

GROUND-WATER LEVELS AND  
CHEMICAL QUALITY IN  
GEAUGA COUNTY, OHIO  
1978

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U.S. GEOLOGICAL SURVEY

Water - Resources Investigations 80-28

Prepared in cooperation with Geauga County  
Sanitation Engineering Department



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By Vance E. Nichols

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Columbus, Ohio  
April 1980

UNITED STATES DEPARTMENT OF THE INTERIOR

CECIL D. ANDRUS, Secretary

GEOLOGICAL SURVEY

H. William Menard, Director

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Conversion Factors

Factors for converting inch-pound units to the  
International System of Units (SI) are given below:

To convert from	To	Multiply by
inch (in.)	millimeter (mm)	25.40
foot (ft)	meter (m)	0.3048
acre	meter <sup>2</sup> (m <sup>2</sup> )	4047.
gallon (gal)	liter (L)	3.785
mile (mi)	kilometer (km)	1.609

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ABSTRACT  
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Most ground water used in Geauga County, Ohio, is withdrawn from bedrock aquifers, chiefly sandstones of the Pottsville and Cuyahoga Formations of Pennsylvanian and Mississippian age, respectively. Two potentiometric-surface maps were constructed from water-level measurements of 77 wells and 2 springs made in June and October 1978. The potentiometric surface did not change more than a few feet between June and October except in four distantly spaced wells where water levels changed not more than 17 feet, probably due to nearby pumping.

The ground water is generally of good quality for domestic use based on guidelines set by the Ohio Environmental Protection Agency and the U.S. Environmental Protection Agency. Some water samples contained high concentrations of dissolved iron and manganese. These metals could have been contributed by deteriorating well casings, bacteria, or iron- and manganese-rich aquifer rocks.

INTRODUCTION

Gauga County, in northeast Ohio (fig. 1), is approximately 400 square miles in area and has a population of about 63,000 (as of April, 1977, oral communication with Ohio State Department of Economic and Community Development). The population has grown significantly since 1975. As a result the use of ground-water for domestic supplies has also increased rapidly, particularly in the western part of Geauga County. Residents and county officials are concerned that the increased ground-water use might lower the water table, cause wells to fail, and adversely effect the ground-water quality.

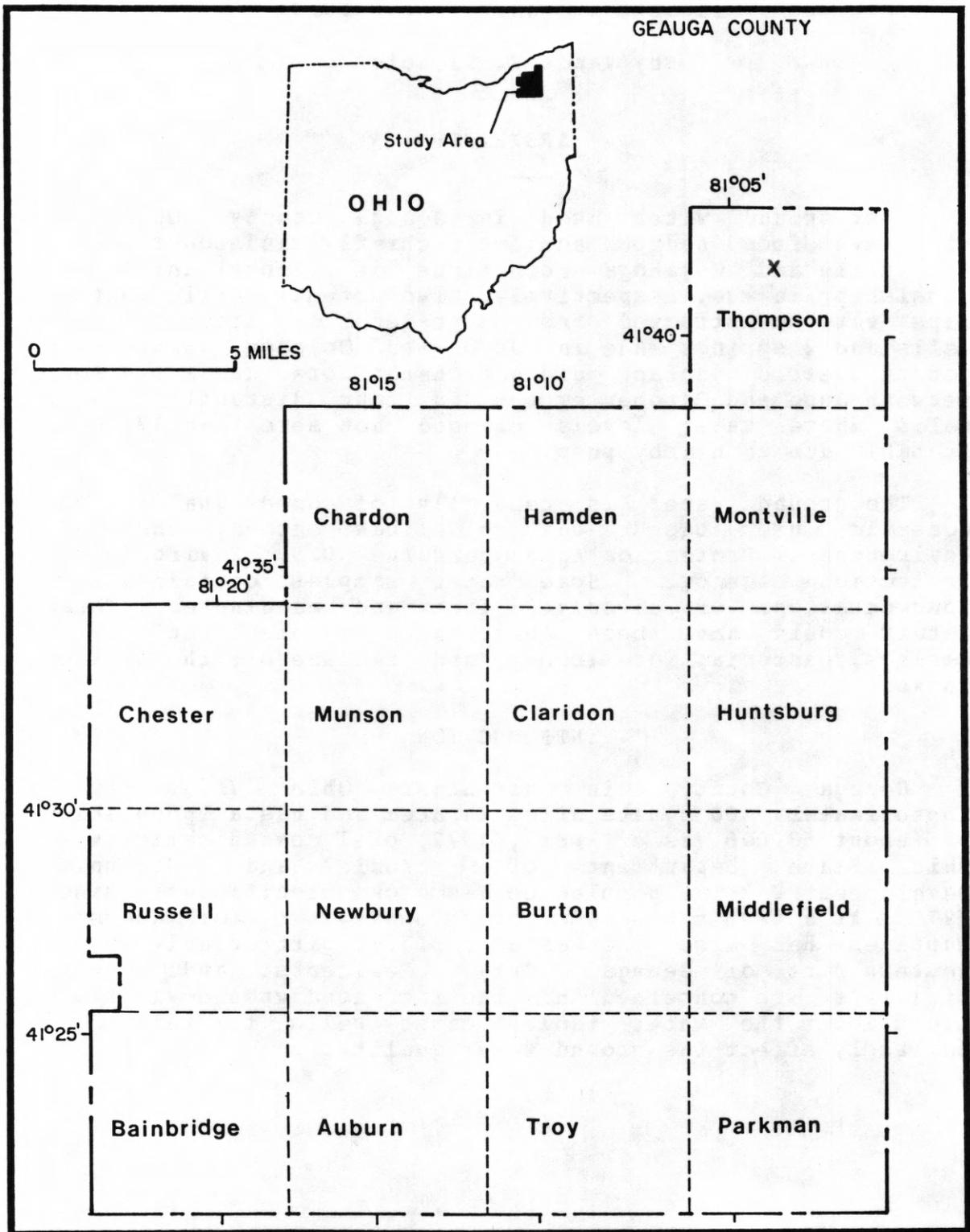


Figure 1.-- Geauga County and townships.

The purpose of this report is to present current (1978) ground-water levels and quality information in the most developed aquifer(s) in Geauga County. These data will serve as a base from which impacts of future ground-water development can be assessed.

Ohio receives, on a statewide average basis, 39 inches of precipitation annually. Geauga County, being close to Lake Erie, experiences climatic patterns that are lake influenced. Precipitation there averages approximately 46 inches annually (National Oceanic and Atmospheric Administration, 1964 through 1977). Norris (1969) estimates ground-water recharge to be 6 inches statewide. The ground-water recharge rate, therefore, is estimated to range between 3 to 7 inches per year. Based on the relation that 1 inch of annual recharge equals 74 gallons per day per acre, estimated recharge rates in Geauga County range from 200 gallons per day per acre (0.1 gallons per minute per acre) to 500 gallons per day per acre (0.3 gallons per minute per acre).

Most domestic and industrial water wells in Geauga County, are drilled into bedrock aquifers, either the Connoquenessing Sandstone Member of the Pennsylvanian Pottsville Formation or the shales and sandstones of the Mississippian Cuyahoga Formation (fig. 2). The former is a water-table (unconfined) aquifer; the latter is at some sites a water-table aquifer and at other sites an artesian (confined) aquifer. Other wells are drilled into unconsolidated sand and gravel, chiefly in buried valleys along the western and near the northwest edge of the county. Few wells are drilled into the productive Mississippian Berea Sandstone because of its depth (Baker, 1964).

The author acknowledges the Geauga County Sanitation Engineering Department for support and assistance in locating wells, and the land owners for permitting access to private wells.

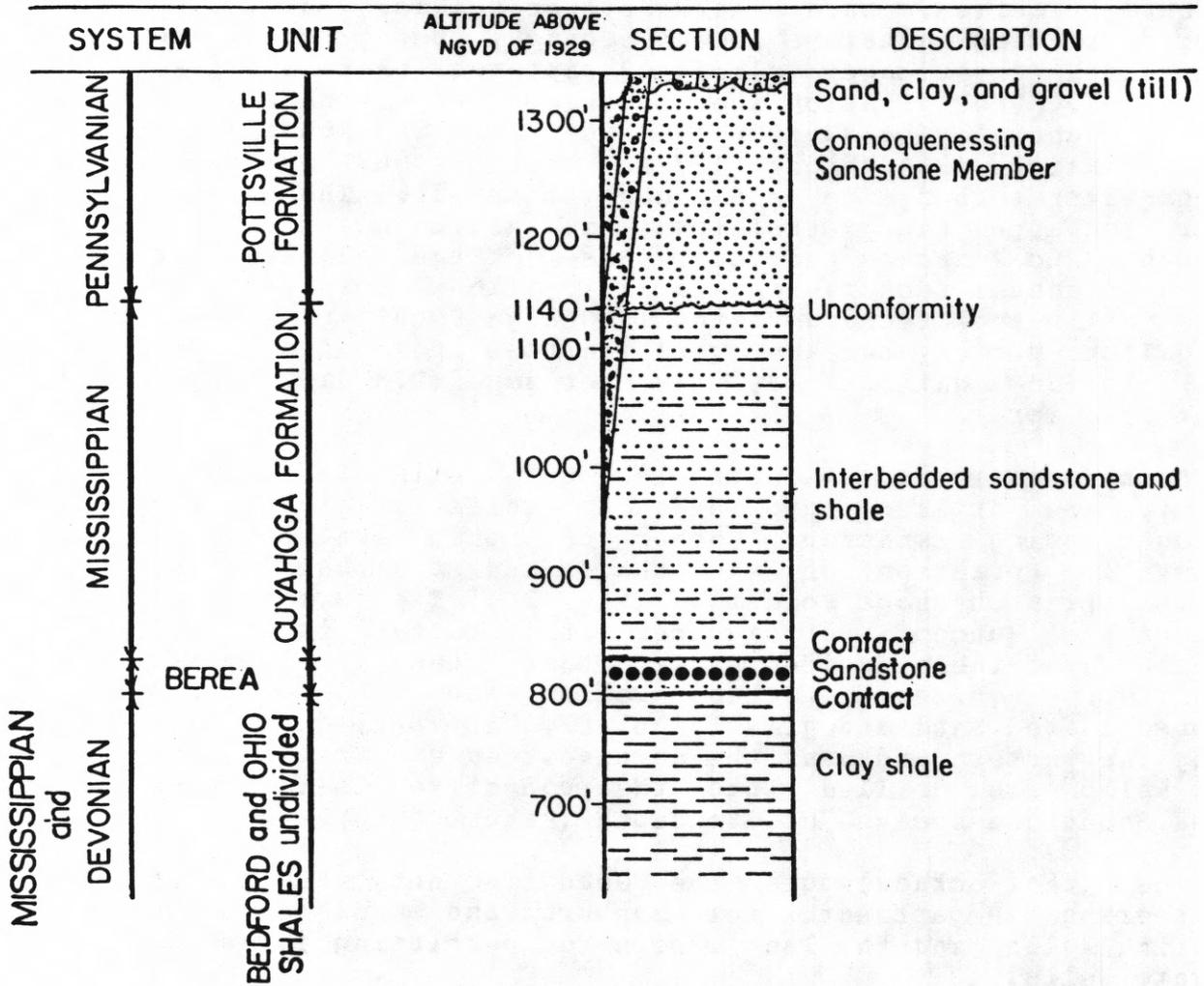


Figure 2.--Generalized geologic column of Geauga County.

## APPROACH AND METHODS

### Observation Wells

Data in this report are from well logs from Ohio Department of Natural Resources, Division of Water, files and Baker's (1964) report titled "Geology and Ground-Water Resources of Geauga County, Ohio." (See References.)

Criteria for observation well selection in Geauga County were accessibility, anticipated long well life, owner cooperation, availability, and good connection with the aquifer. Most of the wells are in the western seven townships (fig. 1) where ground-water use is increasing rapidly. Well GE-3a is located in the Chagrin Falls municipal well field and is equipped with a continuous water level recorder, which the Ohio Division of Water has been operating since 1948. Well and spring locations are shown in fig. 3, and owners names and well data are given in table 1.

### Potentiometric Map Construction

Water levels were measured in 77 wells and 2 springs in Geauga County. Water level data are presented in table 1. The potentiometric-surface maps were constructed from measured water levels, and by reference to information from drillers' logs and the long term hydrograph of well GE-3a.

The aquifer tapped by each well was determined from well logs and maps showing the distribution of the consolidated rocks in Geauga County by Baker (1964). The aquifers of the Pennsylvanian Pottsville Formation, where present, and the Mississippian Cuyahoga Formation were considered as one aquifer in the construction of the potentiometric maps. Water levels were at the same altitude in nearby wells drilled in these two aquifers.

TABLE 1.--SELECTED NETWORK WELLS IN GEauga COUNTY, OHIO, 1978

Owner and location: SSD - Sanitary Sewer District

Water use: C - commercial, H - domestic, N - industrial, P - public, R - recreation, U - unused, Z - other

Site number	Owner and location	Latitude	Longitude	Altitude (feet) <sup>1</sup>	Depth of well (feet)	Water level 6-14-78 <sup>1</sup>	Water level 10-23-78 <sup>1</sup>	Water use
GE-15	Bainbrook Homes SSD nr Bainbridge -----	412225	812052	1040	28.9	1034	1027	U
GE-16	Bainbrook Homes SSD nr Bainbridge -----	412218	812050	1045	101.0	1041	1041	U
GE-17	McFarland Cr SSD on Chagrin R Rd -----	412313	812315	900	<sup>2</sup> 385.0	<sup>3</sup> 883	777	U
GE-18	City of Chagrin Falls well field -----	412512	812215	1135	86.8	1113	1109	U
GE-19	City of Chagrin Falls well field -----	412514	812215	1142	89.0	<sup>4</sup> 1073	1113	U
GE-20	Tanglewood water wells nr Bainbridge on Haskins Rd -----	412339	811925	1090	(5)	1085	1079	P
GE-21	Tanglewood water wells nr Bainbridge on Haskins Rd -----	412346	811925	1120	127.0	1096	1093	U
GE-22	City of Akron LaDue Resv camp ground -----	412331	811230	1160	(5)	1147	1147	R
GE-23	Western Reserve Telephone on Bainbridge Rd at Bainbridge -----	412309	812024	1162	42.5	1152	1149	C
GE-24	Joe Lipocky on Pettybone Rd nr Geauga Lk -----	412142	812236	1040	212.0	958	975	H
GE-25	M.Rider at Chillicothe and Fairmont Rds -----	412927	812024	1030	96.5	1030	1030	H
GE-26	Arrowhead Farm Estates at Dines and County Line Rds -----	412844	812252	995	72.7	957	----	U
GE-27	Troy Oaks Club water wells Shaw Rd near Auburn Corners -----	412250	811123	1190	178.2	1173	1169	P
GE-28	Pilgrim Village SSD Bainbridge Rd near Bainbridge -----	412246	812016	1165	77.1	1162	1160	P
GE-29	Chagrin Falls Park at Woodland and Akron Sts -----	412449	812327	955	56.7	915	912	U
GE-3a	City of Chagrin Falls well field observation well -----	412577	812211	1135	120.0	1118	1111	U
GE-30	S Russell SSD Bell St nr S Russell -----	412532	812119	1090	46.0	1091	1091	P
GE-31	Wenhaven SSD Wenhaven Dr nr Russell -----	412655	812056	1110	25.7	1110	1110	P
GE-32	Russell Park SSD Russell Ln at Russell -----	412803	812100	1010	(5)	1006	1009	P
GE-33	Sherman Hills SSD Sherman Dr nr Chesterland -----	413207	811920	1110	141.4	1011	1011	P
GE-34	Opalaka Dr SSD Opalaka Dr at Chesterland -----	413100	811959	1170	28.7	1167	----	P
GE-35	Kimberly Estates SSD Stockton Dr nr Newbury -----	412922	811435	1200	(5)	1136	1135	P
GE-36	Frank C. Marous at Stafford and Snyder Rds -----	412439	811830	1260	117.0	1197	1194	H
GE-37	W Reserve Mem Gardens Chillicothe Rd nr Chesterland -----	413336	812020	1110	<sup>2</sup> 240.0	1029	1014	H
GE-38	Diblasí Delí Washington and Chillicothe Rds -----	412440	812015	1200	41.3	1174	1172	C
GE-39	Citizens Fed Savings Washington and Chillicothe Rds -----	412514	812022	1200	78.0	1164	1163	C
GE-40	Thermal Analysis Co Munn and Stafford Rds -----	412425	811627	1190	41.4	1175	1174	N
GE-41	Stock Industries at Chillicothe Rd nr McFarland Corners -----	412459	812030	1205	63.9	1186	<sup>6</sup> 1150	N
GE-42	Middlefield wells on Old State Rd SR 608 -----	412905	810455	1130	77.2	1090	1090	P
GE-43	Unknown owner old trailer site at Clay and Mosley Rds nr Thompson -	414220	810455	1032	61.4	1023	1021	U
GE-44	J. Binnig at Thompson and Sidley Rds -----	414124	810101	1045	34.8	1044	1042	H
GE-45	General Refractories (abandoned house) Madison Rd nr Thompson -----	414026	810244	1300	63.5	1261	1258	U
GE-46	Montville Cemetery on Madison Rd -----	413640	810301	1230	49.3	1214	----	Z
GE-47	Western Reserve Telephone at Madison and Mayfield Rds -----	413627	810257	1210	44.8	1192	1190	H
GE-48	Huntsburg Park on Mayfield Rd E of Huntsburg -----	413202	810157	1090	51.3	1085	1084	R
GE-49	Louis Kocsis on Madison Rd nr Middlefield -----	412620	810324	1150	95.8	1136	1136	H
GE-50	Overlook Cemetery at Tavern Rd nr Parkman -----	412233	810313	1210	104.4	1111	1095	Z
GE-51	Chardon Municipal Well Truman 2 -----	413426	811219	1215	68.0	1198	1198	U
GE-52	Geauga Co Theatre in Chardon -----	413449	811216	1295	50.0	1263	1260	U
GE-53	Chardon well field observation well on Woodie Brook Rd -----	413346	811223	1150	87.3	1104	1106	U

GE-54	11623 Woodie Brook Rd nr Chardon -----	413343	811328	1280	54.3	1247	1232	U
GE-55	Lake Aquilla Ohio Parks nr Chardon -----	413258	811009	1147	135.2	1147	1146	R
GE-56	Sohio Oil at Mayfield and Old State Rds at E Claridon -----	413156	810656	1220	104.3	1195	1193	C
GE-57	Troy Twp Hall at Welshfield -----	412315	810829	1242	139.5	1153	1152	P
GE-60	10098 Cracker Rd nr Auburn Center -----	412051	811657	1200	115.0	1142	1141	H
GE-61	Community Church at Wilson Mills and Caves Rds nr Chesterland ----	413243	812150	1195	58.4	1175	1172	P
GE-62	14143 Sperry Rd SL B-5 nr Fullertown -----	412857	811723	1150	49.0	1139	1139	H
GE-63	14770 Sperry Rd nr Yates Corners -----	412751	811719	1270	(5)	1195	----	H
GE-64	W Reserve Telephone Co at Newbury Center -----	412749	811452	1235	(5)	1209	1208	C
GE-65	W.O. Frohring Munn Rd between Music and Bell Sts -----	412622	811625	1165	68.0	1159	1157	N
GE-66	9319 Music St nr Russell -----	412645	811824	1215	40.0	1193	1190	U
GE-67	Geauga Co Parks Russell Park on Rapids Rd -----	412522	810928	1100	67.9	1098	1097	R
GE-68	Pleasant Hill Cemetery at Butternut and Aquillard Rds -----	412949	811046	1200	55.8	1181	1179	P
GE-69	ODOT Munson Yard at Bass Lake and Mayfield Rds -----	413151	811258	1260	65.9	1240	1237	P
GE-70	ODOT Rest Area nr Ravenna and Mayfield Rds -----	413201	811109	1150	66.9	1151	1150	R
GE-71	George A.Chittle on Rapids Rd in Burton -----	412801	810918	1250	89.3	1195	1192	H
GE-72	Chris Hopkins at Claridon and Old State Rds nr Claridon -----	413433	810755	1220	79.7	1208	1205	H
GE-73	ODOT Rest Area at Hamden -----	413629	810828	1300	90.0	1257	1255	R
GE-74	8615 Plank Rd (SR 86) nr Montville -----	413809	810404	1285	(5)	1232	1231	U
GE-75	Unknown owner old well N corner of SR 166 and SR 86 nr Thompson ---	413857	810510	1200	71.0	1192	----	U
GE-76	Fowlers Mill Church at Fowlers Mill and Mayfield Rd -----	413138	811520	1170	113.0	1149	1148	P
GE-77	C.Chambers at Cedar and Caves Rds nr Chesterland -----	413028	812210	1140	165.0	1102	1101	H
GE-78	1129 Hidden Springs Drive SL-34 nr Chardon -----	413247	811732	1300	108.0	1223	1223	H
GE-79s	Spring on Wisner Rd nr Kirtland -----	413659	811653	830	(5)	----	830	P
GE-80	Center Chardon Cemetery on Mentor Rd nr Chardon -----	413656	811536	1090	55.2	1043	1042	R
GE-81	All Souls Cemetery at Kirtland and Chardon Rds nr Chardon -----	413532	811617	1270	50.0	1233	1232	R
GE-82	Unknown owner old church site at Ravenna and Clark Rd nr Chardon --	413735	811312	1130	72.9	1064	1062	U
GE-83	15768 Jug St nr Tavern Rd nr Burton -----	412627	810754	1220	70.0	1191	1188	H
GE-84	Union 76 Oil Service Station at Russell Center -----	412745	812024	1095	111.0	1037	1037	C
GE-85	Punderson Lake State Golf Course nr Newbury -----	412716	811254	1200	76.0	1150	1150	R
GE-85s	Spring on swimming beach at Punderson Lake nr Newbury -----	412720	811235	1145	(5)	----	1145	U
GE-86	Rev Williams 1150 Mayfield Rd nr Fowlers Mill -----	413144	811427	1272	150.0	(?)	(?)	H
GE-87	Russell Elem School at Russell -----	412752	812028	1075	100.0	(?)	(?)	P
GE-88	Becvar Wildlife Preserve 0.4 mi E of Countyline Rd N of Dines Rd nr GE-26 -----	412845	812231	1010	81.0	962	962	N
GE-89	Newbury RV Center at Yates Corners (Sperry and Kinsman Rds) -----	412749	811715	1270	135.0	----	1188	C
GE-91	Lawsons Store at Newbury Center -----	412748	811439	1250	(5)	1210	1210	C
GE-92	Punderson Lake State Park picnic area S of beach -----	412713	811232	1170	72.0	1135	1135	R
GE-93	17295 Old State Rd nr Parkman -----	412354	810104	1080	(5)	1042	1042	H
GE-94	Kardum Construction new brown house at end of S Wyck Dr nr S Russell -----	412547	812115	1110	65.0	1098	1098	H

- 1 Altitude in feet below National Geodetic Vertical Datum of 1929 (formerly mean sea level).
- 2 Reported depth.
- 3 Well was being drilled at time of measurement.
- 4 Nearby wells pumping.
- 5 Depth not measured because of obstructions, too deep, or pump operating.
- 6 Different well.
- 7 Water quality only.

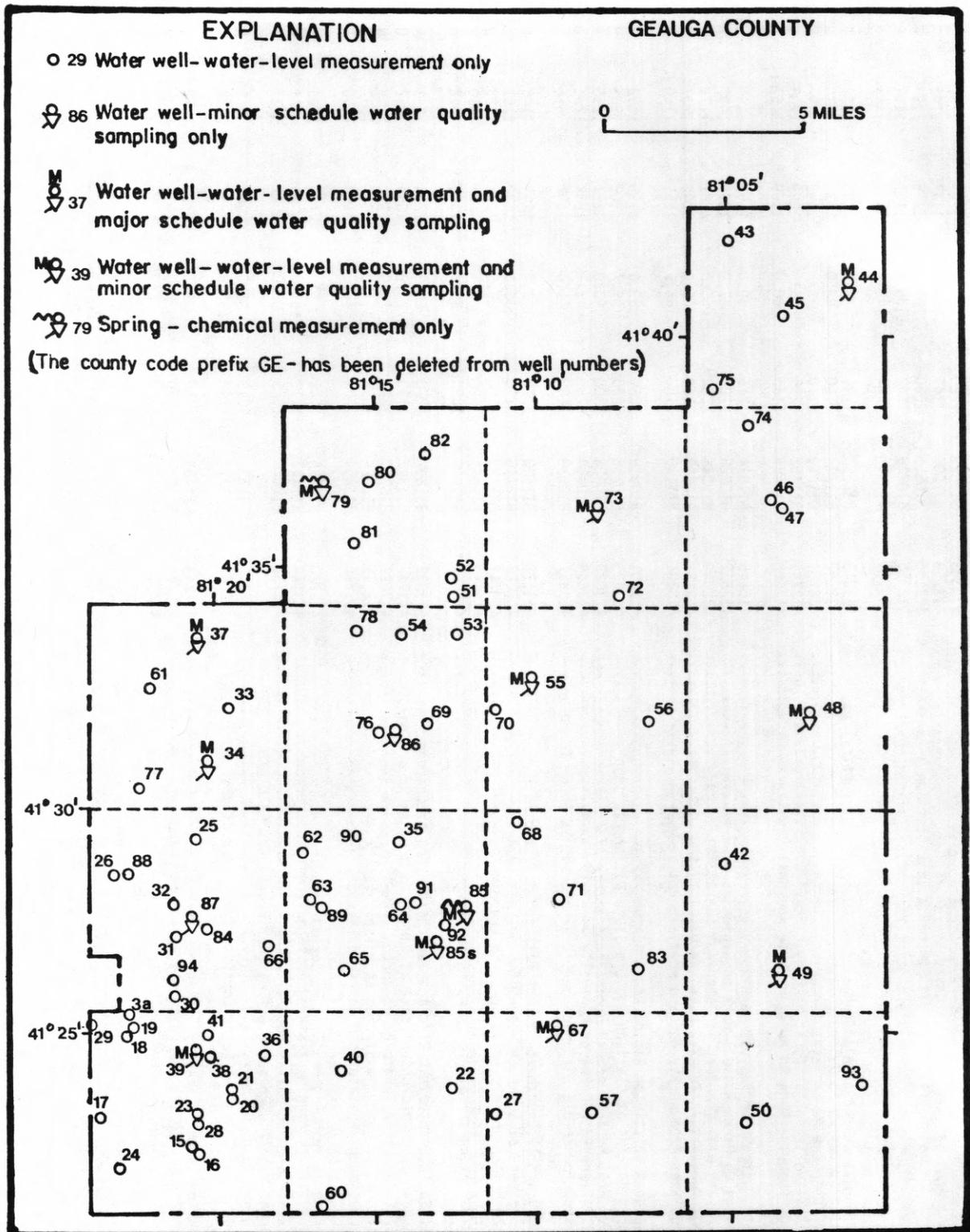


Figure 3.--Well site location map.

Based on the hydrograph of well GE-3a in the Chagrin Falls municipal well field, Kaser (1961) stated that high ground-water levels usually occurred in April through June and low water levels in September through November. Water-level measurements were made during a seasonally high period, June 14, 1978, and a seasonally low period October 23, 1978. A potentiometric surface map was prepared, based on measurements made on June 14, 1978, during the period of high water levels (fig. 4). Seasonal water-level changes are characterized by the construction of the potentiometric-surface-difference map (fig. 5).

#### Water Sample Collection and Analysis

Adverse effects to ground-water quality may result from stresses on the aquifer system. Therefore, chemical-quality characteristics of the ground water are tabulated to document conditions with respect to the present state of development and to allow their use for comparison with data from future water-quality samplings.

Water samples were collected from 14 wells and springs in Geauga County between May and October 1978. Alkalinity, pH, specific conductance, and temperature were field determined. All other chemical constituents in table 2 were determined in the U.S. Geological Survey Central Laboratory in Atlanta, Georgia. All samples were pumped from wells except those taken from springs and flowing wells. A pumped sample is more indicative of the quality of water in an aquifer than water that has been standing in a casing or pressure tank (Brown and others, 1970, and Rainwater and Thatcher, 1960).

#### RESULTS

Potentiometric surfaces generally follow the configuration of the bedrock surface in Geauga County. The potentiometric-surface maps show general directions of ground-water movement. The water moves from high to low altitudes at right angles to the contours. The higher potentiometric levels reflect topographic highs where erosional remnants of the Pottsville Formation overlie the Cuyahoga Formation. The potentiometric-surface highs in this case, also are areas of ground-water recharge. Low potentiometric surfaces, resulting from lower topographic elevations, such as in valleys, indicate areas of ground-water discharge.

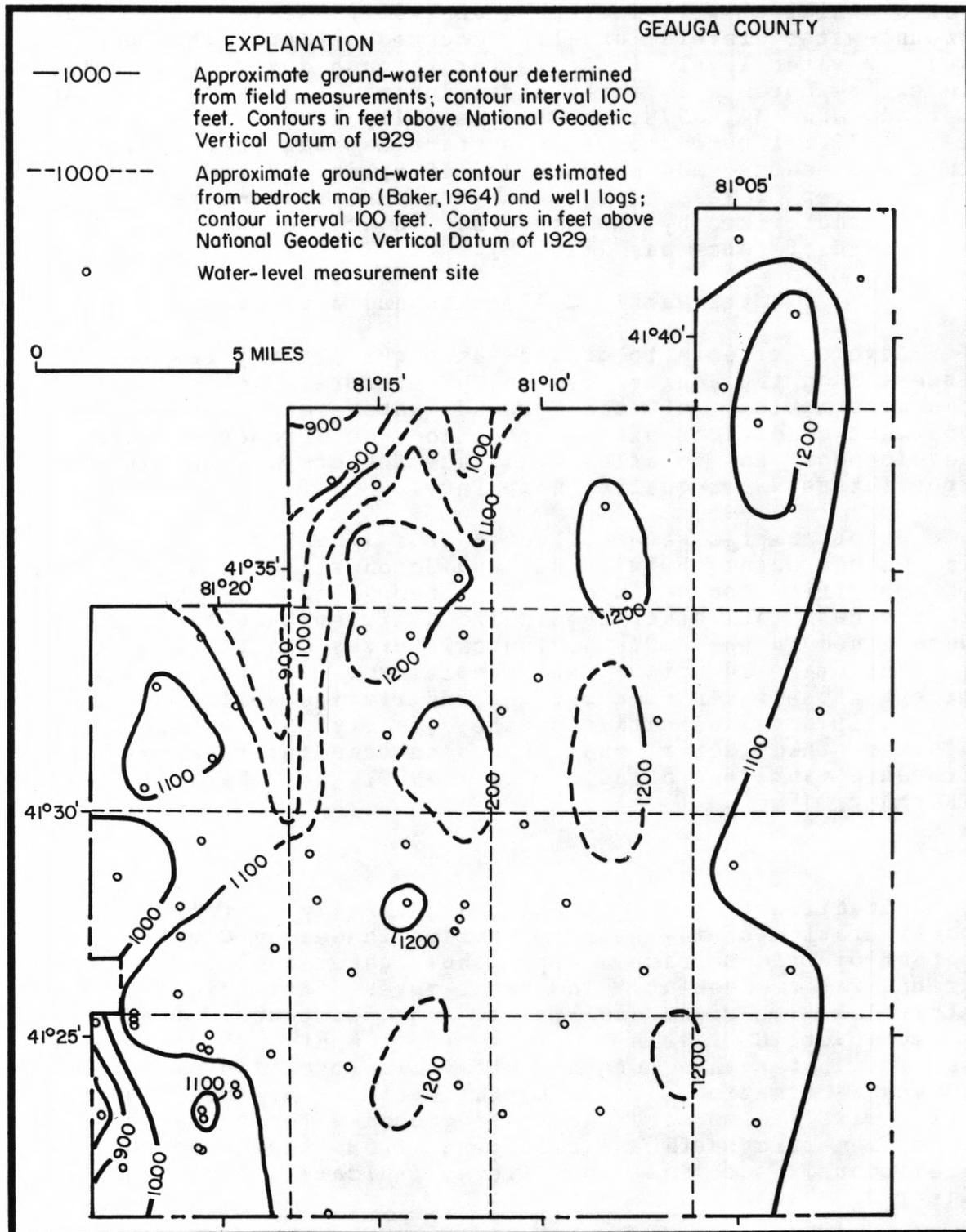


Figure 4.--Potentiometric surface map of Geauga County for June 14, 1978.

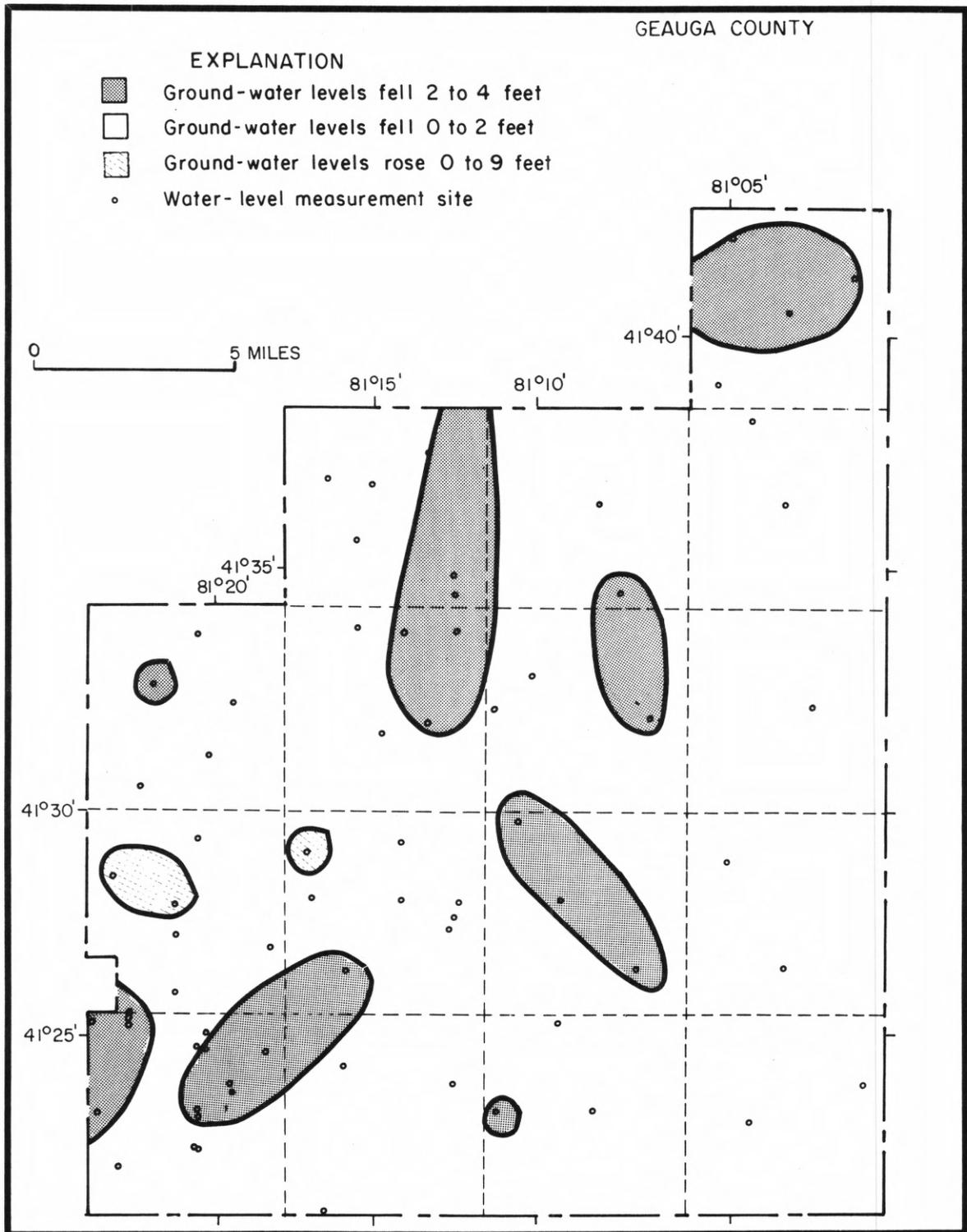


Figure 5.--Ground-water level differences from measurements made on June 14 and October 23, 1978.

No discernible effects from residential development are evident in the regional potentiometric map.

The ground-water quality analyses (table 2) show that none of the constituents determined exceeded the U.S. Public Health Service Drinking Water Standard for 1962, except for iron and manganese concentrations in water samples from some wells. High iron concentrations in samples from five wells and high manganese concentrations in samples from six wells could indicate high levels of these constituents in the aquifer. Deteriorating well casings or iron bacteria could also contribute to the high concentrations of iron.

The majority of analyses indicate that the ground water is a calcium magnesium bicarbonate type. Four analyses indicated a sodium potassium bicarbonate water which suggest localized differences in aquifer properties.

Higher nitrate (concentration) in water from well GE-39 (table 2) could indicate contamination by organic waste such as animal or industrial waste.

The presence of barium and strontium in well GE-37 samples (table 2) could indicate local mixing with brines from deeper aquifers.

Table 2.--Chemical analysis of ground water from Geauga County, Ohio.

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Owner and location	Date of sample	Alkalinity (mg/L as CaCO <sub>3</sub> )	Bicarbonate (mg/L as HCO <sub>3</sub> )	Calcium dissolved (mg/L as Ca)	Carbon, organic dissolved (mg/L as C)	Carbon, organic suspended total (mg/L as C)	Carbon dioxide dissolved (mg/L as CO <sub>2</sub> )	Carbonate (mg/L as CO <sub>3</sub> )	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Hardness, noncarbonate (mg/L CaCO <sub>3</sub> )	Hardness (mg/L as CaCO <sub>3</sub> )	Hydrogen sulfide total (mg/L as H <sub>2</sub> S)	Iron, dissolved (µg/L as Fe)	Iron, suspended recoverable (µg/L as Fe)
Ohio EPA Water Quality Standards, 1978 -----									250	1.2				300	
Water Quality Criteria 1972 <sup>1</sup> -----		> 20							250	1.8 <sup>2</sup>				300	
GE-34 Opalaka Dr SSD Opalaka Dr at Chesterland -----	10-04-78	174	212	58	3.6	0.1	43	0	17	0.1	33	210	0.0	--	--
GE-37 W Reserve Mem Gardens Chillicothe Rd nr Chesterland -----	5-16-78	377	460	80	4.8	.3	23	0	3.7	.3	0	350	.0	140	160
GE-39 Citizens Fed Savings at Washington and Chillicothe Rds --	5-17-78	167	203	75	3.4	.3	41	0	59	.1	95	260	.0	50	--
GE-44 J. Bennig at Thompson and Sidley Rds -----	5-17-78	172	190	1.2	2.9	1.9	.7	10	28	.9	0	5	.7	160	--
GE-48 Huntsburg Park on Mayfield Rd E of Huntsburg -----	10-04-78	266	324	44	3.3	.3	16	0	2.9	.3	0	200	.0	1600	5700
GE-49 Louis Kocsis on Madison Rd nr Middlefield -----	5-16-78	211	257	68	4.0	.2	65	0	1.1	.1	54	260	.2	3800	--
GE-55 Lake Aquilla Ohio Parks nr Chardon -----	10-03-78	268	311	1.0	1.9	.1	2.1	8	49	.7	0	5	.0	90	80
GE-67 Geauga Co Parks Russell Park on Rapids Rd -----	10-03-78	221	269	19	1.0	.2	6.8	0	10	.8	0	69	.0	190	1800
GE-73 ODOT Rest Area at Hamden -----	10-03-78	259	316	80	.8	.3	80	0	2.8	.2	56	320	.0	240	860
GE-79S Spring on Wisner Rd nr Kirtland -----	10-03-78	249	304	90	1.7	.3	31	0	6.7	1.3	78	330	.0	10	10
GE-85 Punderson Lake State Golf Course nr Newburg -----	10-02-78	241	294	70	1.7	.3	47	0	3.0	.1	41	280	.3	3200	38000
GE-85S Spring on swimming beach at Punderson Lake nr Newburg ---	10-03-78	215	262	69	2.3	.2	21	0	.9	.1	36	250	.0	680	0
GE-86 Rev Williams 1150 Mayfield Rd nr Fowlers Mill -----	10-05-78	209	255	45	.2	.3	16	0	4.4	.2	0	160	.0	1100	200
GE-87 Russell Elem School at Russell -----	10-05-78	230	280	33	.9	.1	7.1	0	91	.3	0	130	.0	250	110

<sup>1</sup> Also Quality Criteria for Water 1976.

<sup>2</sup> Dependent on annual average of the maximum daily air temperature.

Table 2.--Chemical analysis of ground water from Geauga County, Ohio.--Continued

Owner and location	Date of sample	Iron, total recoverable (µg/L as Fe)	Magnesium, dissolved (mg/L as Mg)	Manganese, total recoverable (µg/L as Mn)	Nitrogen, ammonia dissolved (mg/L as NH <sub>4</sub> )	Nitrogen, organic dissolved (mg/L as N)	Nitrogen, ammonia + organic dissolved (mg/L as N)	Nitrogen, ammonia dissolved (mg/L as N)	Nitrogen, NO <sub>2</sub> +NO <sub>3</sub> dissolved (mg/L as N)	pH (units)	Phosphorus, dissolved (mg/L as P)	Potassium, dissolved (mg/L as K)	Solids, sum of constituents, dissolved (mg/L)	Sodium adsorption ratio
Ohio EPA Water Quality Standards, 1978 -----				50					10				750	
Water Quality Criteria 1972 <sup>1</sup> -----				50					10	5-9			500	
GE-34 Opalaka Dr SSD Opalaka Dr at Chesterland -----	10-04-78	210	15	570	0.06	0.05	0.10	0.05	0.00	6.9	0.00	0.9	240	0.2
GE-37 W Reserve Mem Gardens Chillicothe Rd nr Chesterland -----	5-16-78	300	37	80	.55	.07	.50	.43	.01	7.5	.03	2.7	419	.5
GE-39 Citizens Fed Savings at Washington and Chillicothe Rds ---	5-17-78	100	18	10	.01	.27	.28	.01	2.4	6.9	.01	2.7	352	.5
GE-44 J. Bennis at Thompson and Sidley Rds* -----	5-17-78	420	.4	10	.43	.32	.65	.33	.01	8.7	.03	1.1	255	20
GE-48 Huntsburg Park on Mayfield Rd E of Huntsburg -----	10-04-78	7300	22	100	.32	.07	.32	.25	.00	7.5	.03	2.7	281	.9
GE-49 Louis Kocsis on Madison Rd nr Middlefield -----	5-16-78	4900	23	410	.09	.11	.18	.07	.02	6.8	.00	1.7	338	.2
GE-55 Lake Aquilla Ohio Parks nr Chardon -----	10-03-78	170	.5	10	.50	.07	.46	.39	.00	8.4	.06	1.3	366	29
GE-67 Geauga Co Parks Russell Park on Rapids Rd -----	10-03-78	2000	5.3	30	.43	.09	.42	.33	.00	7.8	.02	2.5	281	3.9
GE-73 ODOT Rest Area at Hamden -----	10-03-78	1100	28	10	.03	.00	.02	.02	.13	6.8	.00	1.7	359	.1
GE-79S Spring on Wisner Rd nr Kirtland -----	10-03-78	20	25	10	.05	.01	.05	.04	.14	7.2	.01	1.5	389	.2
GE-85 Punderson Lake State Golf Course nr Newburg -----	10-02-78	41000	26	140	.13	.56	.66	.10	.36	7.0	.00	1.5	337	.1
GE-85S Spring on swimming beach at Punderson Lake nr Newburg ----	10-03-78	680	19	90	.13	.00	.01	.10	.00	7.3	.00	1.0	298	.2
GE-86 Rev Williams 1150 Mayfield Rd nr Fowlers Mill -----	10-05-78	1300	12	30	.23	.10	.28	.18	.00	7.4	.01	2.0	283	1.3
GE-87 Russell Elem School at Russell -----	10-05-78	360	11	40	.52	.00	.40	.40	.00	7.8	.01	2.9	407	4.2

<sup>1</sup> Also Quality Criteria for Water 1976.

Table 2.--Chemical analysis of ground water from Geauga County, Ohio.--Continued

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Owner and location	Date of sample	Silica, dissolved (mg/L as SiO <sub>2</sub> )	Sodium, dissolved (mg/L as Na)	Specific conductance (micromhos)	Sulfate dissolved (mg/L as SO <sub>4</sub> )	Temperature (°C)	Aluminum, dissolved (µg/L as Al)	Arsenic dissolved (µg/L as As)	Barium, dissolved (µg/L as Ba)	Cadmium dissolved (µg/L as Cd)	Copper, dissolved (µg/L as Cu)	Lead, dissolved (µg/L as Pb)	Mercury dissolved (µg/L as Hg)	Strontium, dissolved (µg/L as Sr)	Zinc, dissolved (µg/L as Zn)
Ohio EPA Water Quality Standards, 1978 -----				800-1200	250			50	1000	10	1000	50	2		5000
Water Quality Criteria 1972 <sup>1</sup> -----					250			50	1000	10	1000	50	2		5000
GE-34 Opalaka Dr SSD Opalaka Dr at Chesterland -----	10-04-78	12	5.1	410	27	11.0	--	--	--	--	--	--	--	--	--
GE-37 W. Reserve Mem Gardens Chillicothe Rd nr Chesterland ----	5-16-78	19	21	745	27	12.0	20	1	200	2	0	21	<.5	820	40
GE-39 Citizens Fed Savings at Washington and Chillicothe Rd ---	5-17-78	8.9	20	645	57	12.5	20	0	0	0	9	10	<.5	140	10
GE-44 J. Bennis at Thompson and Sidley Rds -----	5-17-78	7.8	100	435	11	11.0	40	0	0	0	0	1	<.5	50	0
GE-48 Huntsburg Park on Mayfield Rd E of Huntsburg -----	10-04-78	17	28	480	2.4	11.5	--	--	--	--	--	--	--	--	--
GE-49 Louis Kocsis on Madison Rd nr Middlefield -----	5-16-78	15	7.2	555	91	12.5	20	4	0	0	4	11	<.5	140	20
GE-55 Lake Aquilla Ohio Parks nr Chardon -----	10-03-78	7.7	140	630	3.9	13.0	--	--	--	--	--	--	--	--	--
GE-67 Geauga Co Parks Russell Park on Rapids Rd -----	10-03-78	8.8	75	400	6.2	11.0	--	--	--	--	--	--	--	--	--
GE-73 ODOT Rest Area at Hamden -----	10-03-78	9.6	5.1	600	75	11.5	--	--	--	--	--	--	--	--	--
GE-79S Spring on Wisner Rd nr Kirtland -----	10-03-78	9.2	6.3	630	98	10.5	--	--	--	--	--	--	--	--	--
GE-85 Punderson Lake State Golf Course nr Newburg -----	10-02-78	8.6	5.5	560	72	11.0	--	--	--	--	--	--	--	--	--
GE-85S Spring on swimming beach at Punderson Lake nr Newburg ---	10-03-78	14	7.2	500	57	11.5	--	--	--	--	--	--	--	--	--
GE-86 Rev Williams 1150 Mayfield Rd nr Fowlers Mill -----	10-05-78	15	38	470	39	11.4	--	--	--	--	--	--	--	--	--
GE-87 Russell Elem School at Russell -----	10-05-78	12	110	680	7.6	12.0	--	--	--	--	--	--	--	--	--

<sup>1</sup> Also Quality Criteria for Water 1976.

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