

**DATA ON WATER QUALITY, LAKE SEDIMENT,  
AND LAKE-LEVEL FLUCTUATION,  
ST. CROIX INDIAN RESERVATION, WISCONSIN,  
1981-87**

*By*

**David P. Krabbenhoft and James T. Krohelski**

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**U.S. GEOLOGICAL SURVEY**

**Open-File Report 92-26**

*Prepared in cooperation with the*  
**ST. CROIX INDIAN TRIBE OF WISCONSIN**



**Madison, Wisconsin  
1992**

**U.S. DEPARTMENT OF THE INTERIOR**

MANUEL LUJAN, JR., *Secretary*

**U.S. GEOLOGICAL SURVEY**

Dallas L. Peck, *Director*

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## CONVERSION FACTORS AND ABBREVIATIONS

<i>Multiply</i>	<i>By</i>	<i>To obtain</i>
inch (in.)	25.4	millimeter
foot (ft)	0.3048	meter
mile (mi)	1.609	kilometer
square mile (mi <sup>2</sup> )	2.590	square kilometer

Temperature in degrees Fahrenheit (°F) as follows:

$$^{\circ}\text{F} = 9/5(^{\circ}\text{C}) + 32$$

**Lake level:** In this report, “lake level” refers to the elevation of a lake surface as determined by readings on a graduated lake-stage gage installed in the lake. The elevation is relative to an arbitrary local datum at each lake site.

**Abbreviated water-quality units used in this report:** Chemical concentrations and water temperature are given in metric units. Chemical concentration is given in milligrams per liter (mg/L) or micrograms per liter (µg/L). Milligrams per liter is a unit expressing the concentration of chemical constituents in solution as weight (milligrams) of solute per unit volume (liter) of water. One thousand micrograms per liter is equivalent to one milligram per liter. For concentrations less than 7,000 mg/L, the numerical value is the same as for concentrations in parts per million.

## SYMBOLS AND ABBREVIATIONS USED IN TABLES

MG/L	milligrams per liter (mg/L)
UG/L	micrograms per liter ( $\mu\text{g/L}$ )
MG/KG	milligrams per kilograms (mg/kg)
US/CM	microsiemens per centimeter ( $\mu\text{s/cm}$ )
DEG C	degrees Celsius ( $^{\circ}\text{C}$ )
BOT.	bottom
MAT.	material
WATSTORE	U.S. Geological Survey's Water Data Storage and Retrieval System
PH	pH
CACO3	calcium carbonate ( $\text{CaCO}_3$ )
CA	calcium (Ca)
MG	magnesium (Mg)
NA	sodium (Na)
K	potassium (K)
CL	chloride (Cl)
SO4	sulfate ( $\text{SO}_4$ )
F	fluoride (F)
SIO2	silica ( $\text{SiO}_2$ )
N	nitrogen (N)
NO2	nitrite ( $\text{NO}_2$ )
NO3	nitrate ( $\text{NO}_3$ )
P	phosphorus (P)
AS	arsenic (As)
AL	aluminum (Al)
BA	barium (Ba)
BE	beryllium (Be)
CD	cadmium (Cd)
CR	chromium (Cr)
CO	cobalt (Co)
CU	copper (Cu)
FE	iron (Fe)
PB	lead (Pb)
MN	manganese (Mn)
HG	mercury (Hg)
MO	molybdenum (Mo)
NI	nickel (Ni)
SE	selenium (Se)
SR	strontium (Sr)
AG	silver (Ag)
ZN	zinc (Zn)

# DATA ON WATER QUALITY, LAKE SEDIMENT, AND LAKE-LEVEL FLUCTUATION, ST. CROIX INDIAN RESERVATION, WISCONSIN, 1981-87

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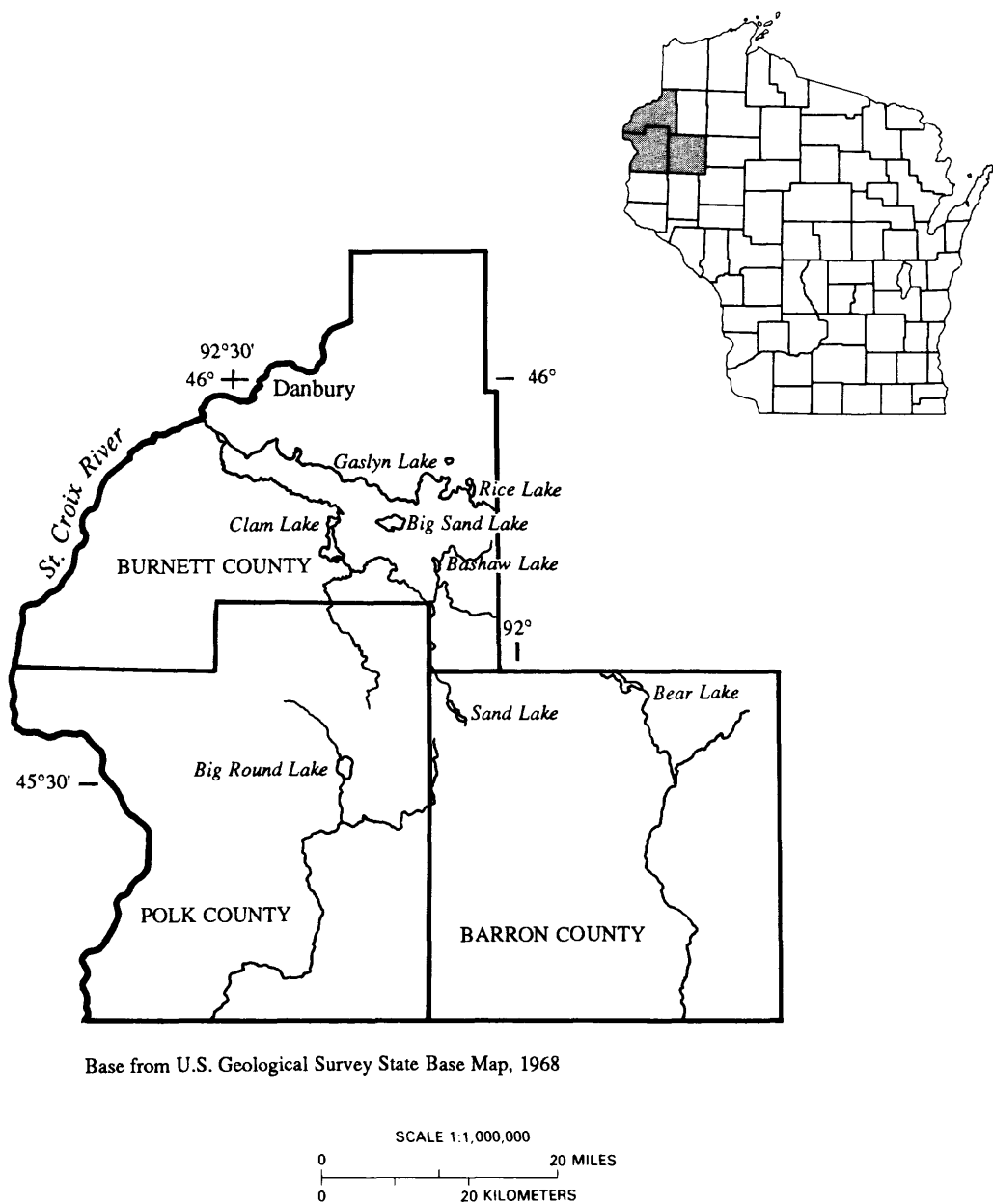
## ABSTRACT

This report is a compilation of data on surface- and ground-water quality, lake sediment, and lake-level fluctuation collected by the U.S. Geological Survey (USGS) during 1981-87 on or near the St. Croix Indian Reservation. The purpose of this report is to provide baseline data on selected aspects of the water resources of the St. Croix Indian Reservation as a reference by which future hydrologic changes can be discerned. The tribal lands are adjacent to Bashaw, Big Round, Big Sand, Clam, Gaslyn, Rice, and Sand Lakes and the Danbury Settlement along the St. Croix River. Water samples from each of these lakes and Bear Lake, which is not adjacent to tribal land, were analyzed for water-quality indicators. Lake-level fluctuations also were measured for each lake except Big Round Lake. Grain-size and chemical analyses were done on lake-sediment samples from Bashaw, Rice, Clam, Gaslyn, and Bear Lakes. Ground-water samples from wells on or near tribal land in Burnett County (27 wells) and Polk County (3 wells) were collected and analyzed for water quality.

## INTRODUCTION

This report is a compilation of data on surface- and ground-water quality, lake sediment, and lake-level fluctuation collected by the U.S. Geological Survey (USGS) during 1981-87 on or near the St. Croix Indian Reservation. The purpose of this report is to provide baseline data on selected aspects of the water resources of the St. Croix Indian Reservation as a reference by which future hydrologic changes can be discerned. Water-resources data were collected only on and near tribal lands established by the Indian Reorganization Act of 1934 (Lurie, 1987). Reservation tribal lands are located in Burnett, Polk, and Barron Counties in northwestern Wisconsin. The tribal lands are adjacent to Bashaw, Big Round, Big Sand, Clam, Gaslyn, Rice, and Sand Lakes and the Danbury Settlement along the St. Croix River (fig. 1). Water samples from each of these lakes and Bear Lake, which is not adjacent to tribal land, were analyzed for water-quality indicators. Lake-level fluctuations also were measured for each lake except Big Round Lake. Grain-size and chemical analyses were made of lake-sediment samples from Bashaw, Rice, Clam, Gaslyn, and Bear Lakes. Ground-water samples from wells on or near tribal land in Burnett County (27 wells) and Polk County (3 wells) were collected and analyzed for water quality.

The authors acknowledge the assistance of members of the St. Croix Indian Tribe who served as local observers and recorded lake-level data.



**Figure 1.** Location of the St. Croix Indian Reservation and lakes monitored.

## DATA COLLECTION AND ANALYSIS

Vertical-depth profiles of dissolved-oxygen concentration, water temperature, pH, and specific conductance, in addition to analyses of water-quality samples, were made for each of the eight lakes studied. Data for the depth profiles were collected from the middle of each lake by lowering sensors to the various depths from a stationary boat. The water-quality samples were analyzed by the USGS National Water Quality Laboratory for physical and chemical characteristics listed in the water-quality tables that follow. Water-quality data are stored in the USGS Water Data Storage and Retrieval System (WATSTORE).

Ground-water samples were collected from 30 wells, the locations of which are shown on the site maps for each of the study areas. The samples were analyzed in the field for temperature, pH, and specific conductance. Ground-water samples were also analyzed by the USGS National Water Quality Laboratory for the physical and chemical characteristics listed in the water-quality tables.

Lake-sediment samples were collected from the bottom material of Bashaw, Rice, Clam, Gaslyn, and Bear Lakes. Each sample was split; one part was sent to a sediment laboratory at the USGS office in Iowa City, Iowa, for grain-size analysis, and the other was sent to the USGS National Water Quality Laboratory for chemical analyses. These chemical analyses included determination of concentrations of total ammonia, total ammonia plus organic nitrogen, total nitrate plus nitrite, and total phosphorus.

Lake levels were monitored by members of the Tribe, who read lake-stage gages at each of the study lakes during ice-free periods. Gage-height elevations are relative to a local benchmark datum; therefore, the lake levels for the individual lakes should not be compared to one another.

## PRESENTATION OF DATA

Because each of the study areas is geographically separated, the data are grouped and presented separately by area rather than by type of data. Maps showing the tribal-land boundaries, study lake, location of wells sampled, location of lake-stage gage, and the location where the lake-sediment sample (if any) was collected are presented for each study area.

Water-quality tables presented for each study area consist of a lake-water-quality table (multiple samplings for some sites) and a ground-water-quality table (if any nearby wells were sampled). Results of the ground-water-quality analyses can be compared to table 1, in which Wisconsin drinking-water standards are listed (Wisconsin Department of Natural Resources, 1978).

For Bashaw, Rice, Clam, Gaslyn, and Bear Lakes, the results of chemical analyses on bottom sediment are presented in the lake-water-quality tables and are identified by "SEDIMENT" in the "medium" columns (to differentiate

them from water samples, which are identified as "WATER"). Grain-size-distribution graphs for the sediment samples also are included for each of these five lakes.

Graphs showing vertical-depth profiles of dissolved-oxygen concentration, water temperature, pH, and specific conductance are included for each lake. Two profile graphs are presented for Gaslyn Lake because measurements were made during consecutive years.

A hydrograph showing lake-level fluctuations over the period of record is presented for each lake except Big Round Lake, for which no such data were available.

Well sites are identified in the ground-water-quality tables by a unique 15-digit station number. The first six digits of the station number are latitude of the site (degrees, minutes, seconds), the next seven are longitude (degrees, minutes, seconds), and the last two are sequence numbers that identify individual wells at sites with multiple wells. Each well is also identified by a local identifier consisting of a two-letter county abbreviation; the township, range, and section; and a four-digit number assigned to each well. Only the two-letter county-code abbreviation and the last four-digit number in the local identifier are used to show wells on the site map for each study area.

## REFERENCES CITED

- Lurie, N.O., 1987, *Wisconsin Indians*: Madison, Wis., State Historical Society of Wisconsin, 66 p.
- Wisconsin Department of Natural Resources, 1978, Wisconsin administrative code, Chapter NR 109, Safe drinking water: Register, February 1978, no. 266, Environmental Protection.

**Table 1.** Summary of Wisconsin's drinking-water standards

[From Wisconsin Department of Natural Resources, 1978. --, standard not applicable]

Constituent	Maximum recommended concentration (all concentrations in milligrams per liter (micrograms per liter in parentheses) unless otherwise indicated)			
	Primary (health) standard		Secondary (aesthetic) standard	
Arsenic	.05	(50)	--	--
Barium	1	(1,000)	--	--
Cadmium	.01	(10)	--	--
Chromium	.05	(50)	--	--
Fluoride	2.2	--	--	--
Lead	.05	(50)	--	--
Mercury	.002	(2)	--	--
Nitrate (as N)	10	--	--	--
Selenium	.01	(10)	--	--
Silver	.05	(50)	--	--
Chloride	--	--	250	--
Color	--	--	15 units	--
Foaming Agents (MBAS)	--	--	.5	--
Hydrogen Sulfide	--	--	not detectable	--
Iron	--	--	.3	(300)
Manganese	--	--	.05	(50)
Odor	--	--	3 threshold number	--
Sulfate	--	--	250	--
Total Residue	--	--	500	--
Zinc	--	--	5	(5,000)

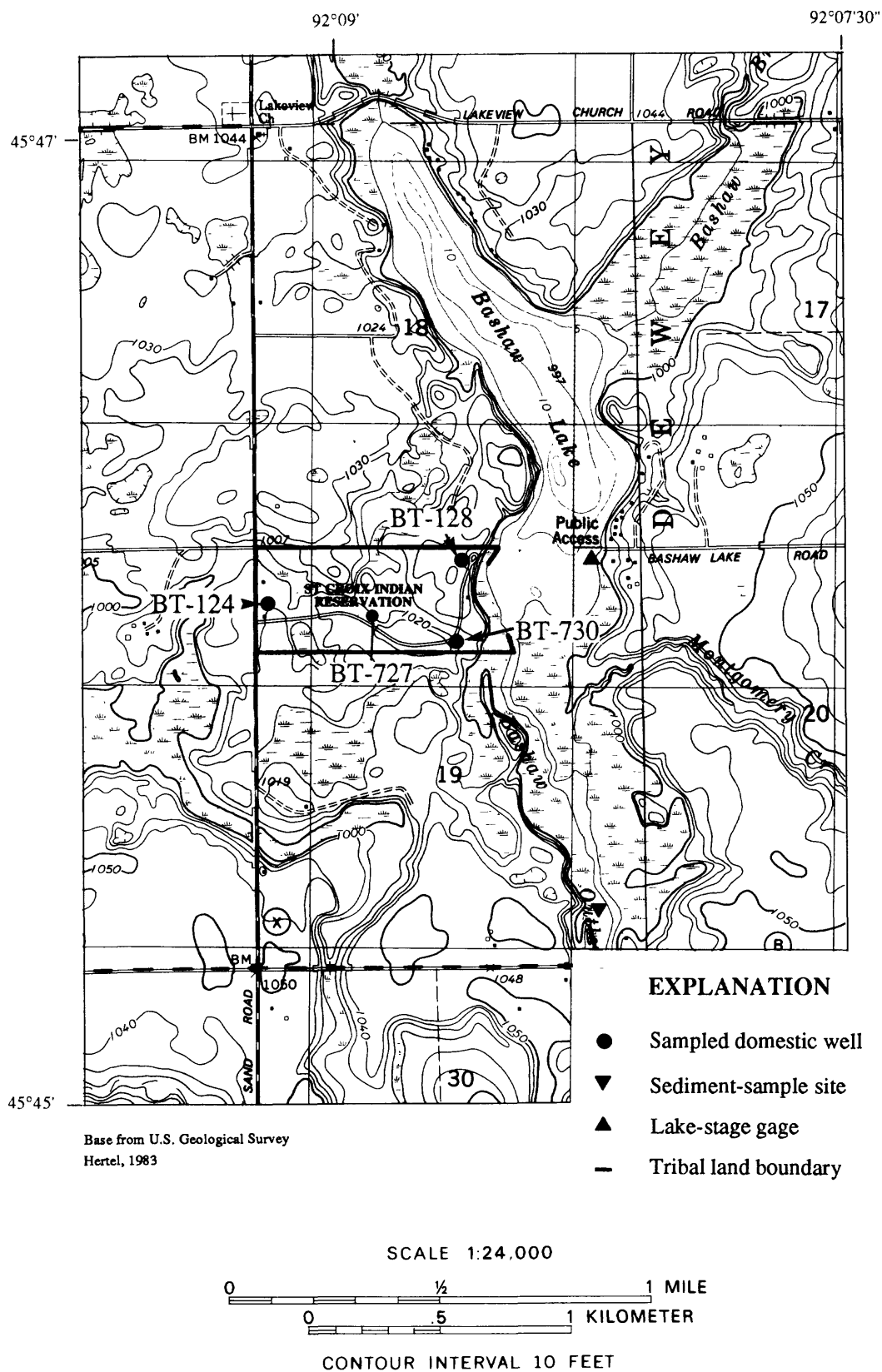
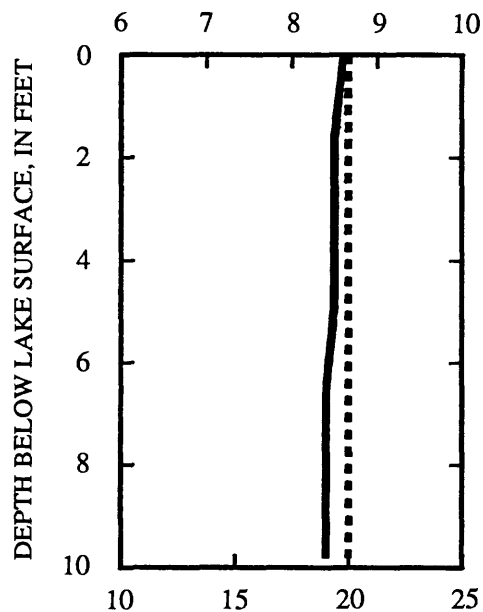
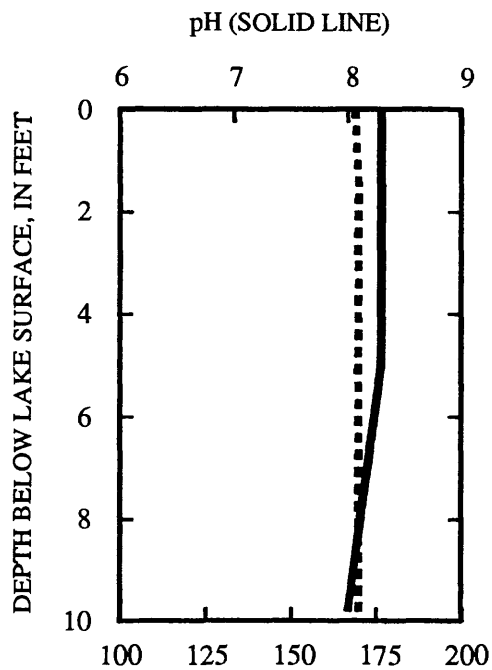


Figure 2. Location of Bashaw Lake and data-collection sites.

DISSOLVED-OXYGEN CONCENTRATION  
(SOLID LINE), IN MILLIGRAMS PER LITER



WATER TEMPERATURE (DASHED LINE),  
IN DEGREES CELSIUS



Specific Conductance (Dashed Line),  
IN MICROSIEMENS PER CENTIMETER AT  
25 DEGREES CELSIUS

**Figure 3.** Depth profiles of dissolved-oxygen concentration, temperature, pH, and specific conductance for Bashaw Lake, August 26, 1986.

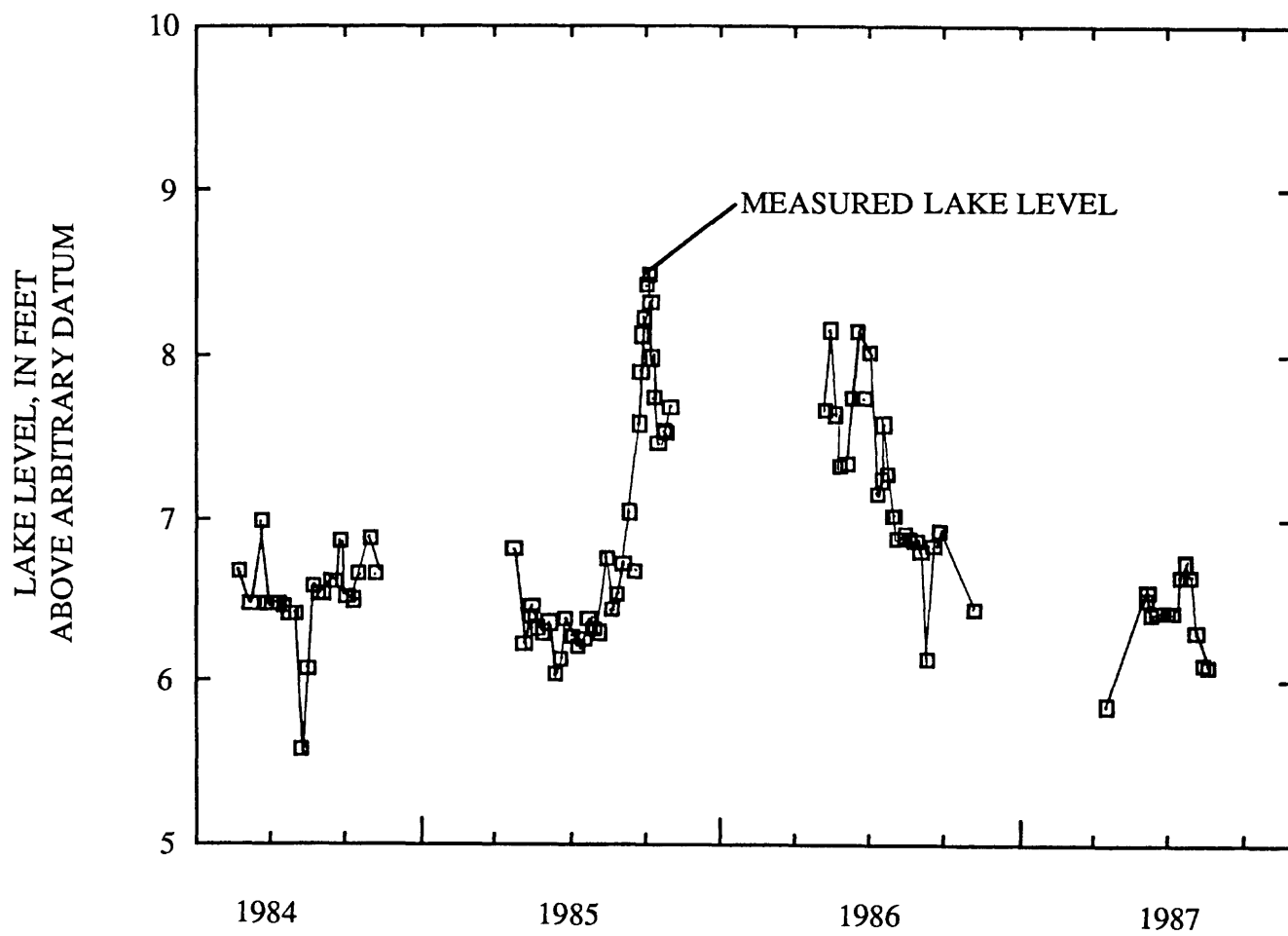
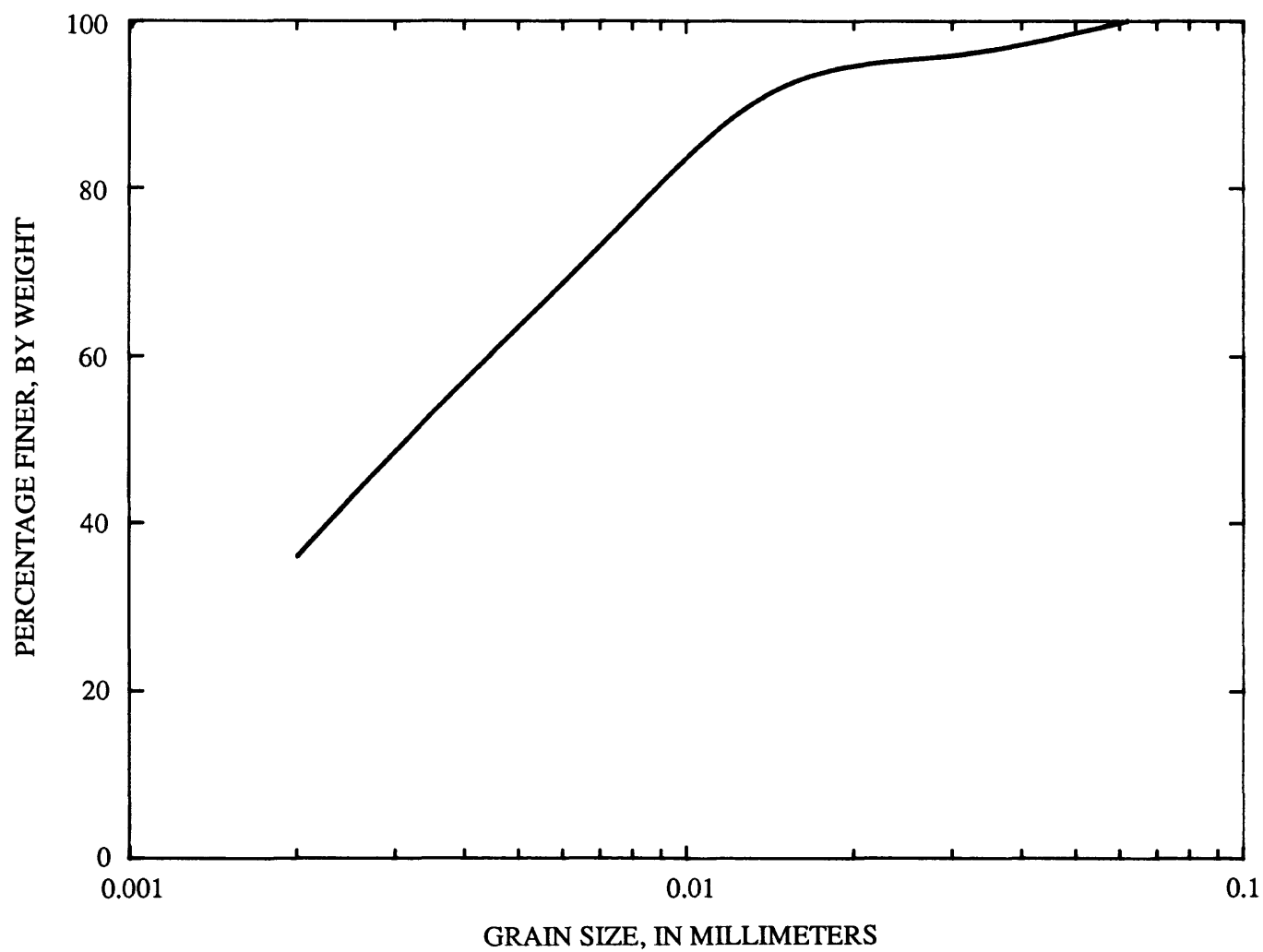


Figure 4. Lake-level fluctuations of Bashaw Lake, 1984-87.



**Figure 5.** Grain-size distribution of bottom sediment sampled from Bashaw Lake.

**Table 2.** Physical and chemical characteristics of water and sediment for Bashaw Lake

[DEG C, degrees Celsius; US/CM, microsiemens per centimeter at 25 degrees Celsius; MG/L, milligrams per liter; MG/KG, milligrams per kilogram; UG/L, micrograms per liter; BOT. MAT., bottom material; <, less than; --, no data available; five-digit number in column headings is the WATSTORE code for the parameter]

DATE	TIME	MEDIUM	TEMPER- ATURE, WATER (DEG C) (00010)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	OXYGEN, DIS- SOLVED (MG/L) (00300)	PH (STAND- ARD UNITS) (00400)	HARD- NESS, TOTAL (MG/L AS CACO3) (00900)	CALCIUM, DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)
08-22-84	1430	WATER	22.0	195	6.3	8.2	94	24	8.3
08-22-84	1430	SEDIMENT	--	--	--	--	--	--	--
09-05-85	0900	SEDIMENT	--	--	--	--	--	--	--
09-05-85	0900	WATER	19.0	249	5.8	7.3	100	27	8.9
08-26-86	1430	WATER	20.0	170	8.5	8.3	86	22	7.5
08-26-86	1430	SEDIMENT	--	--	--	--	--	--	--

DATE	SODIUM, DIS- SOLVED (MG/L AS NA) (00930)	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)	SULFATE, DIS- SOLVED (MG/L AS SO4) (00945)	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	ALKA- LINITY, LAB (MG/L AS CACO3) (90410)	SILICA, DIS- SOLVED (MG/L AS SIO2) (00955)	NITRO- GEN, ORGANIC, TOTAL (MG/L AS N) (00605)	NITRO- GEN, AMMONIA, DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN, AMMONIA, TOTAL (MG/L AS N) (00610)	NITRO- GEN, NITRITE, TOTAL (MG/L AS N) (00615)
08-22-84	2.8	0.70	2.3	6.0	0.10	96	13	0.97	0.110	0.130	<0.010
08-22-84	--	--	--	--	--	--	--	--	--	--	--
09-05-85	--	--	--	--	--	--	--	--	--	--	--
09-05-85	2.9	1.0	3.0	3.0	<.10	104	11	--	.020	--	--
08-26-86	2.7	1.1	3.1	8.4	<.10	87	18	1.4	.020	.020	<.010
08-26-86	--	--	--	--	--	--	--	--	--	--	--

DATE	NITRO- GEN, AM- MONIA + ORGANIC, TOTAL (MG/L AS N) (00625)	NITROGEN, NO2 + NO3, TOTAL (MG/L AS N) (00630)	NITROGEN, NO2 + NO3 DISSOLVED (MG/L AS N) (00631)	PHOS- PHORUS, TOTAL (MG/L AS P) (00665)	PHOS- PHORUS, DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS, ORTHO, DIS- SOLVED (MG/L AS P) (00671)	NITRO- GEN, NH4, TOTAL IN BOT. MAT. (MG/KG AS N) (00611)	NITROGEN, NH4 + ORG., TOTAL IN BOT. MAT. (MG/KG AS N) (00626)	NITROGEN, NO2 + NO3, TOTAL IN BOT. MAT. (MG/KG AS N) (00633)	PHOS- PHORUS, TOTAL IN BOT. MAT. (MG/KG AS P) (00668)	ARSENIC, TOTAL (UG/L AS AS) (01002)
08-22-84	1.1	<.100	<.100	.070	<.010	<.010	--	--	--	--	1
08-22-84	--	--	--	--	--	--	180	<20	<2.0	830	--
09-05-85	--	--	--	--	--	--	180	86,000	240	380	--
09-05-85	--	--	.130	--	.040	<.010	--	--	--	--	--
08-26-86	1.4	<.100	<.100	.100	.020	<.010	--	--	--	--	<1
08-26-86	--	--	--	--	--	--	250	21,000	6.0	770	--



**Table 3.** Physical and chemical characteristics of ground water from wells near Bashaw Lake

[DEG C, degrees Celsius; US/CM, microsiemens per centimeter at 25 degrees Celsius; MG/L, milligrams per liter; UG/L, micrograms per liter; <, less than; five-digit number in column headings is the WATSTORE code for the parameter]

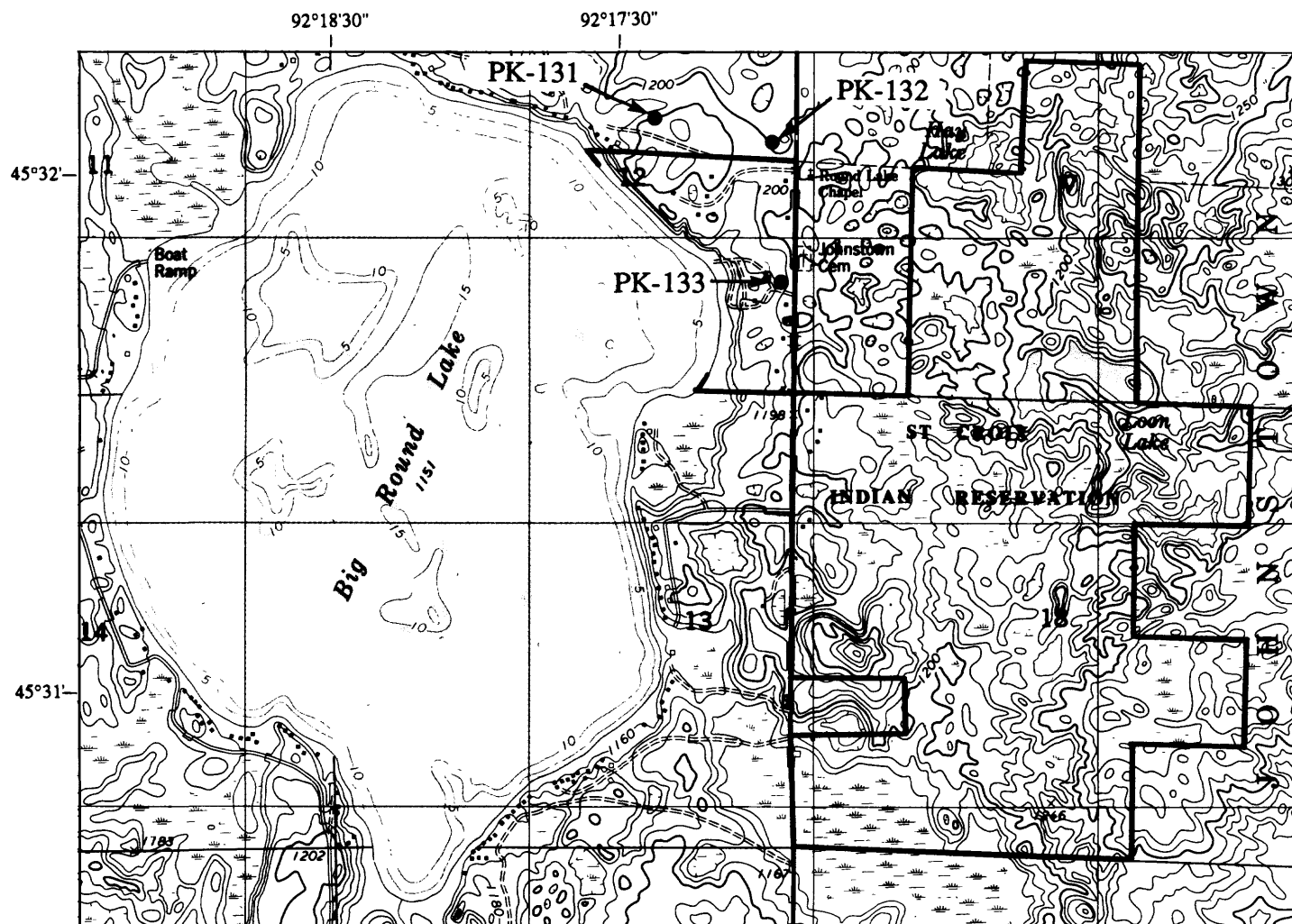
STATION NUMBER	DATE	LOCAL IDENTIFIER	TEMPER- ATURE, WATER (DEG C) (00010)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	HARD- NESS, TOTAL (MG/L AS CACO3) (00900)
454605092091301	08-06-85	BT-38/14W/19-0124	10.0	310	7.6	140
454605092083901	08-07-85	BT-38/14W/19-0128	10.5	255	8.2	120
454600092091301	08-06-86	BT-38/14W/19-0727	9.0	260	7.5	150
454603092083601	08-07-86	BT-38/14W/19-0730	9.5	225	7.6	120

DATE	CALCIUM, DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)	SULFATE, DIS- SOLVED (MG/L AS SO4) (00945)	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	NITROGEN, NO2 + NO3, DIS- SOLVED (MG/L AS N) (00631)	ARSENIC, TOTAL (UG/L AS AS) (01002)	BARIUM, TOTAL RECOV- ERABLE (UG/L AS BA) (01007)	CADMIUM, TOTAL RECOV- ERABLE (UG/L AS CD) (01027)
08-06-85	41	9.2	1.0	1.3	0.10	<0.100	3	100	1
08-07-85	34	9.5	.90	1.7	<.10	<.100	4	<100	1
08-06-86	42	10	.60	3.3	<.10	<.100	3	<100	<1
08-07-86	32	9.0	.50	2.7	.10	<.100	2	100	<1

DATE	CHRO- MIUM, TOTAL RECOV- ERABLE (UG/L AS CR) (01034)	COPPER, TOTAL RECOV- ERABLE (UG/L AS CU) (01042)	IRON, TOTAL RECOV- ERABLE (UG/L AS FE) (01045)	LEAD, TOTAL RECOV- ERABLE (UG/L AS PB) (01051)	MANGA- NESE, TOTAL RECOV- ERABLE (UG/L AS MN) (01055)	MERCURY, TOTAL RECOV- ERABLE (UG/L AS HG) (71900)	SELE- NIUM, TOTAL (UG/L AS SE) (01147)	ZINC, TOTAL RECOV- ERABLE (UG/L AS ZN) (01092)	SOLIDS, RESIDUE 180 DEG C DIS- SOLVED (MG/L) (70300)
08-06-85	<10	9	2,600	6	600	<.10	<1	10	171
08-07-85	<10	10	150	<1	110	<.10	<1	30	150
08-06-86	<10	5	130	<5	90	.10	<1	20	172
08-07-86	<10	5	30	<5	40	.20	<1	20	129

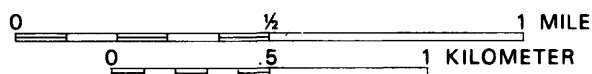


Base from U.S. Geological Survey  
Big Round Lake, 1983

#### EXPLANATION

- Sampled domestic well
- Tribal land boundary

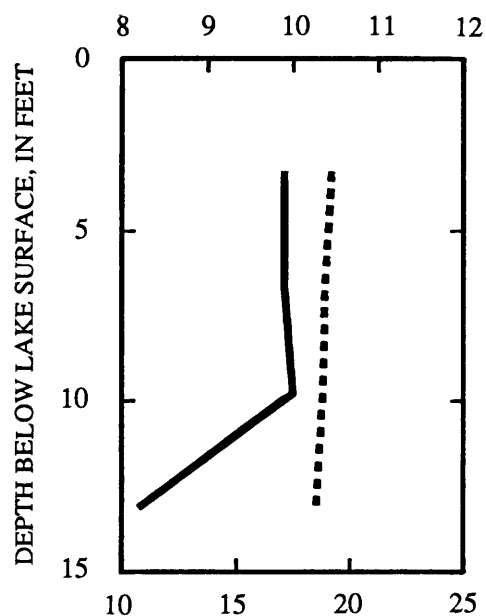
SCALE 1:24,000



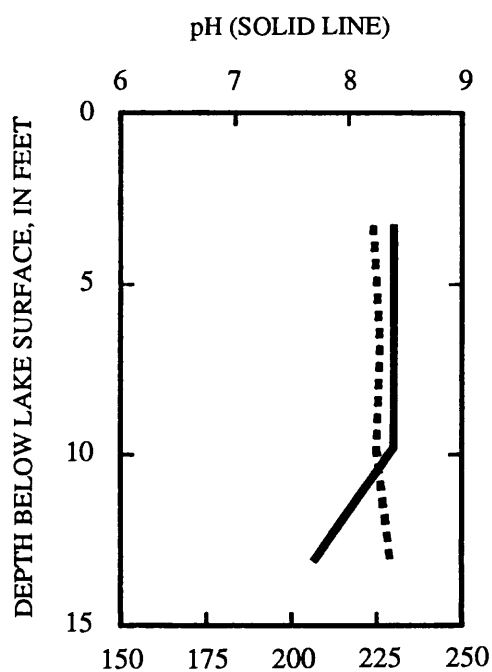
CONTOUR INTERVAL 10 FEET

**Figure 6.** Location of Big Round Lake and data-collection sites.

DISSOLVED-OXYGEN CONCENTRATION  
(SOLID LINE), IN MILLIGRAMS PER LITER



WATER TEMPERATURE (DASHED LINE),  
IN DEGREES CELSIUS



SPECIFIC CONDUCTANCE (DASHED LINE),  
IN MICROSIEMENS PER CENTIMETER AT  
25 DEGREES CELSIUS

**Figure 7.** Depth profiles of dissolved-oxygen concentration, temperature, pH, and specific conductance for Big Round Lake, September 4, 1986.

**Table 4.** Physical and chemical characteristics of water from Big Round Lake

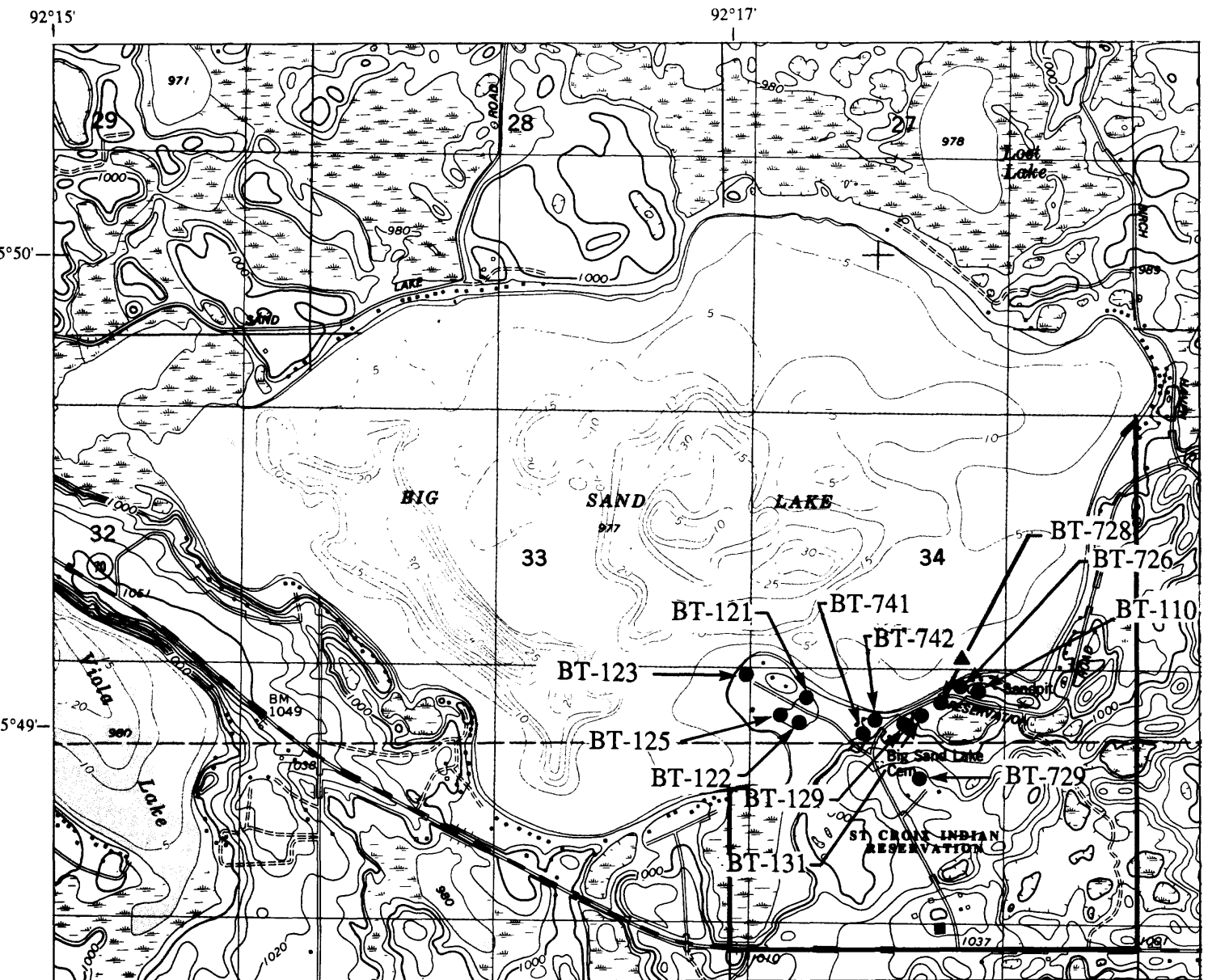
[DEG C, degrees Celsius; US/CM, microsiemens per centimeter at 25 degrees Celsius; MG/L, milligrams per liter; UG/L, micrograms per liter; <, less than; - -, no data available; five-digit number in column headings is the WATSTORE code for the parameter]

DATE	TIME	TEMPER- ATURE, WATER (DEG C) (00010)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	OXYGEN, DIS- SOLVED (MG/L) (00300)	PH (STAND- ARD UNITS) (00400)	HARD- NESS, TOTAL (MG/L AS CACO3) (00900)	CALCIUM, DIS- SOLVED (MG/L AS CA) (00915)			
08-21-84	1630	23.5	240	6.9	9.4	83	20			
09-04-85	1145	20.0	224	9.6	8.5	90	22			
DATE	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)	SODIUM, DIS- SOLVED (MG/L AS NA) (00930)	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)	SULFATE, DIS- SOLVED (MG/L AS SO4) (00945)	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	ALKA- LINITY, LAB (MG/L AS CACO3) (90410)	SILICA, DIS- SOLVED (MG/L AS SIO2) (00955)	NITRO- GEN, ORGANIC, TOTAL (MG/L AS N) (00605)	NITRO- GEN, AMMONIA, DIS- SOLVED (MG/L AS N) (00608)
08-21-84	8.0	2.5	0.90	3.0	4.8	0.10	86	17	2.5	.140
09-04-85	8.6	2.8	.80	2.9	2.8	<.10	95	26	--	.030
DATE	NITRO- GEN, AMMONIA, TOTAL (MG/L AS N) (00610)	NITRO- GEN, NITRITE, TOTAL (MG/L AS N) (00615)	NITRO- GEN, AM- MONIA + ORGANIC, TOTAL (MG/L AS N) (00625)	NITROGEN, NO2 + NO3, TOTAL (MG/L AS N) (00630)	NITROGEN, NO2 + NO3, DISSOLVED (MG/L AS N) (00631)	PHOS- PHORUS, TOTAL (MG/L AS P) (00665)	PHOS- PHORUS, DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS, ORTHO, DIS- SOLVED (MG/L AS P) (00671)	ARSENIC, TOTAL (UG/L AS AS) (01002)	ALUM- INUM, TOTAL RECOV- ERABLE (UG/L AS AL) (01105)
08-21-84	.250	<.010	2.7	<.100	<.100	.150	<.010	<.010	2	40
09-04-85	--	--	.80	--	<.100	.100	.050	<.010	--	--
DATE	BARIUM, TOTAL RECOV- ERABLE (UG/L AS BA) (01007)	BERYL- LIUM, TOTAL RECOV- ERABLE (UG/L AS BE) (01012)	CADMIUM, TOTAL RECOV- ERABLE (UG/L AS CD) (01027)	CHRO- MIUM, TOTAL RECOV- ERABLE (UG/L AS CR) (01034)	COBALT, TOTAL RECOV- ERABLE (UG/L AS CO) (01037)	COPPER, TOTAL RECOV- ERABLE (UG/L AS CU) (01042)	IRON, SUS- PENDE RECOV- ERABLE (UG/L AS FE) (01044)	IRON, TOTAL RECOV- ERABLE (UG/L AS FE) (01045)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, TOTAL RECOV- ERABLE (UG/L AS PB) (01051)
08-21-84	<100	<10	1	2	<1	5	--	490	22	2
09-04-85	--	--	--	--	--	--	100	110	11	--
DATE	MANGA- NESE, TOTAL RECOV- ERABLE (UG/L AS MN) (01055)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MERCURY, TOTAL RECOV- ERABLE (UG/L AS HG) (71900)	MOLYB- DENUM, TOTAL RECOV- ERABLE (UG/L AS MO) (01062)	NICKEL, TOTAL RECOV- ERABLE (UG/L AS NI) (01067)	SELE- NIUM, TOTAL (UG/L AS SE) (01147)	SILVER, TOTAL RECOV- ERABLE (UG/L AS AG) (01077)	STRON- TIUM, DIS- SOLVED (UG/L AS SR) (01080)	ZINC, TOTAL RECOV- ERABLE (UG/L AS ZN) (01092)	SOLIDS, RESIDUE AT 180 DEG C DISSOLVED (MG/L) (70300)
08-21-84	160	32	.20	<1	4	<1	1	39	10	114
09-04-85	--	2	--	--	--	--	--	--	--	121

**Table 5.** Physical and chemical characteristics of ground water from wells near Big Round Lake

[DEG C, degrees Celsius; US/CM, microsiemens per centimeter at 25 degrees Celsius; MG/L, milligrams per liter; UG/L, micrograms per liter; <, less than; five-digit number in column headings is the WATSTORE code for the parameter]

STATION NUMBER	DATE	LOCAL IDENTIFIER			TEMPER- ATURE, WATER (DEG C) (00010)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	HARD- NESS, TOTAL (MG/L AS CACO3) (00900)		
453159092171601	08-05-86	PK-35/16W/12-0131			9.0	340	7.2	190		
453200092171501	08-05-86	PK-35/16W/12-0132			9.5	350	7.4	190		
453145092170301	08-07-86	PK-35/16W/12-0133			9.5	255	7.2	140		
DATE	CALCIUM, DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)	SULFATE, DIS- SOLVED (MG/L AS SO4) (00945)	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	NITROGEN, NO2 + NO4 DISSOLVED (MG/L AS N) (00631)	ARSENIC, TOTAL (UG/L AS AS) (01002)	BARIUM, TOTAL RECOV- ERABLE (UG/L AS BA) (01007)	CADMIUM, TOTAL RECOV- ERABLE (UG/L AS CD) (01027)	
08-05-86	50	17	1.7	4.0	0.10	1.00	<1	<100	<1	
08-05-86	50	17	1.9	4.5	.10	1.50	<1	<100	<1	
08-07-86	38	10	.60	5.3	.10	<.100	2	100	<1	
DATE	CHRO- MIUM, TOTAL RECOV- ERABLE (UG/L AS CR) (01034)	COPPER, TOTAL RECOV- ERABLE (UG/L AS CU) (01042)	IRON, TOTAL RECOV- ERABLE (UG/L AS FE) (01045)	LEAD, TOTAL RECOV- ERABLE (UG/L AS PB) (01051)	MANGA- NESE, TOTAL RECOV- ERABLE (UG/L AS MN) (01055)	MERCURY, TOTAL RECOV- ERABLE (UG/L AS HG) (71900)	SELE- NIUM, TOTAL (UG/L AS SE) (01147)	ZINC, TOTAL RECOV- ERABLE (UG/L AS ZN) (01092)	SOLIDS, RESIDUE 180 DEG C DISSOLVED (MG/L) (70300)	
08-05-86	<10	16	<10	<5	<10	0.50	<1	80	214	
08-05-86	<10	11	3,900	<5	<10	.30	<1	20	227	
08-07-86	<10	5	390	<5	1,900	.10	<1	80	170	



Base from U.S. Geological Survey  
Hertel, 1983

# EXPLANATION

- Sampled domestic well
- ▲ Lake-stage gage
- Tribal land boundary

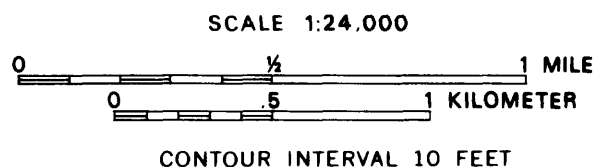
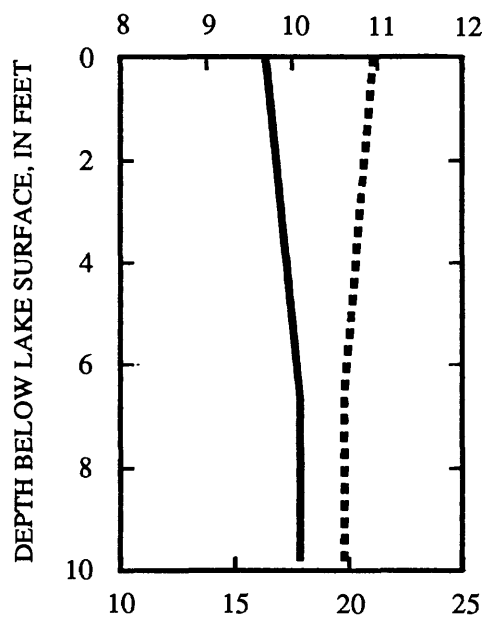
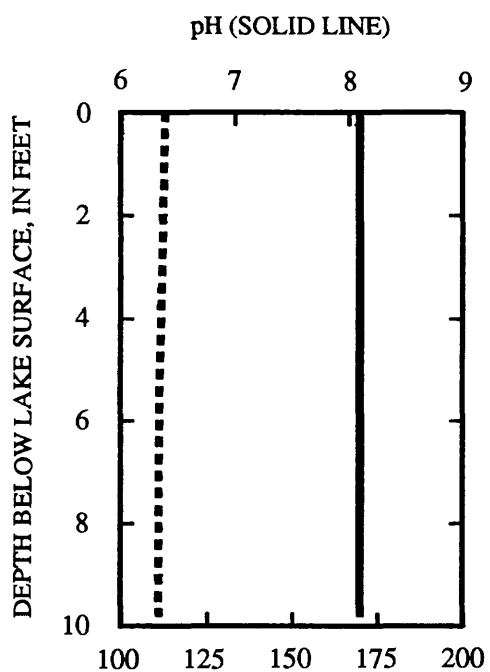


Figure 8. Location of Big Sand Lake and data-collection sites.

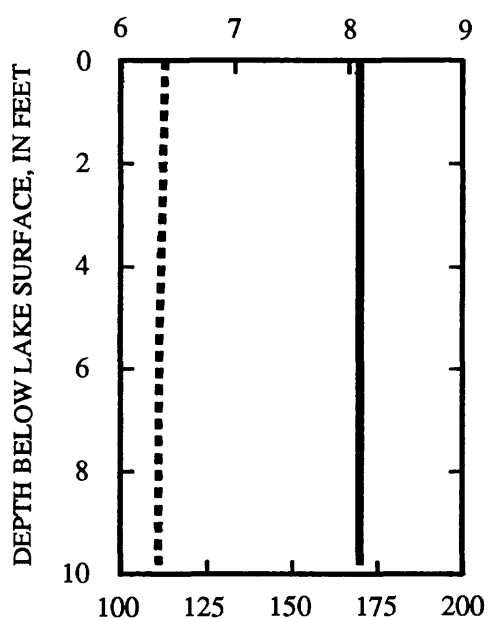
DISSOLVED-OXYGEN CONCENTRATION  
(SOLID LINE), IN MILLIGRAMS PER LITER



WATER TEMPERATURE (DASHED LINE),  
IN DEGREES CELSIUS



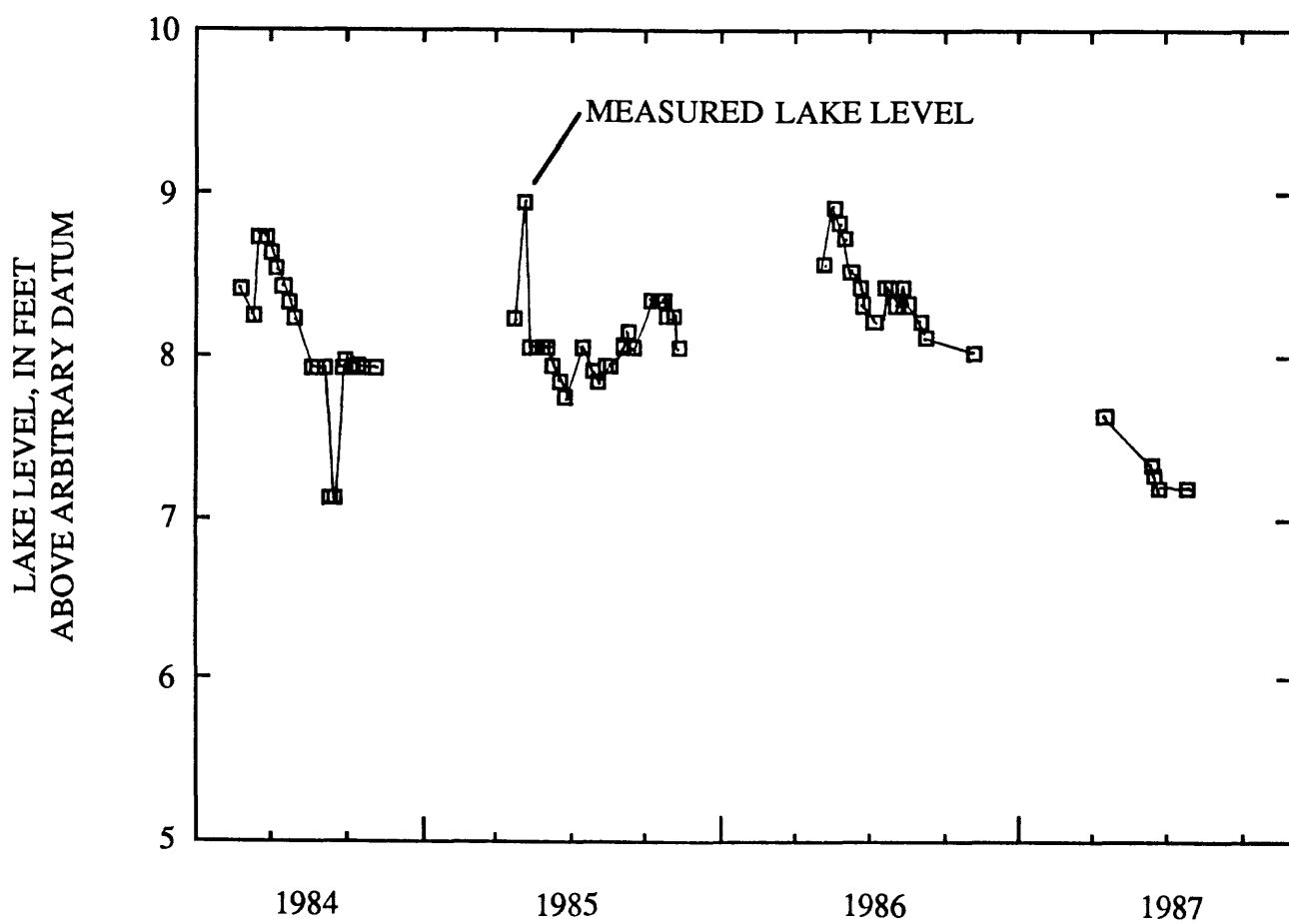
pH (SOLID LINE)



SPECIFIC CONDUCTANCE (DASHED LINE),  
IN MICROSIEMENS PER CENTIMETER AT  
25 DEGREES CELSIUS



**Figure 9.** Depth profiles of dissolved-oxygen concentration, temperature, pH, and specific conductance for Big Sand Lake, September 5, 1985.



**Figure 10.** Lake-level fluctuations of Big Sand Lake, 1984-87.

**Table 6.** Physical and chemical characteristics of water from Big Sand Lake

[DEG C, degrees Celsius; US/CM, microsiemens per centimeter at 25 degrees Celsius; MG/L, milligrams per liter; UG/L, micrograms per liter; <, less than; --, no data available; five-digit number in column headings is the WATSTORE code for the parameter]

DATE	TIME	TEMPER- ATURE, WATER (DEG C) (00010)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	OXYGEN, DIS- SOLVED (MG/L) (00300)	PH (STAND- ARD UNITS) (00400)	HARD- NESS, TOTAL (MG/L AS CACO3) (00900)	CALCIUM, DIS- SOLVED (MG/L AS CA) (00915)			
08-23-84	1000	22.0	85	7.8	8.9	38	9.6			
09-05-85	1545	21.0	111	9.7	8.1	38	9.8			
DATE	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)	SODIUM, DIS- SOLVED (MG/L AS NA) (00930)	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)	SULFATE, DIS- SOLVED (MG/L AS SO4) (00945)	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	ALKA- LINTY, LAB (MG/L AS CACO3) (90410)	SILICA, DIS- SOLVED (MG/L AS SIO2) (00955)	NITRO- GEN, ORGANIC, TOTAL (MG/L AS N) (00605)	NITRO- GEN, AMMONIA, DIS- SOLVED (MG/L AS N) (00608)
08-23-84	3.4	1.8	0.20	1.4	4.1	0.10	39	2.3	<0.010	<0.010
09-05-85	3.3	1.8	.60	1.7	2.0	<.10	40	1.7	.030	--
DATE	NITRO- GEN, NITRITE TOTAL (MG/L AS N) (00615)	NITRO- GEN, AM- MONIA + ORGANIC, TOTAL (MG/L AS N) (00625)	NITROGEN, NO2 + NO3, TOTAL (MG/L AS N) (00630)	NITROGEN, NO2 + NO3, DISSOLVED (MG/L AS N) (00631)	PHOS- PHORUS, TOTAL (MG/L AS P) (00665)	PHOS- PHORUS, DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS, ORTHO, DIS- SOLVED (MG/L AS P) (00671)	ARSENIC, TOTAL (UG/L AS AS) (01002)	ALUM- INUM, TOTAL RECOV- ERABLE (UG/L AS AL) (01105)	BARIUM, TOTAL RECOV- ERABLE (UG/L AS BA) (01007)
08-23-84	<.010	.80	<.100	<.100	<.010	<.010	<.010	1	110	<.100
09-05-85	--	.80	--	<.100	.050	.060	<.010	--	--	--
DATE	BERYL- LIUM, TOTAL RECOV- ERABLE (UG/L AS BE) (01012)	CADMIUM, TOTAL RECOV- ERABLE (UG/L AS CD) (01027)	CHRO- MIUM, TOTAL RECOV- ERABLE (UG/L AS CR) (01034)	COBALT, TOTAL RECOV- ERABLE (UG/L AS CO) (01037)	COPPER, TOTAL RECOV- ERABLE (UG/L AS CU) (01042)	IRON, SUS- PENDE RECOV- ERABLE (UG/L AS FE) (01044)	IRON, TOTAL RECOV- ERABLE (UG/L AS FE) (01045)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, TOTAL RECOV- ERABLE (UG/L AS PB) (01051)	MANGA- NESE, TOTAL RECOV- ERABLE (UG/L AS MN) (01055)
08-23-84	<10	<1	4	<1	3	--	350	63	3	20
09-05-85	--	--	--	--	--	170	200	34	--	--

**Table 6.** Physical and chemical characteristics of water from Big Sand Lake—Continued

DATE	MANGANESE, DIS- SOLVED (UG/L AS MN) (01056)	MERCURY, TOTAL RECOVERABLE (UG/L AS HG) (71900)	MOLYBDENUM, TOTAL RECOVERABLE (UG/L AS MO) (01062)	NICKEL, TOTAL RECOVERABLE (UG/L AS NI) (01067)	SELENIUM, TOTAL (UG/L AS SE) (01147)	SILVER, TOTAL RECOVERABLE (UG/L AS AG) (01077)	STRONTIUM, DIS- SOLVED (UG/L AS SR) (01080)	ZINC, TOTAL RECOVERABLE (UG/L AS ZN) (01092)	SOLIDS, RESIDUE AT 180 DEG C DISSOLVED (MG/L) (70300)
08-23-84	2	<.10	<1	5	<1	<1	24	<10	57
09-05-85	5	--	--	--	--	--	--	--	54

**Table 7.** Physical and chemical characteristics of ground water from wells near Big Sand Lake

[DEG C, degrees Celsius; US/CM, microsiemens per centimeter at 25 degrees Celsius; MG/L, milligrams per liter; UG/L, micrograms per liter; <, less than; --, no data available; five-digit number in column headings is the WATSTORE code for the parameter]

STATION NUMBER	DATE	LOCAL IDENTIFIER	TEMPERATURE, WATER (DEG C) (00010)	SPECIFIC CONDUCTANCE (US/CM) (00095)	PH (STANDARD UNITS) (00400)	HARDNESS, TOTAL AS (MG/L) (00900)	CALCIUM, DIS-SOLVED (MG/L) (00915)	MAGNESIUM, DIS-SOLVED (MG/L) (00925)	SODIUM, DIS-SOLVED (MG/L) (00930)
454900092122701	08-07-85	BT-38/15W/03-0129	10.5	185	8.4	85	25	5.4	--
454849092121201	08-06-86	BT-38/15W/03-0729	9.0	170	7.6	81	21	7.0	--
454951092111601	08-06-86	BT-38/15W/34-0726	10.0	150	7.5	80	22	6.0	--
454845092123001	08-05-86	BT-38/15W/34-0741	9.5	145	7.4	72	19	6.0	--
454848092122801	08-05-86	BT-38/15W/34-0742	11.0	240	7.3	120	30	10	--
454906092121201	11-17-81	BT-39/15W/34-0110	8.0	240	7.8	140	39	9.4	2.9
454903092123701	08-06-85	BT-39/15W/34-0121	10.0	195	8.4	87	26	5.4	--
454859092124401	08-06-85	BT-39/15W/34-0122	11.0	220	8.2	100	29	6.6	--
454906092125701	08-06-85	BT-39/15W/34-0123	11.0	195	8.3	98	28	6.9	--
454858092123501	08-06-85	BT-39/15W/34-0125	10.0	205	8.2	94	26	7.1	--
454902092121801	08-06-85	BT-39/15W/34-0131	9.0	195	8.4	93	26	6.8	--
454927092114501	08-06-86	BT-39/15W/34-0728	10.0	190	7.3	86	23	7.0	--
455053092111501	11-17-81	BT-39/15W/23-0112	8.5	220	7.9	120	34	8.6	3.4

DATE	POTASSIUM, DIS-SOLVED (MG/L) (00935)	CHLORIDE, DIS-SOLVED (MG/L) (00940)	SULFATE, DIS-SOLVED (MG/L) (00945)	FLUORIDE, DIS-SOLVED (MG/L) (00950)	ALKALINITY, LAB AS (MG/L) (90410)	SILICA, DIS-SOLVED AS (MG/L) (00955)	NITROGEN, NO2 + NO3, DISSOLVED AS N (MG/L) (00631)	ARSENIC, TOTAL AS (UG/L) (01002)	BARIUM, TOTAL RECOVERABLE AS BA (UG/L) (01007)	CADMIUM, TOTAL RECOVERABLE AS CD (UG/L) (01027)	CHROMIUM, TOTAL RECOVERABLE AS CR (UG/L) (01034)	COPPER, TOTAL RECOVERABLE AS CU (UG/L) (01042)
08-07-85	--	1.3	3.8	0.10	--	--	<0.100	4	<100	1	<10	57
08-06-86	--	.60	7.9	.20	--	--	.590	3	--	--	--	--
08-06-86	--	1.8	12	<.10	--	--	.320	2	<100	<1	<10	9
08-05-86	--	.80	10	<.10	--	--	<.100	1	<100	<1	10	5
08-05-86	--	6.7	23	.10	--	--	6.60	<1	<100	<1	<10	4
11-17-81	.50	1.2	2.3	<.10	140	26	--	--	--	--	--	--
08-06-85	--	1.5	4.3	.10	--	--	<.100	3	<100	<1	<10	8
08-06-85	--	1.4	6.4	<.10	--	--	.240	2	<100	1	<10	15
08-06-85	--	1.0	5.4	<.10	--	--	<.100	2	<100	2	10	25
08-06-85	--	.80	7.7	<.10	--	--	.180	1	<100	1	<10	11
08-06-85	--	.80	5.8	<.10	--	--	<.100	2	<100	1	10	8
08-06-86	--	4.6	1.3	.10	--	--	1.40	2	--	--	--	--
11-17-81	.60	1.2	<10	<.10	130	31	--	--	--	--	--	--

**Table 7.** Physical and chemical characteristics of ground water from wells near Big Sand Lake—Continued

DATE	IRON, SUS- PENDE D RECOV- ERABLE (UG/L AS FE) (01044)	IRON, TOTAL RECOV- ERABLE (UG/L AS FE) (01045)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, TOTAL RECOV- ERABLE (UG/L AS PB) (01051)	MANGA- NESE, TOTAL RECOV- ERABLE (UG/L AS MN) (01055)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MERCURY, TOTAL RECOV- ERABLE (UG/L AS HG) (71900)	SELE- NIUM, TOTAL (UG/L AS SE) (01147)	ZINC, TOTAL RECOV- ERABLE (UG/L AS ZN) (01092)	SOLIDS, RESIDUE AT 180 DEG C DISSOLVED (MG/L) (70300)
08-07-85	--	130	--	5	40	--	<.10	<1	40	107
08-06-86	--	--	--	--	--	--	<.10	<1	--	132
08-06-86	--	40	--	<5	<10	--	.20	<1	20	94
08-05-86	--	50	--	<5	<10	--	.10	<1	90	97
08-05-86	--	20	--	<5	<10	--	.10	<1	70	163
11-17-81	140	840	700	--	--	540	--	--	--	171
08-06-85	--	340	--	3	20	--	<.10	<1	40	105
08-06-85	--	160	--	6	<10	--	<.10	<1	60	120
08-06-85	--	120	--	17	<10	--	<.10	<1	50	114
08-06-85	--	80	--	5	<10	--	.10	<1	60	113
08-06-85	--	500	--	11	<10	--	<.10	<1	20	109
08-06-86	--	--	--	--	--	--	<.10	<1	--	112
11-17-81	210	690	480	--	--	190	--	--	--	164

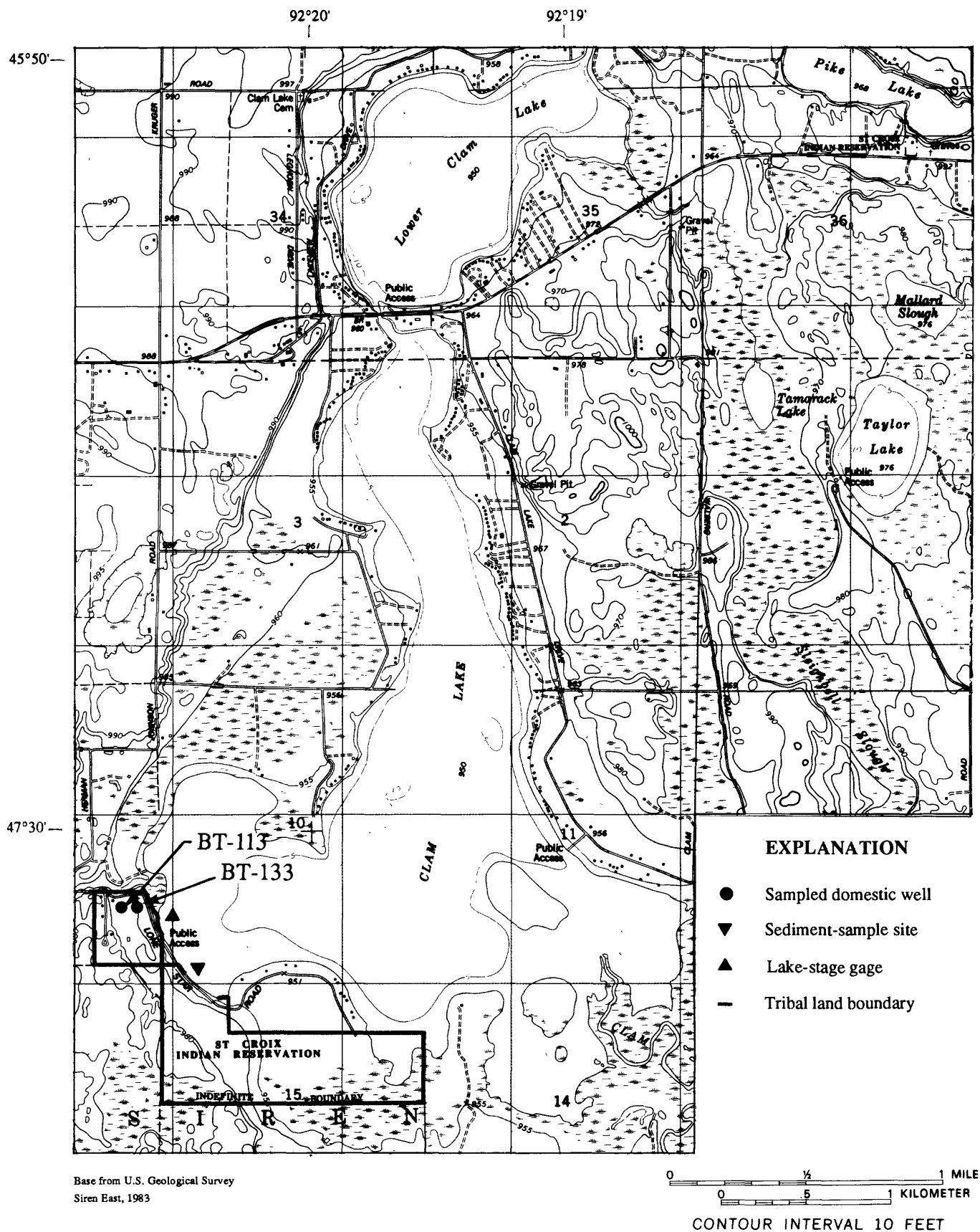
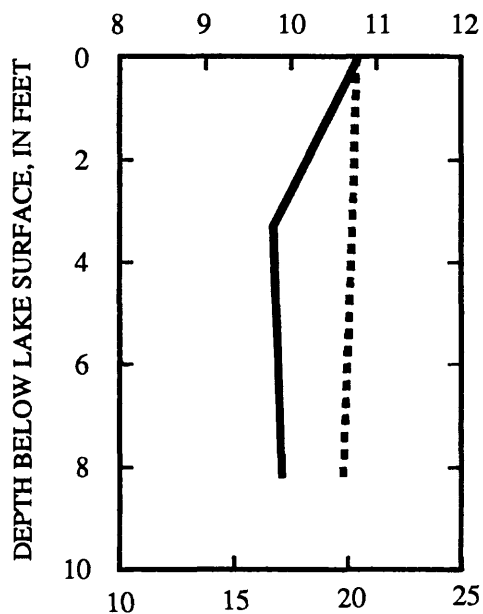
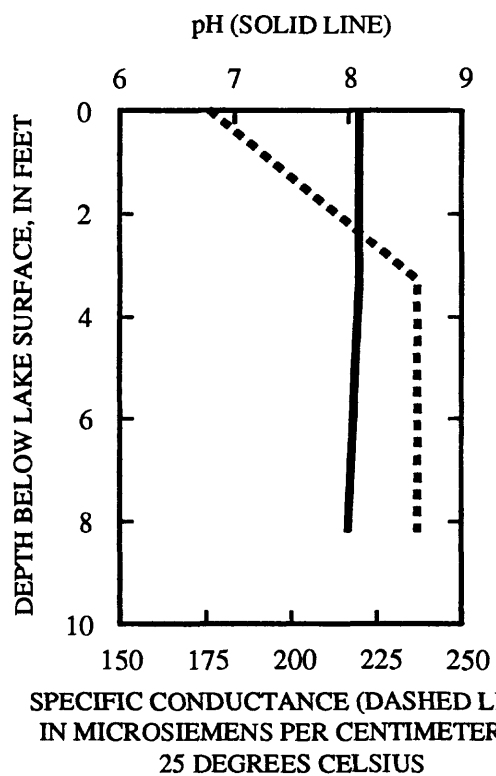


Figure 11. Location of Clam Lake and data-collection sites.

DISSOLVED-OXYGEN CONCENTRATION  
(SOLID LINE), IN MILLIGRAMS PER LITER



WATER TEMPERATURE (DASHED LINE),  
IN DEGREES CELSIUS



**Figure 12.** Depth profiles of dissolved-oxygen concentration, temperature, pH, and specific conductance for Clam Lake, September 4, 1985.

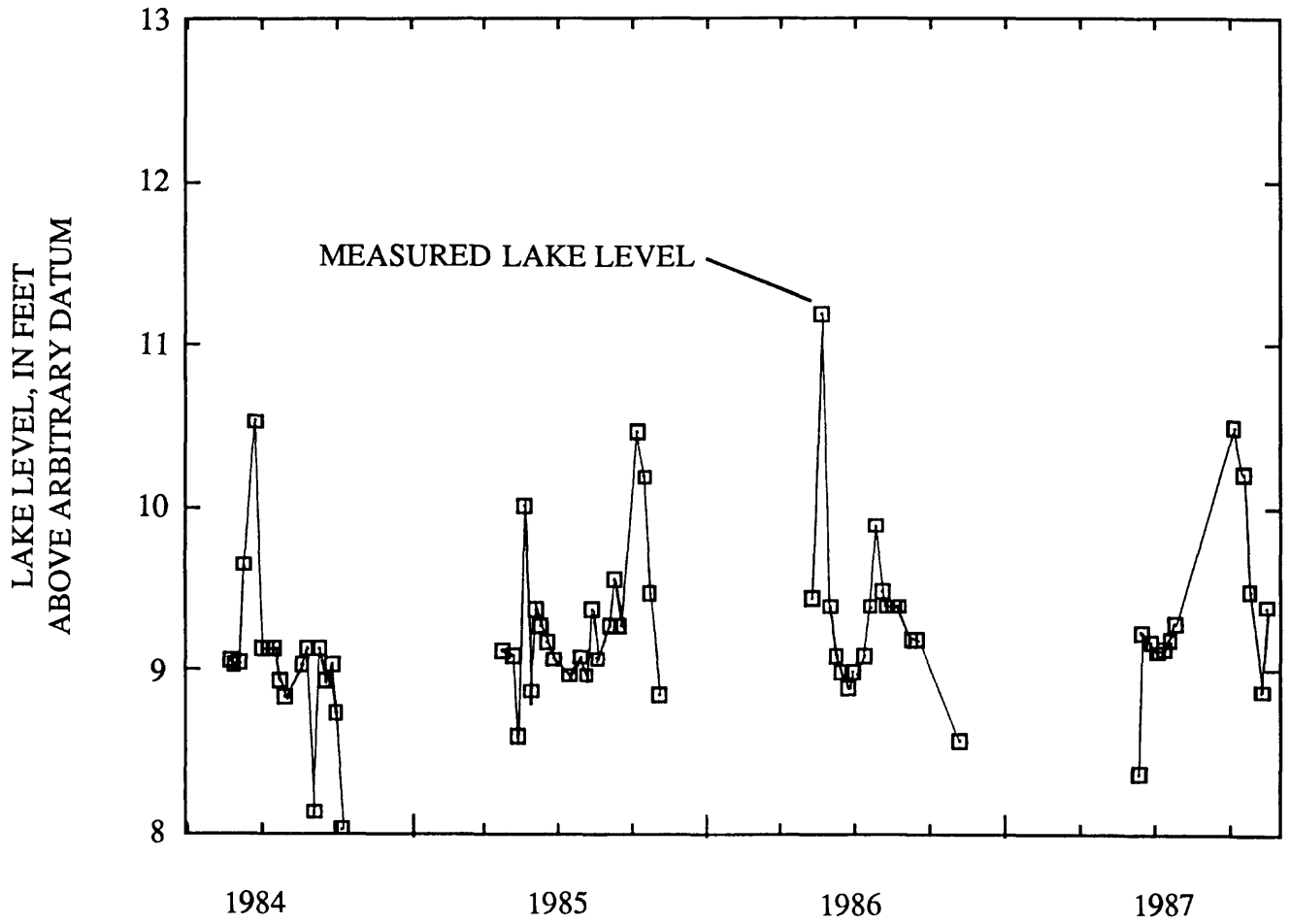
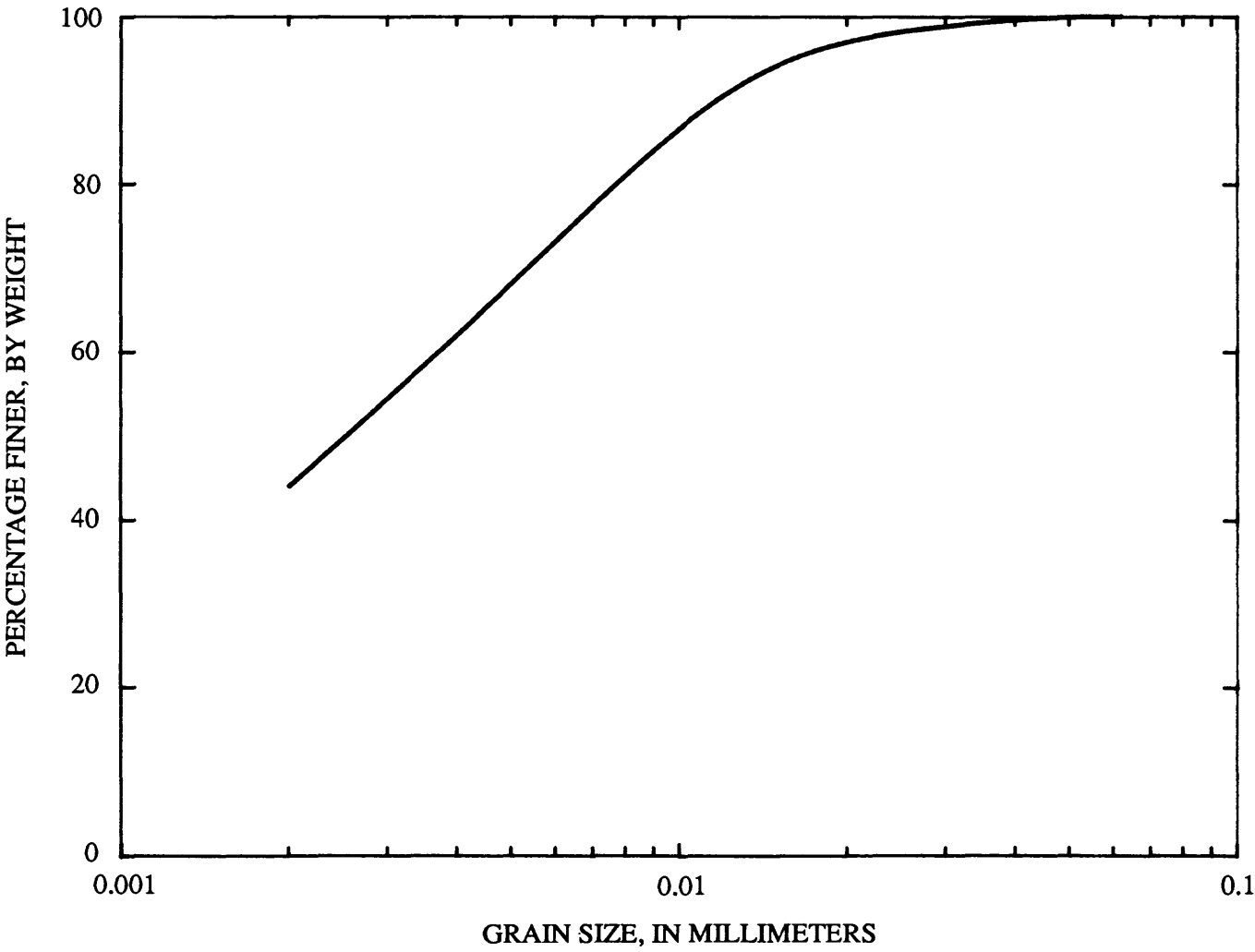


Figure 13. Lake-level fluctuations of Clam Lake, 1984-87.



**Figure 14.** Grain-size distribution of bottom sediment sampled from Clam Lake.

**Table 8.** Physical and chemical characteristics of water and sediment for Clam Lake

[DEG C, degrees Celsius; US/CM, microsiemens per centimeter at 25 degrees Celsius; MG/L, milligrams per liter; MG/KG, milligrams per kilogram; UG/L, micrograms per liter; BOT. MAT., bottom material; <, less than; --, no data available; five-digit number in column headings is the WATSTORE code for the parameter]

DATE	TIME	MEDIUM	TEMPER- ATURE, WATER (DEG C) (00010)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	OXYGEN, DIS- SOLVED (MG/L) (00300)	PH (STAND- ARD UNITS) (00400)	HARD- NESS, TOTAL (MG/L AS CACO3) (00900)	CALCIUM, DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)
08-21-84	1300	WATER	23.0	205	8.7	9.0	100	26	9.3
08-21-84	1300	SEDIMENT	--	--	--	--	--	--	--
09-04-85	1515	WATER	19.5	241	8.1	7.2	98	25	8.7
09-04-85	1515	SEDIMENT	--	--	--	--	--	--	--
08-28-86	1100	WATER	17.5	195	9.1	8.4	100	26	8.9
08-28-86	1100	SEDIMENT	--	--	--	--	--	--	--

DATE	SODIUM, DIS- SOLVED (MG/L AS NA) (00930)	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)	SULFATE, DIS- SOLVED (MG/L AS SO4) (00945)	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	ALKA- LINITY, LAB (MG/L AS CACO3) (90410)	SILICA, DIS- SOLVED (MG/L AS SIO2) (00955)	NITRO- GEN, ORGANIC, TOTAL (MG/L AS N) (00605)	NITRO- GEN, AMMONIA, DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN, AMMONIA, TOTAL (MG/L AS N) (00610)	NITRO- GEN, NITRITE, TOTAL (MG/L AS N) (00615)
08-21-84	2.8	.60	2.0	5.5	.10	106	16	1.3	<.010	.030	<.010
08-21-84	--	--	--	--	--	--	--	--	--	--	--
09-04-85	2.8	.90	2.5	3.1	<.10	101	16	--	.050	--	--
09-04-85	--	--	--	--	--	--	--	--	--	--	--
08-28-86	3.0	.60	1.7	5.6	<.10	102	16	.58	.020	.020	<.010
08-28-86	--	--	--	--	--	--	--	--	--	--	--

DATE	NITRO- GEN, AM- MONIA + ORGANIC, TOTAL (MG/L AS N) (00625)	NITROGEN, NO2 + NO3, TOTAL (MG/L AS N) (00630)	NITROGEN, NO2 + NO3, DISSOLVED (MG/L AS N) (00631)	PHOS- PHORUS, TOTAL (MG/L AS P) (00665)	PHOS- PHORUS, DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS, ORTHO, DIS- SOLVED (MG/L AS P) (00671)	NITRO- GEN, NH4, TOTAL IN BOT. MAT. (MG/KG AS N) (00611)	NITRO- GEN, NH4 + ORG., TOTAL IN BOT. MAT. (MG/KG AS N) (00626)	NITROGEN, NO2 + NO3, TOTAL IN BOT. MAT. (MG/KG AS N) (00633)	PHOS- PHORUS, TOTAL IN BOT. MAT. (MG/KG AS P) (00668)	ARSENIC, TOTAL (UG/L AS AS) (01002)
08-21-84	1.3	<.100	<.100	.040	<.010	<.010	--	--	--	--	2
08-21-84	--	--	--	--	--	--	44	20,000	<2.0	320	--
09-04-85	.50	--	<.100	.100	.060	<.010	--	--	--	--	--
09-04-85	--	--	--	--	--	--	170	93,000	260	34	--
08-28-86	.60	<.100	<.100	.020	.030	<.010	--	--	--	--	<1
08-28-86	--	--	--	--	--	--	190	22,000	5.0	1,600	--

[illegible]

**Table 9.** Physical and chemical characteristics of ground water from wells near Clam Lake

[DEG C, degrees Celsius; US/CM, microsiemens per centimeter at 25 degrees Celsius; MG/L, milligrams per liter; UG/L, micrograms per liter; >, less than; --, no data available; five-digit number in column headings is the WATSTORE code for the parameter]

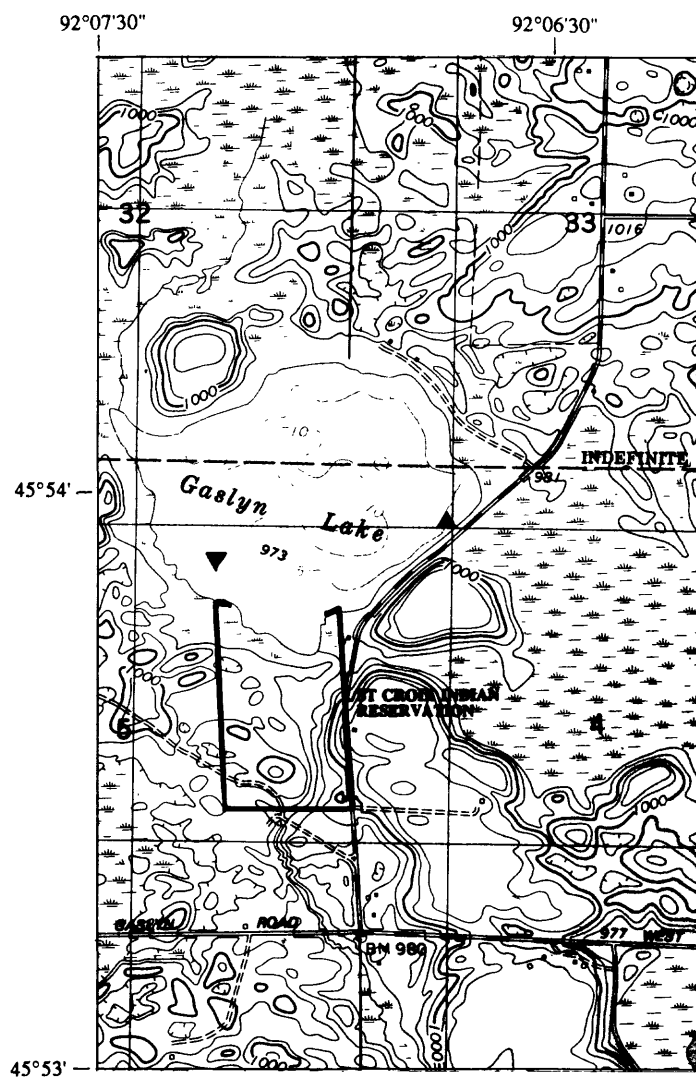
STATION NUMBER	DATE	LOCAL IDENTIFIER	TEMPERATURE, WATER (DEG C) (00010)	SPECIFIC CONDUCTANCE (US/CM) (00095)	PH (STANDARD UNITS) (00400)	HARDNESS, TOTAL (MG/L AS CaCO3) (00900)	CALCIUM, DIS-SOLVED (MG/L AS Ca) (00915)	MAGNESIUM, DIS-SOLVED (MG/L AS Mg) (00925)	SODIUM, DIS-SOLVED (MG/L AS Na) (00930)
454719092205901	11-19-81	BT-38/16W/09-0113	8.0	230	8.3	120	35	8.7	5.6
	08-08-85		10.0	280	8.2	120	36	8.2	--
454717092205401	08-08-85	BT-38/16W/09-0133	10.0	265	8.1	120	35	8.0	--
454944092172501	08-07-85	BT-39/16W/36-0130	10.5	195	7.4	92	23	8.4	--
454945092173201	08-07-85	BT-39/16W/36-0132	9.5	200	6.8	84	20	8.3	--

DATE	POTASSIUM, DIS-SOLVED (MG/L AS K) (00935)	CHLORIDE, DIS-SOLVED (MG/L AS CL) (00940)	SULFATE, DIS-SOLVED (MG/L AS SO4) (00945)	FLUORIDE, DIS-SOLVED (MG/L AS F) (00950)	ALKALINITY, LAB (MG/L AS CaCO3) (90410)	SILICA, DIS-SOLVED (MG/L AS SiO2) (00955)	NITROGEN, NO2 + NO3, DISSOLVED (MG/L AS N) (00631)	ARSENIC, TOTAL (UG/L AS AS) (01002)	BARIUM, TOTAL RECOVERABLE (UG/L AS BA) (01007)	CADMIUM, TOTAL RECOVERABLE (UG/L AS CD) (01027)	CHROMIUM, TOTAL RECOVERABLE (UG/L AS CR) (01034)	COPPER, TOTAL RECOVERABLE (UG/L AS CU) (01042)
11-19-81	0.90	0.90	0.60	0.10	140	26	--	--	--	--	--	--
08-08-85	--	1.0	.40	.10	--	--	<.100	4	<100	1	10	13
08-08-85	--	.60	<.20	.20	--	--	<.100	3	<100	<1	20	7
08-07-85	--	.80	1.2	.10	--	--	<.100	2	<100	<1	10	30
08-07-85	--	11	2.5	.10	--	--	<.100	<1	<100	<1	10	10

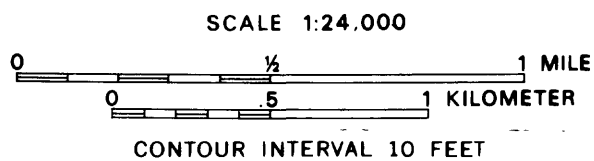
DATE	IRON, SUSPENDED RECOVERABLE (UG/L AS FE) (01044)	IRON, TOTAL RECOVERABLE (UG/L AS FE) (01045)	IRON, DIS-SOLVED (UG/L AS FE) (01046)	LEAD, TOTAL RECOVERABLE (UG/L AS PB) (01051)	MANGANESE, TOTAL RECOVERABLE (UG/L AS MN) (01055)	MANGANESE, DIS-SOLVED (UG/L AS MN) (01056)	MERCURY, TOTAL RECOVERABLE (UG/L AS HG) (71900)	SELENIUM, TOTAL (UG/L AS SE) (01147)	ZINC, TOTAL RECOVERABLE (UG/L AS ZN) (01092)	SOLIDS, RESIDUE AT 180 DEG C DISSOLVED (MG/L) (70300)
11-19-81	640	950	310	--	--	170	--	--	--	159
08-08-85	--	540	--	27	210	--	<.10	<1	50	160
08-08-85	--	230	--	2	310	--	<.10	<1	50	162
08-07-85	--	920	--	6	1,000	--	<.10	<1	120	122
08-07-85	--	510	--	1	270	--	.10	<1	20	133



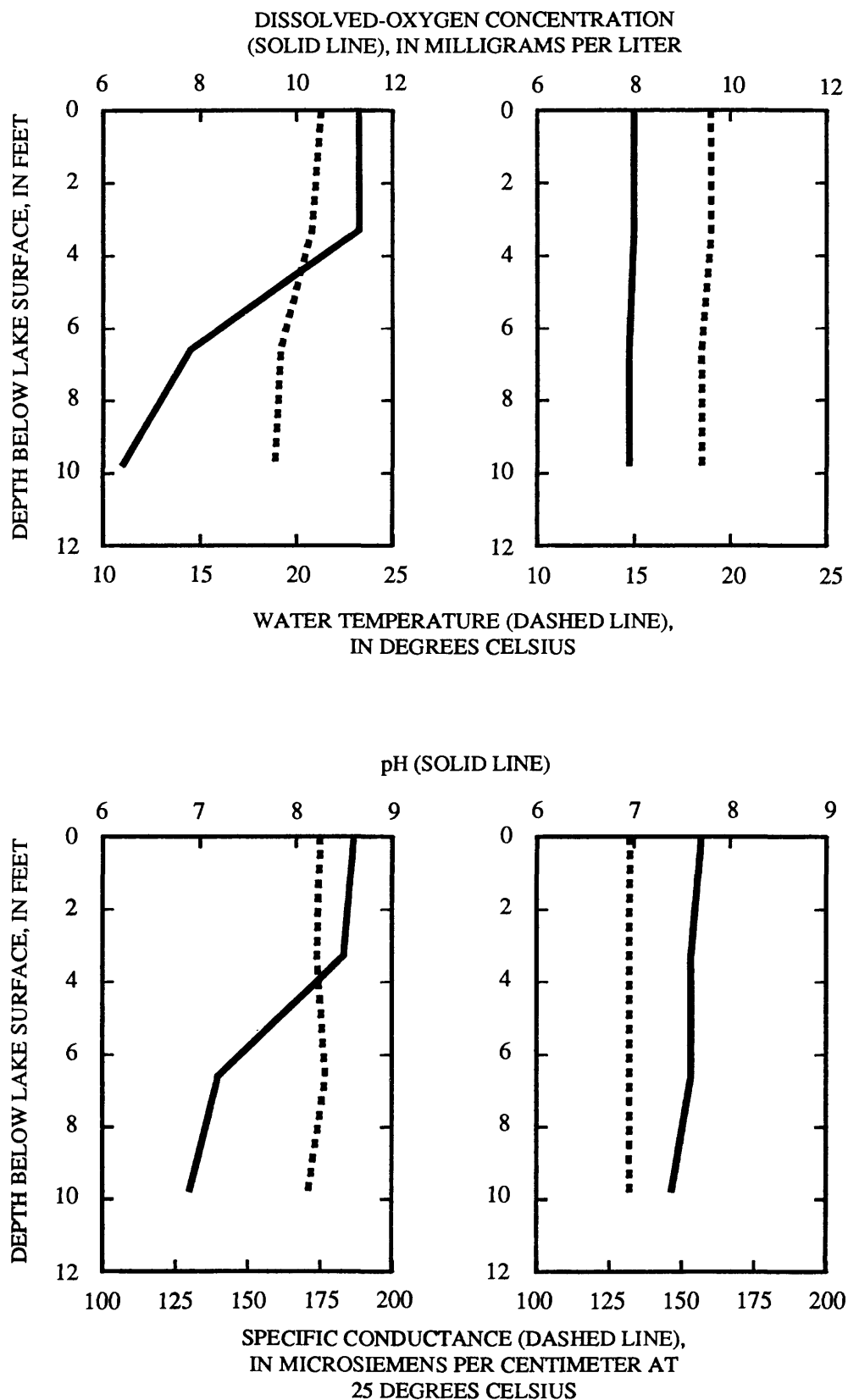
Base from U.S. Geological Survey  
McKenzie Lake, 1983

#### EXPLANATION

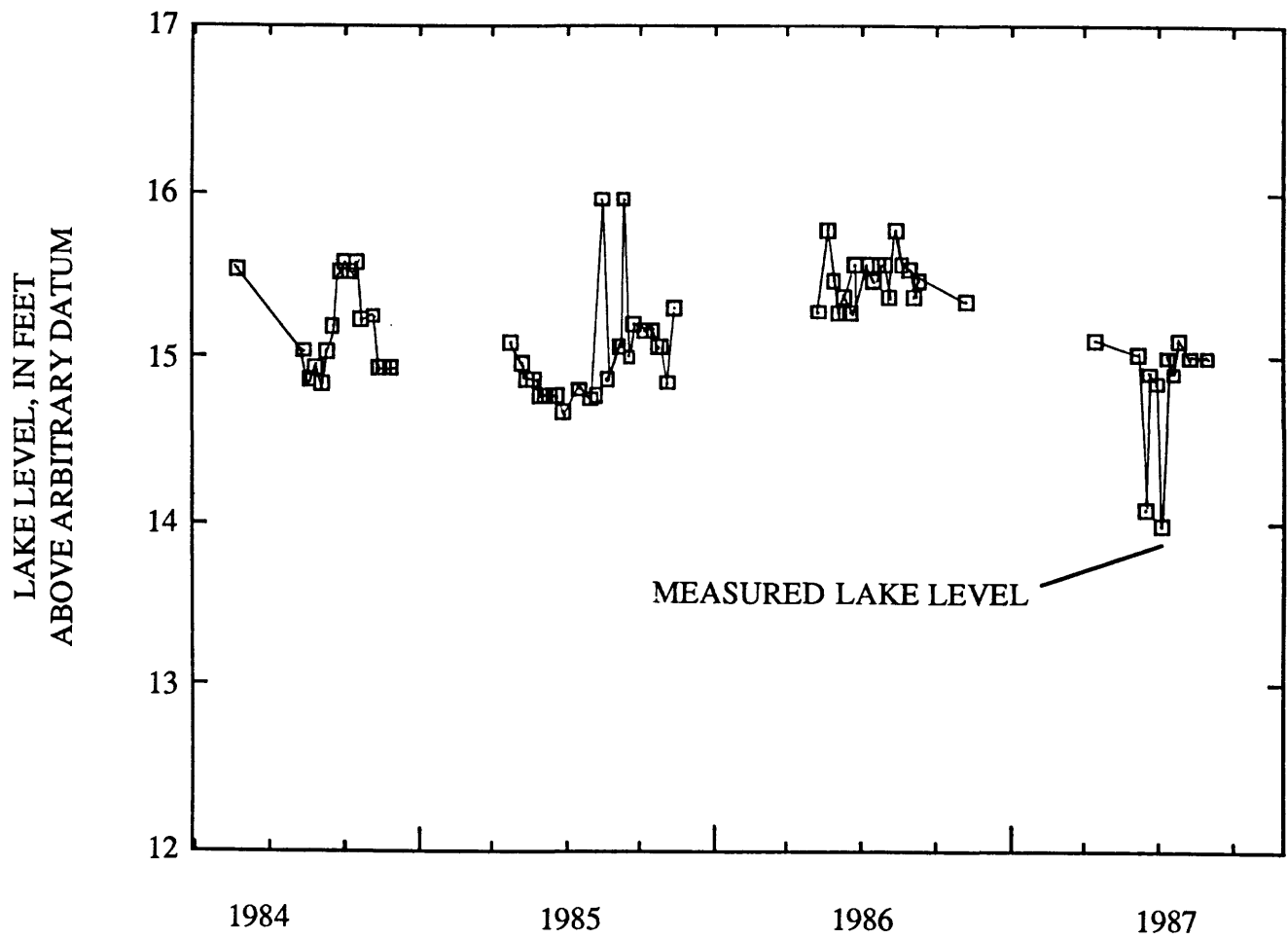
- ▼ Sediment-sample site
- ▲ Lake-stage gage
- Tribal land boundary



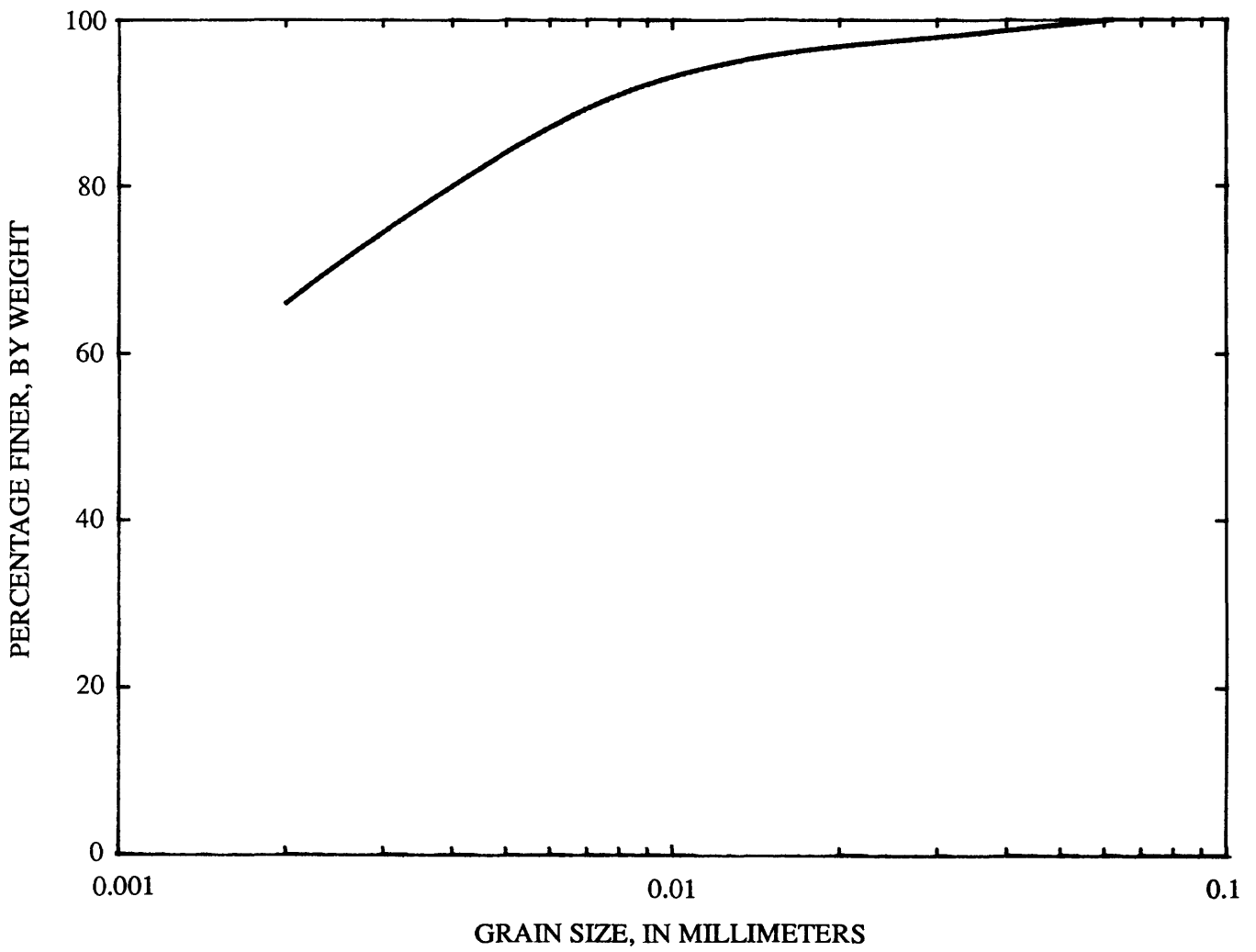
**Figure 15.** Location of Gaslyn Lake and data-collection sites.



**Figure 16.** Depth profiles of dissolved-oxygen concentration, temperature, pH, and specific conductance for Gaslyn Lake, September 5, 1985, and August 27, 1986.



**Figure 17.** Lake-level fluctuations of Gaslyn Lake, 1984-87.



**Figure 18.** Grain-size distribution of bottom sediment sampled from Gaslyn Lake.

**Table 10.** Physical and chemical characteristics of water and sediment for Gaslyn Lake

[DEG C, degrees Celsius; US/CM, microsiemens per centimeter at 25 degrees Celsius; MG/L, milligrams per liter; MG/KG, milligrams per kilogram; UG/L, micrograms per liter; BOT. MAT., bottom material; <, less than; --, no data available; five-digit number in column headings is the WATSTORE code for the parameter]

DATE	TIME	MEDIUM	TEMPER- ATURE, WATER (DEG C) (00010)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	OXYGEN, DIS- SOLVED (MG/L) (00300)	PH (STAND- ARD UNITS) (00400)	HARD- NESS, TOTAL AS CACO3) (00900)	CALCIUM, DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)
08-20-84	1145	WATER	24.0	160	6.0	--	76	21	5.8
08-20-84	1145	SEDIMENT	--	--	--	--	--	--	--
09-05-85	1415	WATER	20.5	134	6.4	6.6	54	15	4.0
09-05-85	1415	SEDIMENT	--	--	--	--	--	--	--
08-27-86	1100	WATER	19.0	130	8.0	7.6	68	19	5.0
08-27-86	1100	SEDIMENT	--	--	--	--	--	--	--

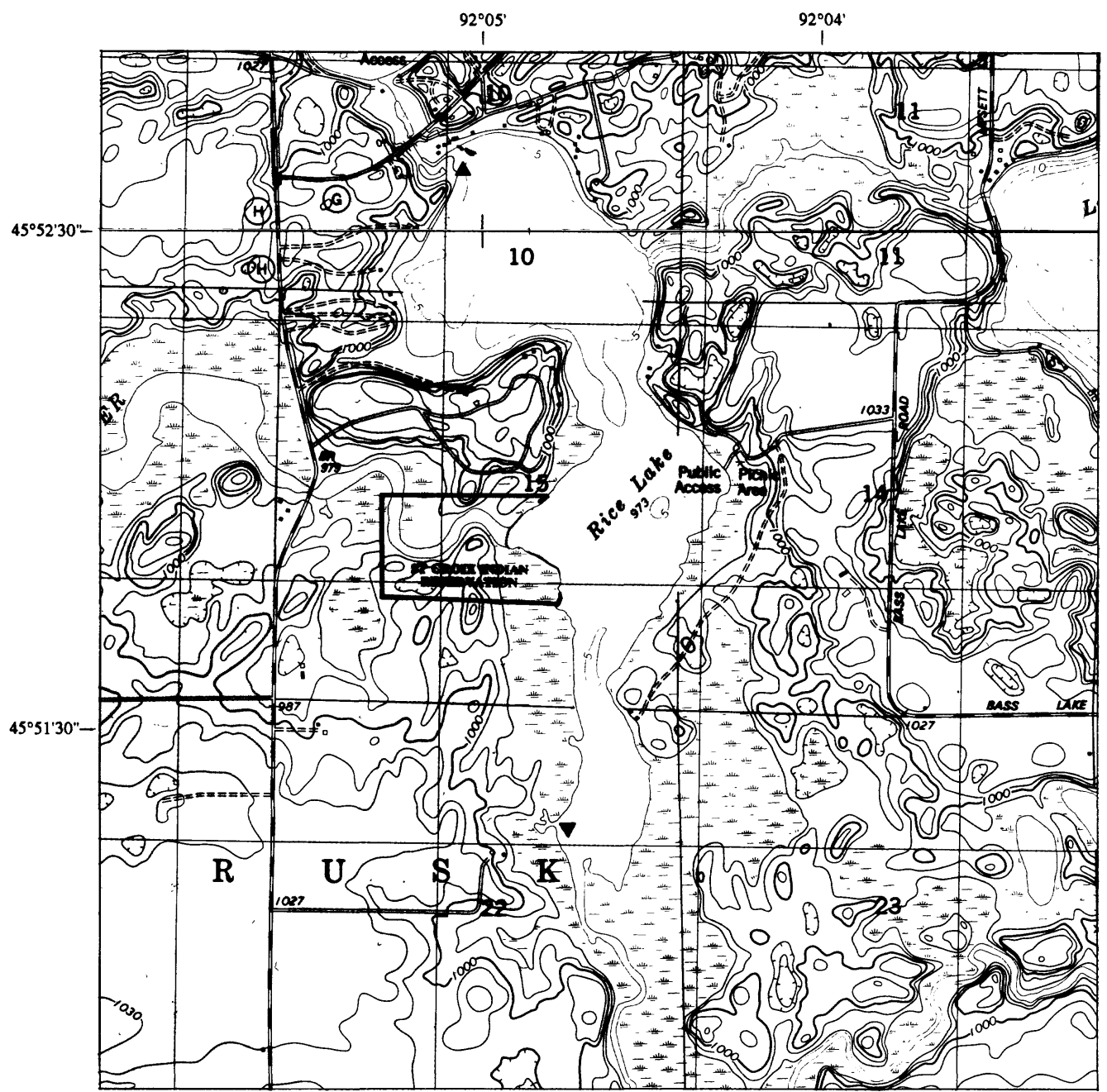
  

DATE	SODIUM, DIS- SOLVED (MG/L AS NA) (00930)	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)	SULFATE, DIS- SOLVED (MG/L AS SO4) (00945)	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	ALKA- LINTY, LAB AS CACO3) (90410)	SILICA, DIS- SOLVED AS SIO2) (00955)	NITRO- GEN, ORGANIC, TOTAL (MG/L AS N) (00605)	NITRO GEN, AMMONIA, DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN, AMMONIA, TOTAL (MG/L AS N) (00610)	NITRO- GEN, NITRITE, TOTAL (MG/L AS N) (00615)
08-20-84	2.7	0.80	1.8	5.1	<0.10	79	17	--	<0.010	<0.010	<0.010
08-24-84	--	--	--	--	--	--	--	--	--	--	--
09-05-85	1.9	.60	1.8	2.4	<.10	52	16	--	.010	--	--
09-05-85	--	--	--	--	--	--	--	--	--	--	--
08-27-86	2.4	.60	1.6	8.5	<.10	68	19	.87	.020	.030	<.010
08-27-86	--	--	--	--	--	--	--	--	--	--	--

DATE	NITRO- GEN, AM- MONIA + ORGANIC, TOTAL (MG/L AS N) (00625)	NITROGEN, NO2 + NO3, TOTAL (MG/L AS N) (00630)	NITROGEN, NO2 + NO3, DISSOLVED (MG/L AS N) (00631)	PHOS- PHORUS, TOTAL (MG/L AS P) (00665)	PHOS- PHORUS, DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS, ORTHO, DIS- SOLVED (MG/L AS P) (00671)	NITRO- GEN, NH4, TOTAL IN BOT. MAT. (MG/KG AS N) (00611)	NITRO- GEN, NH4 + ORG., TOTAL IN BOT. MAT. (MG/KG AS N) (00626)	NITROGEN, NO2 + NO3, TOTAL IN BOT. MAT. (MG/KG AS N) (00633)	PHOS- PHORUS, TOTAL IN BOT. MAT. (MG/KG AS P) (00668)	ARSENIC, TOTAL (UG/L AS AS) (01002)
08-20-84	1.3	<.100	<.100	.040	<.010	<.010	--	--	--	--	2
08-24-84	--	--	--	--	--	--	380	<20	<2.0	280	--
09-05-85	--	--	6.50	--	.040	<.010	--	--	--	--	--
09-05-85	--	--	--	--	--	--	280	73,000	280	920	--
08-27-86	.90	<.100	<.100	.020	.010	<.010	--	--	--	--	1
08-27-86	--	--	--	--	--	--	250	52,000	11	2,400	--

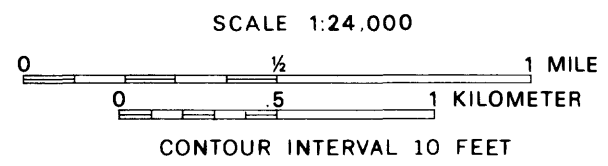




Base from U.S. Geological Survey  
Poquettes Lake, 1983,  
McKenzie Lake, 1983

**EXPLANATION**

- ▼ Sediment-sample site
- ▲ Lake-stage gage
- Tribal land boundary



**Figure 19.** Location of Rice Lake and data-collection sites.

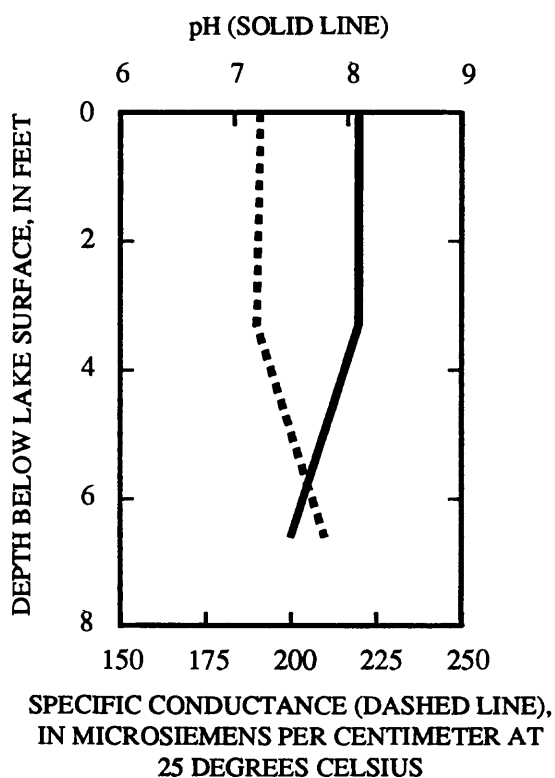
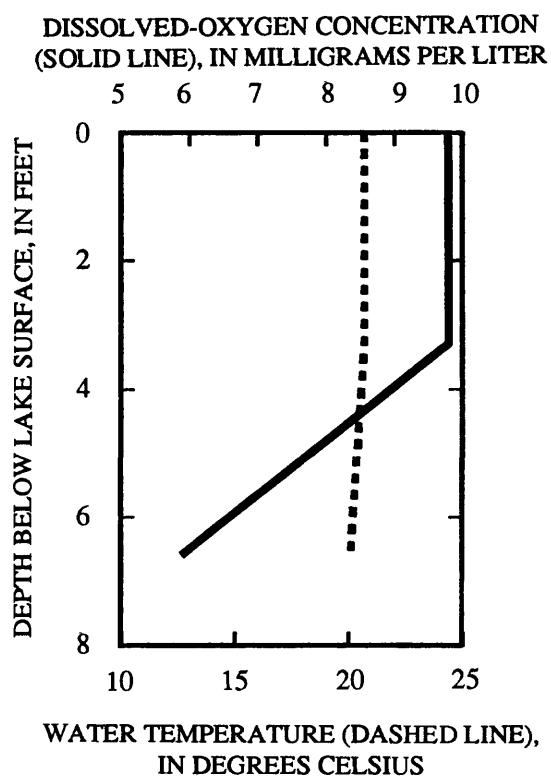


Figure 20. Depth profiles of dissolved-oxygen concentration, temperature, pH, and specific conductance for Rice Lake, September 5, 1985.

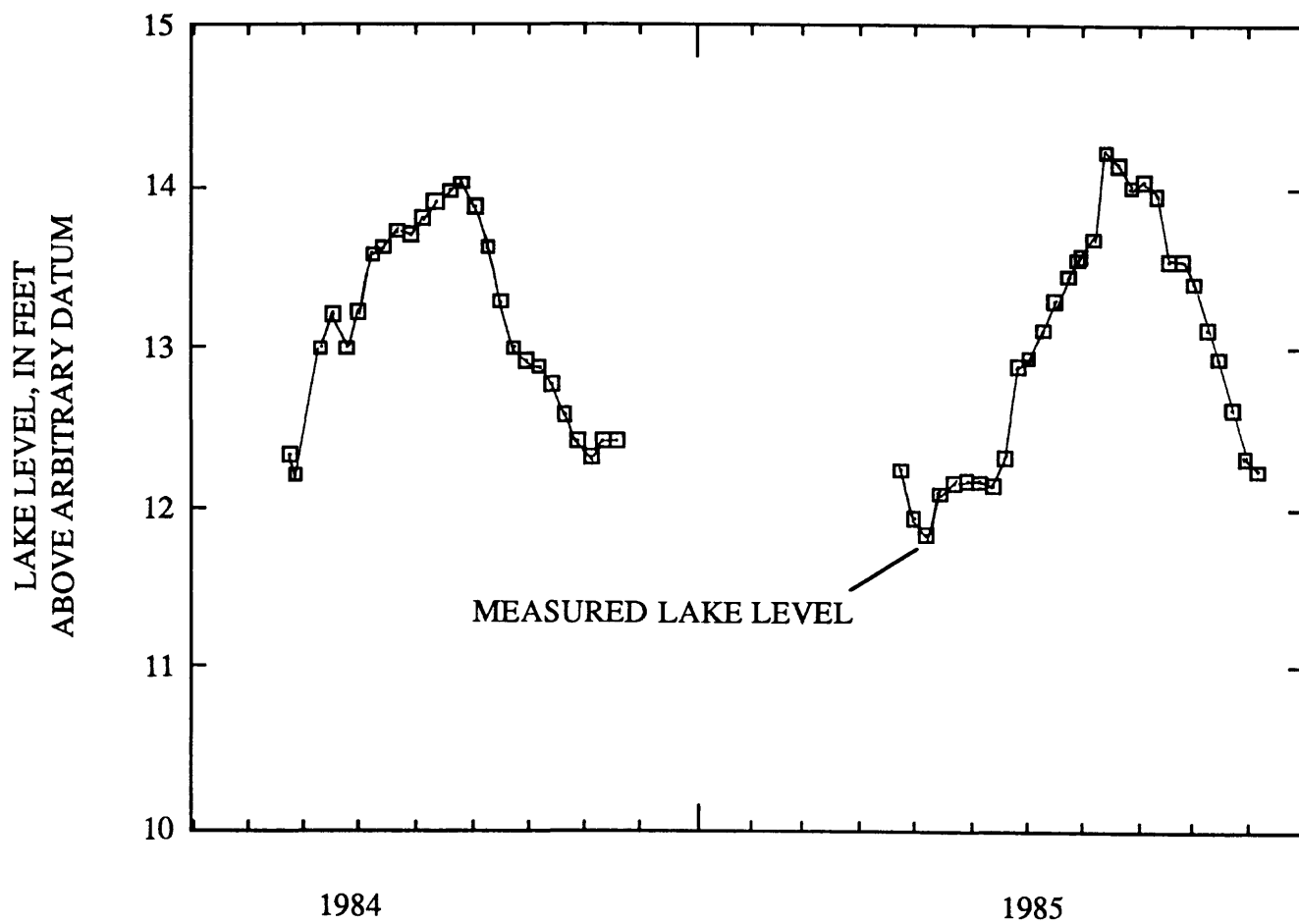
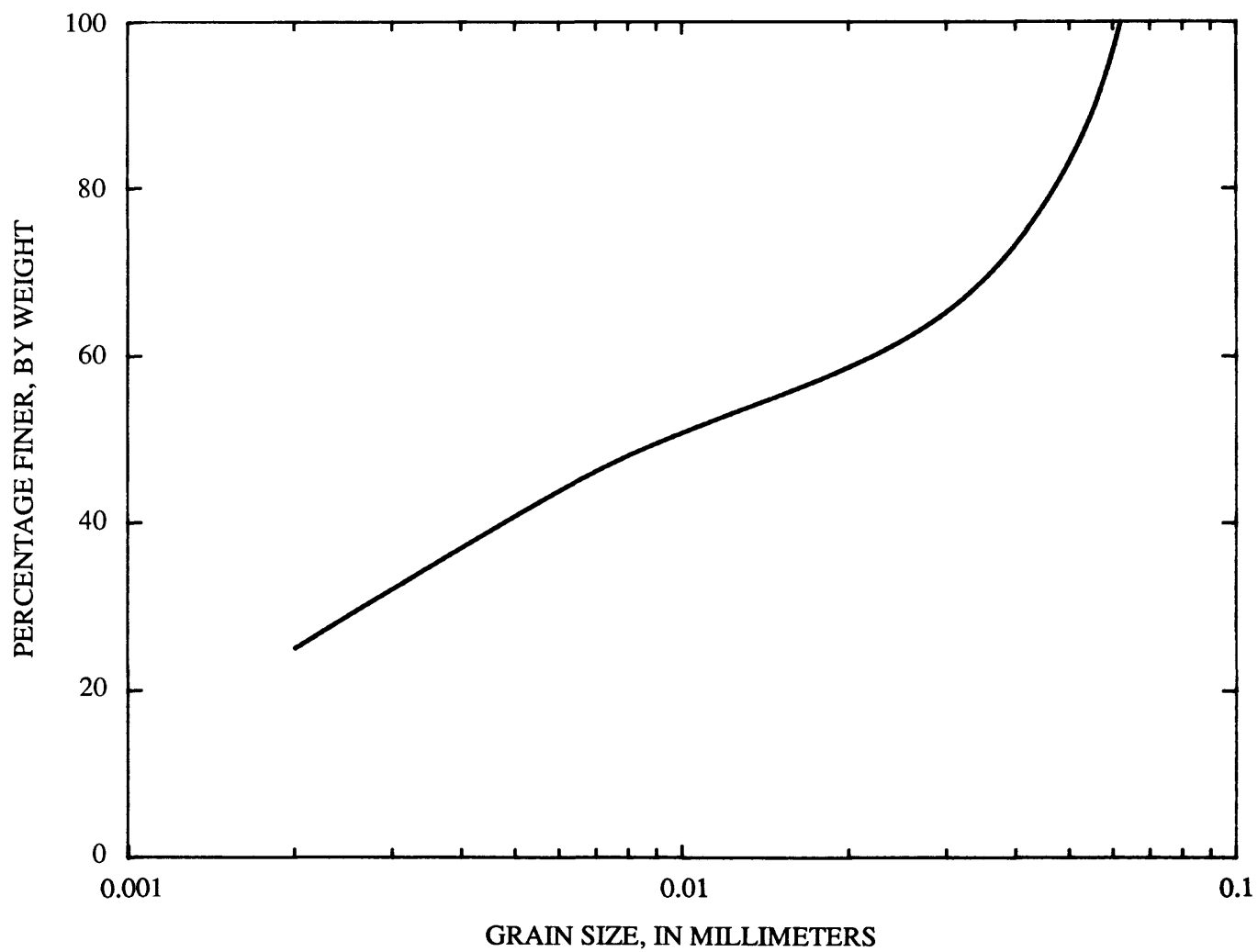


Figure 21. Lake-level fluctuations of Rice Lake, 1984-85.



**Figure 22.** Grain-size distribution of bottom sediment sampled from Rice Lake.

**Table 11.** Physical and chemical characteristics of water and sediment for Rice Lake

[DEG C, degrees Celsius; US/CM, microsiemens per centimeter at 25 degrees Celsius; MG/L, milligrams per liter; MG/KG, milligrams per kilogram; UG/L, micrograms per liter; BOT. MAT., bottom material; <, less than; --, no data available; five-digit number in column headings is the WATSTORE code for the parameter]

DATE	TIME	MEDIUM	TEMPER- ATURE, WATER (DEG C) (00010)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	OXYGEN, DIS- SOLVED (MG/L) (00300)	PH (STAND- ARD UNITS) (00400)	HARD- NESS, TOTAL (MG/L AS CACO3) (00900)	CALCIUM, DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)
08-20-84	1530	WATER	22.5	200	11.9	8.9	98	25	8.7
08-20-84	1530	SEDIMENT	--	--	--	--	--	--	--
09-05-85	1130	WATER	18.0	225	9.7	7.4	89	23	7.6
09-05-85	1130	SEDIMENT	--	--	--	--	--	--	--
08-27-86	0900	WATER	18.0	150	8.7	7.8	75	20	6.0
08-27-86	0900	SEDIMENT	--	--	--	--	--	--	--

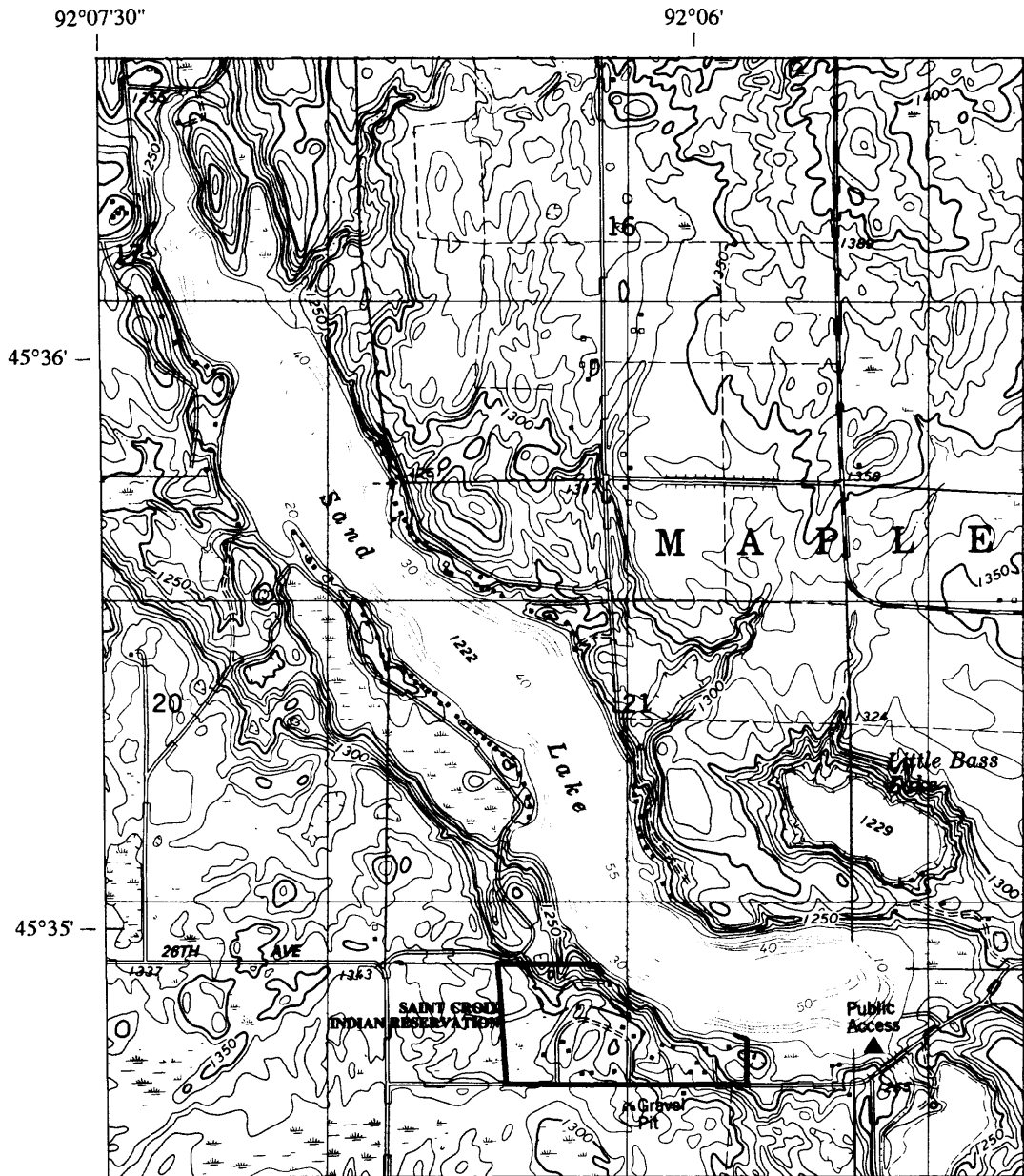
  

DATE	SODIUM, DIS- SOLVED (MG/L AS NA) (00930)	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)	SULFATE, DIS- SOLVED (MG/L AS SO4) (00945)	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	ALKA- LINITY, LAB (MG/L AS CACO3) (90410)	SILICA, DIS- SOLVED (MG/L AS SIO2) (00955)	NITRO- GEN, ORGANIC, TOTAL (MG/L AS N) (00605)	NITRO- GEN, AMMONIA, DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN, AMMONIA, TOTAL (MG/L AS N) (00610)	NITRO- GEN, NITRITE, TOTAL (MG/L AS N) (00615)
08-20-84	3.9	0.70	4.5	6.5	<0.10	90	14	1.0	<0.010	0.070	<0.010
08-20-84	--	--	--	--	--	--	--	--	--	--	--
09-05-85	3.4	.90	4.4	3.8	<10	86	16	--	.010	--	--
09-05-85	--	--	--	--	--	--	--	--	--	--	--
08-27-86	2.6	.70	2.2	6.2	<10	75	16	.58	.030	.020	<.010
08-27-86	--	--	--	--	--	--	--	--	--	--	--

DATE	NITRO- GEN, AM- MONIA + ORGANIC, TOTAL (MG/L AS N) (00625)	NITROGEN, NO2 + NO3, TOTAL (MG/L AS N) (00630)	NITROGEN, NO2 + NO3, DISSOLVED (MG/L AS N) (00631)	PHOS- PHORUS, TOTAL (MG/L AS P) (00665)	PHOS- PHORUS, DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS, ORTHO, DIS- SOLVED (MG/L AS P) (00671)	NITRO- GEN, NH4, TOTAL IN BOT. MAT. (MG/KG AS N) (00611)	NITRO- GEN, NH4 + ORG., TOTAL IN BOT. MAT. (MG/KG AS N) (00626)	NITROGEN, NO2 + NO3, TOTAL IN BOT. MAT. (MG/KG AS N) (00633)	PHOS- PHORUS, TOTAL IN BOT. MAT. (MG/KG AS P) (00668)	ARSENIC, TOTAL (UG/L AS AS) (01002)
08-20-84	1.1	<.100	<.100	.060	<.010	<.010	--	--	--	--	1
08-20-84	--	--	--	--	--	--	180	<20	<2.0	1,300	--
09-05-85	.60	--	.200	.080	.070	.010	--	--	--	--	--
09-05-85	--	--	--	--	--	--	8.0	1,200	57	17	--
08-27-86	.60	<.100	<.100	.030	.020	<.010	--	--	--	--	<1
08-27-86	--	--	--	--	--	--	220	18,000	52	1,500	--

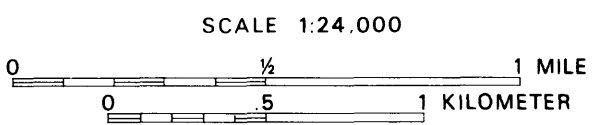




Base from U.S. Geological Survey  
Cumberland, 1983

**EXPLANATION**

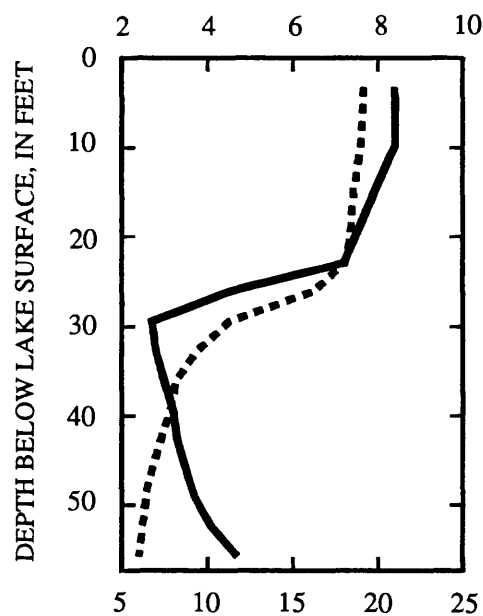
- ▲ Lake-stage gage
- Tribal land boundary



CONTOUR INTERVAL 10 FEET

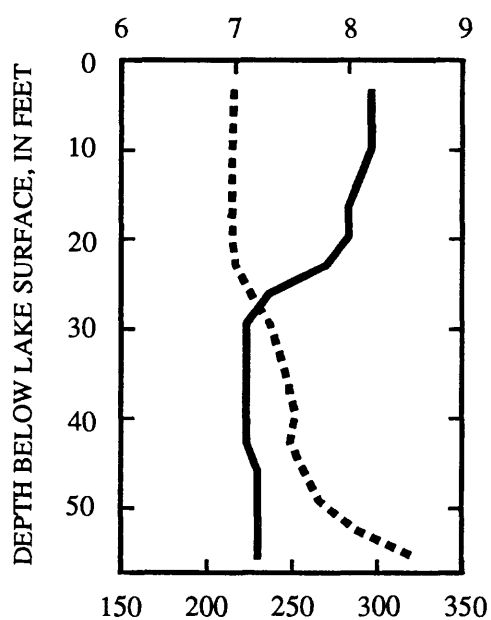
**Figure 23.** Location of Sand Lake and data-collection sites.

DISSOLVED-OXYGEN CONCENTRATION  
(SOLID LINE), IN MILLIGRAMS PER LITER



WATER TEMPERATURE (DASHED LINE),  
IN DEGREES CELSIUS

pH (SOLID LINE)



SPECIFIC CONDUCTANCE (DASHED LINE),  
IN MICROSIEMENS PER CENTIMETER AT  
25 DEGREES CELSIUS

**Figure 24.** Depth profiles of dissolved-oxygen concentration, temperature, pH, and specific conductance for Sand Lake, September 4, 1985.

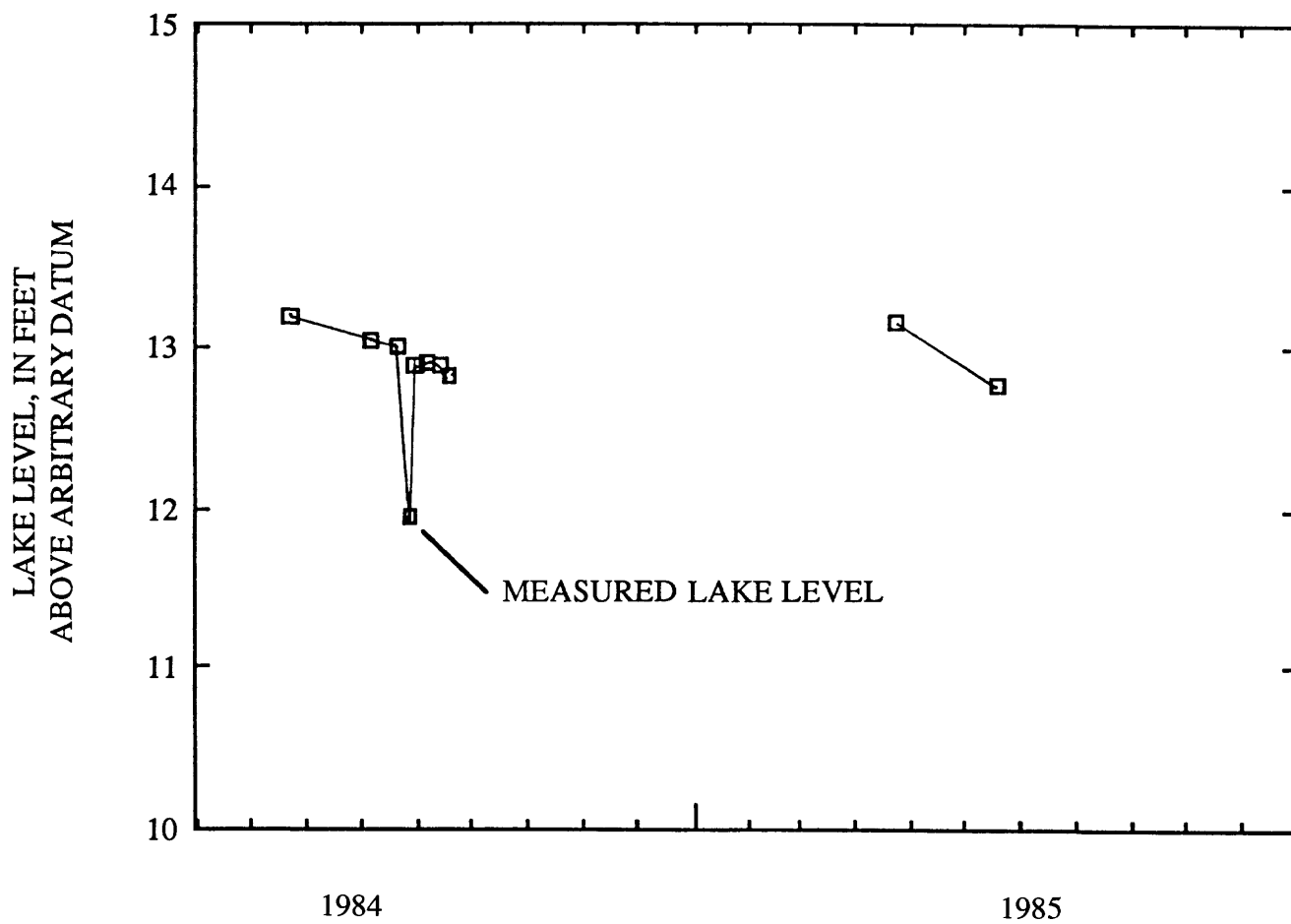


Figure 25. Lake-level fluctuations of Sand Lake, 1984-85.

**Table 12.** Physical and chemical characteristics of water from Sand Lake

[DEG C, degrees Celsius; US/CM, microsiemens per centimeter at 25 degrees Celsius; MG/L, milligrams per liter; UG/L, micrograms per liter; <, less than; --, no data available; five-digit number in column headings is the WATSTORE code for the parameter]

DATE	TIME	TEMPER- ATURE, WATER (DEG C) (00010)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	OXYGEN, DIS- SOLVED (MG/L) (00300)	PH (STAND- ARD UNITS) (00400)	HARD- NESS, TOTAL (MG/L AS CACO3) (00900)	CALCIUM, DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)	SODIUM, DIS- SOLVED (MG/L AS NA) (00930)
08-23-84	1230	22.5	160	9.8	9.1	77	20	6.6	2.4
09-04-85	1000	19.0	216	8.4	8.2	88	23	7.4	2.6

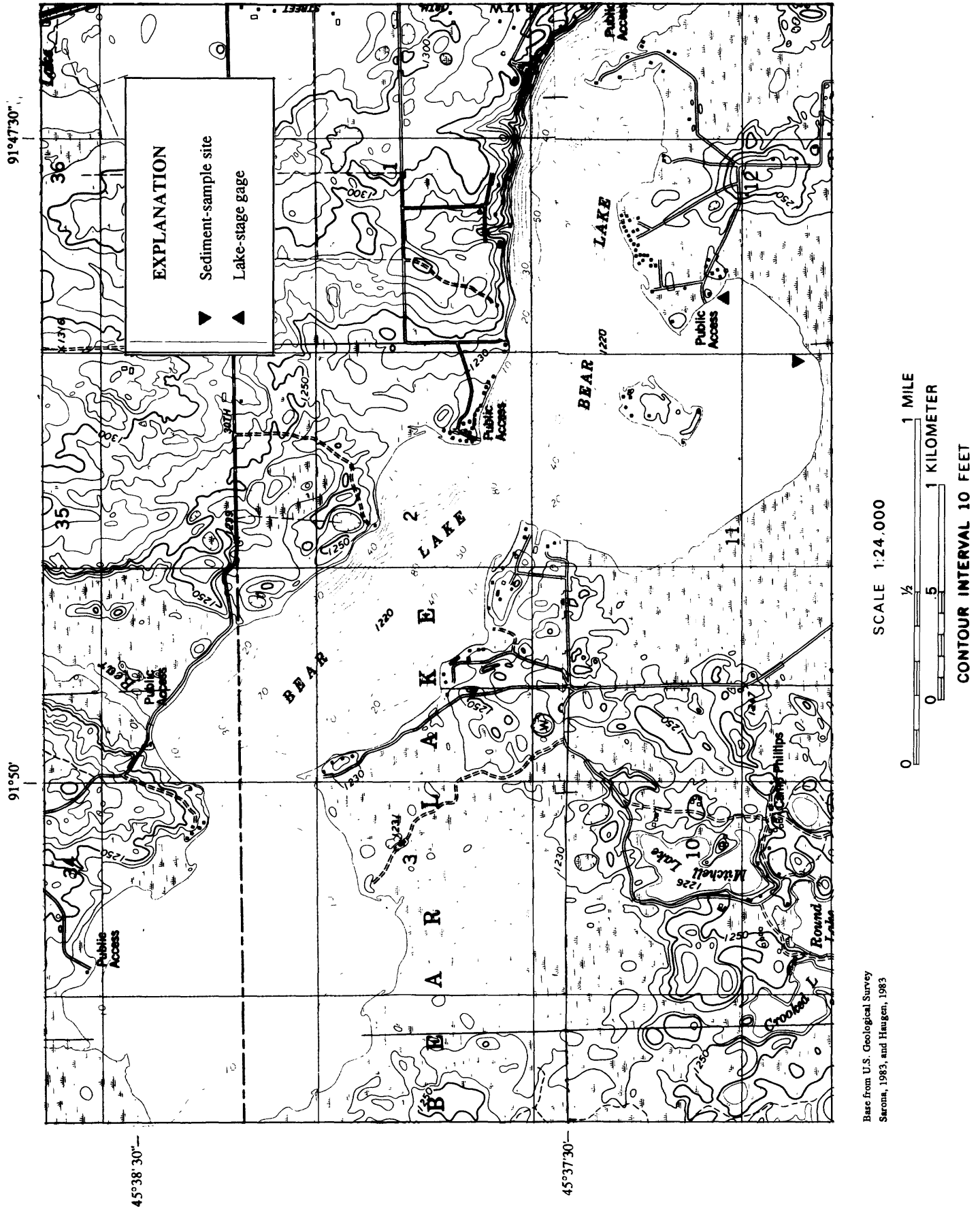
DATE	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)	SULFATE, DIS- SOLVED (MG/L AS SO4) (00945)	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	ALKA- LINTY, LAB (MG/L AS CACO3) (90410)	SILICA, DIS- SOLVED (MG/L AS SIO2) (00955)	NITRO- GEN, AMMONIA, DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN, AMMONIA, TOTAL (MG/L AS N) (00610)	NITRO- GEN, NITRITE, TOTAL (MG/L AS N) (00615)	NITRO- GEN, AM- MONIA + ORGANIC, TOTAL (MG/L AS N) (00625)	NITROGEN, NO2 + NO3, TOTAL (MG/L AS N) (00630)	NITROGEN, NO2 + NO3 DISSOLVED (MG/L AS N) (00631)
08-23-84	1.0	1.6	5.4	<0.10	79	9.6	<0.010	<0.010	<0.010	0.90	<0.100	<0.100
09-04-85	.90	1.6	3.5	<10	90	10	<0.010	--	--	.40	--	<100

DATE	PHOS- PHORUS, TOTAL (MG/L AS P) (00665)	PHOS- PHORUS, DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS, ORTHO, DIS- SOLVED (MG/L AS P) (00671)	ARSENIC, TOTAL (UG/L AS AS) (01002)	ALUM- INUM, TOTAL RECOV- ERABLE (UG/L AS AL) (01105)	BARIUM, TOTAL RECOV- ERABLE (UG/L AS BA) (01007)	BERYL- LIUM, TOTAL RECOV- ERABLE (UG/L AS BE) (01012)	CADMIUM, TOTAL RECOV- ERABLE (UG/L AS CD) (01027)	CHRO- MIUM, TOTAL RECOV- ERABLE (UG/L AS CR) (01034)	COBALT, TOTAL RECOV- ERABLE (UG/L AS CO) (01037)	COPPER, TOTAL RECOV- ERABLE (UG/L AS CU) (01042)	IRON, TOTAL RECOV- ERABLE (UG/L AS FE) (01045)
08-23-84	<0.010	<0.010	<0.010	<1	50	<100	<10	<1	4	<1	2	180
09-04-85	.040	.040	<0.010	--	--	--	--	--	--	--	--	90

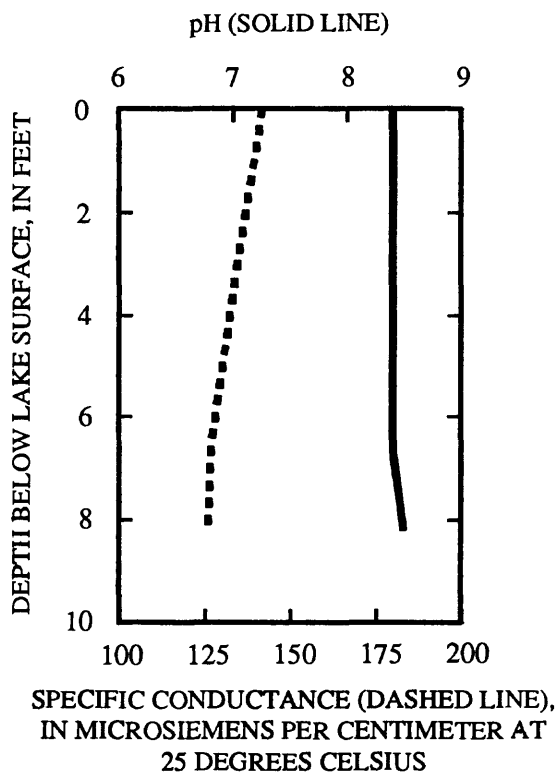
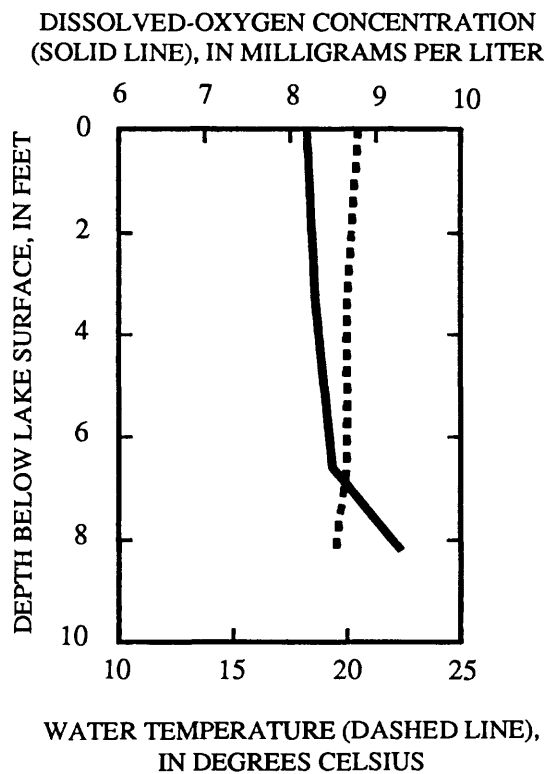
  

DATE	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, TOTAL RECOV- ERABLE (UG/L AS PB) (01051)	MANGA- NESE, TOTAL RECOV- ERABLE (UG/L AS MN) (01055)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MERCURY, TOTAL RECOV- ERABLE (UG/L AS HG) (71900)	MOLYB- DENUM, TOTAL RECOV- ERABLE (UG/L AS MO) (01062)	NICKEL, TOTAL RECOV- ERABLE (UG/L AS NI) (01067)	SELE- NIUM, TOTAL RECOV- ERABLE (UG/L AS SE) (01147)	SILVER, TOTAL RECOV- ERABLE (UG/L AS AG) (01077)	STRON- TIUM, DIS- SOLVED (UG/L AS SR) (01080)	ZINC, TOTAL RECOV- ERABLE (UG/L AS ZN) (01092)	SOLIDS, RESIDUE AT 180 DEG C DISSOLVED (MG/L) (70300)
08-23-84	6	2	30	<1	.10	3	4	<1	1	34	10	80
09-04-85	<3	--	--	<1	--	--	--	--	--	--	--	110

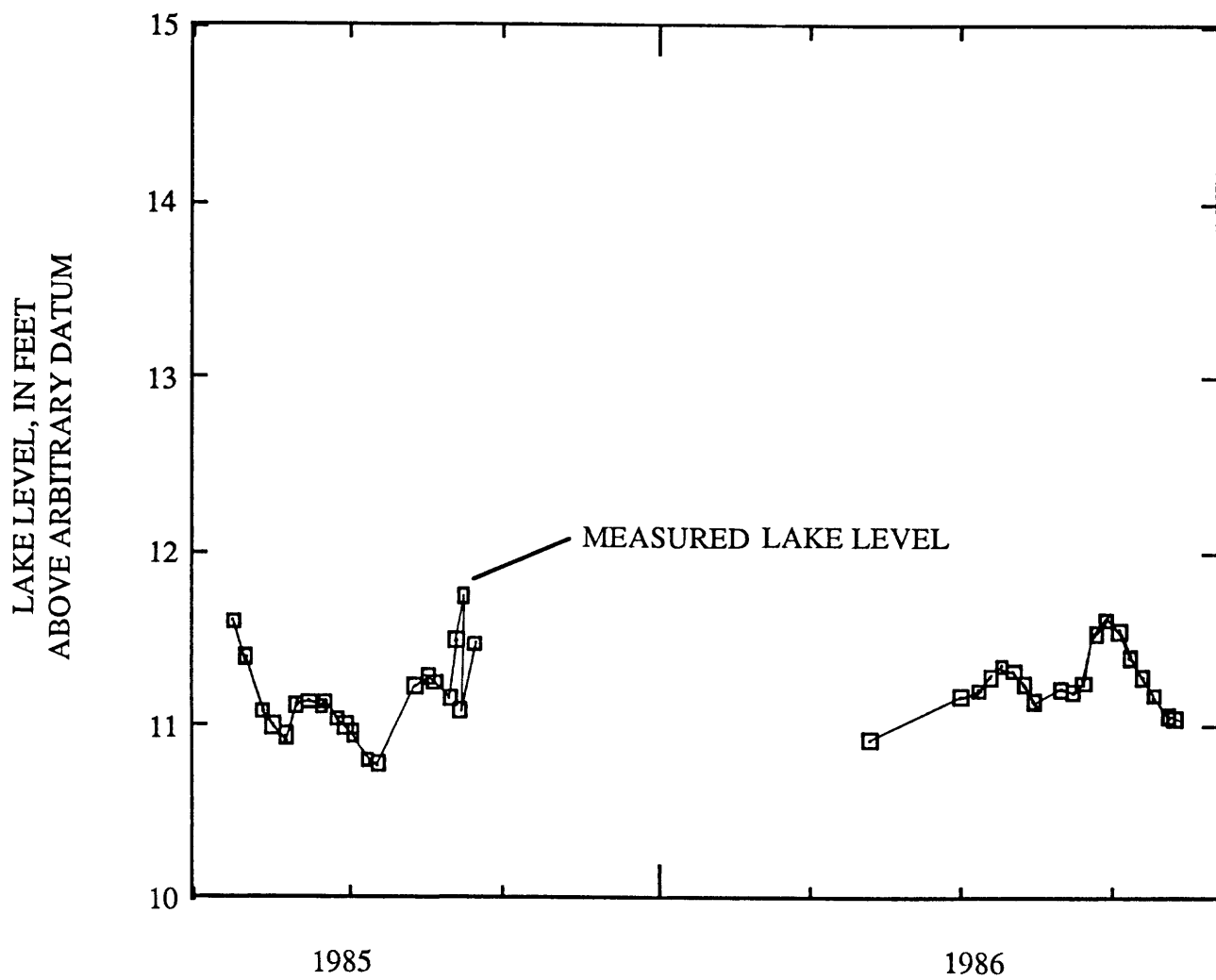


Base from U.S. Geological Survey  
Sarna, 1983, and Haugen, 1983

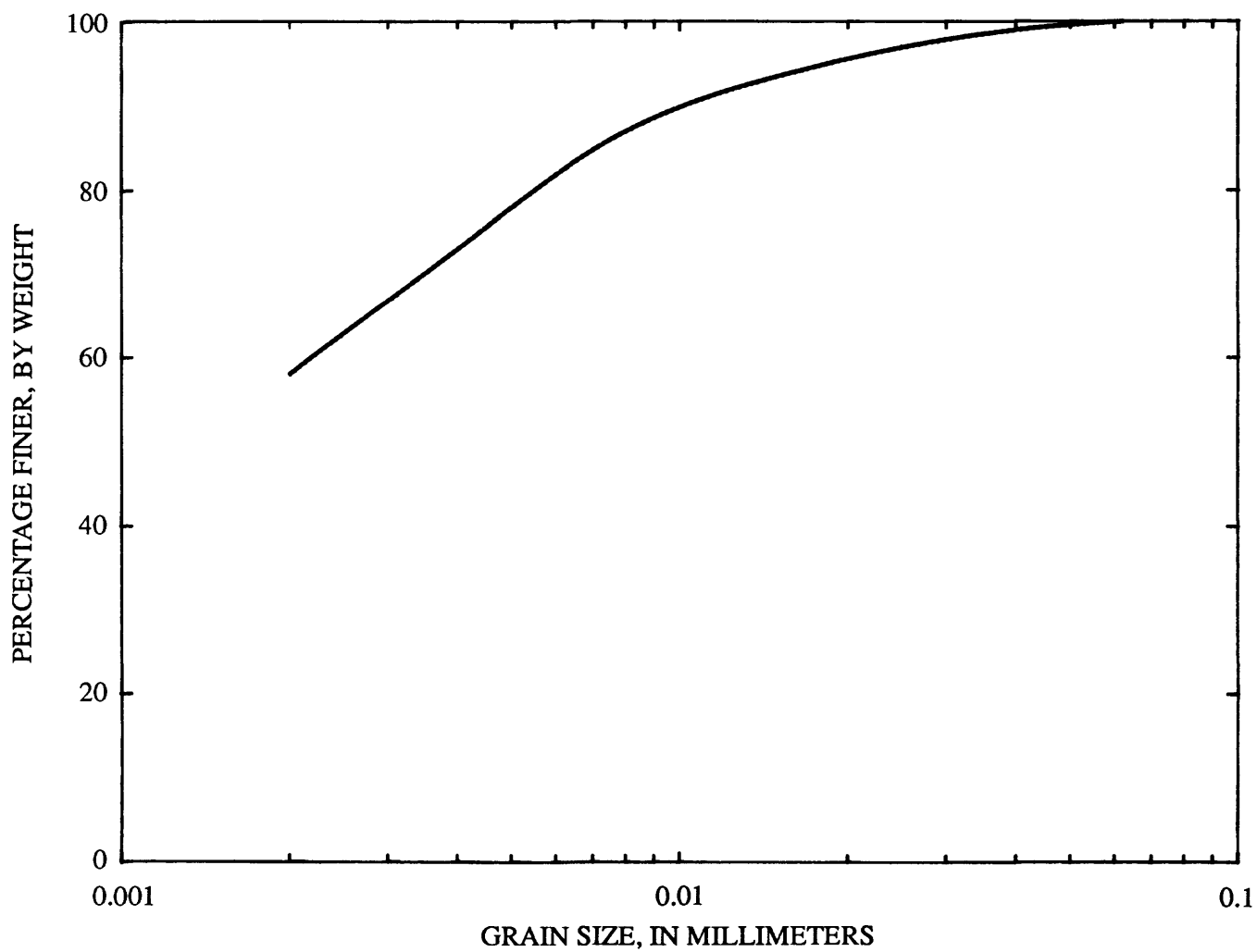
Figure 26. Location of Bear Lake and data-collection sites.



**Figure 27.** Depth profiles of dissolved-oxygen concentration, temperature, pH, and specific conductance for Bear Lake, August 8, 1986.



**Figure 28.** Lake-level fluctuations of Bear Lake, 1985-86.



**Figure 29.** Grain-size distribution of bottom sediment sampled from Bear Lake.

**Table 13.** Physical and chemical characteristics of water and sediment for Bear Lake

[DEG C, degrees Celsius; US/CM, microsiemens per centimeter at 25 degrees Celsius; MG/L, milligrams per liter; MG/KG, milligrams per kilogram; UG/L, micrograms per liter; BOT. MAT., bottom material; <, less than; --, no data available; five-digit number in column headings is the WATSTORE code for the parameter]

DATE	TIME	MEDIUM	TEMPER- ATURE, WATER (DEG C) (00010)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	OXYGEN, DIS- SOLVED (MG/L) (00300)	PH (STAND- ARD UNITS) (00400)	HARD- NESS, TOTAL (MG/L AS CACO3) (00900)	CALCIUM, DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)
09-03-85	1400	WATER	19.0	164	8.2	7.4	63	16	5.7
09-03-85	1400	SEDIMENT	--	--	--	--	--	--	--
08-28-86	1500	WATER	20.0	127	8.5	8.4	64	16	5.8
08-28-86	1500	SEDIMENT	--	--	--	--	--	--	--

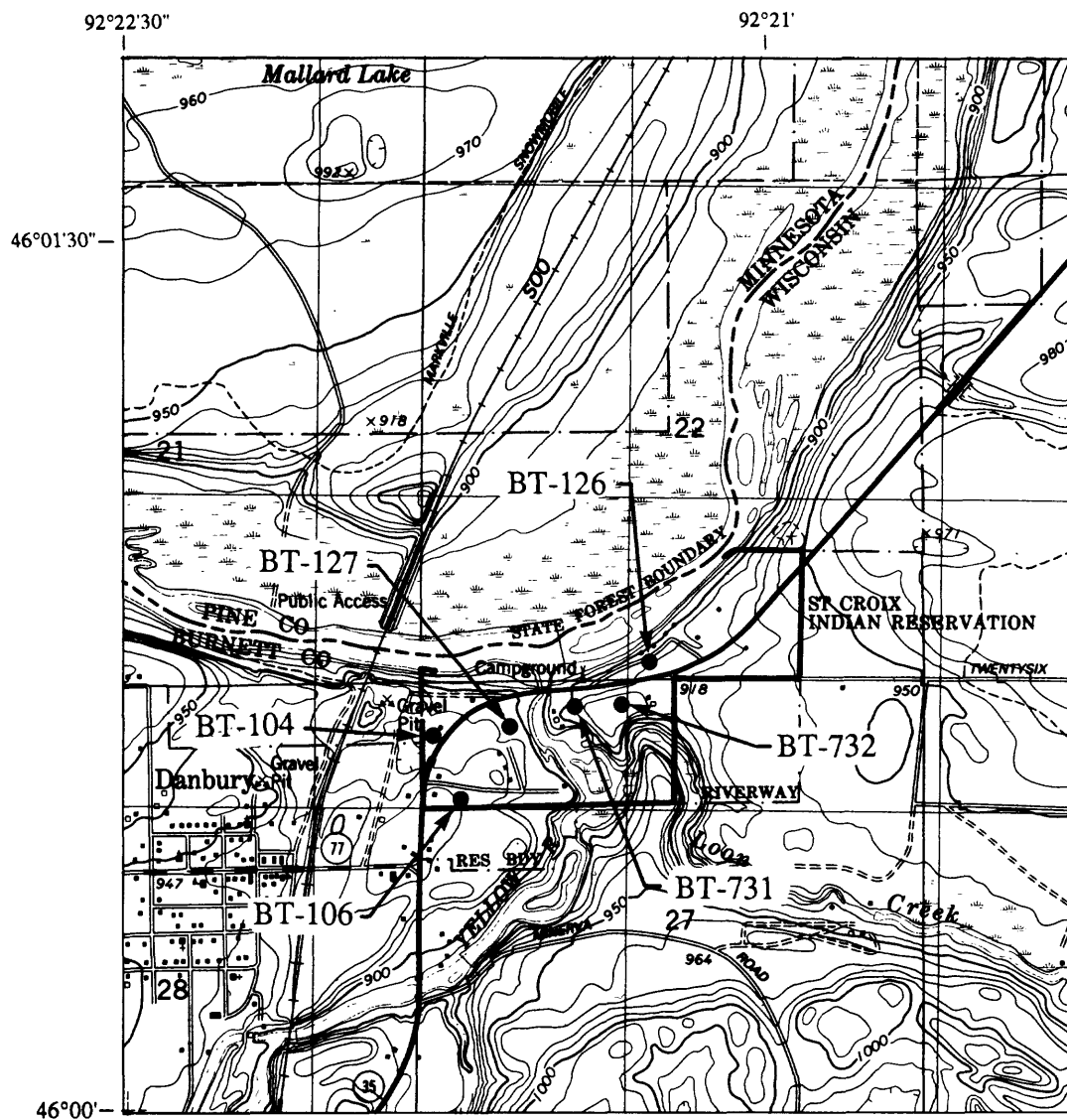
  

DATE	SODIUM, DIS- SOLVED (MG/L AS NA) (00930)	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)	SULFATE, DIS- SOLVED (MG/L AS SO4) (00945)	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	ALKA- LINITY, LAB (MG/L AS CACO3) (90410)	SILICA, DIS- SOLVED (MG/L AS SIO2) (00955)	NITRO- GEN, ORGANIC, TOTAL (MG/L AS N) (00605)	NITRO- GEN, AMMONIA, DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN, AMMONIA, TOTAL (MG/L AS N) (00610)	NITRO- GEN, NITRITE, TOTAL (MG/L AS N) (00615)
09-03-85	2.0	0.70	1.2	2.9	<0.10	66	5.1	--	0.030	--	--
09-03-85	--	--	--	--	--	--	--	--	--	--	--
08-28-86	2.1	.80	1.0	4.9	<.10	64	5.8	.58	.020	.020	<.010
08-28-86	--	--	--	--	--	--	--	--	--	--	--

DATE	NITRO- GEN, AM- MONIA + ORGANIC, TOTAL (MG/L AS N) (00625)	NITROGEN, NO2 + NO3, TOTAL (MG/L AS N) (00630)	NITROGEN, NO2 + NO3, DISSOLVED (MG/L AS N) (00631)	PHOS- PHORUS, TOTAL (MG/L AS P) (00665)	PHOS- PHORUS, DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS, ORTHO, DIS- SOLVED (MG/L AS P) (00671)	NITRO- GEN, NH4, TOTAL IN BOT. MAT. (MG/KG AS N) (00611)	NITRO- GEN, NH4 + ORG., TOTAL IN BOT. MAT. (MG/KG AS N) (00626)	NITROGEN, NO2 + NO3, TOTAL IN BOT. MAT. (MG/KG AS N) (00633)	PHOS- PHORUS, TOTAL IN BOT. MAT. (MG/KG AS P) (00668)	ARSENIC, TOTAL (UG/L AS AS) (01002)
09-03-85	.50	--	<.100	.050	.040	<.010	--	--	--	--	--
09-03-85	--	--	--	--	--	--	330	87,000	510	240	--
08-28-86	.60	<.100	<.100	.010	.010	<.010	--	--	--	--	<1
08-28-86	--	--	--	--	--	--	150	32,000	9.0	590	--



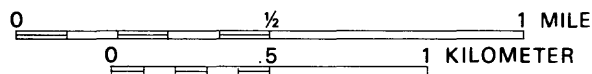


Base from U.S. Geological Survey  
Danbury East, 1983

#### EXPLANATION

- Sampled domestic well
- Tribal land boundary

SCALE 1:24,000



CONTOUR INTERVAL 10 FEET

Figure 30. Location of the Danbury Settlement.

**Table 14.** Physical and chemical characteristics of ground water from wells near the Danbury Settlement

[DEG C, degrees Celsius; US/CM, microsiemens per centimeter at 25 degrees Celsius; MG/L, milligrams per liter; UG/L, micrograms per liter; >, less than; --, no data available; five-digit number in column headings is the WATSTORE code for the parameter]

STATION NUMBER	DATE	LOCAL IDENTIFIER	TEMPERATURE, WATER (DEG C) (00010)	SPECIFIC CONDUCTANCE (US/CM) (00095)	PH (STANDARD UNITS) (00400)	HARDNESS, TOTAL (MG/L AS CaCO3) (00900)	CALCIUM, DIS-SOLVED (MG/L AS Ca) (00915)	MAGNESIUM, DIS-SOLVED (MG/L AS Mg) (00925)	SODIUM, DIS-SOLVED (MG/L AS Na) (00930)
460047092211701	08-07-85	BT-41/16W/22-0126	9.5	140	7.7	58	16	4.3	--
460040092214401	11-18-81	BT-41/16W/27-0104	9.0	320	7.0	150	37	14	15
460032092214101	08-08-85	BT-41/16W/27-0106	10.0	620	7.9	230	59	20	--
460029092212801	08-07-85	BT-41/16W/27-0127	9.0	250	7.6	110	30	8.3	--
460042092212502	08-07-86	BT-41/16W/27-0731	10.0	245	7.4	120	31	10	--
460043092211201	08-07-86	BT-41/16W/27-0732	10.0	110	7.4	56	16	4.0	--

DATE	POTASSIUM, DIS-SOLVED (MG/L AS K) (00935)	CHLORIDE, DIS-SOLVED (MG/L AS CL) (00940)	SULFATE, DIS-SOLVED (MG/L AS SO4) (00945)	FLUORIDE, DIS-SOLVED (MG/L AS F) (00950)	ALKALINITY, LAB (MG/L AS CaCO3) (90410)	SILICA, DIS-SOLVED (MG/L AS SiO2) (00955)	NITROGEN NO2 + NO3, DISSOLVED (MG/L AS N) (00631)	ARSENIC, TOTAL (UG/L AS AS) (01002)	BARIUM, TOTAL RECOVERABLE (UG/L AS BA) (01007)	CADMIUM, TOTAL RECOVERABLE (UG/L AS CD) (01027)	CHROMIUM, TOTAL RECOVERABLE (UG/L AS CR) (01034)	COPPER, TOTAL RECOVERABLE (UG/L AS CU) (01042)
08-07-85	--	2.3	6.7	0.10	--	--	0.540	<1	<100	1	10	30
11-18-81	1.0	30	13	<10	110	19	--	--	--	--	--	--
08-08-85	--	73	13	<10	--	--	4.20	<1	<100	1	<10	31
08-07-85	--	9.7	9.5	.20	--	--	.550	<1	<100	1	<10	260
08-07-86	--	9.9	10	<10	--	--	5.10	3	<100	<1	<10	8
08-07-86	--	.70	7.9	<10	--	--	.120	2	<100	<1	<10	13

DATE	IRON, SUSPENDED RECOVERABLE (UG/L AS FE) (01044)	IRON, TOTAL RECOVERABLE (UG/L AS FE) (01045)	IRON, DIS-SOLVED (UG/L AS FE) (01046)	LEAD, TOTAL RECOVERABLE (UG/L AS PB) (01051)	MANGANESE, TOTAL RECOVERABLE (UG/L AS MN) (01055)	MANGANESE, DIS-SOLVED (UG/L AS MN) (01056)	MERCURY, TOTAL RECOVERABLE (UG/L AS HG) (71900)	SELENIUM, TOTAL (UG/L AS SE) (01147)	ZINC, TOTAL RECOVERABLE (UG/L AS ZN) (01092)	SOLIDS, RESIDUE AT 180 DEG C DISSOLVED (MG/L) (70300)
08-07-85	--	120	--	14	<10	--	.10	<1	30	83
11-18-81	220	230	6	--	--	6	--	--	--	217
08-08-85	--	100	--	20	<10	--	.10	<1	60	335
08-07-85	--	670	--	19	<10	--	.10	<1	70	139
08-07-86	--	<10	--	<5	130	--	.20	<1	70	146
08-07-86	--	50	--	<5	10	--	.20	<1	30	72