of Baraga County, Michigan: Michigan Geological Survey Water Investigation 11.

W90 -- Twenter, F. R., 1981, Geology and hydrology for environmental planning in Marquette County, Michigan: U.S. Geological Survey Water Resources Investigations, 80-90.

W1842 -- Wiitsla, S. W., Newport, T. G., and Skinner, E. L., 1967, Water Resources of the Marquette Iron Range area, Michigan: U.S. Geological Survey Water-Supply Paper 1842.

W4103 -- Handy, A. H., and Twenter, F. R., Water Resources of Pictured Rocks National Lakeshore, Michigan, 1985, U.S. Geological Survey Water Resources Investigations Report 85-4103.

W4114 -- Grannemann, N. G., 1984, Hydrogeology and effects of tailing basins on the hydrology of Sands Plain, Marquette County, Michigan, U.S. Geological Survey Water-Resources Investigations Report 84-4114.

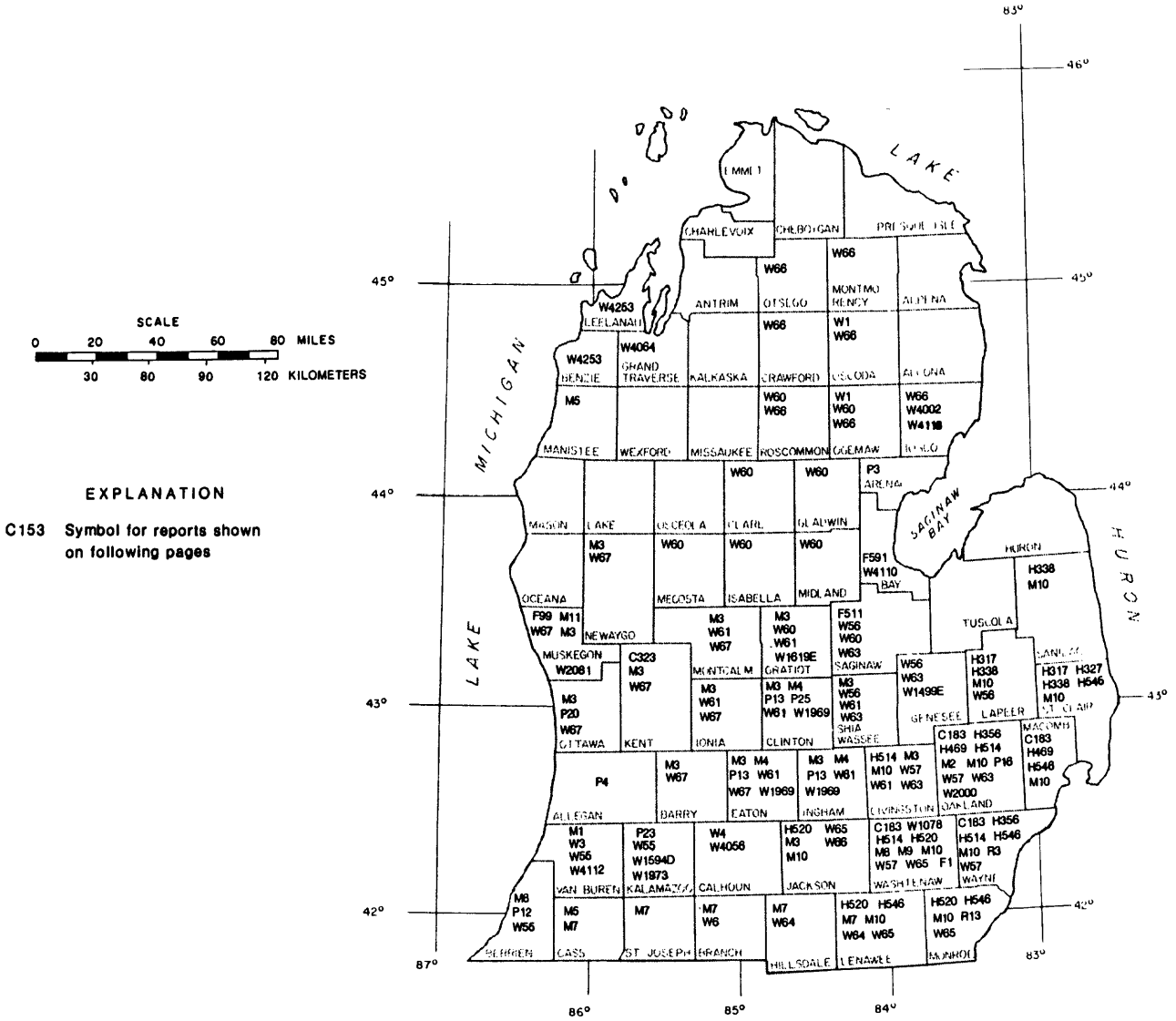


Figure 4.--Areas in the Lower Peninsula where ground-water conditions are described in published reports.

PUBLISHED REPORTS

Lower Peninsula

C183 -- Wisler, C.O., Stramel, G. J., and Laird, L. B., 1952, Water resources of the Detroit area, Michigan: U.S. Geological Survey Circular 183.

C323 -- Stramel, G. J., Wisler, C. O., and Laird, L. B., 1954, Water resources of the Grand Rapids area, Michigan: U.S. Geological Survey Circular 323.

F1 -- Fleck, W. B., 1980, Geology and hydrology for environmental planning in Washtenaw County, Michigan: U.S. Geological Survey Open-File Report unnumbered.

F99 -- McDonald, M. G., and Fleck, W. B., 1978, Model analysis of the impact on ground-water conditions of the Muskegon County wastewater disposal system, Michigan: U.S. Geological Survey Open-File Report 78-99.

F511 -- Handy, A. H., 1982, Water quality of coal deposits and abandoned mines, Saginaw County, Michigan: U.S. Geological Survey Open-File Report 82-511.

F591 -- Stark, J. R., and McDonald, M. G., 1980, Ground water of coal deposits, Bay County, Michigan: U.S. Geological Survey Open-File Report 80-591.

H317 -- Knutilla, R. L., 1969, Water resources of the Belle River basin, southeastern Michigan: U.S. Geological Survey Hydrological Investigation Altas HA-317.

H327 -- ____, 1969, Water resources of the Pine River basin, southeastern Michigan: U.S. Geological Survey Hydrological Investigation Atlas HA-327.

H338 -- ____, 1970, Water resources of the Black River basin, southeastern Michigan: U.S. Geological Survey Hydrological Investigation Atlas HA-338.

H356 -- ____, 1971, Water resources of the River Rouge basin, southeastern Michigan: U.S. Geological Survey Hydrological Investigation Atlas HA-356.

H469 -- Nowlin, J. O., 1973, Water resources of the Clinton River basin, southeastern Michigan: U.S. Geological Survey Hydrological Investigation Atlas HA-469.

H514 -- Larson, R. W., Allen, W. B., and Hanson, S. D., 1975, Water resources of the Huron River basin, southeastern Michigan: U.S. Geological Survey Hydrological Investigation Atlas HA-514.

H520 -- Knutilla, R. L., and Allen, W. B., 1975, Water resources of the River Raisin basin, southeastern Michigan: U.S. Geological Survey Hydrological Investigation Atlas HA-520.

H546 -- Twenter, F. R., Knutilla, R. L., Cummings, T. R., 1975, Water resources of basins for minor streams draining into St. Clair River, Lake St. Clair, Detroit River, and Lake Erie, southeastern Michigan: U.S. Geological Survey Hydrological Investigation Atlas HA-546.

M1 -- Terwilliger, F. W., 1954, The glacial geology and ground-water resources of Van Buren County, Michigan, pt. 1 of Occasional papers for 1954 on the geology of Michigan: Michigan Geological Survey Publication 48.

M2 -- Mozola, A. J., 1954, A survey of ground-water resources in Oakland County, Michigan, pt. 2 of Occasional papers for 1954 on the geology of Michigan: Michigan Geological Survey Publication 48.

M3 -- Vanlier, K. E., 1968, Comprehensive planning study of the Grand River basin, Michigan, Appendix E, Ground-water resources and geology of the Grand River basin, Michigan: U.S. Army Engineers District, Detroit, Michigan.

M4 -- Vanlier, K. E., and Wheeler, M. L., 1968, Analog simulation of ground-water development of the Saginaw Formation, Lansing metropolitan area, Michigan: Tri-County Planning Commission, Lansing Ground-Water Report.

M5 -- Childs, K. E., 1970, History of the salt, brine, and paper industries and their probable effect on the ground-water quality in the Manistee Lake area, Michigan: Michigan Department of Natural Resources.

M6 -- Schneider, A. F., and Keller, S. J., 1970, Indiana Geological Survey regional geological map number 4: Indiana Department of Natural Resources.

M7 -- Johnson, G. H., and Keller, S. J., 1972, Indiana Geological Survey regional geologial map number 8: Indiana Department of Natural Resources.

M8 -- Twenter, F. R., Knutilla, R. L., and Nowlin, J. O., 1976, Water resources of Washtenaw County, Michigan: Washtenaw County Metropolitan Planning Commission.

M9 -- Borton, T. E., 1974, Planning perspectives on water resources, Washtenaw County, Michigan: Washtenaw County Metropolitan Planning Commission.

M10 -- Twenter, F. R., 1975, Ground water and geology -- southeastern Michigan: U.S. Army Corps of Engineers.

M11 -- Fleck, W. B., and McDonald, M. G., 1978, Three-dimensional finite-difference model of ground-water system underlying the Muskegon County wastewater disposal system, Michigan: U.S. Geological Survey Journal of Research, volume 6, number 3.

P3 -- Pringle, G. H., 1937, Geology of Arenac County, Michigan: Michigan Geological Survey Progress Report 3.

P4 -- Riggs, C. H., 1938, Geology of Allegan County, Michigan: Michigan Geological Survey Progress Report 4.

P12 -- Stuart, W. T., and Stallman, R. W., 1945, Ground-water resources of the Benton Harbor area, Michigan: Michigan Geological Survey Progress Report 12.

P13 -- Stuart, W. T., 1945, Ground-water resources of the Lansing area, Michigan: Michigan Geological Survey Progress Report 13.

P16 -- Ferris, J. G., and others, 1954, Ground-water resources of southeastern Oakland County, Michigan: Michigan Geological Survey Progress Report 16.

P20 -- Deutsch, Morris, Burt, E. M., and Vanlier, K. E., 1958, Summary of ground-water investigations in the Holland area, Michigan: Michigan Geological Survey Progress Report 20.

Lower Peninsula

P23 -- Deutsch, Morris, Vanlier, K. E., and Giroux, P. R., 1960, Ground-water hydrology and glecial geology ot the Kalamazoo area, Michigan: Michigan Geological Survey Progress Report 23.

P25 -- Vanlier, K. E., 1962, Summary of ground-water investigations in the Elsie area, Michigan: Michigan Geological Survay Progress Report 25.

R3 -- Mozola, A. J., 1969, Geology for land and ground-water development in Wayne County, Michigan: Michigan Geological Survey Report Investigation 3.

R13 -- ____, 1970, Geology for environmental planning in Monroa County, Michigan: Michigan Geological Survey Report Inveatigation 13.

W1 -- Knutilla, R. L., Twenter, F. R., and Larson, R. W., 1971, Uppar Rifle River Basin -- An Evaluation of its Water Resources and Hydrologic Environment: Michigan Geological Survey Water Information Saries Report 1.

W3 -- Giroux, P. R., Hendrickaon, G. E., Stoimanoff, L. E., and Whetstone, G. W., 1964, Water resources of Van Buren County, Michigan: Michigan Geological Survey Investigation 3.

W4 -- Vanlier, K. E., 1966, Ground-water resources of the Battle Creek area, Michigan: Michigan Geological Survey Water Investigation 4.

W6 -- Giroux, P. R., Stoimenoff, L. E., Nowlin, J. O., and Skinner, E. L., 1966, Water resources of Branch County, Michigan: Michigan Geological Survey Water Investigation 6.

W55 -- Water resource conditions and uses in the Paw Paw River Basin, 1955, (revised report in 1964): Michigan Water Resources Commission Report.

W56 -- Water resource conditions and uses in the Flint River Basin, 1956: Michigan Water Resources Commission Report.

W57 -- Water resource conditions and uses in the Huron River Basin, 1957: Michigen Water Resources Commission Report.

W60 -- Water resource conditions and uses in the Tittabawassee River Basin, 1960: Michigan Weter Resources Commission Report.

W61 -- Water resource conditions and uses in the Upper Grand River Basin, 1961: Michigan Weter Resources Commission Report.

W63 -- Water resource conditions and uses in the Shiawassee River Basin, 1963: Michigen Water Resources Commission Report.

W64 -- Water resource conditions and uses in the Maumee River Basin, 1964: Michigan Water Resources Commiseion Report.

W65 -- Water resource conditions and uses in the River Raisin Basin, 1965: Michigen Water Resources Commission Report.

W66 -- Water resource conditions and uses in the Au Sable River Basin, 1966: Michigan Weter Resources Commission Report.

W67 -- Water resource conditions and uses in the Lower Grend River Basin, 1967, (open file): Michigen Water Resources Commission Report.

W1078 -- McGuinness, C. L., Poindexter, O. F., and Otton, E. G., 1949, Ground-water supplies of the Ypsilanti eree, Michigen: U.S. Geological Survey Water-Supply Paper 1078.

W1499E -- Wiitala, S. W., Vanlier, K. E., and Krieger, R. A., 1963, Water resources of the Flint area, Michigen: U.S. Geological Survey Watar-Supply Peper 1499-E.

W1594D -- Reed, J. E., Deutsch, Morris, and Wiitala, S. W., 1966, Induced recharge of an artesian gleciel-drift aquifer et Kalamezoo, Michigan: U.S. Geological Survey Water-Supply paper 1594-D.

W1619E -- Vanlier, K. E., 1963, Ground-water resources of the Alma area, Michigan: U.S. Geological Survey Water-Supply Paper 1619-E.

W1969 -- Vanlier, K. E., Wood, W. W., and Brunett, J. O., 1973, Water-supply development and management alternetives for Clinton, Eeton, and Ingham Counties, Michigan: U.S. Geological Burvey Water-Supply Peper 1969.

W1973 -- Allen, W. B., Miller, J. B., end Wood, W. W., 1972, Availebility of watar in Kalamazoo County, Michigan: U.S. Geological Survey Water-Supply paper 1973.

W2000 -- Twenter, F. R., and Knutilla, R. L., 1972, Water for a rapidly growing urban community -- Oaklend County, Michigen: U.S. Geological Survey Water-Supply paper 2000.

W2081 -- McDonald, M. G., 1980, Hydraulic characteristics of an underdrained irrigation circle, Muskegon County westawater disposal system, Michigan: U.S. Geological Survey Weter-Supply Paper 2081.

W4002 -- Stark, J. R., Cummings, T. R., end Twenter, F. R., 1983, Ground-water contamination et Wurtsmith Air Force Base, Michigan: U.S. Geological Survey Water Resources Investigations Report 83-4002.

W4056 -- Grannemann, N. G., and Twenter, F. R., 1985, Geohydrology and ground-water flow at Verona Well Field, Battle Creek, Michigan: U.S. Geological Survey Water Resources Investigetions Report 85-4056.

W4064 -- Twenter, F. R., Cummings, T. R., and Grennemann, N. G., 1983, Ground-water contamination in East Bay Township, Michigan: U.S. Geological Survey Water-Resources Investigations Report 85-4064.

W4110 -- Twenter, F. R., end Cummings, T. R, 1985, Quality of ground water in Monitor end Williams Townships, Bay County, Michigan: U.S. Geological Survey Water Resources Inveetigations Report 85-4110.

W4112 -- Cummings, T. R., Twenter, F. R., end Holtschlag, D. J., 1984, Hydrology and land use in Ven Buren County, Michigan: U.S. Geological Survey Water Resources Investigetions Report 84-4112.

W4118 -- Cummings, T. R., Twenter, F. R., 1986, Asseeement of ground-water contemination at Wurtsmith Air Force Base, Michigan, 1982-85: U.S. Geological Survey Water Reeources Inveatigatione Report 86-4118.

W4253 -- Handy, A. H., and Stark, J. R., 1984, Water reeources of Sleeping Bear Dunes National Lakeshore, Michigan: U.S. Geological Survey Water Reaources Inveatigations Report 83-4253.

GROUND-WATER LEVELS

Water levels, measured in 112 observation wells throughout the State (fig. 1 and table 1) in 1986, generally follow precipitation trends. Rising levels usually occur where precipitation has been above normal and declining levels where precipitation has been below normal. Hydrographs (fig. 5) show that water levels are generally highest in spring. At this time, snowmelt and rain normally recharge ground-water reservoirs. However, ice cover or frost in the ground can impede infiltration. Under these conditions, most water from snowmelt flows overland and little recharge occurs. Generally, less recharge occurs during the summer, as most rainfall is evaporated, transpired, or flows overland after intense thunderstorms. In the fall, when evapotranspiration is reduced, heavy rains may cause water levels to rise. Frozen ground impedes infiltration of water during winter.

Although quantity of precipitation is a major factor affecting ground-water levels, many other natural factors, such as soil condition, nature of underlying rock, and slope of the land surface affect the levels. Minor fluctuation in levels are caused by earth tides and variation in barometric pressure. Evapotranspiration causes small daily declines in water levels in some shallow wells. Pumping withdrawals can lower water levels appreciably. If withdrawals are greater than recharge, long-term water-level declines will occur. Uniform pumping rates throughout the year may allow levels to follow precipitation trends.

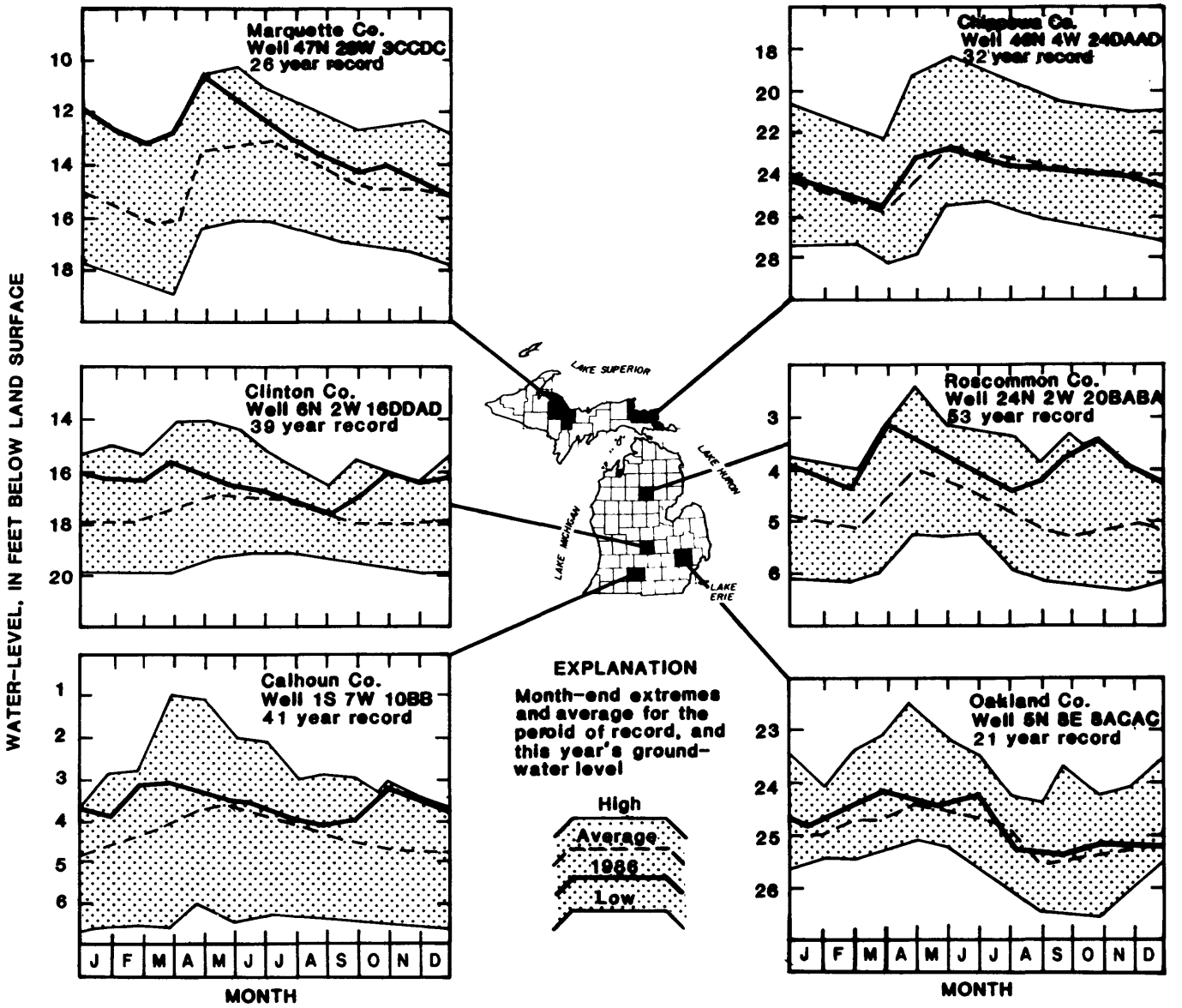
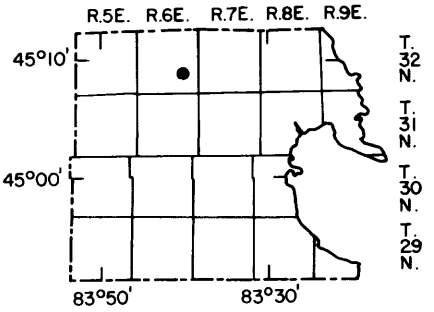
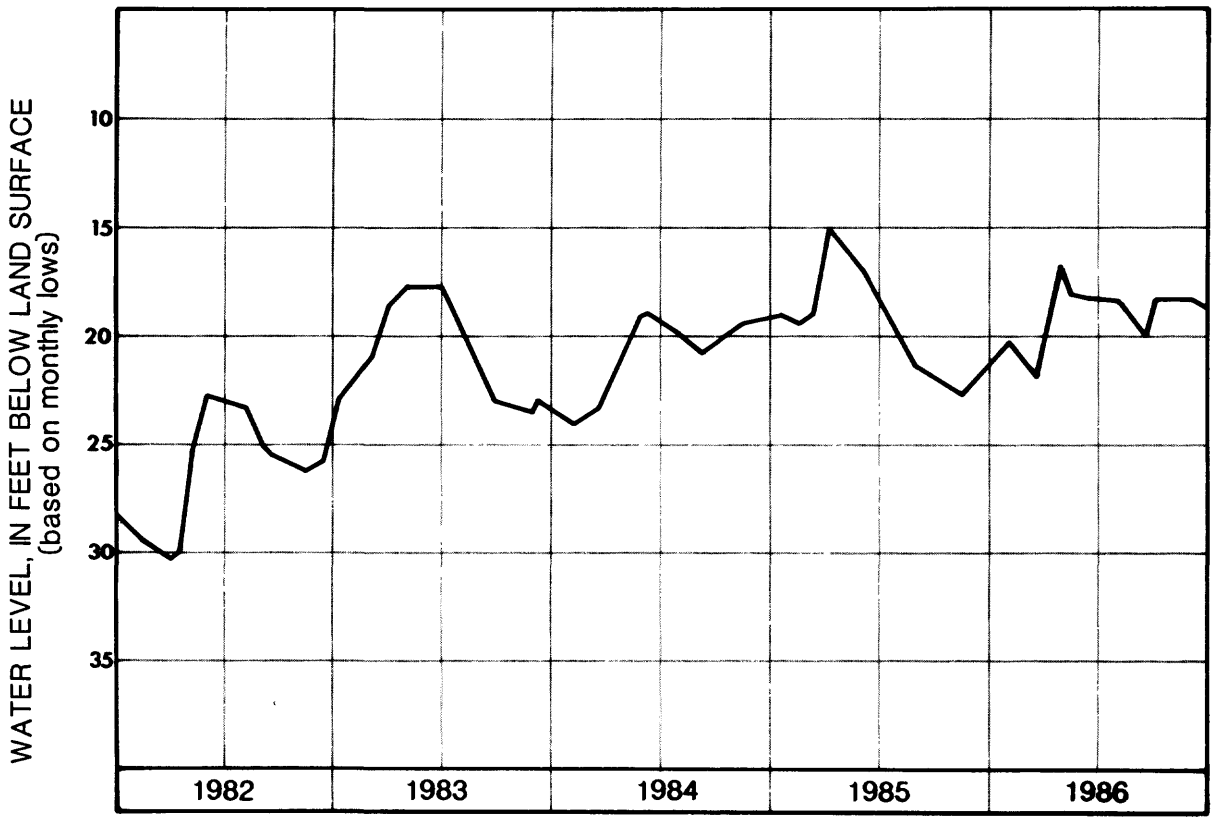


Figure 5.--Water levels in selected wells.

GROUND-WATER DATA

Variation of water levels and descriptions of some ground-water supplies in Michigan follow alphabetically, by county. Yield of wells and pumpage data are given as reported by water departments and consultants.





Water levels in well 32N 6E 23DDDA1. Well is 88 feet deep and in sand. Water-quality data in ground-water reports for 1977 and 1982 (Huffman, 1979, 1983).

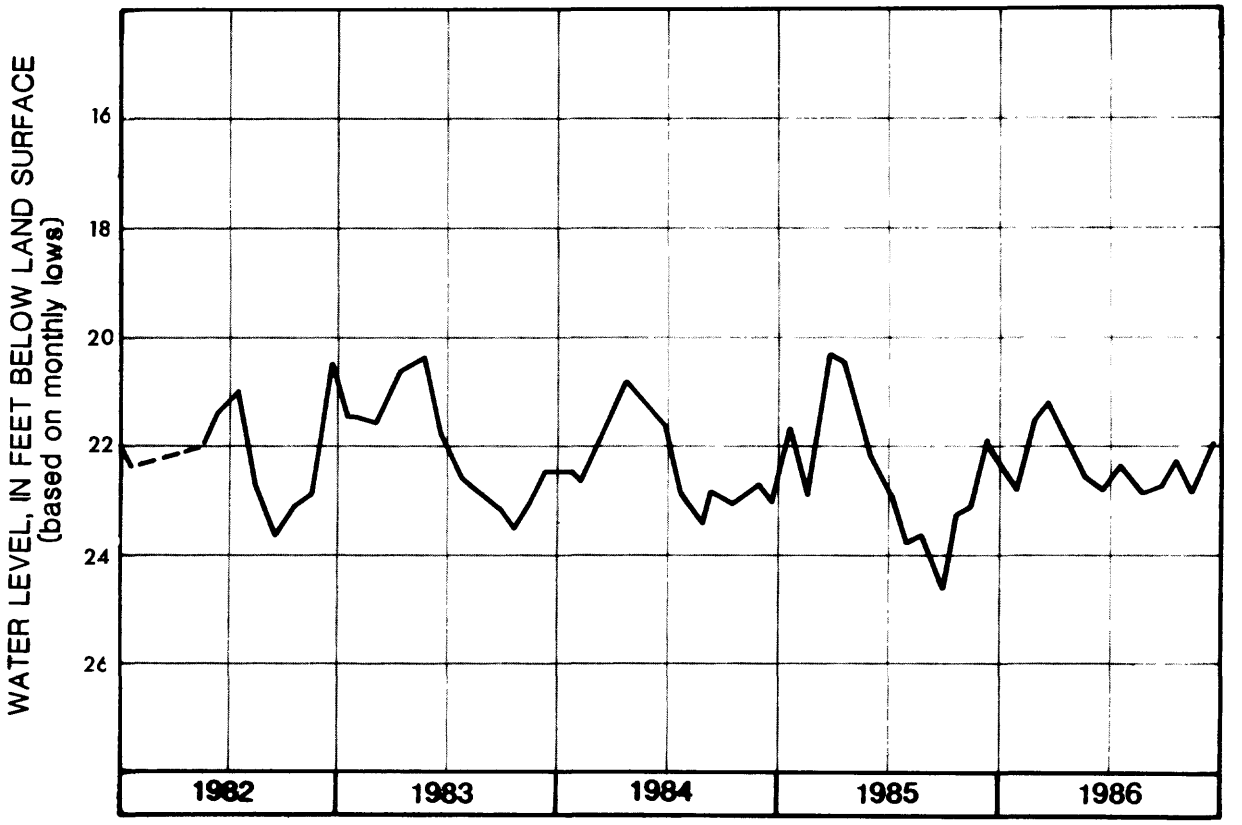
BRANCH COUNTY - CITY OF COLDWATER

SUPPLY AND SOURCE -- 4 wells, 117 to 129 feet deep, tap glacial deposits.

YIELD OF WELLS -- 1,200 to 2,850 gal/min; specific capacity -- 80 to 190 gal/min/ft of drawdown.

PUMPAGE -- Total annual pumpage, in million gallons, for past 5 years.

1986 - 1,183
1985 - 1,168
1984 - 1,115
1983 - 1,308
1982 - 1,123



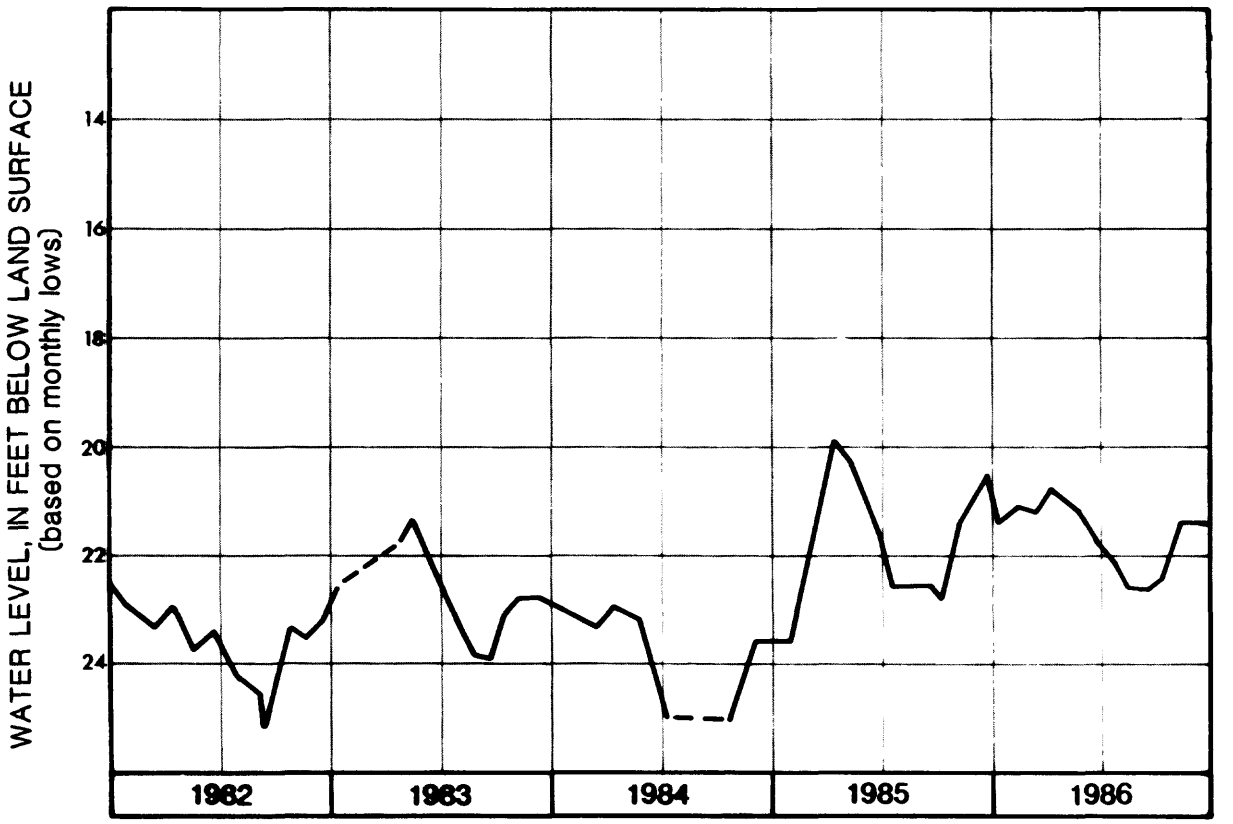
Water levels in well 6S 6W 22CABA1. Well is 113 feet deep and in glacial deposits.

SUPPLY AND SOURCE -- 38 wells, 110 to 180 feet deep, tap sandstones of Marshall Formation.

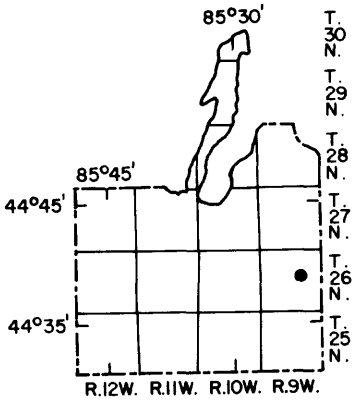
YIELD OF WELLS -- 300 to 1,000 gal/min; specific capacity -- 50 to 650 gal/min/ft of drawdown.

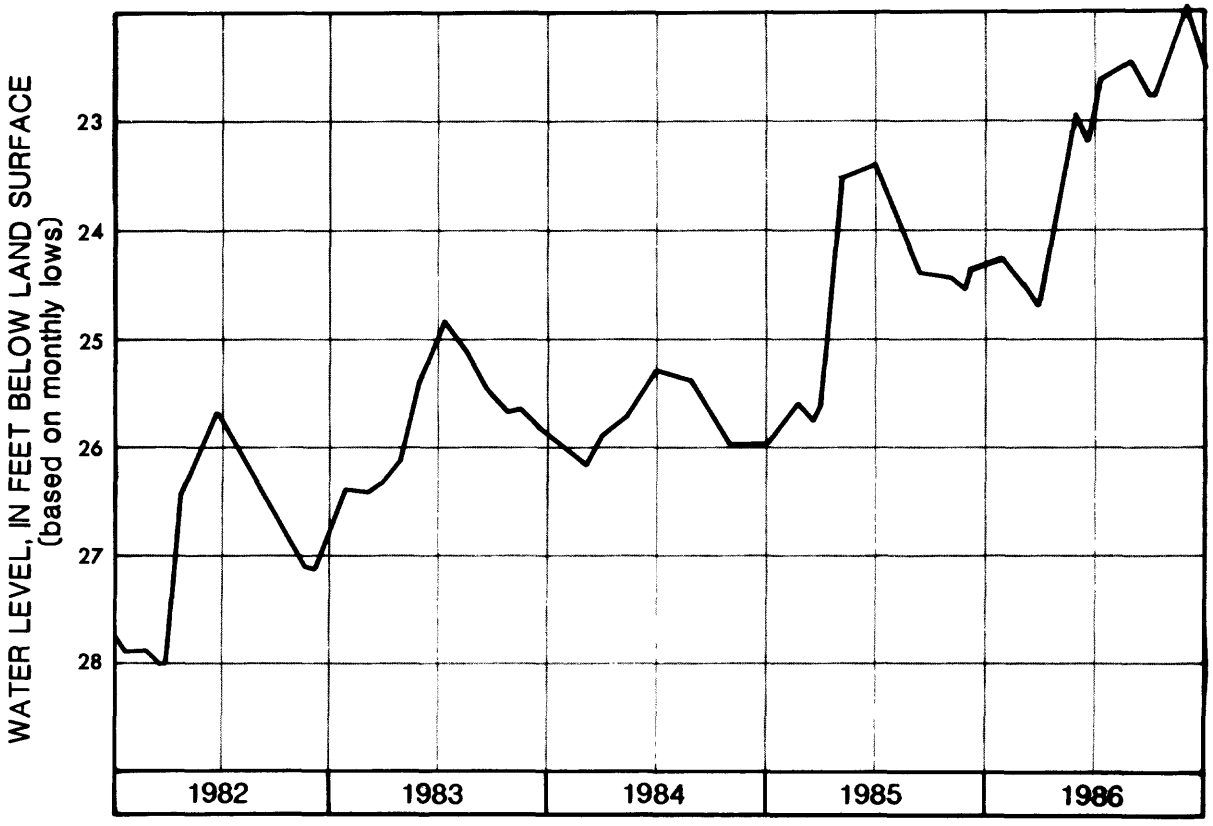
PUMPAGE -- Total annual pumpage, in million gallons, for past 5 years.

1986 - 3,518
1985 - 2,950
1984 - 3,083
1983 - 3,495
1982 - 3,590

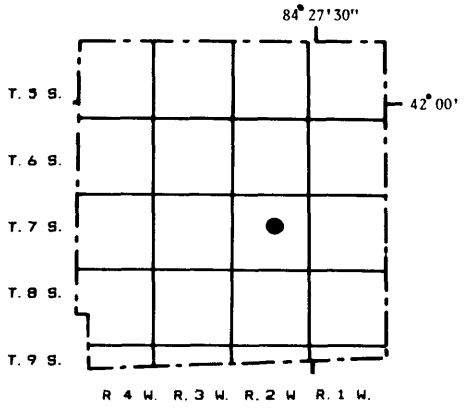


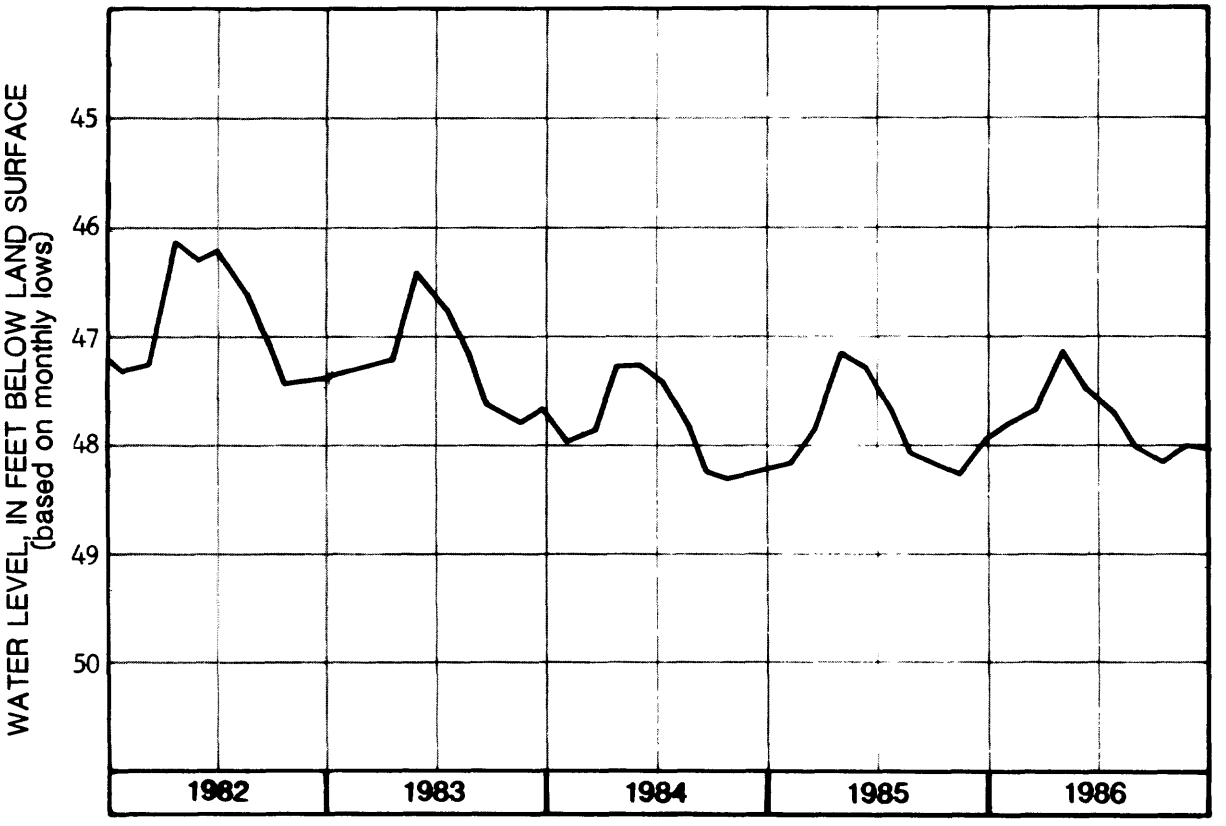
Water levels in well 1S 7W 32BDCC1. Well is 95 feet deep and in Marshall Formation. Water-quality data in ground-water reports for 1977 and 1982 (Huffman, 1979, 1983).





Water levels in well 26N 9W 14ABAA1. Well is 80 feet deep and in sand. Water-quality data in ground-water reports for 1977 and 1982 (Huffman 1979, 1983).





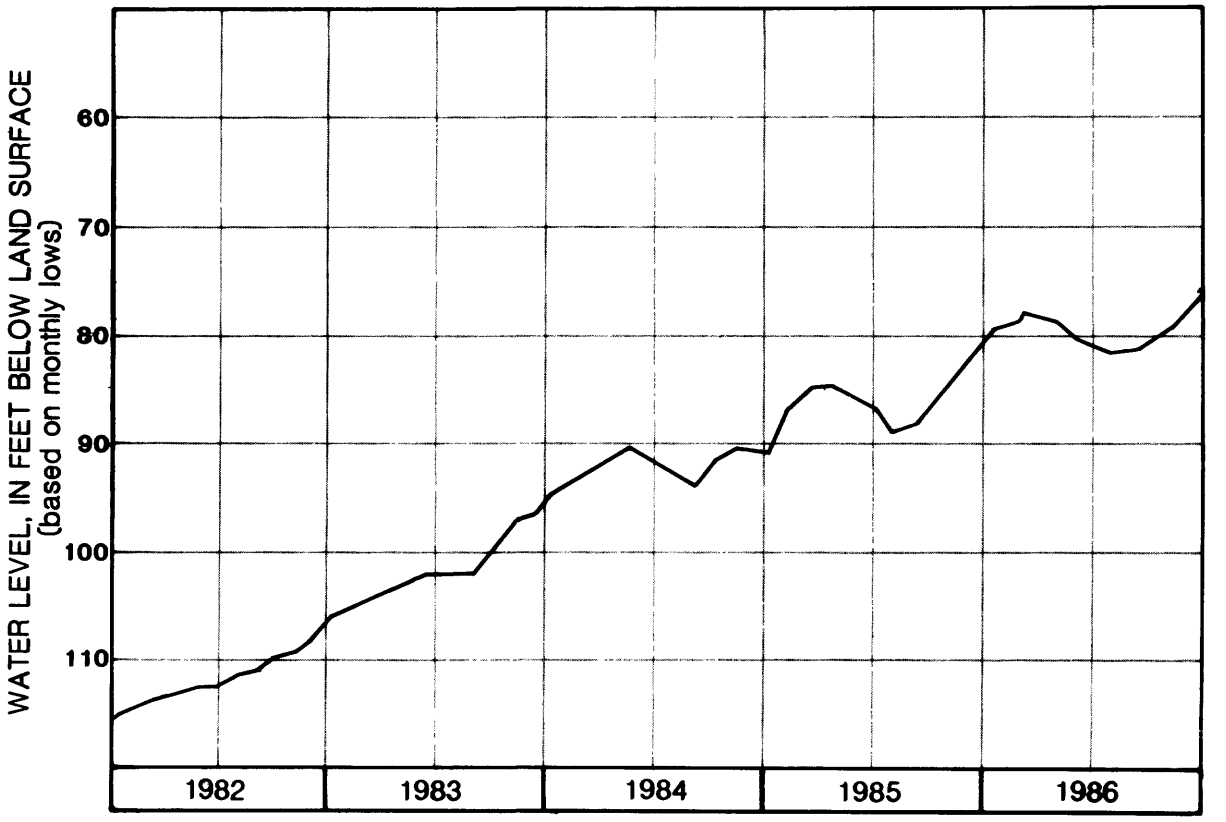
Water levels in well 7S 2W 15BCBA1. Well is 150 feet deep and in glacial outwash. Water-quality data in ground-water reports for 1979 and 1984 (Huffman, 1980, 1985).

SUPPLY AND SOURCE -- 125 wells, 400 to 425 feet deep, tap sandstones of Saginaw Formation; 3 wells, 85 to 105 feet deep, tap sand beds in glacial deposits.

YIELD OF WELLS -- Sandstone - 100 to 700 gal/min; specific capacity --3 to 10 gal/min/ft of drawdown.
-- Glacial deposits - 790 to 1,200 gal/min, specific capacity -- 12 to 80 gal/min/ft of drawdown.

PUMPAGE -- Total annual pumpage, in million gallons, for past 5 years.

1986 - 7,690
1985 - 7,945
1984 - 8,249
1983 - 8,105
1982 - 8,182



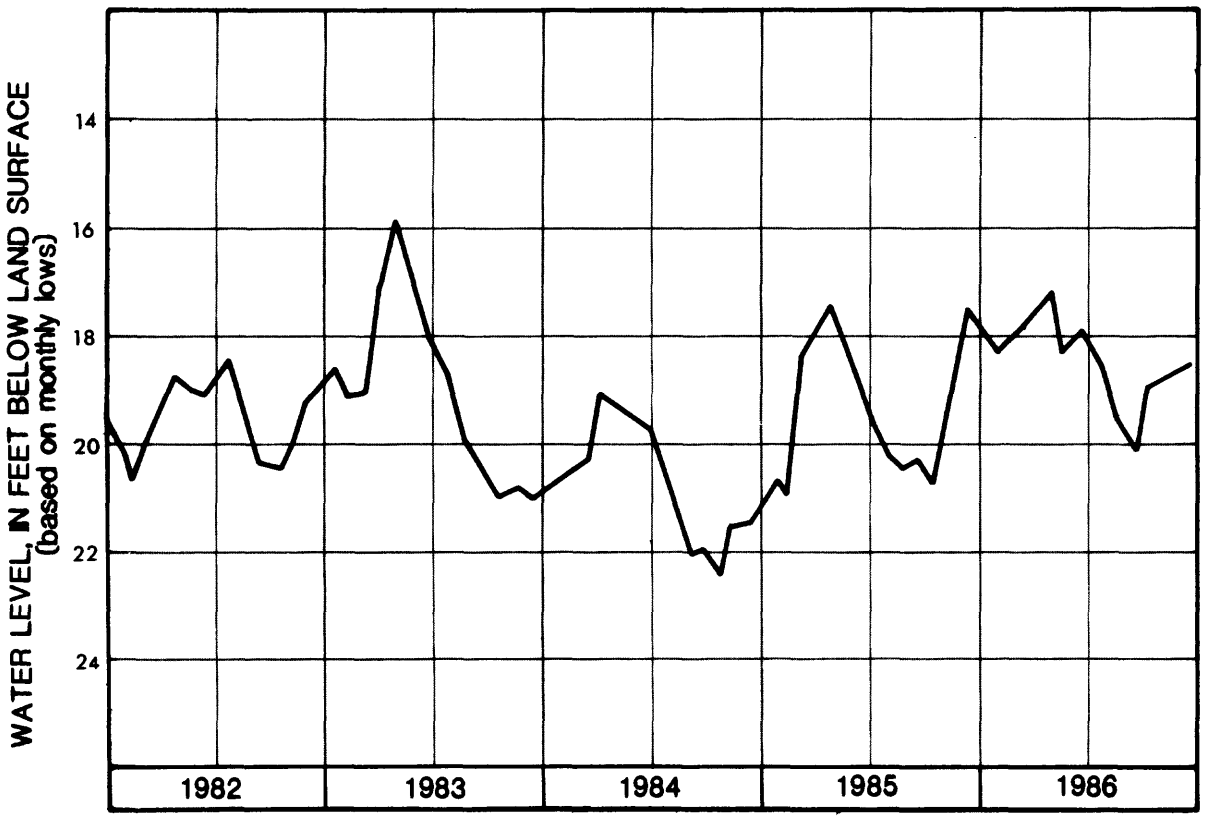
Water levels in well 4N 2W 17AB. Well is 424 feet deep and in Saginaw Formation.

SUPPLY AND SOURCE -- 1 well, about 50 feet deep, taps glacial deposits; 2 wells, 218, 223 feet deep, tap sandstones of Saginaw Formation.

YIELD OF WELLS -- 675 to 700 gal/min; specific capacity -- No. 3 yields 30 gal/min/ft of drawdown from the glacial deposits.

PUMPAGE -- Total annual pumpage, in million gallons, for past 5 years.

1986 - 232
1985 - 240
1984 - 240
1983 - 232
1982 - 228



Water levels in well 2N 1W 5BCAB1. Well is 210 feet deep and in Saginaw Formation. Water-quality data in ground-water reports for 1977 and 1984 (Huffman, 1979, 1985).

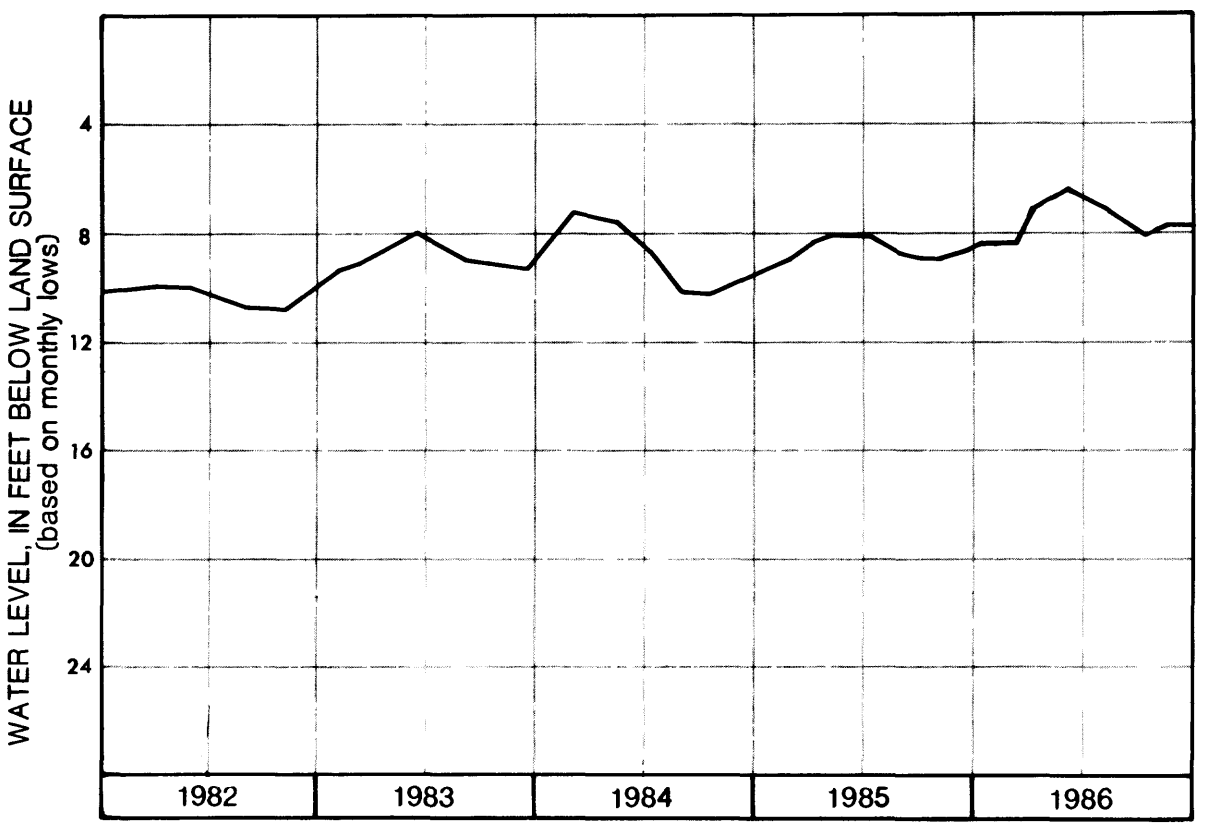
KALAMAZOO COUNTY - CITY OF KALAMAZOO

SUPPLY AND SOURCE -- 84 wells, 130 to 254 feet deep, tap glacial deposits.

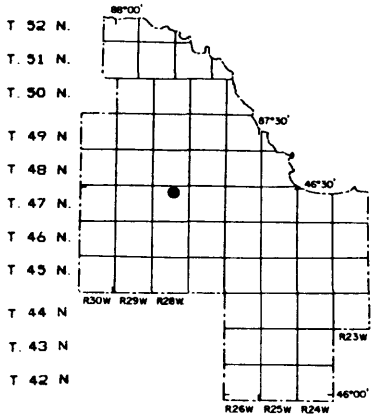
YIELD OF WELLS -- 200 to 2,000 gal/min; specific capacity -- 7 to 100 gal/min/ft of drawdown.

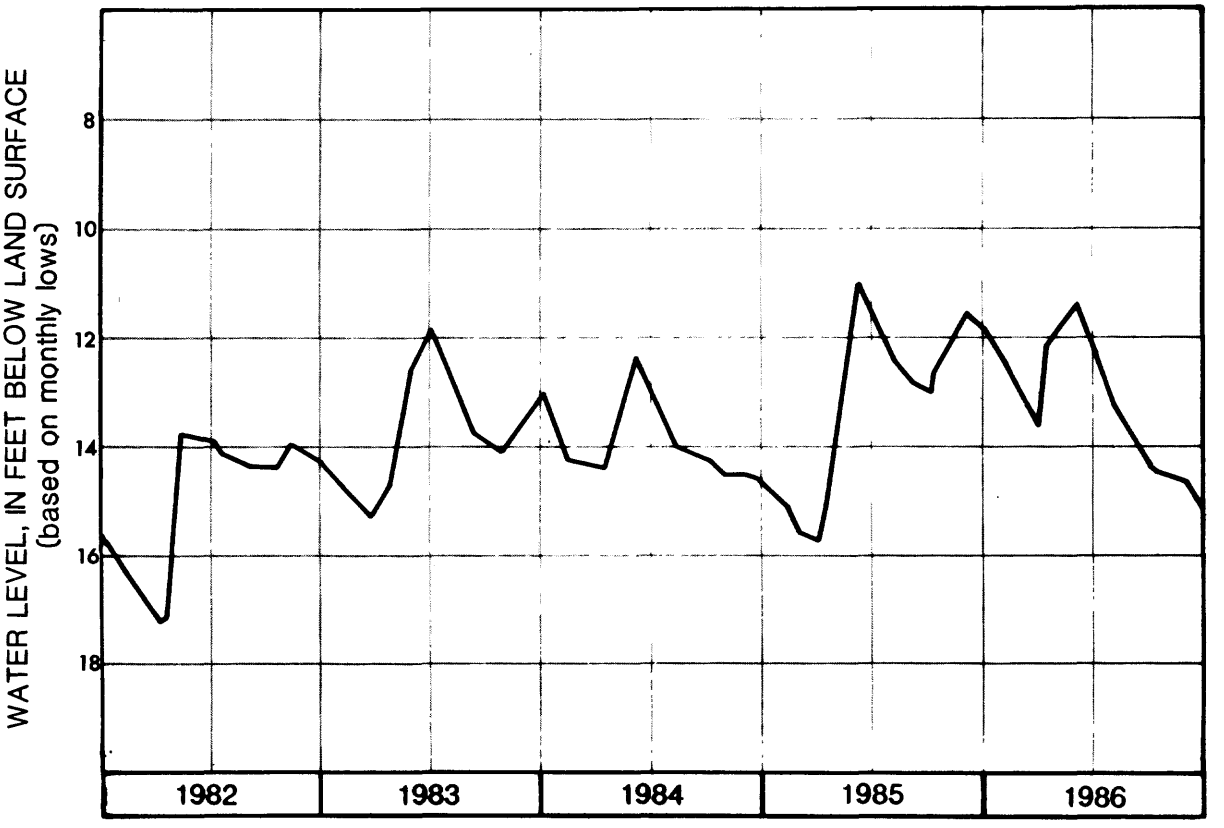
PUMPAGE -- Total annual pumpage, in million gallons, for past 5 years.

1986 - 6,638
1985 - 6,736
1984 - 7,275
1983 - 7,204
1982 - 5,772

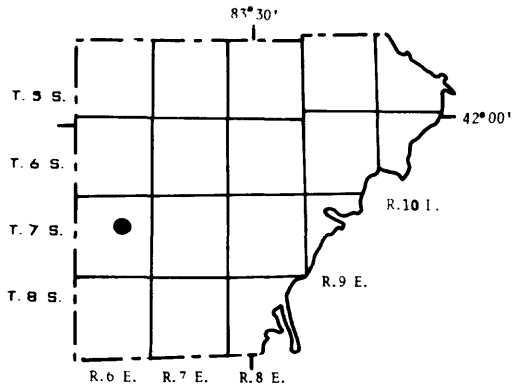


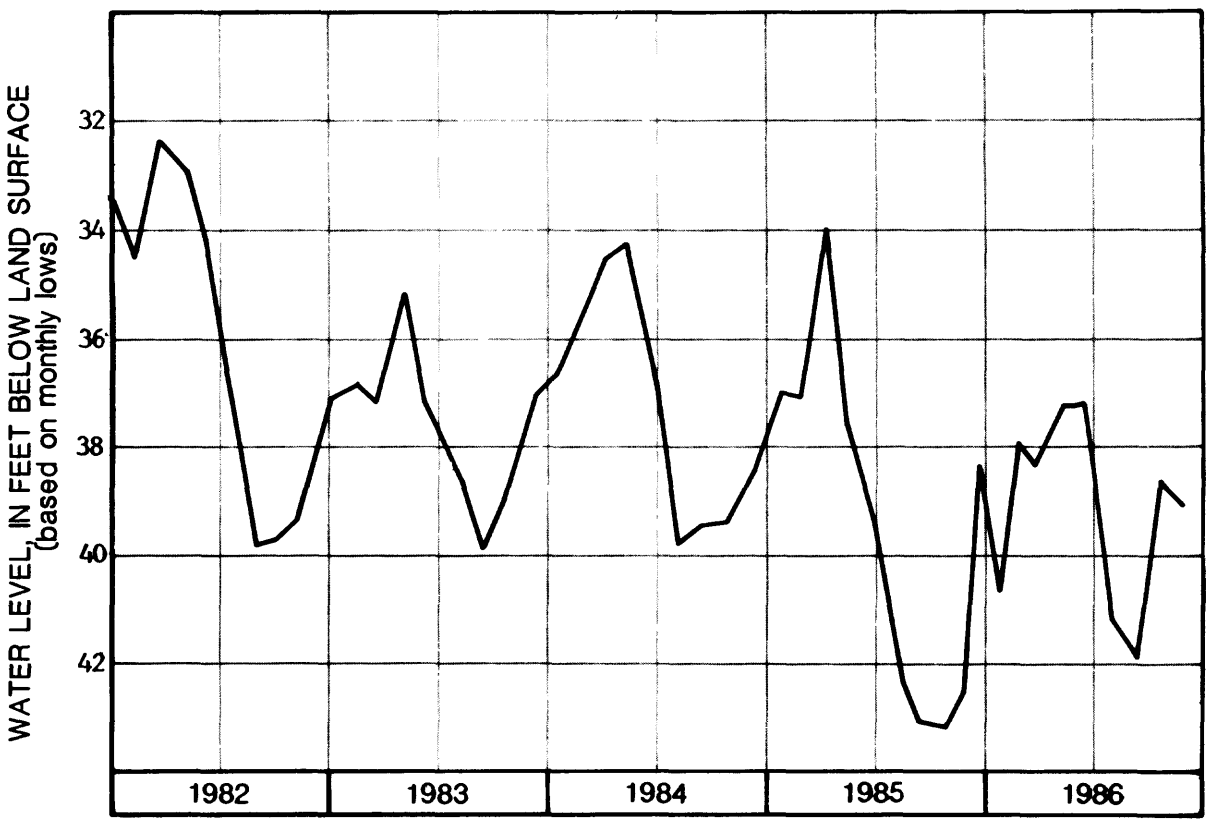
Water levels in well 2S 11W 22CD. Well is 137 feet deep and in outwash.



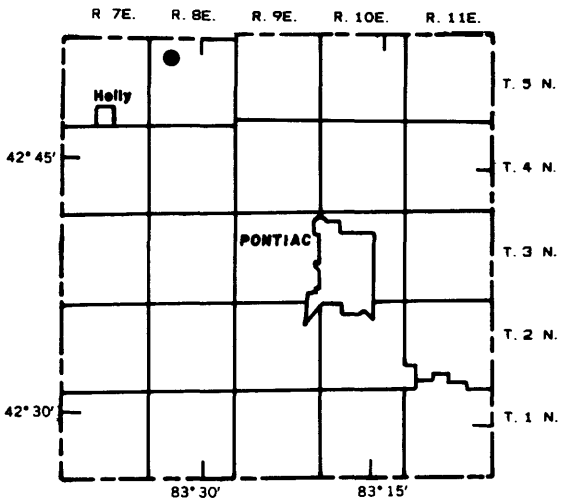


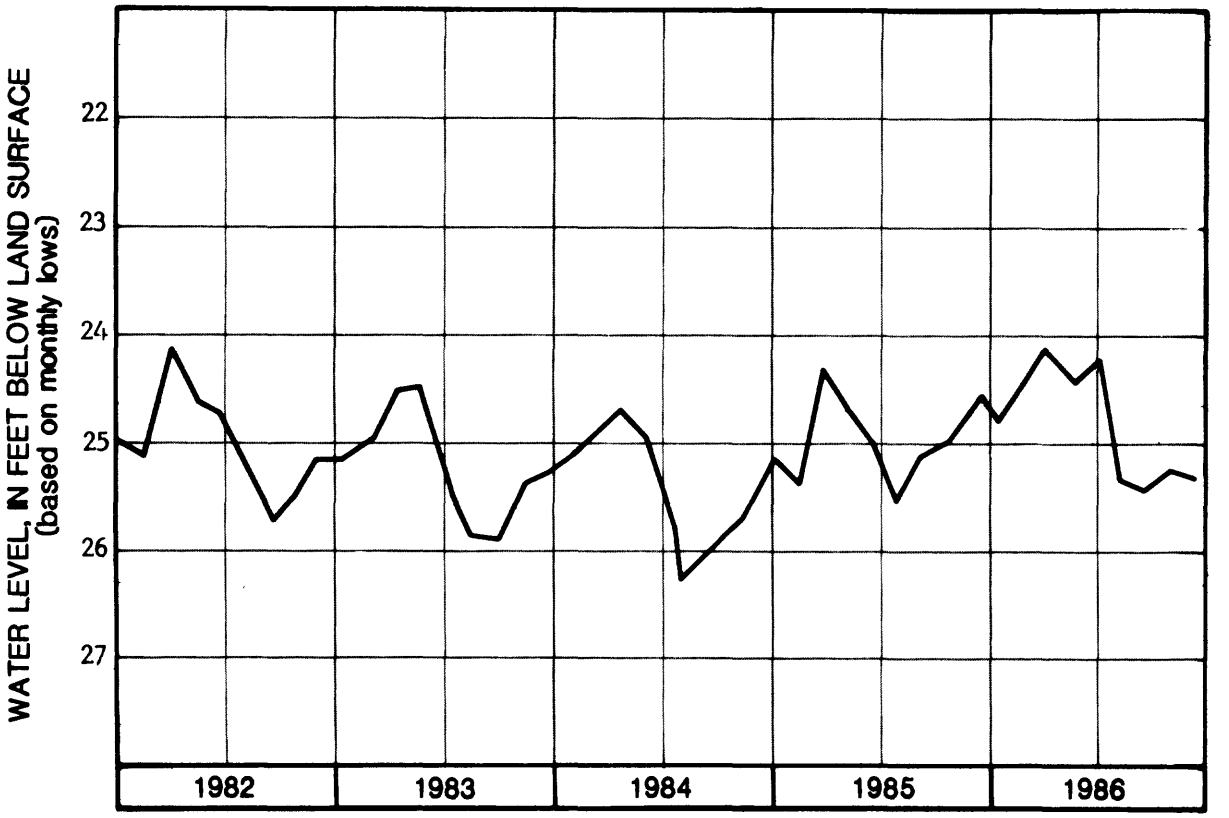
Water levels in well 47N 28W 3CCDC1. Well is 75 feet deep and in outwash. Levels are typical of observation wells in Marquette Iron Range. Water-quality data in ground-water report for 1977 (Huffman, 1979).



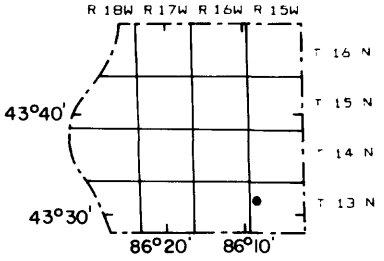


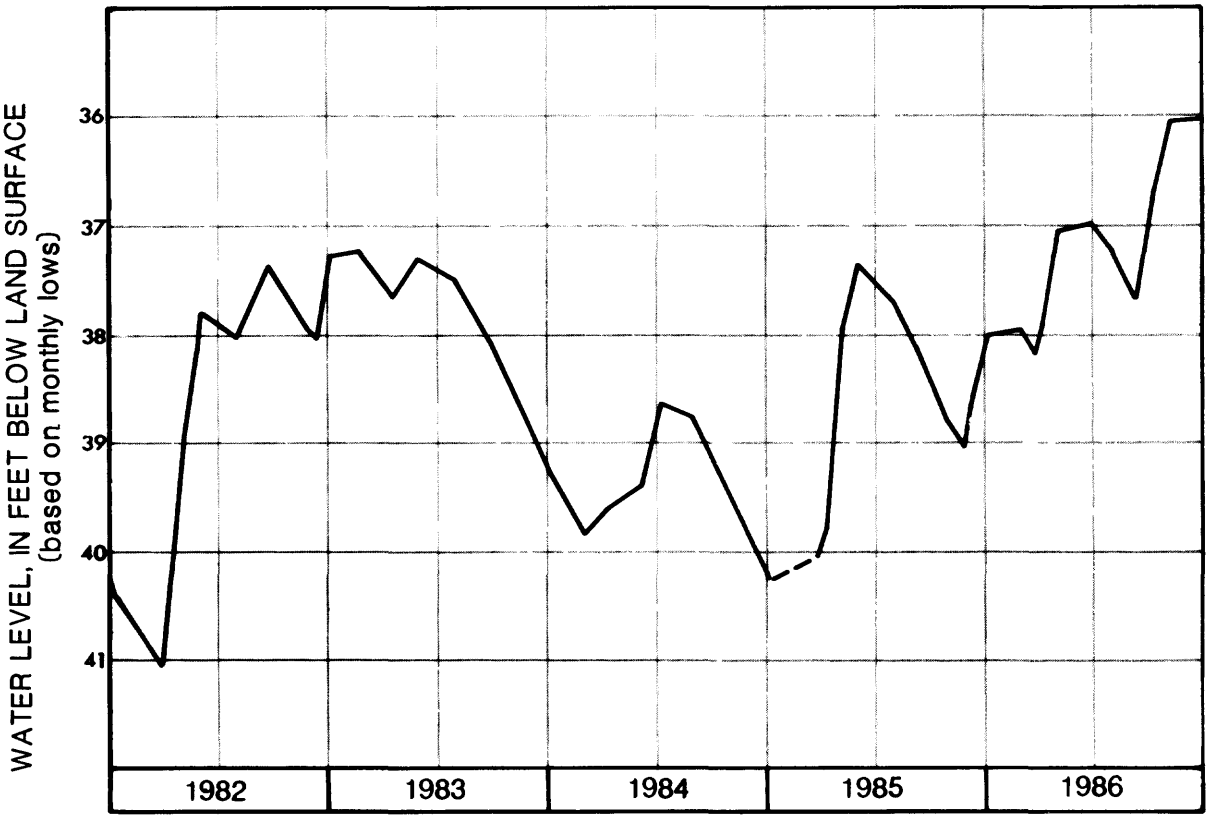
Water levels in well 7S 6E 15ACAA1. Well is 73 feet deep and in the Detroit River Group. Water-quality data in ground-water reports for 1979 and 1984 (Huffman, 1980, 1985).



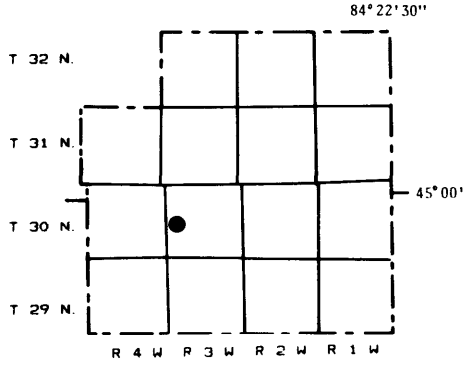


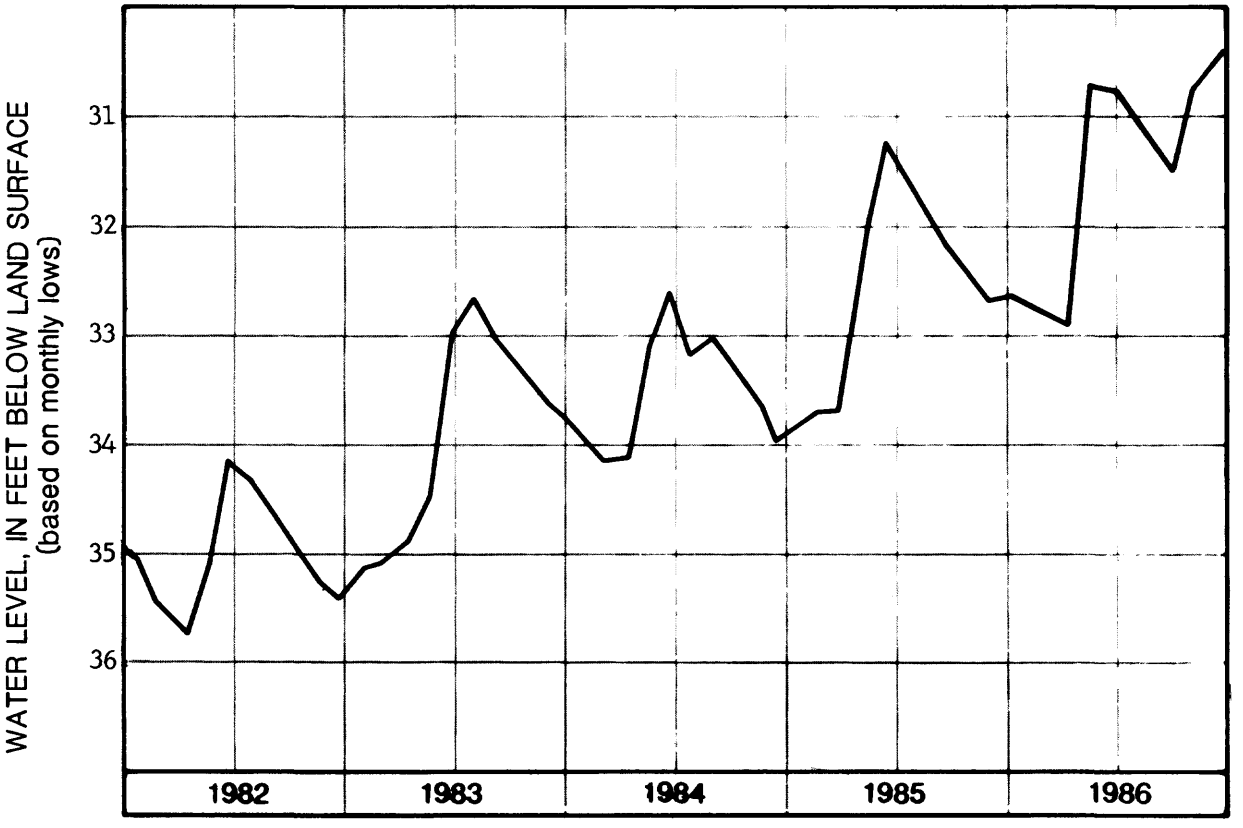
Water levels in well 5N 8E 8ACAC1. Well is 42 feet deep and in glacial deposits.





Water levels in well 13N 15W 18AAAA1. Well is 79 feet deep and in outwash. Water-quality data in ground-water reports for 1978 and 1984 (Huffman, 1979, 1985).





Water levels in well 30N 3W 19ABBB1. Well is 90 feet deep and in glacial outwash. Water-quality data in ground-water reports for 1979 and 1984 (Huffman, 1980, 1985).

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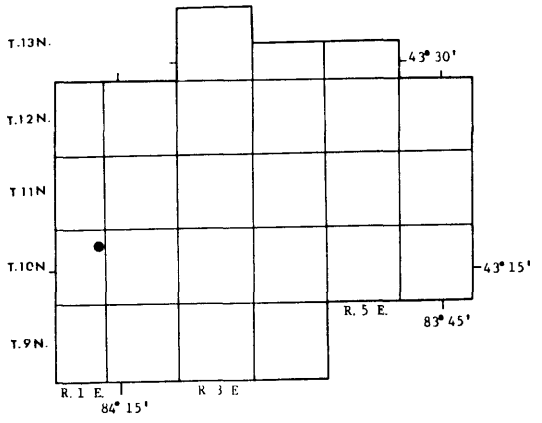
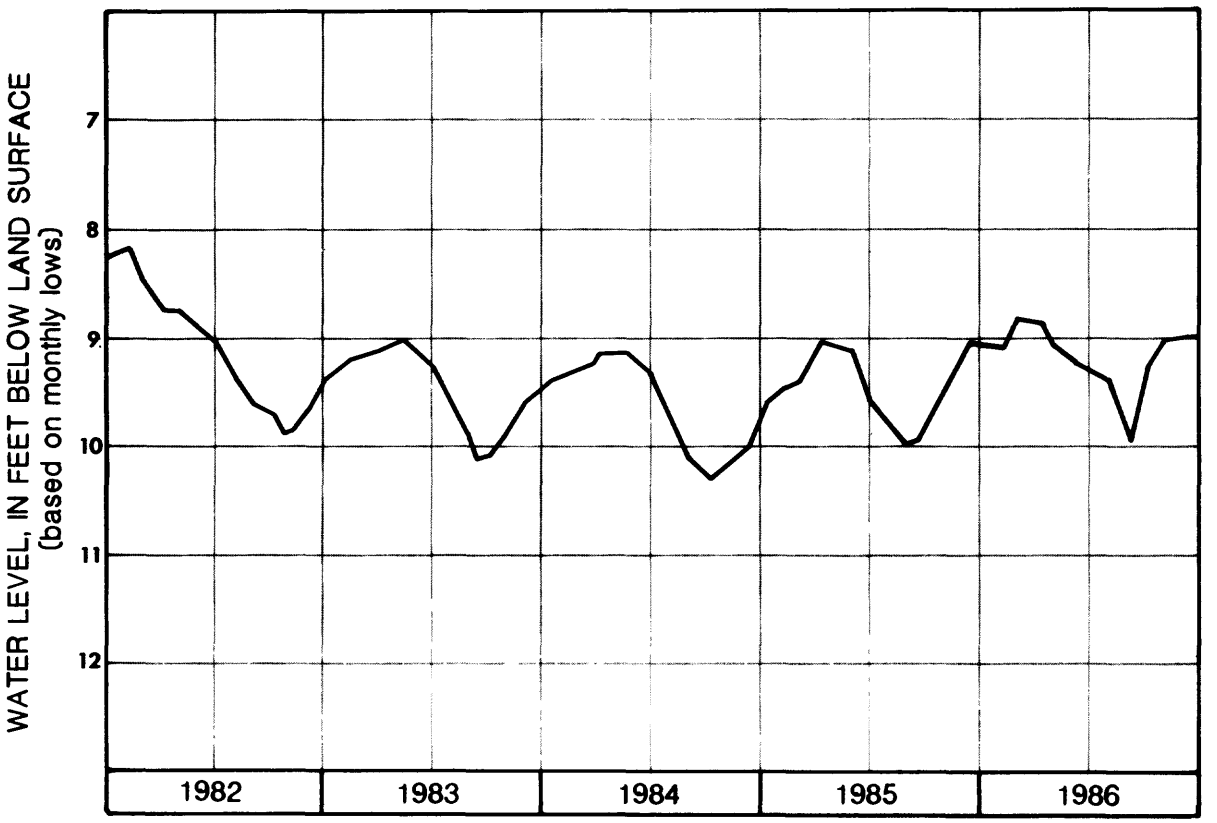
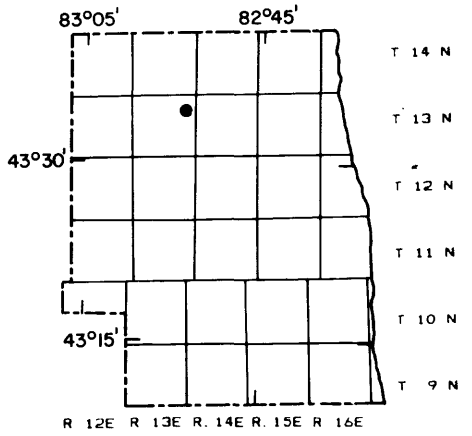
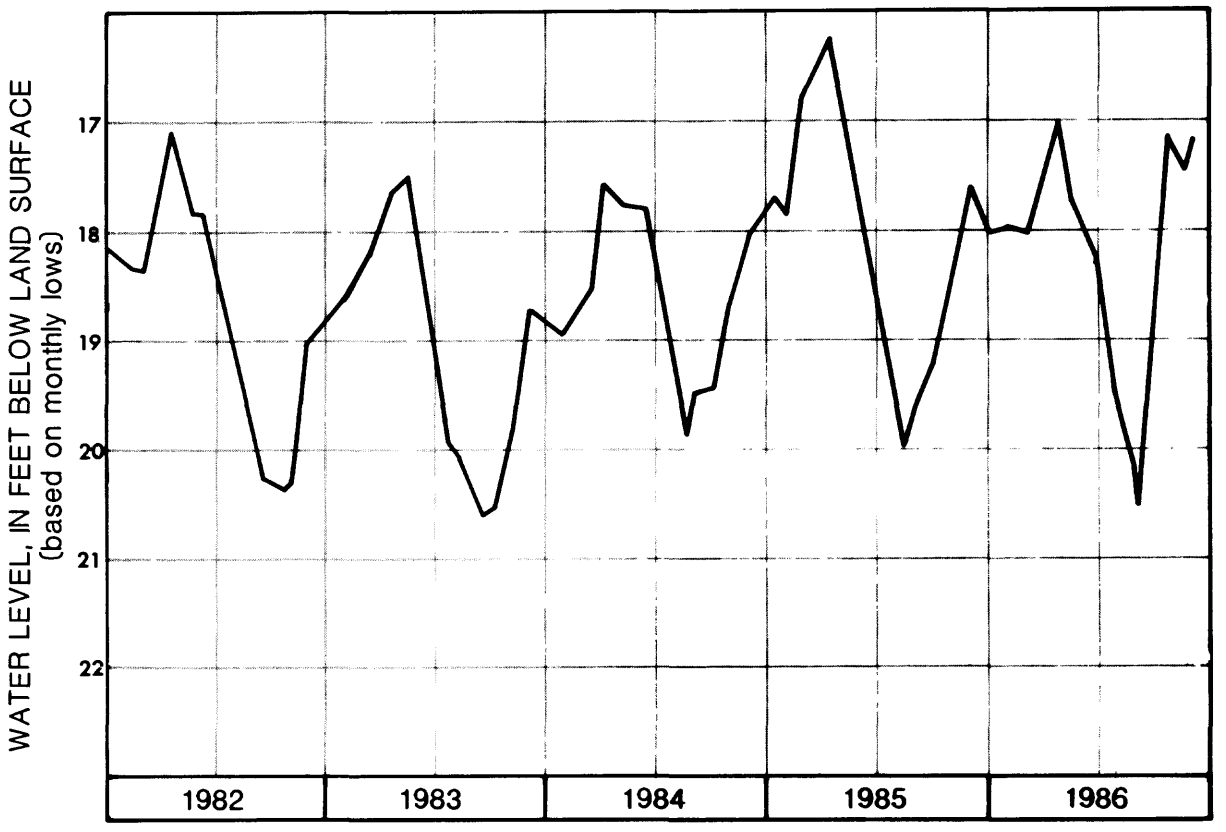




Water levels in well 10N 1E 22DADA1. Well is 210 feet deep and in Saginaw Formation. Water-quality data in ground-water reports for 1977 and 1984





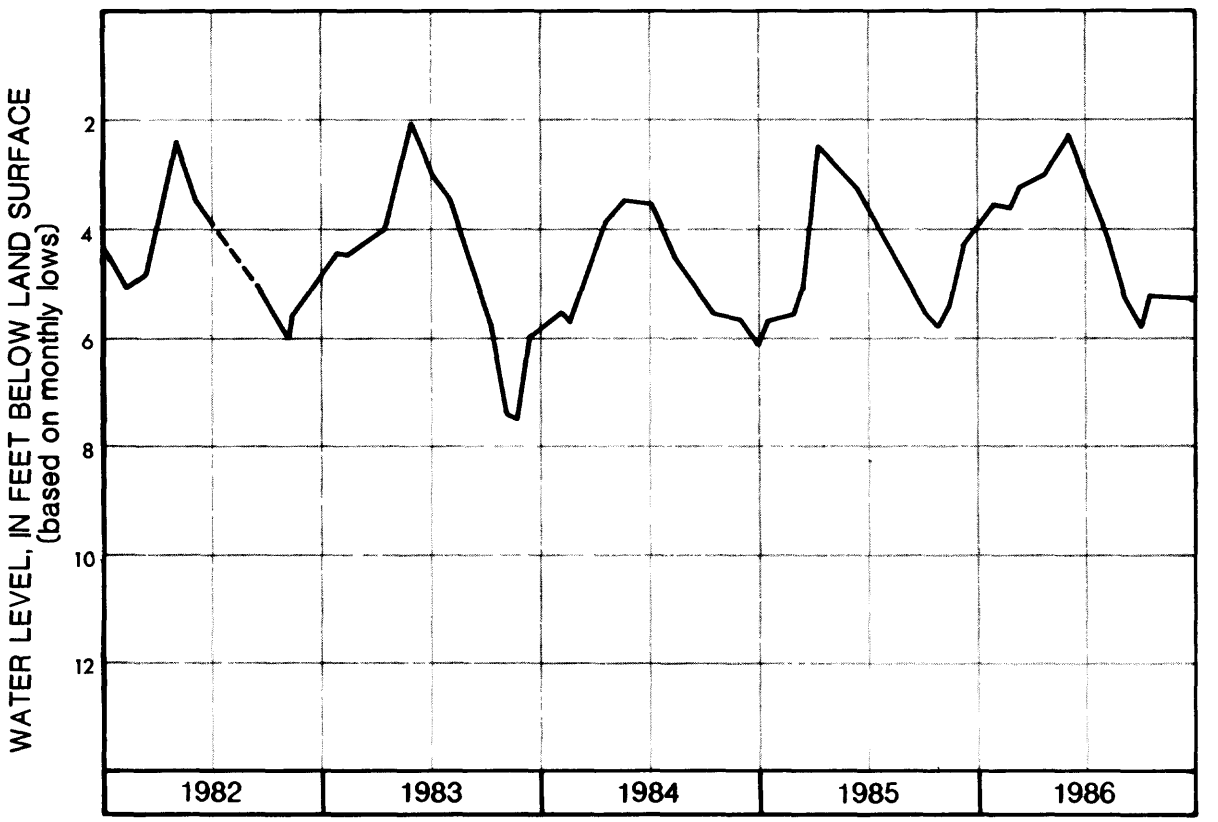
Water levels in well 13N 13E 12ADAA1. Well is 130 feet deep and in the Marshall Formation. Water-quality data in ground-water reports for 1977 and 1982 (Huffman, 1979, 1983).

SUPPLY AND SOURCE -- 3 wells, 91 to 196 feet deep, tap glacial deposits; most water is pumped from the Huron River.

YIELD OF WELLS -- 1,050 to 4,860 gal/min; specific capacity -- 20 to 600 gal/min/ft of drawdown.

PUMPAGE -- Total annual ground-water pumpage, in million gallons, for past 5 years (ground water is used to augment supply from Huron River).

1986 - 1,044
1985 - 1,177
1984 - 1,192
1983 - 810
1982 - 720



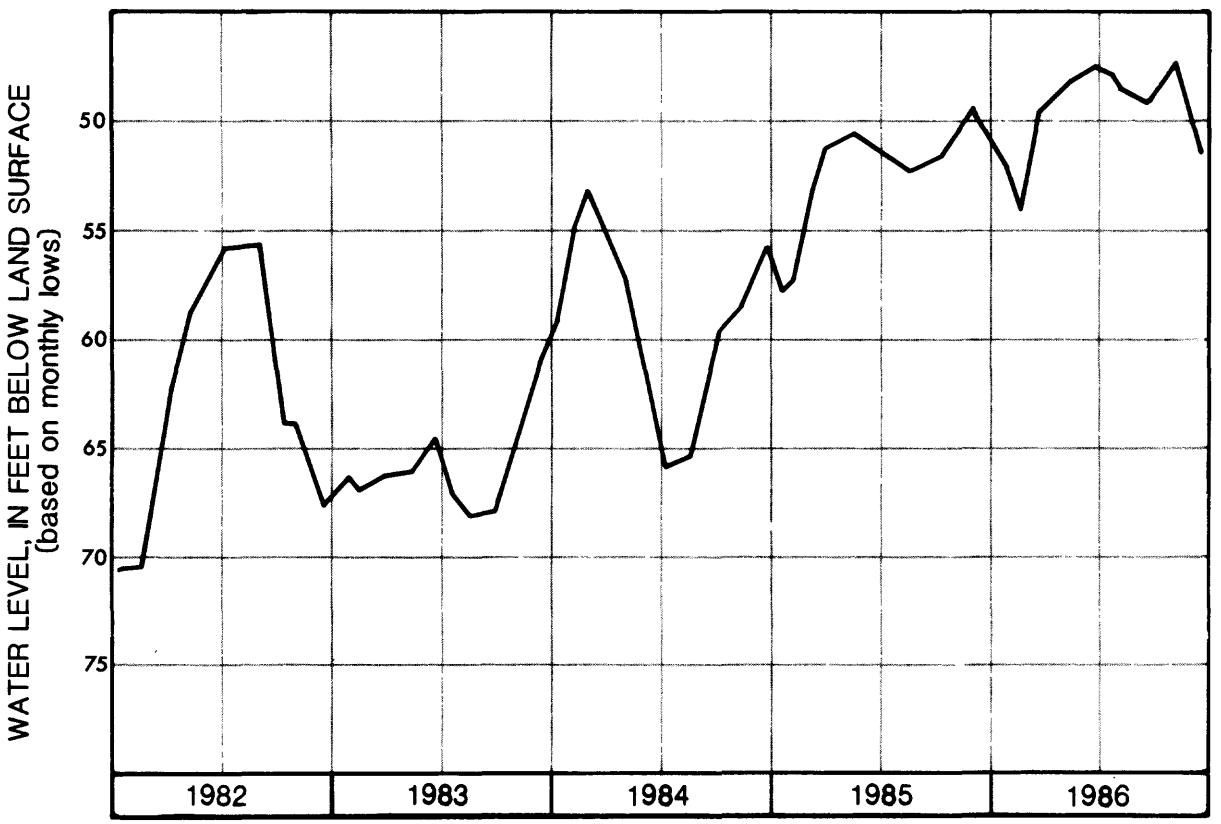
Water levels in well 3S 6E 16BCCD1. Well is 55 feet deep and in glacial deposits. Water-quality data in ground-water reports 1977 and 1984 (Huffman, 1979, 1985).

SUPPLY AND SOURCE -- 6 wells, 87 to 102 feet deep, tap glacial deposits.

YIELD OF WELLS -- Average 450 gal/min; specific capacity -- 25 to 180 gal/min/ft of drawdown.

PUMPAGE -- Total annual pumpage, in million gallons, for past 5 years.

1986 - 925
1985 - 906
1984 - 1,155
1983 - 1,112
1982 - 1,196



Water levels in well 3S 7E 9ADBC1. Well is 94 feet deep and in glacial deposits.

TABLES

Table 1.--Records of Michigan observation wells

COUNTY AND WELL NUMBER: See section in text entitled "Well-numbering system".
NAME: CCC - Civilian Conservation Corp.; MDNR - Michigan Department of Natural Resources; MSHD - Michigan State Highway Department; TWSP - Township; USFS - U.S. Forest Service; WEP - Wisconsin Electric Power Company.
AQUIFER:

112GLCL	Glacial deposits	337MRSL	Marshall Formation		
112GRVL	Gravel	341TRVR	Traverse Group	3610DVCU	Ordovician, Upper
1120TSH	Outwash	344DUND	Dundee Formation	365TBRV	Trenton-Black River Group
112SAND	Sand	348DRRV	Detroit River Group	368PRDC	Prairie du Chien Group
112SDGV	Sand and Gravel	355SLINH	Salina Formation	372MNSG	Munising Sandstone
324SGNW	Saginaw Formation	355MNSQ	Manistique Dolomite	420FRED	Freda Sandstone

ALTITUDE: Land-surface datum in feet above sea level.
MEASUREMENTS, 1986 (frequency): R - Continuous recorder; D - Daily; W - Weekly; M - Monthly; Q - Quarterly; S - Semiannually; A - Annually; I - Intermittent.
OBSERVED WATER-LEVEL EXTREMES: Data for calendar years. In feet below or above (+) land surface. 1986 measurements underscored are extremes for entire record.
REMARKS: P - Water levels affected by pumping. Water-level measurements are made by the U.S. Geological Survey unless otherwise noted.

COUNTY AND WELL NUMBER / TWSP, RANGE, SECTION	NAME	DEPTH (FT)	DIAMETER (IN)	AQUIFER	ALTITUDE	YRS. RECORD	MEAS. 1986	OBSERVED WATER-LEVEL EXTREMES THROUGH 1985 MAXIMUM	THROUGH 1985 MINIMUM	IN 1986 MAXIMUM	IN 1986 MINIMUM	REMARKS
ALGER												
45n 19w 25BDCD1	CCC	66	6	112GLCL	850	28	Q	6.4 Jun 1960	14.2 Apr 1964	10.0 May	11.4 Nov	
ALPENA												
32N 6E 23DDDA1	Alpena State Forest	88	6	112SAND	713	10	R	13.6 May 1983	30.0 Mar 1982	14.8 Apr	21.7 Mar	
ARENAC												
19N 5E 7DABA1	Omer, D	185	6	324SGNW	667	7	M	8.3 Jul 1980	10.9 Oct 1984	9.7 Apr	10.5 Sep	
7DA8A2	Omer, S	21	6	112GLCL	667	7	M	2.3 May 1983	6.9 Aug 1980	2.8 Jul	6.0 Sep	
BARAGA												
48n 32w 12dd	WEP14	10	1	112GLCL	1,630	39	M	3.3 Apr 1965	8.1 Sep 1969	5.8 Apr	7.8 Jul	Meas.byWEP
BARRY												
4N 9W 5DA	Solomon Road	131	2	112GLCL	860	23	Q	111.5 Mar 1978	122.0 Mar 1965	115.2 Nov	116.5 Jan	
BAY												
17N 4E 22DCAA1	Pinconning Twsp	110	6	324SGNW	620	25	M	0.0 Mar 1976	10.5 Aug 1963	1.3 Mar	3.6 Jul	
BRANCH												
6S 6W 18CCCD1	Coldwater Twsp	56	6	1120TSH	950	23	M	18.3 Mar 1976	28.3 Jul 1964	22.9 Apr	23.7 Jan	
22CABA1	Coldwater Test 4	113	6	112GLCL	970	23	R	9.0 May 1975	25.9 May 1977	11.0 Mar	22.9 Aug	P
CALHOUN												
1S 7W 10BB	Sabin	12	1	112GLCL	908	41	W	0.9 Mar 1950	7.2 Dec 1964	2.4 Mar	4.2 Sep	Meas.by owner
32BDCC1	Penfield Twsp	95	6	337MRSL	845	23	R	15.6 Apr 1974	27.0 Aug 1964	18.8 Apr	22.7 Sep	P
32DABD	Battle Creek	127	8	337MRSL	830.8	48	D	0.7 Apr 1950	16.8 Jul 1959	5.7 Mar	10.2 Sep	P,Meas.by owner
2S 6W 25AA	Marshall	59	6	337MRSL	904.8	37	M	5.5 May 1950	9.7 Aug 1964	7.2 Apr	7.9 Sep	P,Meas.by owner
CASS												
8S 14W 17BA	Little	55	28	112GLCL	840	42	M	46.2 Jul 1950	55.0 Mar 1957	49.3 Jul	50.2 Nov	
CHEBOYGAN												
33N 1W 26DABA1	Pigeon River CCC	164	6	112SAND	933	21	R	55.2 May 1985	60.2 Jul 1982	56.5 May	58.0 Mar	
39N 3W 29CBCB1	Mackinaw, D	125	6	344DUND	705	8	M	5.2 May 1979	11.7 Feb 1981	4.7 Apr	8.7 Sep	
29CBCB2	Mackinaw, S	55	6	112SDGV	705	8	M	2.0 Apr 1984	6.5 Feb 1981	1.8 Apr	4.5 Aug	

Table 1.--Records of Michigan observation wells--Continued

COUNTY AND WELL NUMBER / TWSP, RANGE, SECTION	NAME	DEPTH (FT)	DIAMETER (IN)	AQUIFER	ALTITUDE	YRS. RECORD	MEAS. 1986	OBSERVED WATER-LEVEL EXTREMES THROUGH 1985 MAXIMUM	THROUGH 1985 MINIMUM	IN 1986 MAXIMUM	IN 1986 MINIMUM	REMARKS
CHIPPEWA												
46N 4W 24DAAD1	Raco	54	6	112OTSH	850	34	R	18.4 Jun 1971	28.4 Apr 1964	22.5 May	25.3 Apr	
CLARE												
17N 4W 34DCAD	Clare	91	4	112GLCL	850	12	R	7.9 Mar 1976	24.9 May 1977	8.4 Oct	17.4 Aug	
CLINTON												
5N 2W 31CBBA1	Capital City Airport	195	6	324SGNW	850	29	R	45.0 Mar 1949	66.4 Jan 1967	50.8 Mar	54.2 Aug	P
32DC	Quarantine Farm	135	4	324SGNW	849.2	43	M	42.0 Sep 1944	99.2 May 1966	70.6 Jan	76.5 Dec	P
6N 1W 3BB2	Sleepy Hollow 5	62	1	112GLCL	814.0	17	I	37.6 Apr 1983	43.5 Nov 1966	37.8 May		
6N 2W 16DDAD1	MSHD, U.S. 27	23	14	112GLCL	803.3	39	M	13.8 Apr 1974	19.9 Feb 1964	15.6 Mar	17.7 Aug	Federal key well
7N 1W 34CC	Sleepy Hollow 7	32	1	112OTSH	785.3	20	A	16.5 Apr 1983	20.3 Oct 1973	17.2 May		
CRAWFORD												
25N 1W 15DDCD1	Eldorado	56	6	112GLCL	1,190	39	R	25.7 May 1976	36.0 Apr 1951	25.6 Nov	28.0 Mar	
DELTA												
39N 23W 28AC	Schemmel	530	5	372MNSG	680	29	R	1.3 May 1960	8.6 Feb 1977	5.2 Apr	7.2 Jul	
41N 18W 31CD	Isabella	250	5	361DDVCU	615	29	M	3.3 Sep 1979	6.4 Feb 1977	4.3 Oct	5.9 Jul	
42N 18W 17ABBD	Cooks CCC	60	6	112GLCL	760	25	Q	21.2 May 1960	28.4 Mar 1966	22.9 May	24.7 Nov	
42N 19W 20AA	Pollack CCC	134	6	112GLCL	740	29	Q	23.4 Jul 1982	28.1 Feb 1977	24.8 May	25.4 Nov	
43N 19W 24BB	Clarage	405	4	365TBRV	860	29	Q	77.0 Jul 1960	88.8 Oct 1966	28.8 May	79.2 Nov	
DICKINSON												
43N 28W 32ADAB1	Felch	31	1	112SAND	1,160	21	M	13.1 May 1972	16.8 May 1968	13.0 Apr	14.6 Sep	
EATON												
3N 3W 2BA	Lansing, Stiefel	66	1	112GLCL	839	23	R	3.1 Mar 1965	18.0 Nov 1968	3.0 Jun	8.9 Jan	P
4N 3W 12CD	Robins Road	381	6	324SGNW	861.9	34	R	67.5 Nov 1953	103.6 Aug 1969	74.8 Mar	91.7 Aug	P
GENESEE												
6N 7E 9DCCC1	Fisher Body No. 2	385	10	324SGNW	837.0	14	R	52.3 Dec 1975	87.0 Jun 1977	55.8 Jan	74.6 Aug	P
GRAND TRAVERSE												
26N 9W 14ABAA1	Fife Lake State Forest	80	6	112SAND	960	10	R	23.0 May 1985	28.0 Mar 1982	21.3 Oct	24.7 Mar	
HILLSDALE												
7S 2W 10BDDD1	Pittsford Game Area	20	1	112SAND	1,070	21	M	5.8 Apr 1982	11.1 Sep 1967	7.4 Mar	8.6 Aug	
2W 15BCBA1	Osseo	150	6	112OTSH	1,095	8	M	46.1 Apr 1982	49.0 Dec 1979	47.1 Apr	48.1 Oct	
INGHAM												
2N 1E 24DB	Dansville Game Area	87	2	112GLCL	930	23	Q	22.4 Apr 1974	29.3 Oct 1964	23.1 Mar	23.8 Oct	
2N 1W 5BCAB1	Mason	210	8	324SGNW	890	23	R	14.7 Mar 1973	23.8 Nov 1964	16.3 Mar	20.3 Sep	P
3N 1E 7DDCA1	Lotte	184	3	324SGNW	900	23	M	+2.4 Apr 1974	7.0 Nov 1964	+0.7 Mar	2.1 Sep	P
2W 23BCBD	Holt	188	8	324SGNW	895	5	R	18.3 May 1983	25.5 Oct 1985	18.6 Mar	21.8 Sep	P
4N 1W 16DA	Meridian Twsp	398	4	342SGNW	841.2	19	M	6.3 Mar 1976	18.6 Jul 1984	14.6 Mar	17.7 Jul	P

Table 1.--Records of Michigan observation wells--Continued

COUNTY AND WELL NUMBER	NAME	DEPTH (FT)	DIAMETER (IN)	AQUIFER	ALTITUDE	YRS. RECORD	MEAS. 1986	OBSERVED WATER-LEVEL EXTREMES THROUGH 1985 MAXIMUM	THROUGH 1985 MINIMUM	IN 1986 MAXIMUM	IN 1986 MINIMUM	REMARKS
TWSP, RANGE, SECTION												
INGHAM--Continued												
4N 1W 28BCAD1	Okemos	125	4	324SGNW	865	11	R	17.6 Apr 1985	24.2 Sep 1978	18.3 Jun	21.2 Aug	P
2W 9BD	Lansing, Seymour	401	14	324SGNW	828.8	53	R	15.6 Mar 1931	179.4 Apr 1968	46.2 Dec	61.0 Jul	P
16DA	Lansing, Cedar	417	12	324SGNW	829.1	42	R	34.5 Dec 1985	67.0 Aug 1949	30.3 Dec	38.9 Aug	P
17AB	Lansing, Logan	424	20	324SGNW	858.7	56	R	34.3 Dec 1929	168.3 May 1968	75.5 Dec	81.3 Aug	P
21BA3	Lansing, Scott Park	400	4	324SGNW	835	8	R	32.0 Jan 1985	58.8 Jun 1979	27.3 Dec	38.1 Aug	P
22BC	Lansing, P-5	338	12	324SGNW	823.6	57	M	7.1 Jul 1932	80.5 Feb 1979	23.8 Jun	31.9 Feb	P
24CA	Spartan Village	453	10	324SGNW	853.4	42	R	25.5 Mar 1946	105.5 May 1972	57.6 Dec	75.8 Jul	P
27BB	Fenner Arboretum	215	6	324SGNW	835	19	R	45.1 Oct 1985	89.5 Oct 1972	35.9 May	46.9 Dec	P
31CC	Maybel Street	204	3	324SGNW	880.2	43	M	18.9 Apr 1952	45.9 Jul 1980	41.2 Dec	45.5 Jun	P
IOSCO												
24N 7E 13ADAD1	Oscoda	69	6	112SAND	760	7	M	28.3 Jun 1985	32.7 Mar 1982	27.3 Nov	28.4 Mar	
IRON												
43N 35W 11AD	WEP 23	47	36	112GLCL	1,565	42	M	35.3 Aug 1983	47.1 Aug 1949	36.7 Jul	38.7 Dec.	Meas.by WEP
20DC	WEP 25	48	1	112GLCL	1,560	42	M	40.7 Jun 1973	48.3 Aug 1949	42.0 Oct	43.1 Dec	Do.
44N 37W 14BB	CCC Camp	102	6	112GLCL	1,730	28	Q	90.9 Nov 1985	97.1 Aug 1982	90.6 Sep	90.8 Feb	
JACKSON												
3S 1W 11AA1	Jackson, 4a Belden	360	6	324SGNW, 337MRSL	935	29	D	18.6 Jan 1961	119.1 Jun 1971	48.8 Dec	88.5 Aug	P,Meas. by owner
KALAMAZOO												
2S 10W 4D	Kalamazoo, Campbell	13	4	112OTSH	836.5	18	R	1.9 Apr 1974	8.4 Sep 1984	5.0 Jun	6.1 Sep	P
9B	Kalamazoo,Schoonover	21	6	112OTSH	828	18	R	+1.0 Apr 1975	4.3 Oct 1984	0.7 Jun	2.5 Aug	P
11W 20BB2	Kalamazoo, Kendall	106	4	112OTSH	880	19	R	12.5 Feb 1976	48.4 Jun 1971	16.4 Nov	36.2 Aug	P
22CD	Kalamazoo, Stockbridge	137	4	112OTSH	764.7	27	R	4.8 Feb 1975	31.1 Aug 1961	6.0 May	8.4 Jan	P
28AA	Kalamazoo, Maple	245	4	112OTSH	820	18	R	32.9 Jan 1979	73.1 Jul 1985	33.1 Dec	64.6 Jul	P
31CD	Kalamazoo, Colony	226	4	112OTSH	910	18	R	41.4 Sep 1982	71.8 May 1978	50.9 Feb	66.1 Mar	P
36CB	Kalamazoo, Emerald	226	4	112OTSH	860	18	R	25.4 Apr 1985	50.4 Jun 1971	26.2 Oct	39.6 Apr	P
3S 11W 4AD1	Kalamazoo, A-D	135	3	112OTSH	854.0	28	R	0.5 May 1967	12.9 Jul 1964	2.0 Feb	9.8 Aug	P
4AD2	Kalamazoo, A-S	40	3	112OTSH	854.0	28	R	+0.2 Sep 1975	9.1 Nov 1959	0.0 Jan	1.8 Sep	P
14AA	Upjohn 28	233	16	112OTSH	870	20	R	23.5 Aug 1982	45.2 Jul 1977	28.3 Dec	38.9 Jan	P
22BBCD	Portage	102	12	112GLCL	877	5	R	24.8 Apr 1985	27.9 Nov 1984	25.7 Oct	27.2 Jan	P
12W 11BD	Kalamazoo, Atwater	248	3	112OTSH	880	26	R	+3.0 Sep 1969	1.0 Aug 1977	+1.4 Mar	0.5 Aug	P
11AD1	Kalamazoo, Sabo-D	300	4	112OTSH	877	14	R	4.5 Jul 1973	16.6 Jul 1984	5.7 Mar	15.6 Sep	P
11AD2	Kalamazoo, Sabo-S	38	6	112OTSH	877	14	R	9.1 Aug 1975	12.8 Aug 1984	9.8 Mar	12.2 Sep	P
4S 11W 3CDDA1	Prairie View Park	190	4	112OTSH	870	18	R	18.0 Apr 1985	20.6 Dec 1977	18.6 Aug	19.7 Feb	P
KENT												
5N 12W 4DCCD1	Wyoming, Wobma	86	6	112GRVL	868.0	25	M	7.8 Oct 1978	12.9 Aug 1964	9.3 Apr	10.1 Jan	
10N 12W 13DD	Rouge River Game Area	30	1	112GLCL	785	21	Q	0.8 Jan 1975	9.2 Oct 1969	3.0 Oct	7.0 Jul	

Table 1.--Records of Michigan observation wells--Continued

COUNTY AND WELL NUMBER / TWSP, RANGE, SECTION	NAME	DEPTH (FT)	DIAMETER (IN)	AQUIFER	ALTITUDE	YRS RECORD	MEAS. 1986	OBSERVED WATER-LEVEL EXTREMES THROUGH 1985 MAXIMUM	THROUGH 1985 MINIMUM	IN 1986 MAXIMUM	IN 1986 MINIMUM	REMARKS
LAKE												
20N 13W 13ACAC1	Irons	57	6	112OTSH	945	7	M	11.1 Dec 1985	18.0 Mar 1982	9.1 Oct	12.0 Mar	
LEELANAU												
28N 14W 8DDCA1	Sleeping Bear,D	128	6	112SAND	750	7	M	112.2 Aug 1985	114.5 Jun 1984	111.6 Dec	112.4 Mar	
28N 14W 18BABB1	Sleeping Bear,S	60	6	112SAND	625	7	R	21.8 Apr 1985	24.9 Nov 1982	20.8 Oct	22.9 Mar	
LENAWEE												
5S 1E 12DDBD1	Onsted Game Area	39	1	112GLCL	1,000	21	M	15.9 Mar 1982	19.3 Sep 1971	16.3 Mar	17.6 Sep	
6S 4E 8DDBA1	Fisher Body	81	8	112OTSH	800	22	R	9.9 Apr 1982	18.4 Feb 1965	12.4 Apr	14.4 Dec	
LIVINGSTON												
1N 6E 13DBAB1	American Aggregate	29	2	112OTSH	930	17	R	12.1 Apr 1974	21.6 Oct 1979	14.4 Apr	16.2 Dec	
MACKINAC												
41N 5W 23BC	Round Lake CCC	47	6	355SLINH	610	31	Q	2.9 Apr 1985	17.8 Feb 1981	7.4 Apr	13.3 Feb	
42N 2W 7AABB1	Pontchartrain CCC	102	6	355MNSQ	680	31	R	12.5 Apr 1985	32.3 Feb 1977	15.2 Apr	27.2 Mar	
MARQUETTE												
47N 28W 3CCDC1	Ely Twsp	75	8	112OTSH	1,572.0	26	R	9.4 Apr 1985	19.3 Apr 1964	10.4 Apr	15.2 Dec	Federal key well
49N 30W 22AC	WEP 13	17	1	112GLCL	1,680	39	M	0.6 May 1951	13.3 Sep 1948	6.4 Apr	10.6 Jul	Meas.by WEP
MENOMINEE												
37N 26W 19DADA1	Carney	17	4	365TBRV	800	28	Q	3.5 Apr 1979	8.6 Jan 1977	3.3 Mar	5.3 Dec	
MONROE												
7S 6E 15ACAA1	Petersburg, rock	73	6	348DRRV	860	8	M	32.3 Mar 1982	43.2 Oct 1985	37.3 May	41.9 Sep	
15ADBB1	Petersburg Game Area	17	1	112GLCL	675	21	M	3.0 Feb 1966	7.4 Oct 1985	5.6 Jun	6.8 Jan	
MUSKEGON												
11N 15W 34ADDD1	Muskegon Game Area	31	1	112SAND	595	21	Q	+0.2 Apr 1978	4.7 Sep 1972	0.8 Apr	2.4 Jul	
OAKLAND												
2N 7E 5BA	Honeywell Lake Road	44	2	112GLCL	1,020	19	R	23.9 Apr 1976	28.9 Dec 1971	25.8 Oct	27.0 Jan	
8E 18DBAD1	Proud Lake Park	45	6	112OTSH	910	18	R	2.8 May 1974	6.4 Sep 1971	3.8 Mar	5.3 Sep	P
3N 7E 5DA	Fish Lake Road	49	2	112GLCL	1,055	18	R	29.5 Jun 1976	38.7 Dec 1972	33.0 May	34.4 Jan	
10E 13AC	Oakland UNiversity	183	6	112GLCL	940	6	R	56.2 Apr 1984	93.5 Jul 1963	55.8 Dec	57.5 Apr	
5N 8E 8ACAC1	Holly Recreation Area	42	1	112GLCL	930	21	M	22.3 Apr 1974	26.5 Sep 1966	24.1 Apr	25.4 Sep	
OCEANA												
13N 15W 18AAAA1	Hesperia	79	6	112OTSH	703	9	R	36.6 Jun 1979	41.0 Mar 1982	35.8 Dec	38.2 Mar	
OGEMAW												
23N 1E 2BAAA1	Rose City Road, D	105	1	112GLCL	1,265	19	Q	73.6 Oct 1976	78.2 Apr 1969	74.2 Oct	74.3 Jan	
2BAAA2	Rose City Road, S	20	1	112SAND	1,265	19	Q	7.6 Apr 1976	13.6 Dec 1972	8.8 Oct	10.3 Jan	

Table 1.--Records of Michigan observation wells--Continued

COUNTY AND WELL NUMBER / TWSP, RANGE, SECTION	NAME	DEPTH (FT)	DIAMETER (IN)	AQUIFER	ALTITUDE	YRS. RECORD	MEAS. 1986	OBSERVED WATER-LEVEL EXTREMES THROUGH 1985 MAXIMUM	THROUGH 1985 MINIMUM	IN 1986 MAXIMUM	IN 1986 MINIMUM	REMARKS
ONTONAGON												
51N 41W 8BDBC1	Silver City	100	6	420FRED	620	29	Q	8.2 Apr 1959	21.8 Dec 1976	9.6 May	13.4 Sep	
OTSEGO												
30N 3W 19ABBB1	Gaylord	90	6	112OTSH	1,308	8	M	30.7 Jul 1979	35.8 Apr 1982	30.6 Dec	32.9 Mar	
PRESQUE ISLE												
33N 6E 8BBBB1	Styma	61	6	341TRVR	800	28	Q	4.8 Mar 1984	18.8 Mar 1963	7.7 Apr	12.6 Jul	
ROSCOMMON												
24N 2W 20BABA1	Exp. Station	14	8	112OTSH	1,145.3	53	R	2.1 Apr 1976	6.2 Dec 1949	3.0 Apr	4.7 Aug	Federal key well
SAGINAW												
10N 1E 22DADA1	Marion Springs, D	210	6	324SGNW	657	9	R	7.9 Feb 1981	10.3 Oct 1984	8.6 Dec	9.9 Sep	
SANILAC												
13N 13E 12ADAA1	Minden Game Area	130	6	337MRSL	805	10	R	15.5 Apr 1985	22.7 Oct 1979	16.6 Oct	20.5 Sep	
SCHOOLCRAFT												
45N 13W 16CCCB1	Seney	154	4	361ODVCU	710	35	R	4.6 Apr 1971	6.5 Oct 1963	5.0 Apr	6.0 Jul	
47N 16W 30BBBB1	Cusino CCC	57	6	36BPRDC	900	30	R	5.6 Apr 1985	16.4 Feb 1977	7.6 Apr	15.2 Dec	
VAN BUREN												
2S 13W 2BBCD1	Almena, D	108	4	112GLCL	737	6	M	5.8 Mar 1984	10.7 Aug 1981	4.7 Oct	7.3 Jun	
2BBCD2	Almena, S	44	4	112GLCL	737	6	M	9.0 Oct 1982	12.6 Sep 1984	8.4 Oct	11.0 Aug	
WASHTENAW												
2S 3E 9DAAB2	Waterloo Park	48	6	112SDGV	970	18	R	4.1 May 1974	7.0 Aug 1971	4.5 Mar	6.2 Sep	P
3S 6E 16BCCD1	Ann Arbor	55	10	112GLCL	821.5	24	R	0.7 Mar 1974	15.9 Oct 1964	1.4 May	5.8 Sep	P
7E 5BB	Ypsilanti, Superior	69	8	112GLCL	720	25	R	1.8 Feb 1965	21.4 Dec 1965	6.6 Oct	9.1 Jan	P
9ADBC1	Ypsilanti, Gilbert	94	6	112GLCL	710	36	R	29.1 Nov 1945	78.8 Oct 1974	45.4 Dec	54.3 Feb	P
24CA1	Ypsilanti Twsp 104	87	4	112GLCL	665.6	41	R	5.8 Jan 1950	22.7 Feb 1971	13.9 Jul	16.1 Mar	P
24CD	Ypsilanti Twsp 117	75	6	112GLCL	657.8	40	R	4.7 Oct 1981	63.2 Feb 1970	10.7 Apr	27.4 Aug	P
WEXFORD												
22N 12W 13BA	Harrietta Fish	141	4	112GLCL	1,060	26	R	+13.8 Mar 1970	1.6 Jan 1981	+11.0 Jul	+6.2 Feb	P

Table 2.--Reported ground-water pumpage
(in millions of gallons)

COUNTY AND WATER USER	1986 TOTAL	MAXIMUM DAY	MINIMUM DAY
ALCONA			
Harrisville	21.5	0.127	0.032
ALGER			
Burt Township	43.2	.240	.060
Chatham	11.4	.108	.012
ALLEGAN			
Allegan	360.0	1.560	.569
Douglas	52.2	[a]--	--
Fennville	216.0	--	--
Otsego	359.2	1.424	.710
Plainwell	199.7	.827	.280
Saugatuck	138.9	--	--
ANTRIM			
Bellaire	60.7	.358	.121
Central Lake	37.6	.342	--
Mancelona	141.9	.755	.118
BARRY			
Middleville	112.2	--	--
Nashville	41.8	.163	.073
BENZIE			
Beulah	16.7	.104	.026
Frankfort	99.3	--	--
BERRIEN			
Berrien Springs	153.9	.866	.267
Coloma	97.2	.748	.149
Niles	976.1	3.930	1.780
Niles Township	93.9	.995	.293
Watervliet	87.2	.526	.000
BRANCH			
Bronson	240.7	1.082	.183
Coldwater	1,083.8	4.450	1.320
Quincy	82.3	.476	--
Coldwater Regional Center	70.8	.323	.089
CALHOUN			
Albion	939.3	4.040	1.234
Athens	36.4	.179	.280
Battle Creek	3,518.1	14.490	4.170
Battle Creek Township	682.6	3.590	1.210
Homer	83.7	.527	.104
Marshall	575.0	2.312	.800
CASS			
Cassopolis	84.0	.354	.138
Dowagiac	349.3	2.034	.462
CHARLEVOIX			
Boyne City	370.3	1.926	.486
East Jordan	219.2	.980	.400
CHIPPEWA			
Kinross Township	101.1	.543	.141
CLARE			
Clare	227.3	1.691	.418
Farwell	46.2	.210	.060
Harrison	74.1	.276	.123
CLINTON			
Fowler	27.2	0.287	0.031
Maple Rapids	31.0	--	--
Ovid	84.8	.384	.004
St. Johns	453.7	1.870	.616
Westphalia	20.2	.123	.031
CRAWFORD			
Grayling	281.9	1.043	.691
DICKINSON			
Breitung Township	36.6	--	--
EATON			
Bellevue	56.5	.440	.000
Charlotte	371.7	1.620	.667
Delta Twp.	927.5	--	--
Eaton Rapids	250.5	1.180	.472
Grand Ledge	248.2	1.399	.323
Sunfield	26.2	--	--
EMMET			
Harbor Springs	169.5	1.370	.280
Petosky	560.1	--	.068
GENESEE			
Beecher Metro District	464.3	2.108	.841
Burton	267.9	1.607	.440
Davison	222.1	1.486	.024
Fenton	333.5	1.526	.651
Grand Blanc	459.1	3.161	.473
Grand Blanc Township	176.1	--	--
Linden	77.1	.434	.097
Otisville	21.8	--	--
GLADWIN			
Beaverton	47.6	--	--
GOGEBIC			
Ironwood	499.8	--	--
Marenisco Township	46.7	.339	.079
Wakefield	162.5	.621	.163
GRAND TRAVERSE			
Kingsley	28.3	--	--
GRATIOT			
Breckenridge	42.4	.360	.075
Ithaca	103.8	--	--
St. Louis	216.5	1.353	.367
HILLSDALE			
Hillsdale	398.0	1.834	.716
Jonesville	162.5	1.040	.266
Litchfield	54.0	.300	.087
Waldron	31.5	.143	.061
HOUGHTON			
[b]Adams Township - South Range Water Authority	270.7	--	--
[c]Adams Township - South Range Water Authority	118.5	--	--
Chassell Township	6.6	.113	.000
Houghton	396.3	1.682	.716
[d]Northern Michigan Water	348.1	1.251	.662

Table 2.--Reported ground-water pumpage--Continued
(in millions of gallons)

COUNTY AND WATER USER	1986 TOTAL	MAXIMUM DAY	MINIMUM DAY
HURON			
Elkton	52.2	0.310	0.102
Pigeon	28.3	--	--
Sebewaing	181.9	.929	.163
INGHAM			
East Lansing-Meridian Township	2,174.7	10.360	4.050
Lansing	7,689.5	30.873	16.200
Lansing Township	353.9	--	--
Mason	232.2	--	--
Michigan State University	1,528.7	5.145	1.532
Stockbridge	38.1	.158	.060
Webberville	53.3	--	--
Williamston	93.5	.452	.083
IONIA			
Belding	637.4	--	--
Ionia	555.7	2.183	.833
Riverside Facility, Ionia	38.9	.255	.067
Michigan Training Unit, Ionia	54.8	.449	.104
[f]Muir	48.6	.203	.108
Pewamo	20.6	--	--
Portland	155.8	--	--
Saranac	57.9	.360	.029
IOSCO			
Oscoda Township	288.4	--	--
Wurtsmith AFB	479.8	--	--
IRON			
Alpha	11.9	--	--
Caspian	104.6	.580	.184
Crystal Falls	167.5	.912	.363
Crystal Falls Township	64.9	.270	.128
Iron River	128.3	.657	.102
Stambaugh	65.7	.315	.029
ISABELLA			
[g]Mt. Pleasant	885.8	4.175	.893
JACKSON			
Concord	74.2	.578	.004
Grass Lake	25.2	.229	.032
Jackson	3,327.0	12.060	5.310
Springport	50.7	--	--
State Prison, Jackson	579.0	--	--
KALAMAZOO			
Augusta	29.0	.470	.042
Galesburg	64.7	.436	.127
Kalamazoo	6,638.0	30.215	12.178
Parchment	124.9	1.268	.093
Portage	1,188.8	7.957	1.458
Upjohn Company	6,555.9	23.358	7.452
Vicksburg	113.2	.838	.177
KALKASKA			
Kalkaska	182.2	1.332	.248

COUNTY AND WATER USER	1986 TOTAL	MAXIMUM DAY	MINIMUM DAY
KENT			
Alloytek, Incorporated	78.3	--	--
Cedar Springs	139.1	0.609	0.244
Kent County Airport	[e]12.0	--	--
Lowell	246.0	1.211	.297
Plainfield Township	695.4	5.000	1.160
LAKE			
Baldwin	77.6	.501	.150
LAPEER			
Columbiaville	31.1	.189	.049
Dryden	14.7	.151	.025
North Branch	36.1	.234	.075
LEELANAU			
Northport	24.3	.198	.016
LENAWEE			
Britton	18.1	.090	.015
Clinton	111.3	--	--
Hudson	128.6	.530	.119
Morenci	91.4	.429	.131
Onsted	32.8	--	--
Tecumseh	353.4	1.594	.596
Inland Division, Tecumseh	8.7	.076	.029
LIVINGSTON			
Brighton	295.1	1.300	.480
Fowlerville	126.9	.550	.238
Green Oak Township	32.8	--	--
Howell	499.8	2.142	.722
LUCE			
Newberry	91.1	--	--
Newberry Health Center	16.6	--	--
MACOMB			
Armada	34.7	--	--
Romeo	[e]151.7	--	--
Richmond	143.6	--	--
MANISTEE			
Filer Township	56.6	.362	.000
Manistee	394.4	1.854	.907
MARQUETTE			
Ishpeming Township	149.2	--	--
K.I. Sawyer AFB	411.1	2.707	.612
Powell Township	14.2	.117	.017
MENOMINEE			
Stephenson	39.8	.191	.079
MISSAUKEE			
Lake City	59.4	.337	.098
MONROE			
Petersburg	49.1	.191	.082

Table 2.--Reported ground-water pumpage--Continued
(in millions of gallons)

COUNTY AND WATER USER	1986 TOTAL	MAXIMUM DAY	MINIMUM DAY
MONTCALM			
Carson City	67.7	0.310	0.150
Edmore	60.0	.590	.058
Greenville	940.4	4.029	1.030
Howard City	40.1	--	--
Sheridan	31.4	--	--
MUSKEGON			
Montague	97.2	.626	.096
NEWAYGO			
Freemont	417.5	2.746	.261
Hesperia	22.8	--	--
Newaygo	63.2	.385	.072
White Cloud	73.4	.379	.090
OAKLAND			
Holly	174.9	.798	.338
Independence Township	182.3	--	--
Milford	240.3	1.164	.389
Orion Township	228.9	1.508	.413
Oxford	166.8	.793	.179
Rochester	614.1	2.834	1.191
Southfield	4.8	--	--
South Lyon	693.1	--	--
Sylvan Lake	99.7	--	--
Walled Lake	274.8	1.625	.100
Waterford Township	2,078.9	--	--
Wolverine Lake	69.5	--	--
OCEANA			
Hart	249.2	--	--
Shelby	16.7	--	--
OGEMAW			
West Branch	98.8	.687	.000
ONTONAGON			
Bergland Township	e)10.2	--	--
Rockland Township	10.7	.059	.011
OSCEOLA			
Evart	768.0	3.800	.340
Reed City	122.7	--	--
OTSEGO			
Gaylord	212.2	--	--
OTTAWA			
Spring Lake	151.2	.891	.152
PRESQUE ISLE			
Onaway	59.4	--	--
Rogers City	157.9	1.052	.314
ROSCOMMON			
Roscommon	61.1	--	--
ST. CLAIR			
Capac	38.4	0.259	0.048
Yale	107.5	--	--
ST. JOSEPH			
Constantine	104.6	.972	.070
Sturgis	795.0	3.570	1.423
SANILAC			
Croswell	194.4	.977	.245
Deckerville	52.0	.252	.101
Marlette	111.9	.427	.090
Peck	18.4	--	.036
Port Sanilac	36.7	--	--
Sandusky	146.4	.828	.214
SHIAWASSEE			
Bancroft	18.3	--	--
Durand	127.9	.528	.265
Owosso	709.1	3.261	1.450
Perry	60.7	.328	.100
TUSCOLA			
Caro	198.5	1.394	.100
Cass City	122.6	.655	.168
Kingston	15.5	.086	.034
Mayville	29.4	--	--
State Hospital, Caro	54.4	.290	.080
Vassar	171.9	.874	.339
VAN BUREN			
Bangor	62.2	.324	.075
Decatur	90.6	--	--
Gobles	91.9	--	--
Hartford	108.9	.764	.095
Lawrence	39.5	--	--
Lawton	273.7	1.859	--
Paw Paw	188.4	1.148	.295
WASHTENAW			
Ann Arbor	h)1,043.9	--	--
Chelsea	175.9	.685	.350
Dexter	87.9	.387	.118
Milan	316.6	1.247	.010
Saline	443.2	1.864	.621
Webster Township	32.5	.309	.028
Ypsilanti	924.7	5.250	1.800
Ypsilanti Township	1,731.2	8.309	.792
WEXFORD			
Cadillac	747.9	3.056	1.164
Manton	55.6	.427	.017

NOTES

a Indicates data not available.
b Amount pumped to supply Houghton, Hancock, Portage Township, Copper Range Company, and Atlantic Mine.
c Amount pumped to supply Painesdale, Trimountain, Baltic, and South Range.
d Amount pumped to supply Calumet, Calumet Township, Copper City, Lake Linden, Laurin, Osceola Township, Torch Lake Township, Ahmeek, and Alleouez Township.
e Wholly or partly estimated.
f Supplies water to Lyons.
g Use Ranney Collector system at Chippewa River site.
h Also pumped 4,750 million gallons from Huron River.

Table 3.--Water-quality data

LOCAL IDENTIFIER: See section in text entitled "Well-numbering system"; also includes abbreviated spelling of county name.

GEOLOGIC UNIT:

112SAND	Sand	368PRDC	Prairie Du Chien Group
112SDGC	Sand and Gravel	368PCTP	Prairie Du Chien-Trempealeau Formations
337MRSL	Marshall Formation	372TPMG	Trempealeau-Munsining Formations
337BERE	Berea Sandstone	372MNSG	Munising Sandstone
344DUND	Dundee Formation	377CBPB	Cambrian-Precambrian Rocks
348DRRV	Detroit River Group	420JCBV	Jacobsville Sandstone
348SLVN	Sylvania Sandstone	420CPHB	Copper Harbor Conglomerate
352BILD	Bass Islands Dolomite	420PGLK	Portage Lake Volcanics
355NGRN	Niagarin Series	430MCGM	Michigamme Slate
365BKRV	Black River Limestone	430IRND	Ironwood Iron-Formation
365TBRV	Trenton-Black River Group		

UNITS: UNits are reported in NTU = Nephelometric Turbidity Units; MG/L = Milligrams per liter UG/L = Micrograms per liter; PCI/L = Picocuries per liter.

LOCAL IDENTIFIER		DATE OF SAMPLE	GEOLOGIC UNIT	DEPTH OF WELL, TOTAL (FEET)	SPECIFIC CONDUCTANCE (US/CM)	PH (STANDARD UNITS)	TEMPERATURE (DEG C)	COLOR (PLATINUM-COBALT UNITS)	TURBIDITY (NTU)	HARDNESS (MG/L AS CACO3)	HARDNESS NONCARBONATE (MG/L AS CACO3)
48N 34W 22AAAD01	BARAGA	08-26-86	430MCGM	250	199	7.70	8.5	5	0.20	110	1
38N 24W 07DAAA01	DELTA	09-04-86	365TBRV	428	653	7.60	10.5	5	1.5	340	164
39N 22W 06CCAD01	DELTA	09-05-86	365BKRV	343	430	8.20	11.0	5	.30	210	0
41N 22W 06BAB 01	DELTA	08-29-86	368PRDC	305	426	8.10	11.0	2	.50	230	41
41N 27W 03CCAA01	DICKNSN	09-04-86	377CBPB	122	432	7.90	7.0	5	1.5	230	17
47N 45W 09BCDC01	GOGEBC	08-29-86	430IRND	390	379	7.60	10.0	5	.20	180	0
24N 09E 15DDD 01	IOSCO	05-20-86	112SAND	149	2790	8.30	9.0	5	1.0	290	196
24N 09E 20ADCD01	IOSCO	05-19-86	337MRSL	195	2150	7.70	10.0	5	1.8	760	666
58N 28W 06BADD01	KEWENW	08-27-86	420CPHB	210	306	7.40	7.0	5	3.0	160	0
59N 29W 28CDBD01	KEWENW	08-27-86	420CPHB	250	201	8.10	10.0	5	1.4	94	0
48N 08W 12BACB01	LUCE	08-26-86	372MNSG	150	243	8.70	14.5	5	.30	120	13
41N 03W 19CCCC01	MACKNC	08-27-86	355NGRN	560	643	7.80	10.5	3	3.5	330	156
42N 25W 07DACC01	MARQTE	09-03-86	368PCTP	83	584	7.70	12.0	3	.20	320	82
47N 24W 07ABAC01	MARQTE	09-03-86	420JCBV	170	196	8.50	11.5	3	.20	97	0
16N 09W 15CCCC01	MECSTA	08-26-86	112SAND	84	431	8.00	17.5	2	.30	180	28
35N 27W 22AAAD01	MENOME	09-05-86	372TPMG	385	488	7.70	8.0	5	1.1	260	40
38N 27W 02CACC01	MENOME	08-29-86	372MNSG	200	430	8.00	13.0	3	5.3	240	4
05S 08E 31DAAC01	MONROE	08-29-86	348DRRV	55	800	7.20	11.0	5	--	560	276
06S 06E 15AADD01	MONROE	09-03-86	344DUND	120	934	7.60	14.0	5	1.0	420	178
07S 07E 03AAAA01	MONROE	08-29-86	348SLVN	97	920	7.30	13.5	5	8.5	600	202
07S 09E 17CCCB01	MONROE	09-03-86	352BILD	112	2190	7.10	12.0	5	.20	1500	1300
48N 42W 03BCAD01	ONTNGN	08-28-86	420PGLK	100	280	7.60	9.0	5	.70	74	0
48N 42W 04BADB01	ONTNGN	08-28-86	420PGLK	280	278	9.50	9.0	5	3.5	9	0
20N 08W 30AAAB01	OSEOLA	08-26-86	112SAND	218	343	7.90	18.0	2	.20	180	6
44N 18W 07AABD01	SCHCFT	08-28-86	368PRDC	280	192	8.10	7.5	3	1.6	84	0
45N 13W 33DAAD01	SCHCFT	08-26-86	368PRDC	815	363	7.95	14.5	5	.30	150	24
01S 08E 06BDDB01	WAYNE	09-05-86	112SDGV	183	541	7.70	10.0	5	40	270	0
01S 09E 07CBCB01	WAYNE	09-05-86	112SDGV	69	813	7.20	14.5	5	22	410	98
01S 09E 07CBCC01	WAYNE	09-05-86	337BERE	314	598	8.40	12.5	5	.40	22	0

Table 3.--Water-quality data--Continued

LOCAL IDENTIFIER		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 LAB (MG/L AS CACO3)	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG C DISSOLVED (MG/L)
48N 34W 22AAAD01	BARAGA	34	4.9	2.9	0.80	104	8.2	0.80	<0.10	18	128
38N 24W 07DAAA01	DELTA	95	26	6.8	3.1	181	57	24	.20	6.9	400
39N 22W 06CCAD01	DELTA	48	23	7.2	3.6	216	16	4.2	.30	8.3	248
41N 22W 06BAB 01	DELTA	53	24	6.8	3.2	190	19	3.0	.40	7.4	192
41N 27W 03CCAA01	DCKNSN	44	30	4.0	1.7	217	18	1.3	.10	20	238
47N 45W 09BCDC01	GOGEBC	41	18	9.8	1.3	185	6.3	8.2	10	13	212
24N 09E 15DDD 01	IOSCO	50	41	430	3.4	98	88	800	1.4	9.0	1480
24N 09E 20ADCD01	IOSCO	170	82	1200	8.7	97	56	2500	.80	8.3	4180
39N 28W 06BADD01	KEWENW	53	6.4	2.0	.50	158	5.6	80	< 10	8.7	173
59N 29W 28CDBD01	KEWENW	30	4.6	2.8	.90	143	5.0	10	20	8.1	180
48N 08W 12BACB01	LUCE	33	8.4	3.2	1.0	104	20	2.7	< 10	15	150
41N 03W 19CCCC01	MACKNC	73	35	8.4	2.5	171	140	3.9	2.0	8.5	353
42N 25W 07DACC01	MARQTE	72	33	5.2	1.2	234	8.8	28	.10	6.9	300
47N 24W 07ABAC01	MARQTE	26	7.7	3.2	1.7	101	5.2	1.1	< 10	10	124
16N 09W 15CCCC01	MECSTA	48	15	18	3.5	154	17	38	< 10	6.9	241
35N 27W 22AAAD01	MENOME	65	23	4.0	1.3	217	15	7.5	.10	13	242
38N 27W 02CACC01	MENOME	48	30	1.4	2.6	240	6.9	.90	< 10	8.9	226
05S 08E 31DAAC01	MONROE	130	58	16	3.4	285	--	--	1.0	26	767
06S 06E 15AADD01	MONROE	68	61	47	2.9	243	300	8.5	1.2	19	635
07S 07E 03AAAA01	MONROE	200	24	23	1.9	397	230	47	.70	14	670
07S 09E 17CCCB01	MONROE	400	120	6.0	2.6	194	1200	9.4	1.4	13	1970
48N 42W 03BCAD01	ONTNGN	13	10	34	.10	138	5.3	5.3	.60	20	155
48N 42W 04BADB01	ONTNGN	3.0	.40	55	.20	89	5.5	26	.80	15	178
20N 08W 30AAAB01	OSEOLA	47	15	2.4	.70	173	13	.80	<.10	11	196
44N 18W 07AABD01	SCHCFT	19	8.9	4.3	3.7	85	14	.50	.80	5.5	110
45N 13W 33DAAD01	SCHCFT	34	16	15	3.5	127	51	7.2	.70	6.5	208
01S 08E 06BDDB01	WAYNE	49	37	21	1.6	309	10	1.4	.70	12	353
01S 09E 07CBCB01	WAYNE	110	32	26	2.2	309	64	59	.30	19	440
01S 09E 07CBCC01	WAYNE	4.5	2.5	140	1.2	270	2.1	46	1.8	9.0	378

LOCAL IDENTIFIER		SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	NITROGEN, NITRITE TOTAL (MG/L AS N)	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, ORGANIC TOTAL (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	NITROGEN, TOTAL (MG/L AS N)	PHOSPHORUS, TOTAL (MG/L AS P)	PHOSPHORUS, ORTHO, TOTAL (MG/L AS P)	ALUMINUM, TOTAL RECOVERABLE (UG/L AS AL)
48N 34W 22AAAD01	BARAGA	130	<0.010	0.010	--	<0.20	0.20	--	0.010	<0.010	<10
38N 24W 07DAAA01	DELTA	330	.010	.040	--	< 20	.10	--	< 010	<.010	2400
39N 22W 06CCAD01	DELTA	240	<.010	.090	--	<.20	< 10	--	030	.030	<10
41N 22W 06BAB 01	DELTA	230	<.010	.080	--	<.20	< 10	--	.020	<.010	<10
41N 27W 03CCAA01	DCKNSN	250	<.010	.080	.12	.20	< 10	--	< 010	<.010	<10
47N 45W 09BCDC01	GOGEBC	210	< 010	.030	--	< 20	20	--	020	.010	<10
24N 09E 15DDD 01	IOSCO	1500	<.010	.380	.12	.50	<.10	--	.020	<.010	<10
24N 09E 20ADCD01	IOSCO	4100	<.010	1.90	.00	1.9	<.10	--	010	<.010	10
38N 28W 06BADD01	KEWENW	170	<.010	<.010	--	< 20	.30	--	.010	010	50
59N 29W 28CDBD01	KEWENW	173	<.010	.040	--	<.20	.20	--	030	< 010	30
48N 08W 12BACB01	LUCE	150	<.010	.020	--	< 20	.10	--	< 010	020	<10
41N 03W 19CCCC01	MACKNC	380	<.010	.050	--	< 20	< 10	--	020	<.010	<10
42N 25W 07DACC01	MARQTE	300	< 010	.020	.38	40	3.4	3.8	< 010	<.010	<10
47N 24W 07ABAC01	MARQTE	120	<.010	.010	--	<.20	.10	--	< 010	<.010	<10
16N 09W 15CCCC01	MECSTA	240	.020	.020	.18	20	.60	80	< 010	< 010	<10
35N 27W 22AAAD01	MENOME	260	<.010	.040	26	.30	<.10	--	< 010	<.010	<10
38N 27W 02CACC01	MENOME	240	<.010	.120	--	< 20	< 10	--	.020	<.010	<10
05S 08E 31DAAC01	MONROE	--	<.010	.300	.10	.40	< 10	--	.020	.020	<10
06S 06E 15AADD01	MONROE	650	<.010	.500	.20	.70	<.10	--	< 010	< 010	<10
07S 07E 03AAAA01	MONROE	780	<.010	.220	.08	.30	< 10	--	.020	<.010	<10
07S 09E 17CCCB01	MONROE	1900	<.010	.440	.16	60	<.10	--	< 010	< 010	<10
48N 42W 03BCAD01	ONTNGN	180	<.010	.030	--	< 20	< 10	--	< 010	< 010	30
48N 42W 04BADB01	ONTNGN	150	<.010	.030	--	< 20	< 10	--	< 010	< 010	130
20N 08W 30AAAB01	OSEOLA	190	<.010	.020	--	<.20	1.8	--	< 010	.010	<10
44N 18W 07AABD01	SCHCFT	110	<.010	.070	--	< 20	<.10	--	020	.020	20
45N 13W 33DAAD01	SCHCFT	210	<.010	.060	--	<.20	<.10	--	<.010	< 010	<10
01S 08E 06BDDB01	WAYNE	320	<.010	.510	.09	.60	< 10	--	010	<.010	30
01S 09E 07CBCB01	WAYNE	500	<.010	.170	.03	.20	< 10	--	020	<.010	<10
01S 09E 07CBCC01	WAYNE	370	<.010	.220	.18	.40	<.10	--	060	.060	<10

Table 3.--Water-quality data--Continued

LOCAL IDENTIFIER		ARSENIC TOTAL (UG/L AS AS)	BARIUM, TOTAL RECOVERABLE (UG/L AS BA)	BERYLLIUM, TOTAL RECOVERABLE (UG/L AS BE)	BORON, TOTAL RECOVERABLE (UG/L AS B)	CADMIUM TOTAL RECOVERABLE (UG/L AS CD)	CHROMIUM, TOTAL RECOVERABLE (UG/L AS CR)	COBALT, TOTAL RECOVERABLE (UG/L AS CO)	COPPER, TOTAL RECOVERABLE (UG/L AS CU)	IRON, TOTAL RECOVERABLE (UG/L AS FE)	IRON, DISSOLVED (UG/L AS FE)
48N 34W 22AAAD01	BARAGA	5	<100	<10.0	<10	<1	<10	<1	<5	80	17
38N 24W 07DAAA01	DELTA	2	<100	<10.0	<10	<1	<10	2	5	970	350
39N 22W 06CCAD01	DELTA	<1	100	<10.0	180	<1	<10	2	4	150	35
41N 22W 06BAB 01	DELTA	<1	<100	<10.0	160	<1	<10	<1	1	250	49
41N 27W 03CCAA01	DCKNSN	2	<100	<10.0	20	<1	<10	<1	140	1500	20
47N 45W 09BCDC01	GOGEBC	<1	<100	<10.0	80	<1	<10	<1	2	40	23
24N 09E 15DDD 01	IOSCO	11	<100	<10.0	0	<1	<10	<1	39	130	10
24N 09E 20ADCD01	IOSCO	4	100	<10.0	1000	<1	<10	<1	6	840	510
58N 28W 06BADD01	KEWENW	<1	<100	<10.0	70	<1	30	<1	3	100	15
59N 29W 28CDBD01	KEWENW	<1	<100	<10.0	950	<1	<10	<1	13	240	18
48N 08W 12BACB01	LUCE	1	<100	<10.0	20	<1	<10	<1	26	<10	<3
41N 03W 19CCCC01	MACKNC	<1	<100	<10.0	130	<1	<10	<1	2	610	260
42N 25W 07DACC01	MARQTE	<1	<100	<10.0	<10	<1	<10	1	23	<10	12
47N 24W 07ABAC01	MARQTE	3	<100	<10.0	<10	2	<10	1	13	40	7
16N 09W 15CCCC01	MECSTA	<1	<100	<10.0	70	<1	<10	<1	4	20	6
35N 27W 22AAAD01	MENOME	2	300	<10.0	<10	<1	<10	<1	2	500	40
38N 27W 02CACC01	MENOME	2	<100	<10.0	<10	<1	<10	<1	3	1100	49
05S 08E 31DAAC01	MONROE	<1	<100	<10.0	170	<1	<10	<1	4	50	39
06S 06E 15AADD01	MONROE	<1	<100	<10.0	540	<1	<10	<1	1	270	210
07S 07E 03AAAA01	MONROE	<1	<100	<10.0	110	<1	<10	<1	7	2300	1800
07S 09E 17CCCB01	MONROE	<1	<100	<10.0	130	<1	10	<1	2	50	40
48N 42W 03BCAD01	ONTNGN	1	<100	<10.0	700	<1	<10	<1	2	150	86
48N 42W 04BADB01	ONTNGN	<1	<100	<10.0	840	<1	10	1	10	120	38
20N 08W 30AAAB01	OSEOLA	<1	<100	<10.0	20	<1	10	<1	7	60	58
44N 18W 07AABD01	SCHCFT	<1	100	<10.0	190	<1	30	<1	6	910	30
45N 13W 33DAAD01	SCHCFT	<1	<100	<10.0	130	<1	<10	<1	4	140	49
01S 08E 06BDDB01	WAYNE	1	100	<10.0	90	1	<10	3	240	4900	1700
01S 09E 07CBCB01	WAYNE	<1	200	<10.0	<10	1	10	2	22	1900	1900
01S 09E 07CBCC01	WAYNE	<1	<100	<10.0	620	<1	<10	2	1	140	63

LOCAL IDENTIFIER		LEAD, TOTAL RECOVERABLE (UG/L AS PB)	LITHIUM TOTAL RECOVERABLE (UG/L AS LI)	MANGANESE, TOTAL RECOVERABLE (UG/L AS MN)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY TOTAL RECOVERABLE (UG/L AS HG)	MOLYBDENUM, TOTAL RECOVERABLE (UG/L AS MO)	NICKEL, TOTAL RECOVERABLE (UG/L AS NI)	SELENIUM, TOTAL (UG/L AS SE)	SILVER, TOTAL RECOVERABLE (UG/L AS AG)	STRONTIUM, TOTAL RECOVERABLE (UG/L AS SR)
48N 34W 22AAAD01	BARAGA	<5	<10	<10	1	0.10	3	4	<1	<1	70
38N 24W 07DAAA01	DELTA	<5	<10	20	12	.40	4	5	<1	<1	240
39N 22W 06CCAD01	DELTA	<5	20	30	14	.40	3	5	<1	<1	580
41N 22W 06BAB 01	DELTA	<5	10	20	10	<.10	1	4	<1	<1	500
41N 27W 03CCAA01	DCKNSN	11	<10	30	30	<.10	1	2	<1	<1	180
47N 45W 09BCDC01	GOGEBC	<5	10	<10	3	<.10	<1	<1	10	<1	140
24N 09E 15DDD 01	IOSCO	9	<10	20	10	<.10	25	2	<1	<1	1700
24N 09E 20ADCD01	IOSCO	5	40	150	150	<.10	8	9	<1	<1	4000
58N 28W 06BADD01	KEWENW	<5	<10	<10	1	<.10	3	5	<1	<1	40
59N 29W 28CDBD01	KEWENW	26	40	<10	1	<.10	<1	2	<1	<1	220
48N 08W 12BACB01	LUCE	<5	<10	<10	4	<.10	3	2	<1	<1	50
41N 03W 19CCCC01	MACKNC	<5	20	10	8	<.10	3	2	<1	<1	16000
42N 25W 07DACC01	MARQTE	6	<10	<10	<1	.20	3	6	<1	12	40
47N 24W 07ABAC01	MARQTE	9	<10	<10	<1	<.10	3	4	<1	<1	160
16N 09W 15CCCC01	MECSTA	<5	<10	<10	3	.20	1	1	<1	<1	10
35N 27W 22AAAD01	MENOME	<5	<10	30	30	<.10	2	2	<1	<1	160
38N 27W 02CACC01	MENOME	<5	<10	20	15	<.10	2	<1	<1	<1	120
05S 08E 31DAAC01	MONROE	<5	60	20	14	<.10	<1	1	<1	<1	--
06S 06E 15AADD01	MONROE	<5	40	20	12	<.10	2	3	<1	<1	26000
07S 07E 03AAAA01	MONROE	<5	20	30	26	<.10	2	1	<1	<1	15000
07S 09E 17CCCB01	MONROE	<5	50	20	10	<.10	<1	2	<1	<1	12000
48N 42W 03BCAD01	ONTNGN	<5	<10	20	16	<.10	2	<1	<1	<1	240
48N 42W 04BADB01	ONTNGN	<5	<10	<10	3	<.10	3	3	<1	<1	50
20N 08W 30AAAB01	OSEOLA	<5	<10	<10	2	<.10	1	2	<1	<1	20
44N 18W 07AABD01	SCHCFT	6	<10	20	16	<.10	4	2	<1	<1	500
45N 13W 33DAAD01	SCHCFT	<5	10	<10	7	.20	7	3	<1	<1	370
01S 08E 06BDDB01	WAYNE	17	<10	90	62	.80	13	4	<1	<1	1600
01S 09E 07CBCB01	WAYNE	<5	<10	50	37	.30	4	4	<1	<1	310
01S 09E 07CBCC01	WAYNE	<5	20	<10	2	.60	8	3	<1	<1	130

Table 3.--Water-quality data--Continued

LOCAL IDENTIFIER		VANADIUM, DISSOLVED (UG/L AS V)	ZINC, TOTAL RECOVERABLE (UG/L AS ZN)	TRITIUM TOTAL (PCI/L)	CARBON, ORGANIC DISSOLVED (MG/L AS C)	CYANIDE TOTAL (MG/L AS CN)	PHENOLS TOTAL (UG/L)	2,4-D, TOTAL (UG/L)	2,4-DP TOTAL (UG/L)
48N 34W 22AAAD01	BARAGA	1	680	83	1.9	<0.010	1	<0.01	<0.01
38N 24W 07DAAA01	DELTA	<1	170	83	2.0	<.010	2	<.01	<.01
39N 22W 06CCAD01	DELTA	<1	60	<10	1.2	<.010	3	<.01	<.01
41N 22W 06BAB 01	DELTA	1	80	<10	.90	<.010	1	<.01	<.01
41N 27W 03CCAA01	DCKNSN	<1	540	16	1.5	<.010	<1	--	--
47N 45W 09BCDC01	GOGEBC	<1	50	160	1.1	<.010	<1	<.01	<.01
24N 09E 15DDD 01	IOSCO	19	990	<200	2.0	< 010	3	<.01	<.01
24N 09E 20ADCD01	IOSCO	52	660	<200	1.1	<.010	9	<.01	<.01
58N 28W 06BADD01	KEWENW	6	130	130	2.1	<.010	3	<.01	<.01
59N 29W 28CDBD01	KEWENW	28	910	51	3.0	<.010	<1	<.01	<.01
48N 08W 12BACB01	LUCE	<1	490	310	1.1	<.010	<1	<.01	<.01
41N 03W 19CCCC01	MACKNC	<1	110	<10	1.1	<.010	1	<.01	<.01
42N 25W 07DACC01	MARQTE	<1	60	80	1.4	<.010	3	<.01	<.01
47N 24W 07ABAC01	MARQTE	11	30	26	.50	<.010	2	<.01	<.01
16N 09W 15CCCC01	MECSTA	<1	1100	120	--	<.010	1	--	--
35N 27W 22AAAD01	MENOME	<1	20	77	2.9	<.010	1	<.01	<.01
38N 27W 02CACC01	MENOME	1	290	19	2.1	.060	4	<.01	<.01
05S 08E 31DAAC01	MONROE	<1	60	19	--	<.010	--	<.01	<.01
06S 06E 15AADD01	MONROE	2	50	<10	1.6	<.010	2	<.01	<.01
07S 07E 03AAAA01	MONROE	<1	500	61	2.3	<.010	2	<.01	<.01
07S 09E 17CCCB01	MONROE	<1	80	<10	3.5	<.010	3	<.01	<.01
48N 42W 03BCAD01	ONTNGN	1	50	<10	1.5	<.010	<1	<.01	<.01
48N 42W 04BADB01	ONTNGN	<1	10	22	1.6	<.010	<1	<.01	<.01
20N 08W 30AAAB01	OSEOLA	<1	300	110	3.8	<.010	14	<.01	<.01
44N 18W 07AABD01	SCHCFT	<1	180	19	.90	<.010	2	<.01	<.01
45N 13W 33DAAD01	SCHCFT	<1	20	13	1.8	<.010	<1	<.01	<.01
01S 08E 06BDDB01	WAYNE	<1	550	<10	1.7	<.010	2	<.01	<.01
01S 09E 07CBCB01	WAYNE	<1	90	42	1.2	<.010	3	<.01	<.01
01S 09E 07CBCC01	WAYNE	<1	30	<10	1.7	<.010	2	<.01	<.01

LOCAL IDENTIFIER		2,4,5-T TOTAL (UG/L)	BILVEX, TOTAL (UG/L)	URANIUM DISSOLVED, EXTRACTION (UG/L)
48N 34W 22AAAD01	BARAGA	<0.01	<0.01	.79
38N 24W 07DAAA01	DELTA	<.01	<.01	2.7
39N 22W 06CCAD01	DELTA	<.01	<.01	.03
41N 22W 06BAB 01	DELTA	<.01	<.01	.24
41N 27W 03CCAA01	DCKNSN	--	--	.03
47N 45W 09BCDC01	GOGEBC	<.01	<.01	.33
24N 09E 15DDD 01	IOSCO	<.01	<.01	.20
24N 09E 20ADCD01	IOSCO	<.01	<.01	<.17
58N 28W 06BADD01	KEWENW	<.01	<.01	.18
59N 29W 28CDBD01	KEWENW	<.01	<.01	4.2
48N 08W 12BACB01	LUCE	<.01	<.01	.10
41N 03W 19CCCC01	MACKNC	<.01	<.01	.02
42N 25W 07DACC01	MARQTE	<.01	<.01	.22
47N 24W 07ABAC01	MARQTE	<.01	<.01	2.2
16N 09W 15CCCC01	MECSTA	--	--	.06
35N 27W 22AAAD01	MENOME	<.01	<.01	.21
38N 27W 02CACC01	MENOME	<.01	<.01	.04
05S 08E 31DAAC01	MONROE	<.01	<.01	.02
06S 06E 15AADD01	MONROE	<.01	<.01	<.01
07S 07E 03AAAA01	MONROE	<.01	<.01	.25
07S 09E 17CCCB01	MONROE	<.01	<.01	<.01
48N 42W 03BCAD01	ONTNGN	<.01	<.01	.77
48N 42W 04BADB01	ONTNGN	<.01	<.01	.67
20N 08W 30AAAB01	OSEOLA	<.01	<.01	.26
44N 18W 07AABD01	SCHCFT	<.01	<.01	.04
45N 13W 33DAAD01	SCHCFT	<.01	<.01	.15
01S 08E 06BDDB01	WAYNE	<.01	<.01	.03
01S 09E 07CBCB01	WAYNE	<.01	<.01	.03
01S 09E 07CBCC01	WAYNE	<.01	<.01	<.01

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1935	777	1944	1016	1953	1265
1936	817	1945	1023	1954	1321
1937	840	1946	1071	1955	1404
1938	845	1947	1096	1956-57	1537
1939	886	1948	1126	1958-62	1782
1940	906	1949	1156	1963-67	1977
1941	936	1950	1165	1968-72	2140
1942	944	1951	1191		
1943	986	1952	1221		

U.S. Geological Survey Water-Data Reports:

Year	WDR Number
1975	MI-75-1
1976	MI-76-1
1977	MI-77-1
1978	MI-78-1
1979	MI-79-1
1980	MI-80-1
1981	MI-81-1
1982	MI-82-1
1983	MI-83-1
1984	MI-84-1
1985	MI-85-1
1986	MI-86-1

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