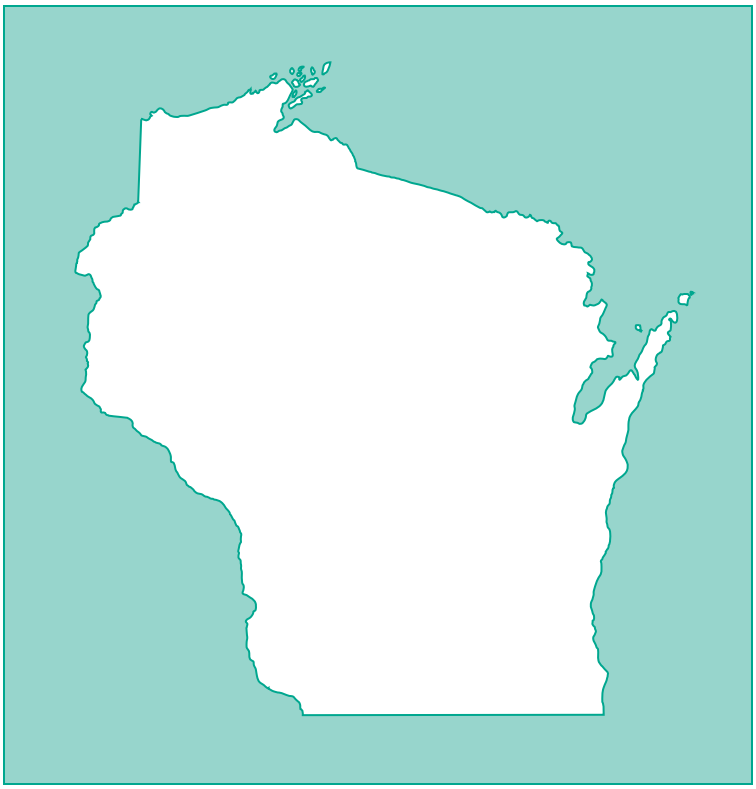
Water-Quality and Lake-Stage Data for Wisconsin Lakes, Water Year 2005



U.S. GEOLOGICAL SURVEY
Open-File Report 2006–1080

Prepared in cooperation with the
State of Wisconsin and local agencies

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Water-Quality and Lake-Stage Data for Wisconsin Lakes, Water Year 2005

A report by the Wisconsin District Lake-Studies Team–
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U.S. Department of the Interior
U.S. Geological Survey

Middleton, Wisconsin
2006

U.S. DEPARTMENT OF THE INTERIOR
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U.S. Geological Survey
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CONVERSION FACTORS, VERTICAL DATUM, AND ABBREVIATED WATER-QUALITY UNITS

Multiply	By	To Obtain
mile (mi)	1.609	kilometer
pound (lb)	453.6	gram
acre	0.4048	hectare
foot (ft)	0.3048	meter
meter (m)	3.281	foot
gallon (gal)	3.785	liter
square mile (mi^2)	2.590	square kilometer

Temperature, in degrees Celsius (°C) can be converted to degrees Fahrenheit (°F) by use of the following equation

$$°F = 1.8(°C) + 32$$

Sea level: In this report "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)–a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called Sea Level Datum of 1929.

Abbreviated water-quality units: Chemical concentrations and water temperature are given in metric units. Chemical concentration is given in milligrams per liter (mg/L) or micrograms per liter (mg/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 water with dissolved-solids concentrations less than 7,000 mg/L, the numerical values for concentrations expressed as mg/L and mg/L are the same as for concentrations in parts per million and parts per billion, respectively.

Specific conductance of water is expressed in microsiemens per centimeter at 25 degrees Celsius (mS/cm). This unit is equivalent to micromhos per centimeter (mmho/cm) at 25 degrees Celsius, formerly used by the U.S. Geological Survey.

WATER-QUALITY AND LAKE-STAGE DATA FOR WISCONSIN LAKES, WATER YEAR 2005

By Wisconsin Water Science Center
Lake-Studies Team

INTRODUCTION

The U.S. Geological Survey (USGS), in cooperation with local and other agencies, collects data at selected lakes throughout Wisconsin. These data, accumulated over many years, provide a data base for developing an improved understanding of the water quality of lakes. To make these data available to interested parties outside the USGS, the data are published annually in this report series. The locations of water-quality and lake-stage stations in Wisconsin for water year 2005 are shown in figure 1. A water year is the 12-month period from October 1 through September 30. It is designated by the calendar year in which it ends. Thus, the period October 1, 2004 through September 30, 2005 is called “water year 2005.”

The purpose of this report is to provide information about the chemical and physical characteristics of Wisconsin lakes. Data that have been collected at specific lakes, and information to aid in the interpretation of those data, are included in this report. Data collected include measurements of in-lake water quality and lake stage. Time series of Secchi depths, surface total phosphorus and chlorophyll *a* concentrations collected during non-frozen periods are included for all lakes. Graphs of vertical profiles of temperature, dissolved oxygen, pH, and specific conductance are included for sites where these parameters were measured. Descriptive information for each lake includes: location of the lake, area of the lake’s watershed, period for which data are available, revisions to previously published records, and pertinent remarks. Additional data, such as streamflow and water quality in tributary and outlet streams of some of the lakes, are published in another volume: “Water Resources Data-Wisconsin, 2005."

Water-resources data, including stage and discharge data at most streamflow-gaging stations, are available through the World Wide Web on the Internet. The Wisconsin Water Science Center’s home page is at http://wi.water.usgs.gov/. Information on the Wisconsin Water Science Center’s Lakes Program is found at wi.water.usgs.gov/lake/index.html and wi.water.usgs.gov/projects/index.html.

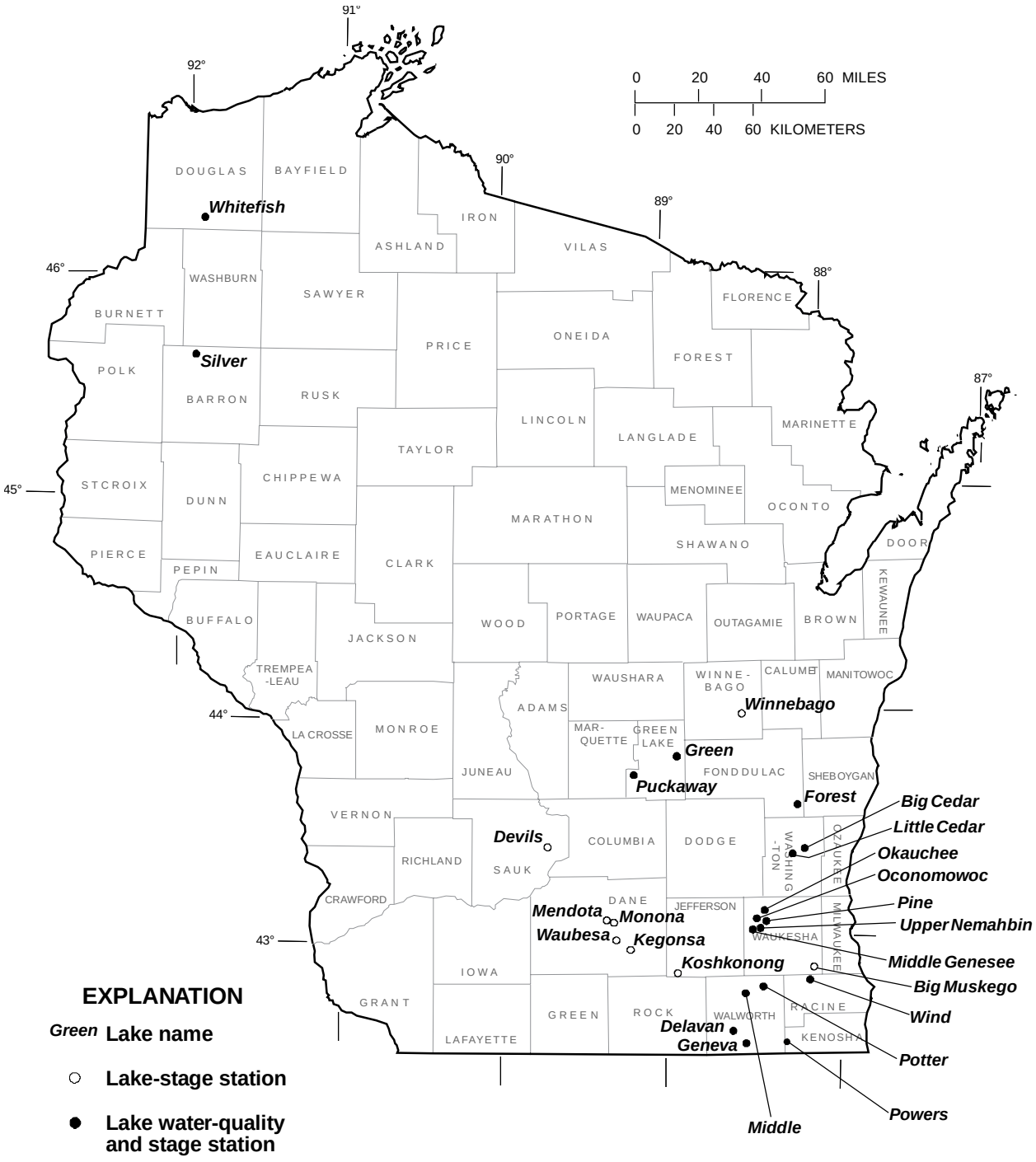

Figure 1. Location of lake water-quality and lake-stage stations in Wisconsin.

The USGS has done cooperative lake monitoring with local and other agencies since 1983. Cooperators in 2005 included:

Barron County Soil and Water Conservation Department
Big Cedar Lake Protection and Rehabilitation District
City of Chenequa
City of Delafield
City of Muskego
Dane County
Delavan Lake Sanitary District
Geneva Lake Environmental Agency
Green Lake Sanitary District
Lake Puckaway Protection and Rehabilitation District
Lauderdale Lakes Lake District
Little Cedar Lake Protection and Rehabilitation District
Middle Genesee Lake District
Okauchee Lake Management District
Potters Lake Protection and Rehabilitation District
Powers Lake District
Rock County Public Works Department
Town of Auburn (Forest Lake Association)
Town of Rice Lake (Desair Lake Restoration, Inc.)
Town of Wascott (Whitefish Lake Conservation Organization)
U.S. Army Corps of Engineers
Village of Oconomowoc Lake
Wind Lake Management District
Wisconsin Department of Natural Resources

Lake data-collection sites are identified by a unique identification number. Lake water-quality sites are identified by a 15-digit number that is a concatenation of the site's latitude, longitude, and a two-digit sequence number. The sequence number is used to distinguish between sites located at the same latitude-longitude designation. The site identification number is permanently assigned to the site; actual latitude and longitude of the site are subject to update and are stored separately. For some lakes, which have historical records of lake stage, an eight-to-ten digit number is assigned according to downstream order. Gaps are left in the numerical series to allow for new stations; hence, the numbers are not consecutive. The first two digits of the complete eight-to-ten digit number, such as 04087000 or 054310157, designate the major river basin. For example, "04" designates the St. Lawrence River Basin and "05" designates the Upper Mississippi River Basin.

The water-quality lake stations that were discontinued prior to water year 2005 are listed in table 1. Discontinued lake-stage stations are not included in this table.

This report is the culmination of a concerted effort by a number of people who collected, compiled, analyzed, verified, and organized the data, and who typed, edited, and assembled the report. The authors had primary responsibility for assuring that the information contained herein is accurate, complete, and adheres to USGS policy and established guidelines. Technicians in charge of the field offices are: T.J. Popowski (Rice Lake and Merrill), and S.A. March (Middleton). The data were collected and processed by C.J. Bloom, G.L. Goddard, D.E. Housner, S.B. Marsh, B.W. Olson, D.L. Olson, J.G. Schuler, and B. J. Siebers. S.B. Marsh assembled, edited, and formatted the report. Additional assistance in preparation of the report was provided by C.J. Bloom, M.M. Greenwood, and D.L. Olson.

METHODS OF DATA COLLECTION

Depth profiles of water temperature, dissolved oxygen, pH, and specific conductance were collected using multi-parameter meters. Prior to measurements, the meters were calibrated using standards for pH and conductance, and dissolved oxygen was calibrated using the air calibration method. Generally, field measurements in profiles were made at 0.5-m intervals if the maximum depth of the lake was 5 m or less and at 1.0-m intervals if the maximum depth was greater than 5 m.

Table 1. Discontinued lake stations

Station name	Site identification number	Period of record
Alma Lake near St. Germain	455426089254700	Oct. 1984–Sept. 1990, May 1992–Sept.1996
Balsam Lake, off Cedar Island, at Balsam Lake	452755092264600	Feb. 1991–Aug. 1994
off Little Narrows, near Balsam Lake	452858092265300	May 1991–Aug. 1994
off Rock Island, near Balsam Lake	452754092234300	May 1991–Aug. 1994
Balsam Lake near Birchwood	453907091345800	Mar. 1993–Aug. 1994, Mar. 1996–Aug. 1997, Mar.–Sept. 2001
Bass Lake near Shawano	445215088300300	Feb. 1990–Aug. 1992
Bear Lake at Deep Hole near Haugen	453754091490900	Mar. 1992–Aug. 1993
Beaver Dam Lake, South end, at Beaver Dam	432814088515000	June–Oct. 1991
North end, near Beaver Dam	433122088545700	June–Oct. 1991
Benedict Lake near Powers Lake	423201088180800	May 1998–Aug. 2000
Big Blacksmith Lake near Keshena	445401088334500	Feb. 1990–Aug. 1992
Big Hills (Hills) Lake near Wild Rose	440912089092000	June 1983–Aug. 1984, Feb.–Aug. 1987, Feb.–Aug. 1990, Feb.–Aug. 1993, Feb.–Aug. 1996, Feb.–Aug. 1999
Big Muskego Lake, at North Site, near Muskego	425301088061300	Feb.–Aug. 1988
Research Base, near Muskego	425235088075300	May–June 1994
Big Round Lake near Milltown	453142092180100	Feb.–Sept. 2001
Big St. Germain Lake, near St. Germain	455557089311000	Feb. 1992–Aug. 1996
near Lake Tomahawk	05390750	1991–2001
Big Sand Lake, Deep Hole, near Hertel	454910092134000	Feb.–Sept. 2001
East Site, near Hertel	454921092124300	Feb.–Sept. 2001
Big Sissabagama Lake, near Stone Lake	454724091303600	Apr. 1986–Sept. 1996, Oct. 1997–Sept. 2002
North Site, near Stone Lake	454800091312900	Mar. 1998–Sept. 2001
Booth Lake near East Troy	424800088254800	Feb. 1992–Aug. 1994, Feb. 2001–Aug. 2003
Buffalo Lake, Center Site, at Packwaukee	434558089260600	May 1998–Sept. 2001
East End, at Montello	434720089201600	May 1998–Sept. 2001
West End, near Endeavor	434414089282400	May 1998–Sept. 2001

Table 1. Discontinued lake stations--continued

Station name	Site identification number	Period of record
Butternut Lake, near Park Falls	455854090310300	Oct. 2002–Oct. 2004
Deep Hole, near Park Falls	455803090310800	Mar. 2003–Sept. 2004
North Site, near Butternut	455904090303400	Mar. 2003–Sept. 2004
Far South Site, near Park Falls	455651090312700	Mar. 2003–Sept. 2004
Denoon Lake at Wind Lake	425044088100300	Feb. 1991–Aug. 1996
Druid Lake near Hartford	431643088243300	Feb. 1991–Sept. 1996
Eagle Lake near Kansasville	05544500	1936–64, 1975–77, 1979, Feb. 1993–Sept. 1996
Eagle Lake, at Deep Hole, near Kansasville	424207088072400	Feb. 1993–Aug. 1996
Eagle Spring Lake at Eagleville	425103088261500	Apr. 1991–Sept. 2001
Elizabeth Lake near Twin Lakes	423051088155300	Feb. 1995–Sept. 1997
Fish Lake near Sauk City	05406050	Nov. 1966–Sept. 1981, Apr. 1985–May 1987, May 1988, Apr. 1989–Oct. 1990, Oct. 1990–Nov. 1996, Nov. 1996–Sept. 2004
Fowler Lake, Center, at Oconomowoc	430653088294601	Jan.–Dec. 1984, Oct. 1986–Sept. 1996
Fox Lake Deep Hole at Fox Lake	433458088560600	June 1991–Mar. 1993
Geneva Lake, Geneva Bay, at Lake Geneva	423455088263800	Apr. 1997–Feb. 1999
Williams Bay, at Williams Bay	423420088320500	Apr. 1997–Feb. 1999
Center, near Lake Geneva	423402088301400	Apr. 1997–Mar. 1999
East End, near Lake Geneva	423421088272300	Apr. 1997–May 2000
Hemlock Lake near Mikana	453421091333700	Mar. 1993–Aug. 1994, Mar. 1996–Aug. 1997, Mar.–Sept. 2001
Hooker Lake at Salem	423335088060300	Feb. 1992–Aug. 1993
Kawaguesaga, Deep Hole, near Minocqua	455208089435800	May–Sept. 2003
South Site, near Minocqua	455145089442600	May–Sept. 2003
Kirby Lake near Cumberland	453554092042101	Nov. 1995–Oct. 1996
(Site 1) near Cumberland	453608092035801	Nov. 1995–Nov. 1996
(Site 2) near Cumberland	453601092035301	Nov. 1995–Nov. 1996

Table 1. Discontinued lake stations--continued

Station name	Site identification number	Period of record
(Site 3) near Cumberland	453612092034901	Nov. 1995–Nov. 1996
(Site 4) near Cumberland	453603092035701	Nov. 1995–Nov. 1996
(Site 5) near Cumberland	453608092041201	Nov. 1995–Nov. 1996
(Site 6) near Cumberland	453555092040901	Nov. 1995–Nov. 1996
Lac La Belle at Oconomowoc	430733088305900	Feb. 1984–Aug. 1985, Apr. –Aug. 1991, Feb. 2001–Aug. 2003
NW, at Oconomowoc	430809088313900	Feb. 1984–Aug. 1985
SE, at Oconomowoc	430707088301400	Feb. 1984–Aug. 1985
Lake Blass at Lake Delton	433545089482400	Mar. 1989–Aug. 1990
Lake Desair near Rice Lake	453446091465100	Aug. 2004
Lake Keesus, East Bay, near Merton	430957088183400	Apr. 1991–Aug. 1995
North Bay, near Merton	431006088191000	Apr. 1991–Aug. 1995
Lake Morris at Mount Morris	440654089120500	Jun. 1983–Sept. 1989
Lake Nebagamon, Northeast Bay, at Lake Nebagamon	463050091412300	May 1992–Aug. 1995
Southeast Bay, at Lake Nebagamon	462928091413500	Mar. 1992–Sept. 1995
West Bay, at Lake Nebagamon	463034091425300	May 1992–Aug. 1995
Lake Noquebay near Crivitz	451511087550900	Feb. 1987–Aug. 1988, Apr. 1991–Aug. 1994
East End, near Crivitz	451540087525700	Apr. 1991–Aug. 1994
Lamotte Lake near Shawano	445305088361200	Feb. 1990–Aug. 1992
Lauderdale Lakes at Lauderdale	424554088332700	Oct. 1993–Oct. 1994
Green, Auxiliary, Number 1, near Lauderdale	424640088341900	June 1999–Sept. 2000
Green, near Lauderdale	424652088341500	Nov. 1993–Nov. 1994, Aug. 2002
Mill, at Lauderdale	424555088335700	Nov. 1993–Nov. 1994, Aug. 2002
Legend Lake (site 1) near Shawano	445342088312700	Feb. 1990–Feb. 1992
Little Arbor Vitae near Woodruff	455446089370300	Feb. 1991–Sept. 2002
Little Green Lake, at Center, near Markesan	434412088590700	Feb. 1991–Aug. 2003
Little Muskego Lake at Muskego	425425088083500	Oct. 1986–Aug. 2002
Little Rock Lake near Woodruff	455946089415702	Oct. 1983–Sept. 1996
Little St. Germain Lake, near Eagle River	05390700	(a)
Upper East Bay, at St. Germain	455532089253900	Dec. 1996–Mar. 97, Mar. 1999, Mar. 2000–Aug. 2003

Table 1. Discontinued lake stations--continued

Station name	Site identification number	Period of record
Northeast Bay, near St. Germain	455545089262500	Apr. 1991–Aug. 1994, Aug. 1996–Aug. 1997, Mar. 1999–Aug. 2003
South Bay, near St. Germain	455437089270800	Apr. 1991–Aug. 1994, Aug. 1996–Aug. 1997, Mar. 1999–Aug. 2003
West Bay, at St. Germain	455428089282400	Apr. 1991–Aug. 1994, Aug. 1996–Aug. 1997, Mar. 1999–Aug. 2003
Little Sand Lake - Site No. 2 - near Mole Lake	452826088544101	May1996–Sept. 2003
Long (Kee Nong Go-Mong) Lake at Wind Lake	424937088103400	Feb. 1988–Aug. 1989, Feb. 1991–Aug. 1996
Loon Lake near Shawano	445009088303700	Feb. 1991–Aug. 1993
Lost Lake near Beaver Dam	432640088580500	June–Oct. 1991
McKenzie Lakes		
McKenzie (Big McKenzie)		
Deep Hole, near Spooner	455507092013500	Feb. 1987–Aug. 1998
Northern Site, near Spooner	455540092022000	June 1997–Aug. 1998
South Site, near Spooner	455437092022300	June 1997–Aug. 1998
Lower McKenzie, near Webb Lake	455902092011900	June 1997–Aug. 1998
Middle McKenzie, near Spooner	455635092021800	June 1997–Aug. 1998
Mary (Marie) Lake at Twin Lakes	423128088151200	Feb. 1995–Aug. 1997
Max Lake near Woodruff	460128089423501	Mar. 1988–Dec. 1996
Mead Lake, East Bay near Willard	444720090445000	Apr. 1991–Aug. 1995
West Bay near Willard	444733090460100	Feb. 1991–Sept. 1995
Minocqua Lake		
Deep Hole, at Minocqua	455214089412800	May–Sept. 2003
North Bay, at Minocqua	455232089424100	May–Sept. 2003
South Bay, at Minocqua	455206089425200	May–Sept. 2003
Montello Lake at Montello	434748089195800	Feb. 1995–Aug. 1998
Moon Lake near St. Germain	455504089260500	Feb. 1992–Aug. 1996
Morgan Lake near Fence	454622088324801	Oct. 1987–Sept. 1998.
Moshawquit Lake near Shawano	445352088295800	Feb. 1990–Aug. 1992
Muskego (Big Muskego)		
Auxiliary Number 1, near Muskego	425329088054000	June 1996–Aug. 2000
Bass Bay, near Muskego	425344008807010	Feb. 1988–Aug. 2002

Table 1. Discontinued lake stations--continued

Station name	Site identification number	Period of record
near Wind Lake	425109088075000	Oct. 1987–Sept. 1989, Jan. 1991–Sept. 2002
South Site, near Muskego	425212088072800	Feb. 1988–Aug. 2002
Muskellunge Lake near Eagle River	455700089224900	June 2000–Aug. 2001
Muskellunge Lake, near Lake Outlet near Eagle River	455706089232400	Nov. 2000–Oct. 2001
Nagawicka Lake, at Deep Hole, at Delafield	430417088230300	Feb. 2003–Sept. 2004
Namekagon Lakes		
Garden, near Cable	461224091033200	Mar. 1998–Aug. 1999
Jackson, near Cable	461457091065900	Mar. 1998–Aug. 1999
Namekagon		
Deep Hole, near Cable	461308091065100	Mar. 1998–Aug. 1999
East Basin, near Cable	461228091044300	Mar. 1998–Aug. 1999
Northeast Basin, near Cable	461410091050700	Mar. 1998–Aug. 1999
Park Lake (site 1) at Pardeeville	433239089175800	Feb. 1986–Aug. 1987, May–Nov. 1993
(site 2) at Pardeeville	433226089175500	May–Nov. 1993
(site 3) at Pardeeville	433245089173000	May–Nov. 1993
(site 4) at Pardeeville	433257089165100	May–Nov. 1993
Pike Lake near Hartford	431916088200501	Dec. 1998–Dec. 2000
Pike Lake-QW Site-near Hartford	431835088200600	Feb.–Aug. 2000
Pretty Lake, at Deep Hole, near Dousman	425722088295000	Feb. 1993–Aug. 1997
Red Cedar Lake, at Mikana	453522091360600	Mar. 1993–Aug. 1994, Mar. 1996–Aug. 1997, Oct. 2000–Sept. 2001
Deep Hole, near Mikana	453725091345100	Mar. 1993–Aug. 1994, Mar. 1996–Aug. 1997, Mar. –Sept. 2001
South End, at Mikana	453519091352500	Mar. 1993–Aug. 1994, Mar. 1996–Aug. 1997, Mar. –Sept. 2001
Rice Lake at Deep Hole near Whitewater	424629088415700	Apr.–Nov. 1991
Round Lake near Shawano	445328088335000	Feb. 1990–Aug. 1992
Sand Lake (Deep Hole) near Keshena	445321088323101	June–Aug. 1992
Shell Lake at Shell Lake	05334000	Aug. 1936–Sept. 1999
Silver Lake near Oconomowoc	430436088293300	Apr. 1992–Aug. 1996
Silver Lake near West Bend	432322088125000	Feb. 1996–Aug. 1997
Sinissippi Lake, off Anthony Is., at Hustisford	432113088361100	Feb. 1991–Aug. 1993

Table 1. Discontinued lake stations--continued

Station name	Site identification number	Period of record
off Butternut Is., near Hustisford	432240088363900	Apr. 1991–Aug. 1993
off Sam Point, near Hustisford	432300088374200	Apr. 1991–Aug. 1993
Spirit Lake near Keshena	445400088320100	Apr.–Aug. 1992
Spooner Lake, Deep Hole, near Spooner	455034091493300	June 2002–Aug. 2004
Southeast Site, near Spooner	454945091483900	June 2002–Aug. 2004
Stewart Lake at Mt. Horeb	430117089442701	May 1992–Sept. 1993
Tichigan Lake near Waterford	424854088123300	Mar. 1994–Aug. 1996, Apr. 2003–Aug. 2004
Tombeau Lake near Powers Lake	423153088184800	May 1998–Aug. 2000
Twin Lake, East Twin, near Westfield	435430089350700	June 2002–Aug. 2004
West Twin, near Westfield	435438089352300	June 2002–Aug. 2004

In most lakes, water samples were collected at two depths - near the surface and near the bottom. Chemical analyses of water samples were performed using standard analytical methods by either the USGS National Water Quality Laboratory (Wershaw and others, 1987; Fishman and Friedman, 1989; Fishman, 1993) or the Wisconsin State Laboratory of Hygiene (Wisconsin State Laboratory of Hygiene, 1993). Analyses for dissolved constituents were performed on samples that were filtered in the field through a 0.45-mm (micrometer) pore-size filter. Total or total recoverable constituents were determined by analyzing unfiltered water samples. Preservation and shipment of samples followed standard protocols established by the laboratories. Water-quality data were archived in the Water Quality Data Base (QWDATA) of the National Water Information System (NWIS). Additional descriptive information about water-quality data is available in the data report: "Water Resources Data – Wisconsin, 2005". NWIS parameter codes and minimum laboratory reporting levels for chemical constituents are given in table 2.

Records of lake stage are considered complete when one or more manual or automatic measurements were obtained per day. Partial records of lake stage result when measurements were less frequent than daily. A complete description of manual or automatic measurements of lake stage is described by Rantz and others (1982).

Table 2. Parameter identification numbers and laboratory reporting levels (LRL) for chemical parameters commonly measured in lakes, and analyzed at the National Water Quality Laboratory (NWQL) or the Wisconsin State Laboratory of Hygiene (WSLH)

				(NWQL)				(WSLH)	
				Standard Analysis		Low-Level Analysis			
Parameter Name	Units	CAS Number[1]	Parameter Code[2]	LRL	Lab Code	LRL	Lab Code	LRL	Test Code
Calcium, diss. (Ca)	mg/L	7440-70-2	00915	0.020	659	0.002	1895	0.02	I230IUD
Magnesium, diss. (Mg)	mg/L	7439-95-4	00925	0.004	663	0.001	1897	0.02	I390IUD
Sodium, diss. (Na)	mg/L	7440-23-5	00930	0.09	675	0.025	1898	0.09	I80IUD
Potassium, diss. (K)	mg/L	7440-09-7	00935	0.24	54	0.01	833	0.3	I540IUD
Sulfate, diss. (SO4)	mg/L	14808-79-8	00945	0.31	1572	0.01	1263	1.0	I600DLD
Chloride, diss. (Cl)	mg/L	16887-00-6	00940	0.29	1571	0.01	1259	0.1	I240ELD
Fluoride, diss. (F)	mg/L	16984-48-8	00950	0.100	31	0.01	1260	0.03	I330FLD
Iron, diss. (Fe)	(µg/L)	7439-89-6	01046	10	645	3	1896	10	I370IUD
Manganese, diss. (Mn)	(µg/L)	7439-96-5	01056	2.2	648	1	1793	0.4	I400IUD
Silica, diss. (SiO2)	mg/L	7631-86-9	00955	0.1	56	0.02	1899	0.008	I560LLD
Nitrogen, NO2+NO3, diss.	mg/L	--	00631	0.05	1975	0.005	1979	0.01	I460MLD
Nitrogen, ammonia, diss.	mg/L	7664-41-7	00608	0.02	1976	0.002	1980	0.013	I440NLD
Nitrogen, amm.+org., total[4]	mg/L	17778-88-0	00625	0.100	1985	--	--	0.2	I470BLT
Nitrogen, amm.+org.,diss.	mg/L	--	00623	--	--	--	--	--	I470DLD
Nitrogen, total[5]	mg/L	--	00600	--	--	--	--	--	--
Nitrogen, dissolved	mg/L	--	00602	--	--	--	--	--	--
Phosphorus, total	mg/L	7723-14-0	00665	0.05	1984	0.004	2333	0.005	I520PLT
Phosphorus, ortho, diss.	mg/L	14265-44-2	00671	0.01	1262	0.002	1978	0.002	I530CLD
Chlorophyll a, phytoplankton	(µg/L)	479-61-8	70953	0.1	586	--	--	--	--
Chlorophyll a, phytoplankton	(µg/L)	479-61-8	32210	--	--	--	--	0.26	I250UNF

1: CAS (Chemical Abstracting Services) number = unique identification for each constituent

2: Parameter Code - unique number for storage of data in database

3: Calculated as difference between total ammonia + organic nitrogen and ammonia nitrogen

4: Also known as Total Kjeldahl Nitrogen (TKN)

5: Calculated as sum of TKN + Nitrogen as (NO2+NO3)

EXPLANATION OF PHYSICAL AND CHEMICAL CHARACTERISTICS OF LAKES

Following are brief, generalized explanations of some of the common measurements of water quality and some of the physical processes occurring in lakes that influence these measures of water quality. More detailed explanations of water-quality data and lake processes are given by Wetzel (1983), Hem (1985), and Shaw and others (1993).

Water Temperature and Thermal Stratification

Water temperature in lakes is important because of its role in stratification and because of the temperature dependence of many chemical reactions and life processes of aquatic organisms. The extent of thermal stratification in lakes depends on the interaction between the lake's shape, water clarity, solar heating, and wind-driven mixing. Complete mixing of the lake is usually inhibited by thermal stratification in summer and by ice cover in winter. Thermal stratification affects water quality and the distribution of organisms in the lake. Summer thermal stratification can occur in any lake, but in Wisconsin it commonly occurs in lakes deeper than about 6 m (Shaw and others, 1993).

The density of water increases with decreasing temperature down to a temperature of 4°C, then decreases with decreasing temperature between 4°C and the freezing point of water (0°C). For a brief period in the spring after the ice is out, water temperature is usually uniform through the entire water column and wind action causes the lake to mix completely. This process is known as "spring turnover." As the lake absorbs the sun's energy, the surface water becomes warmer and its density decreases, making it more resistant to complete mixing. The difference in density caused by different water temperatures can prevent warm and cold water from mixing. In most lakes, therefore, a density "barrier" forms between the warmer surface water (epilimnion) and the underlying colder water (hypolimnion). This barrier is often marked by a sharp temperature gradient known as the "thermocline (metalimnion)." During the stratified summer period, these three distinct layers of lake water are often present. As the temperature difference between surface and deep water increases, this "stratified" condition stabilizes and can persist until surface temperatures decrease in the fall, which decreases the stability of the stratification. The mixing of the lake water in the fall is known as "fall turnover."

Thermal stratification may also occur under ice cover in the winter. In the winter, the coldest water (near 0°C) under the ice at the surface of the lake is less dense than water deeper in the lake with warmer temperatures.

Specific Conductance

Specific conductance is a measure of the ability of water to conduct an electrical current and is an indicator of the concentration of dissolved solids in the water. Because conductance is temperature related, reported values are normalized at 25°C and are termed specific conductance. As the concentration of dissolved minerals increases, specific conductance increases. During winter and summer thermal stratification, concentrations of dissolved constituents near the lake bottom increase due to the decomposition of materials settling from the epilimnion, or release of dissolved materials (such as iron, manganese, and phosphorus) from the bottom sediments during anoxic periods. Therefore, differences in specific conductance with depth indicate differences in concentrations of dissolved solids.

Water Clarity

Water clarity, or transparency, is commonly measured using a Secchi disc. The range of depths within which photosynthetic activity occurs depends largely on depth of light penetration, which is influenced by water clarity. A Secchi disc, most commonly an 20-cm.-diameter disc with alternating black-and-white quadrants, is lowered to a depth at which it is no longer visible. This depth is referred to as the Secchi depth. Clarity can be reduced by algae, zooplankton, water color, and suspended sediment. Algae are often the most dominant influence on clarity in lakes and, therefore, Secchi depth is usually correlated with the algal abundance. Secchi depths are generally the least during summer when algal populations are largest.

pH

The pH is a measure of the acidity of the water. It is defined as the negative logarithm of hydrogen-ion concentration and varies over a 14-unit log scale, with a pH of 7 being neutral. Values less than 7 indicate acidic conditions; the lower the value, the stronger the acidity. Values greater than 7 indicate alkaline conditions. The pH of water is influenced in part by

photosynthesis and respiration of planktonic algae and aquatic plants. It is important because it affects the solubility of many chemical constituents, and because aquatic organisms have limited pH tolerances. Planktonic algae and aquatic plants produce oxygen and consume carbon dioxide as they photosynthesize during daytime; they consume oxygen and produce carbon dioxide when they respire at night. Carbon dioxide combines with the water molecule to form carbonic acid; therefore respiration causes a decrease in pH at night and photosynthesis during the day causes an increase in pH. The result is a daily cycle in pH. Because phytoplankton are usually concentrated in the near-surface water, changes in pH in the epilimnion are more extreme than in the hypolimnion, where less photosynthesis usually occurs.

Lakes having good fish populations and productivity generally have a pH between 6.7 and 8.2. Values of pH greater than 8.5 have been shown to cause the release of phosphorus from lake sediments (James and Barko, 1991).

Dissolved Oxygen

Dissolved oxygen is one of the most critical factors affecting a lake ecosystem because it is essential to most aquatic organisms, and it is involved in many chemical reactions. Very low dissolved oxygen concentrations can control some types of chemical reactions. The solubility of oxygen in water is inversely related to temperature–that is, oxygen solubility decreases as water temperature increases. This relation is important because at warmer temperatures the metabolic rate of organisms increases but less oxygen is available for respiration. The primary sources of dissolved oxygen are from the air and from photosynthesis. The minimum dissolved oxygen concentration specified in national water-quality criteria for early life stages of warmwater aquatic life is 5.0 mg/L (U.S. Environmental Protection Agency, 1986).

In early summer, if thermal stratification develops, the metalimnion restricts the surface supply of dissolved oxygen to the hypolimnion. The hypolimnion can become isolated from the atmosphere. Thus, as summer progresses, the dissolved oxygen concentration can decrease in response to decomposition of dead algae that settle from the epilimnion and in response to the biological and chemical oxygen demand of the sediments. The oxygen demand from these processes may completely deplete the oxygen (anoxia) in the water near the lake bottom. The oxygen depletion then progresses upward but usually is confined to the hypolimnion.

Anoxia in the hypolimnion is common in stratified eutrophic (nutrient-rich) lakes in Wisconsin. Complete anoxia, however, is often not detected because of meter constraints. During anoxic conditions, many aquatic organisms cannot survive, but many other species (primarily bacteria) actually function only in such conditions. Therefore, a shift from oxic to anoxic conditions produces a rapid and dramatic change in the biological community and chemical environment. Anoxia also can cause release of phosphorus from the bottom sediments. This phosphorus then mixes throughout the water column during spring and fall turnover.

Phosphorus

Phosphorus is one of the essential nutrients for plant growth. High phosphorus concentrations can cause dense algal populations (blooms) and can therefore be a major cause of eutrophication in lakes. When phosphorus concentrations exceed 0.025 mg/L at the time of spring overturn in lakes and reservoirs, these water bodies may occasionally experience excess or nuisance growth of algae or other aquatic plants (U.S. Environmental Protection Agency, 1986). In many regions of the country, including the upper Midwest, other nutrients, particularly nitrogen, tend to be in abundant supply. Phosphorus is often the nutrient in shortest supply, therefore limiting or controlling plant growth. About 90 percent of the lakes in Wisconsin are limited by phosphorus (Shaw and others, 1993). In water, dissolved orthophosphate is that part of total phosphorus that is most readily available for use by algae.

Internal phosphorus recycling occurs in many lakes. Phosphorus used by algae, aquatic plants, fish, and zooplankton is stored within these organisms. As these organisms die and decompose, this phosphorus is returned to the lake water and sediments. Anoxia in the hypolimnion makes phosphorus more soluble, adding further to the release of phosphorus from the falling particles and the lake sediments. During spring and fall turnover the phosphorus, which was released from the bottom sediments into the hypolimnion during anoxia, is mixed throughout the lake. The phosphorus is then available for algal growth. These phenomena are part of the internal-recycling processes of lakes.

Nitrogen

Nitrogen, like phosphorus, is an essential nutrient for plant and algal growth. Usually in Wisconsin lakes, nitrogen is in abundant supply from the atmosphere and other sources. If phosphorus is abundant relative to algal needs, nitrogen can become the limiting nutrient. In that case, algal blooms are more likely to be triggered by increases in nitrogen than by increases in phosphorus. Some bluegreen algal species can fix nitrogen from the atmosphere (Wetzel, 1983). Therefore, in situations where other types of algae are excluded because of a shortage of nitrogen, the nitrogen-fixing bluegreen algae have a competitive advantage and may be present in abundance.

Lakes with a nitrogen to phosphorus ratio larger than 15 to 1 near the surface may generally be considered phosphorus limited; a ratio from 10 to 1 to 15 to 1 indicates a transition situation; and a ratio smaller than 10 to 1 generally indicates nitrogen limitation. Total nitrogen is the sum of ammonia, organic nitrogen, and nitrate-plus-nitrite nitrogen. The near-surface concentration is commonly used to compute the total nitrogen to phosphorus ratio because most algal species grow near the lake surface.

Chlorophyll *a*

Chlorophyll *a* is a photosynthetic pigment found in algae (Wetzel, 1983) and other green plants. Its concentration, therefore, is commonly used as a measure of the density of the algal population in a lake. Chlorophyll *a* concentrations are generally highest during summer when algal populations are highest. Moderate populations of desirable algae are important in the food chain; however, excessive populations or algal blooms are undesirable. Algal blooms can cause taste and odor problems, and limit light penetration needed to support growth of submerged aquatic plants. Certain species of bluegreen algae can produce toxins (Rapavich and others, 1987).

CLASSIFICATION OF LAKES

Two methods are commonly used to classify and evaluate Wisconsin lakes according to their water quality or trophic state: Lillie and Mason's (1983) water-quality index and Carlson's (1977) trophic state index (TSI). In previous USGS data reports, a modification of Carlson's trophic state index for Wisconsin lakes by Lillie and others (1993) had been used; however, this approach did not properly classify oligotrophic and highly euthrophic lakes and, therefore, was discontinued.

Lillie and Mason's (1983) water quality indices for Wisconsin lakes were developed based on summer measurements of total phosphorus and chlorophyll *a* concentrations, and Secchi depth from a random set of lakes in Wisconsin. These data were used to classify the lakes's water quality as shown below:

Water-quality index	Total phosphorus range (mg/L)	Chlorophyll *a* range (µg/L)	Water clarity range (Secchi depth, in meters)
"Excellent"	<0.001	<1.0	>6.0
"Very good"	.001-.009	1.0-4.9	3.0-6.0
"Good"	.010-.029	5.0-9.9	2.0-2.9
"Fair"	.030-.049	10.0-14.9	1.5-1.9
"Poor"	.050-.149	15.0-30.0	1.0-1.4
"Very poor"	>.150	>30.0	<1.0

Carlson's (1977) TSI approach to lake classification assigns numerical ranges to the three trophic conditions generally used to describe the wide range of lake water-quality conditions. Oligotrophic lakes are typically clear, algal populations and phosphorus concentrations are low, and the deepest water is likely to contain oxygen throughout the year. Mesotrophic lakes typically have a moderate supply of nutrients, experience moderate algal blooms, and have occasional oxygen depletions at depth. Eutrophic lakes are nutrient rich with relatively severe water-quality problems, such as frequent seasonal algal blooms, oxygen depletion in lower parts of the lakes, and poor clarity. When eutrophic conditions are very severe, the lake is considered hypereutrophic.

Carlson's (1977) TSI values are also based on near-surface total phosphorus and chlorophyll *a* concentrations, and Secchi depths. The indices were developed to place these three characteristics on similar scales to allow comparison of different lakes. TSI values based on phosphorus concentrations (TSI_P), Secchi depths (TSI_{SD}), and chlorophyll *a* concentrations (TSI_C) typically are computed only for measurements collected during the open-water period.

TSI values for a lake can be calculated using the following equations (Carlson, 1977):

$TSI_P = 4.15 + 14.42 \times (\ln [\text{total phosphorus concentration} \times 1{,}000])$

$TSI_{SD} = 60.0 - 14.41 \times (\ln \text{Secchi depth})$

$TSI_C = 30.6 + 9.81 \times (\ln \text{chlorophyll } a \text{ concentration})$

where: total phosphorus is in milligrams per liter,
Secchi depth is in meters, and
chlorophyll *a* is in micrograms per liter.

The three main trophic conditions are defined with the following boundaries for total phosphorus, Secchi disc, and chlorophyll *a*:

Trophic level	Trophic State Index	Total phosphorus (mg/L)	Secchi depth (m)	Chlorophyll *a* (µg/L)
Eutrophic				
----------	---------50----------	-------0.024--------	---------2.0---------	---------7.2---------
Mesotrophic				
----------	---------40----------	-------0.012--------	---------4.0---------	---------2.6---------
Oligotrophic				

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LAKE DATA

Remarks codes and symbols used in the following tables:

[<, less than; M, present but not quantified; --, not available; E, estimated]

432409088151600 BIG CEDAR LAKE, NORTH SITE, NEAR WEST BEND, WI

LOCATION.--Lat 43°24'09", long 88°15'16", in NE ¼ SW ¼ sec.20, T.11 N., R.19 E., Washington County, Hydrologic Unit 04040003, near West Bend.

PERIOD OF RECORD.--February 2000 to current year.

REMARKS.--Lake sampled on north side at a depth of 12 m. Lake ice-covered during February sampling. Water-quality analyses by Wisconsin State Laboratory of Hygiene.

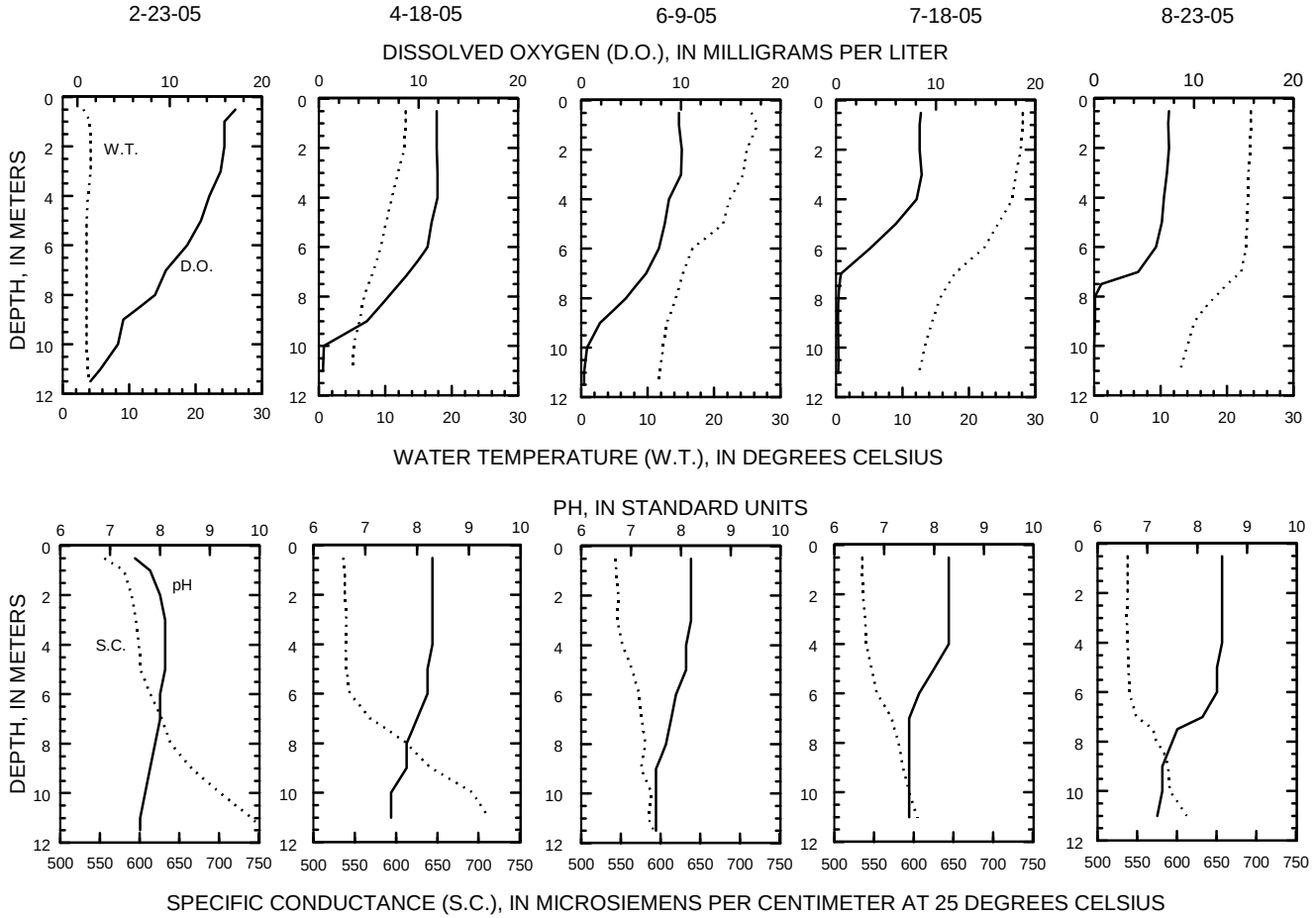
WATER-QUALITY DATA, FEBRUARY 23 TO AUGUST 23, 2005

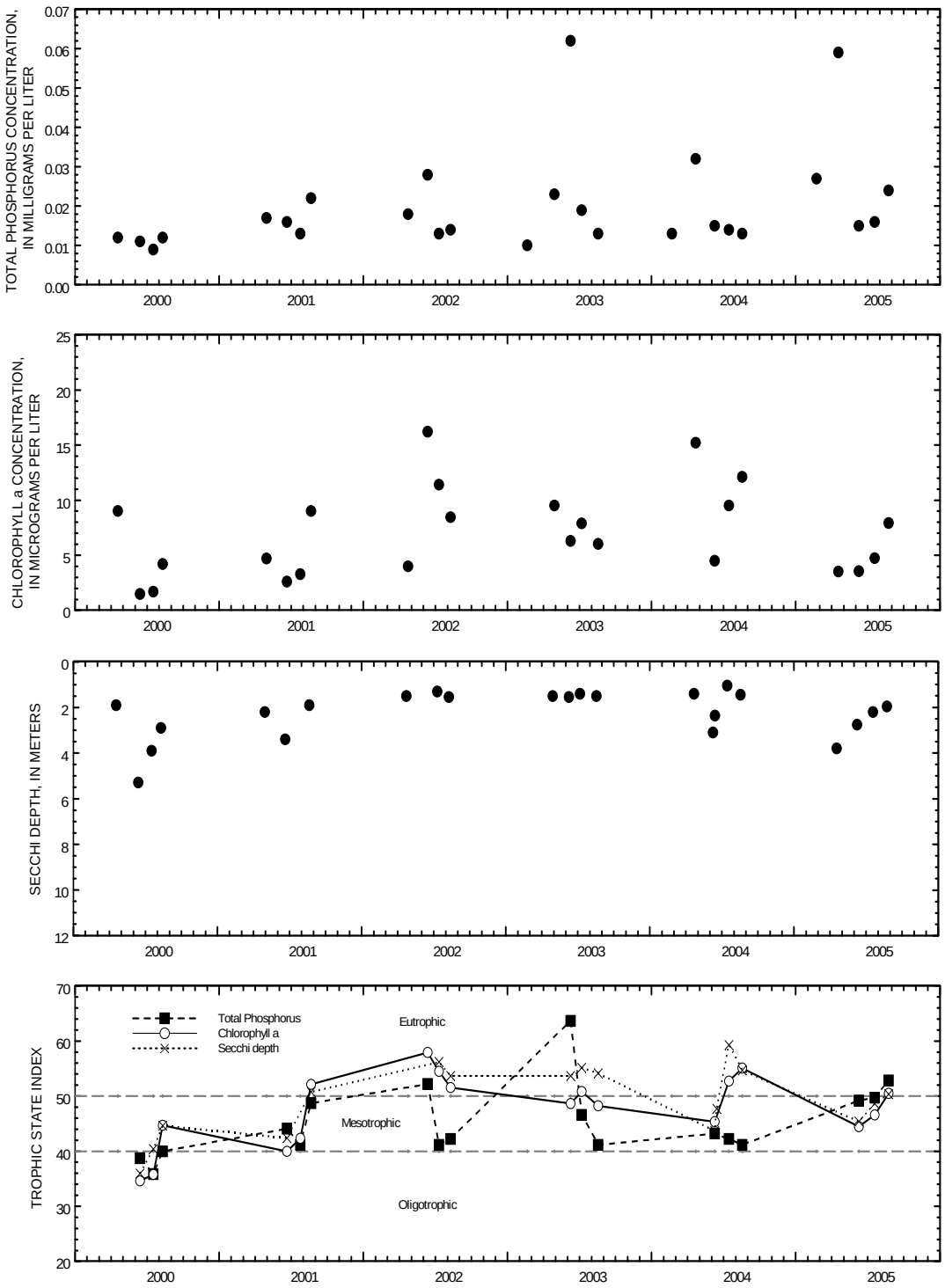
(Milligrams per liter unless otherwise indicated)

Date	Time	Gage height, feet (00065)	Transparency Secchi disc, meters (00078)	Sampling depth, meters (00098)	Temperature, water, deg C (00010)	Specif. conductance, wat unf uS/cm 25 degC (00095)	pH, water, unfltrd field, std units (00400)	Dissolved oxygen, mg/L (00300)	Phosphorus, water, unfltrd mg/L (00665)	Chlorophyll a wat unf trichr. method, uncorr, ug/L (32210)	Sampling method, code (82398)
FEB 2005											
23...	1015	--	--	.50	3.1	555	7.5	17.1	.027	--	100
23...	1027	--	--	11.5	3.9	756	7.6	1.4	.014	--	100
APR											
18...	0930	--	--	.50	13.1	536	8.3	11.8	.059	3.52	100
18...	0941	--	--	11.0	5.0	712	7.5	.4	.023	--	100
18...	0955	--	3.80	--	--	--	--	--	--	--	--
JUN											
09...	1800	--	--	.50	25.6	543	8.2	9.8	.015	3.57	100
09...	1812	--	--	11.5	11.7	591	7.5	.3	.027	--	100
09...	1820	10.30	2.75	--	--	--	--	--	--	--	--
JUL											
19...	1520	--	--	.50	28.1	535	8.3	8.5	.016	4.74	100
19...	1531	--	--	11.0	12.5	604	7.5	.2	.051	--	--
19...	1535	10.11	2.20	--	--	--	--	--	--	--	--
AUG											
23...	1400	--	--	.50	23.6	538	8.5	7.5	.024	7.92	100
23...	1413	--	--	11.0	12.9	612	7.2	.0	.049	--	100
23...	1415	10.09	1.95	--	--	--	--	--	--	--	--

432409088151600 BIG CEDAR LAKE, NORTH SITE, NEAR WEST BEND, WI

LAKE-DEPTH PROFILES, FEBRUARY 23 TO AUGUST 23, 2005





Surface total phosphorus, chlorophyll a concentrations, Secchi depths, and TSI data for Big Cedar Lake, North Site, near West Bend, Wisconsin.

432224088154900 BIG CEDAR LAKE, SOUTH SITE, NEAR WEST BEND, WI

LOCATION.--Lat 43°22'24", long 88°15'49", in NE ¼ SE ¼ sec.31, T.11 N., R.19 E., Washington County, Hydrologic Unit 04040003, near West Bend.

PERIOD OF RECORD.--February 2000 to current year.

REMARKS.--Lake sampled on south side at deep hole. Lake ice-covered during February sampling. Water-quality analyses by Wisconsin State Laboratory of Hygiene.

WATER-QUALITY DATA, FEBRUARY 23 TO AUGUST 23, 2005
(Milligrams per liter unless otherwise indicated)

Date	Time	Gage height, feet (00065)	Transparency Secchi disc, meters (00078)	Sampling depth, meters (00098)	Temperature, water, deg C (00010)	Specif. conductance, wat unf uS/cm 25 degC (00095)	pH, water, unfltrd field, std units (00400)	Dissolved oxygen, mg/L (00300)	Chlorophyll a wat unf trichr. method, uncorr, ug/L (32210)	Phosphorus, water, unfltrd mg/L (00665)	Orthophosphate, water, fltrd, mg/L as P (00671)	Total nitrogen, water, unfltrd mg/L (00600)
FEB 2005												
23...	1115	--	--	.50	2.0	538	7.4	13.6	--	.035	--	--
23...	1131	--	--	30.0	3.4	605	7.4	4.1	--	.028	--	--
APR												
18...	1010	--	--	.50	9.5	532	8.4	12.3	1.15	.012	.004	.65
18...	1026	--	--	30.0	3.8	557	7.9	6.8	--	.028	--	--
18...	1040	--	7.90	--	--	--	--	--	--	--	--	--
JUN												
09...	1830	--	--	.50	22.9	543	8.2	9.7	1.03	.009	--	--
09...	1846	--	--	29.5	5.3	577	7.6	3.9	--	.054	--	--
09...	1900	10.30	10.2	--	--	--	--	--	--	--	--	--
JUL												
19...	1630	--	--	.50	27.4	525	8.3	8.8	2.63	.013	.003	--
19...	1649	--	--	30.0	5.4	601	7.5	.2	--	.058	--	--
19...	1650	10.11	4.50	--	--	--	--	--	--	--	--	--
AUG												
23...	1510	--	--	.50	23.7	523	8.6	8.2	5.72	.018	--	--
23...	1529	--	--	30.0	5.3	593	7.3	.1	--	.157	--	--
23...	1530	10.09	3.30	--	--	--	--	--	--	--	--	--

432224088154900 BIG CEDAR LAKE, SOUTH SITE, NEAR WEST BEND, WI

WATER-QUALITY DATA, FEBRUARY 23 TO AUGUST 23, 2005--CONTINUED
(Milligrams per liter unless otherwise indicated)

Date	Sampling depth, meters (00098)	Ammonia water, fltrd, mg/L as N (00608)	Ammonia + org-N, water, fltrd, mg/L as N (00623)	Ammonia + org-N, water, unfltrd mg/L as N (00625)	Nitrite + nitrate water fltrd, mg/L as N (00631)	Turbidity, NTU (00076)	Apparent color, water, unfltrd Pt-Co units (00081)	Hardness, water, mg/L as CaCO3 (00900)	Calcium water, fltrd, mg/L (00915)	Magnesium, water, fltrd, mg/L (00925)	Sodium, water, fltrd, mg/L (00930)	Potassium, water, fltrd, mg/L (00935)
FEB 2005												
23...	.50	--	--	--	--	--	--	--	--	--	--	--
23...	30.0	--	--	--	--	--	--	--	--	--	--	--
APR												
18...	.50	<.015	--	.29	.361	1.2	10	240	38.1	34.0	20.2	2.00
18...	30.0	--	--	--	--	--	--	--	--	--	--	--
18...	--	--	--	--	--	--	--	--	--	--	--	--
JUN												
09...	.50	--	--	--	--	--	--	--	--	--	--	--
09...	29.5	--	--	--	--	--	--	--	--	--	--	--
09...	--	--	--	--	--	--	--	--	--	--	--	--
JUL												
19...	.50	.019	.43	--	.072	--	--	--	--	--	--	--
19...	30.0	--	--	--	--	--	--	--	--	--	--	--
19...	--	--	--	--	--	--	--	--	--	--	--	--
AUG												
23...	.50	--	--	--	--	--	--	--	--	--	--	--
23...	30.0	--	--	--	--	--	--	--	--	--	--	--
23...	--	--	--	--	--	--	--	--	--	--	--	--

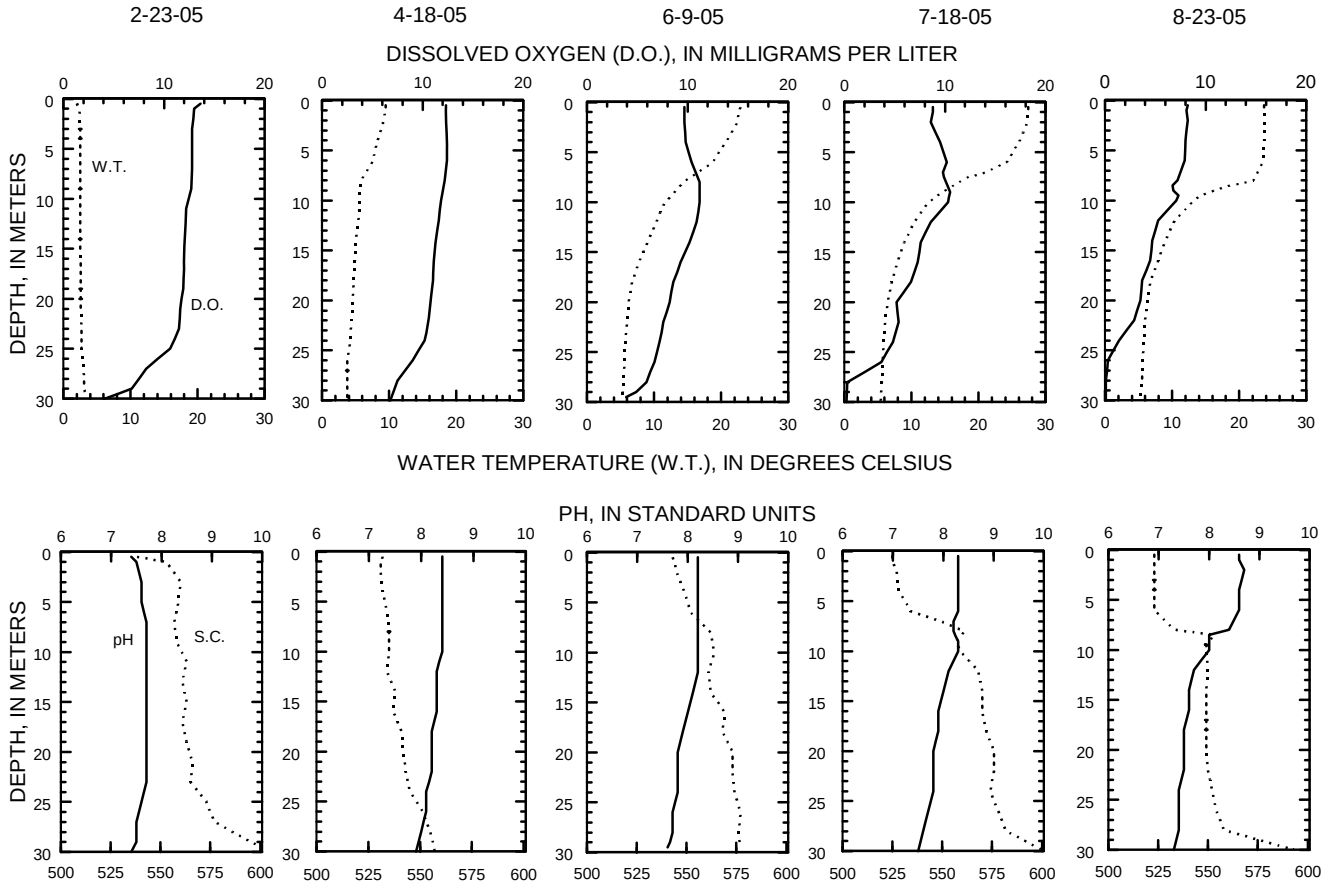
432224088154900 BIG CEDAR LAKE, SOUTH SITE, NEAR WEST BEND, WI

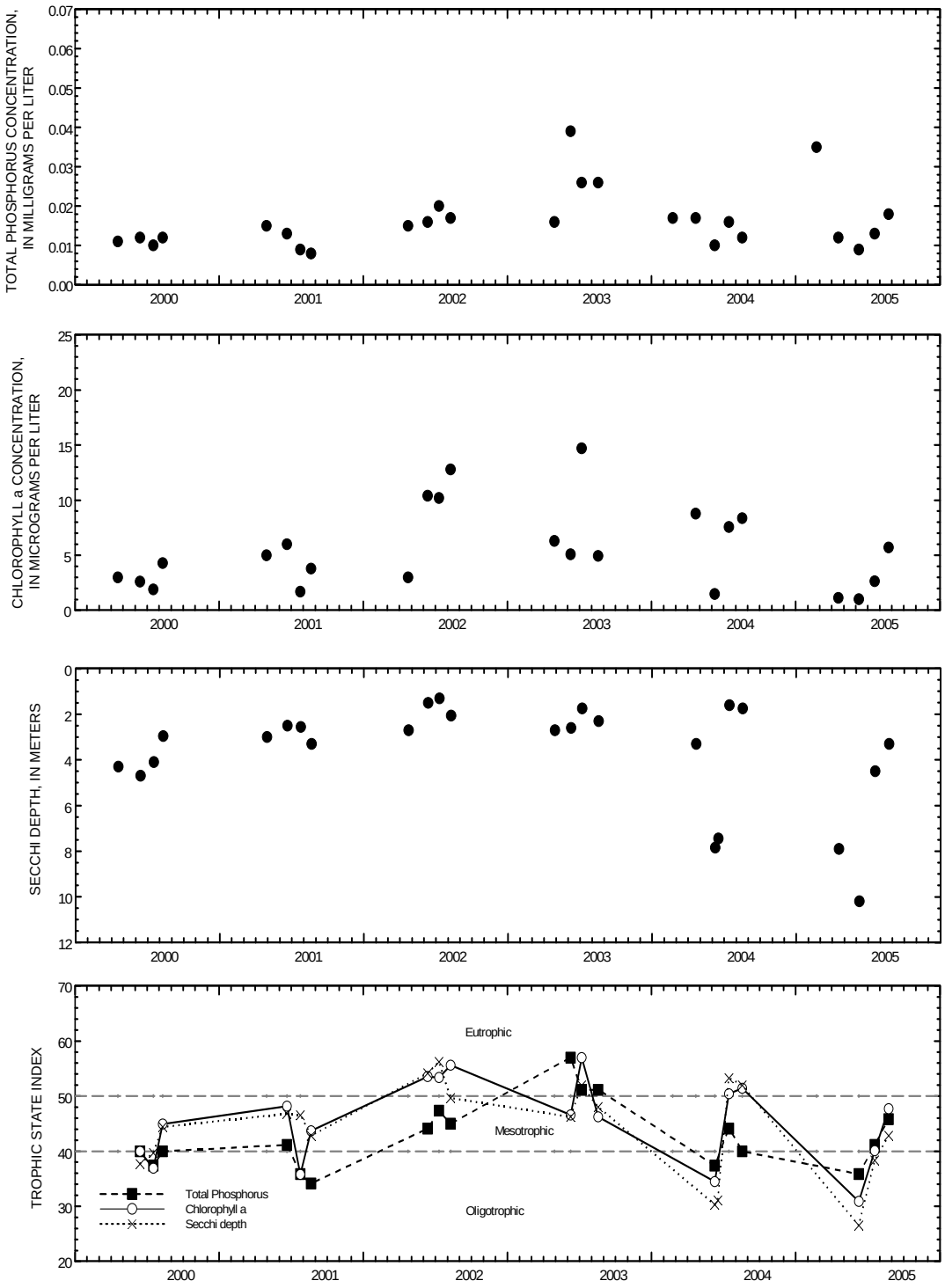
WATER-QUALITY DATA, FEBRUARY 23 TO AUGUST 23, 2005--CONTINUED
(Milligrams per liter unless otherwise indicated)

Date	Sampling depth, meters (00098)	ANC, wat unf fixed end pt, lab, mg/L as CaCO3 (00417)	Chloride, water, fltrd, mg/L (00940)	Sulfate water, fltrd, mg/L (00945)	Silica, water, fltrd, mg/L (00955)	Iron, water, fltrd, ug/L (01046)	Manganese, water, fltrd, ug/L (01056)	Residue on evap. at 180degC wat flt mg/L (70300)	Sampling method, code (82398)
FEB 2005									
23...	.50	--	--	--	--	--	--	--	100
23...	30.0	--	--	--	--	--	--	--	100
APR									
18...	.50	188	45.1	21.6	.623	<100	M	292	100
18...	30.0	--	--	--	--	--	--	--	100
18...	--	--	--	--	--	--	--	--	--
JUN									
09...	.50	--	--	--	--	--	--	--	100
09...	29.5	--	--	--	--	--	--	--	100
09...	--	--	--	--	--	--	--	--	--
JUL									
19...	.50	--	--	--	--	--	--	--	100
19...	30.0	--	--	--	--	--	--	--	100
19...	--	--	--	--	--	--	--	--	--
AUG									
23...	.50	--	--	--	--	--	--	--	100
23...	30.0	--	--	--	--	--	--	--	100
23...	--	--	--	--	--	--	--	--	--

432224088154900 BIG CEDAR LAKE, SOUTH SITE, NEAR WEST BEND, WI

LAKE-DEPTH PROFILES, FEBRUARY 23 TO AUGUST 23, 2005





Surface total phosphorus, chlorophyll a concentrations, Secchi depths, and TSI data for Big Cedar Lake, South Site, near West Bend, Wisconsin.

423706088363400 DELAVAN LAKE NEAR DELAVAN, WI

LOCATION.--Lat 42°36'27", long 88°36'19", in SW ¼ NE ¼ sec.28, T.2 N., R.16 E., Walworth County, Hydrologic Unit 07090001, at Delavan Lake Sanitary District Lift Station No. 2 at Delavan Lake Yacht Club, 1.0 mi southeast of outlet, and 2.7 mi southeast of Delavan.

DRAINAGE AREA.--41.4 mi^2, of which 2.3 mi^2 is non-contributing. Area of Delavan Lake, 2,072 acres.

PERIOD OF RECORD.--October 1983 to current year. October 1983 to September 1985 data published in Water Resources Investigation series report "Water Quality and Hydrology of Delavan Lake in Southeastern Wisconsin" by S. J. Field and M. D. Duerk (1988).

GAGE.--Water-stage recorder. Datum of gage is 922.92 ft above NGVD of 1929. Prior to Sept. 5, 1989, Staff gage at bridge on North Shore Drive at same datum.

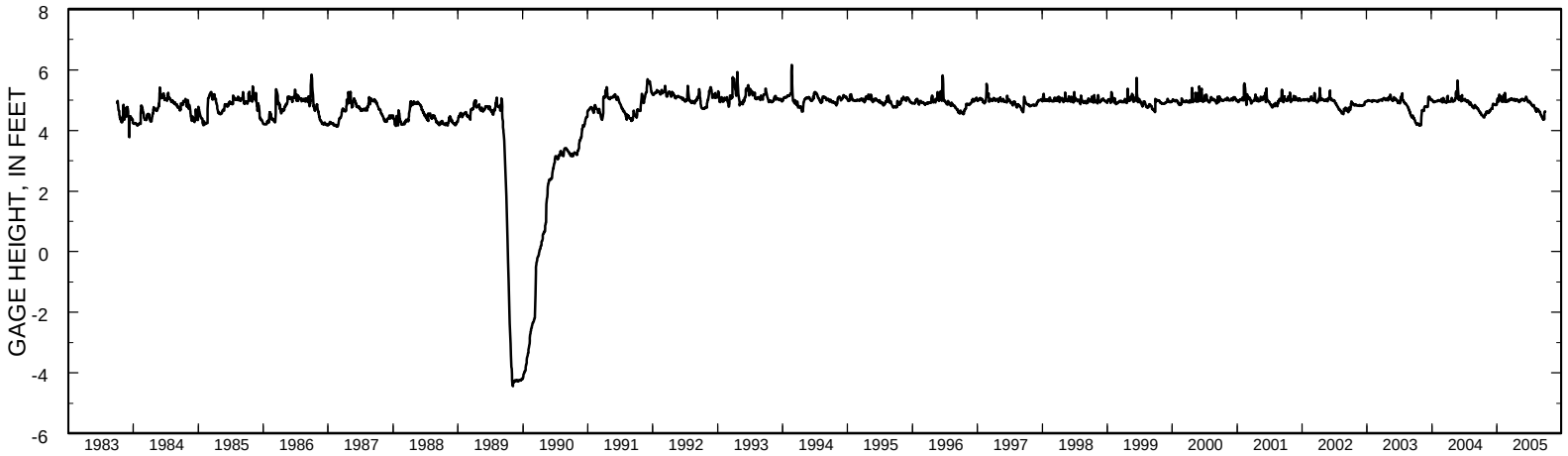
REMARKS.--Lake was ice covered from Dec. 25 to Mar. 30. Lake levels controlled by Delavan Lake Sanitary District. Gage-height telemeter at station.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height observed, 6.19 ft, Feb. 21, 1994; minimum daily, -4.44 ft, Nov. 6, 1989 (lake drawn down for lake rehabilitation program).

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 5.26 ft, Feb. 15, 16; minimum, 4.33 ft, Sept. 18.

GAGE HEIGHT, FEET
WATER YEAR OCTOBER 2004 TO SEPTEMBER 2005
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	4.58	4.58	4.73	4.88	4.96	4.98	5.01	4.98	5.00	4.97	4.74	4.58
2	4.59	4.62	4.73	4.98	4.96	4.98	5.02	4.97	4.99	4.94	4.72	4.56
3	4.57	4.62	4.73	5.01	4.97	4.97	5.01	4.96	4.98	4.93	4.70	4.54
4	4.54	4.64	4.72	5.02	4.97	4.97	5.00	4.96	4.98	4.92	4.70	4.53
5	4.53	4.63	4.72	5.04	4.98	4.96	4.99	4.94	5.05	4.92	4.68	4.51
6	4.51	4.62	4.75	5.06	5.01	4.97	4.99	4.94	5.05	4.94	4.67	4.51
7	4.50	4.62	4.80	5.04	5.14	5.00	5.05	4.96	5.04	4.92	4.65	4.50
8	4.51	4.61	4.84	5.01	5.17	5.01	5.05	4.96	5.04	4.91	4.64	4.49
9	4.51	4.60	4.85	4.98	5.13	5.01	5.04	4.97	5.03	4.89	4.64	4.48
10	4.50	4.59	4.87	4.95	5.09	5.02	5.03	4.97	5.03	4.88	4.64	4.46
11	4.50	4.59	4.88	4.94	5.04	5.04	5.01	5.01	5.04	4.87	4.62	4.45
12	4.49	4.58	4.88	4.97	4.98	5.03	5.01	5.01	5.07	4.87	4.72	4.44
13	4.49	4.58	4.88	5.11	4.95	5.03	5.02	5.01	5.09	4.87	4.71	4.43
14	4.48	4.57	4.87	5.18	5.11	5.02	5.01	5.02	5.11	4.86	4.70	4.42
15	4.48	4.58	4.87	5.19	5.24	5.01	4.99	5.01	5.09	4.85	4.68	4.40
16	4.47	4.59	4.86	5.17	5.24	5.01	4.98	5.00	5.07	4.84	4.67	4.39
17	4.44	4.60	4.86	5.15	5.19	5.02	4.99	4.99	5.04	4.83	4.65	4.38
18	4.44	4.61	4.86	5.14	5.13	5.02	4.99	4.99	5.03	4.82	4.67	4.37
19	4.44	4.64	4.85	5.12	5.06	5.04	4.99	5.02	5.02	4.80	4.67	4.38
20	4.43	4.65	4.85	5.10	5.01	5.06	5.02	5.05	5.01	4.79	4.70	4.38
21	4.43	4.66	4.85	5.08	4.96	5.06	5.02	5.05	5.00	4.82	4.70	4.37
22	4.42	4.65	4.84	5.11	4.95	5.06	5.03	5.05	4.98	4.83	4.68	4.38
23	4.49	4.65	4.84	5.09	4.96	5.06	5.04	5.04	4.96	4.83	4.66	4.38
24	4.51	4.65	4.84	5.06	4.96	5.06	5.02	5.03	4.95	4.84	4.64	4.37
25	4.51	4.65	4.84	5.03	4.96	5.05	5.00	5.02	4.93	4.84	4.63	4.44
26	4.52	4.65	4.84	5.01	4.96	5.04	5.00	5.02	4.96	4.84	4.62	4.60
27	4.53	4.68	4.84	4.98	4.96	5.02	5.00	5.01	4.95	4.82	4.64	4.61
28	4.53	4.70	4.84	4.97	4.98	5.02	5.00	5.01	4.95	4.80	4.62	4.62
29	4.53	4.70	4.84	4.95	---	5.01	4.99	5.01	4.93	4.78	4.62	4.63
30	4.57	4.71	4.85	4.95	---	5.01	4.99	5.01	4.98	4.76	4.61	4.62
31	4.55	---	4.87	4.96	---	5.01	---	5.01	---	4.75	4.59	---
MEAN	4.50	4.63	4.83	5.04	5.04	5.02	5.01	5.00	5.01	4.86	4.66	4.47
MAX	4.59	4.71	4.88	5.19	5.24	5.06	5.05	5.05	5.11	4.97	4.74	4.63
MIN	4.42	4.57	4.72	4.88	4.95	4.96	4.98	4.94	4.93	4.75	4.59	4.37



Stage hydrograph for Delavan Lake, 1983 – 2005.

423556088365001 DELAVAN LAKE AT CENTER NEAR DELAVAN LAKE, WI

LOCATION.--Lat 42°35'56", long 88°36'50", in SE ¼ SW ¼ sec.28, T.2 N., R.16 E., Walworth County, Hydrologic Unit 07090001, 2.6 mi southeast of Delavan.

DRAINAGE AREA.--41.4 mi^2, of which 2.3 mi^2 is non-contributing. Area of Delavan Lake, 2,072 acres.

PERIOD OF RECORD.--October 1983 to current year.

REMARKS.--Lake ice-covered during February measurements. Water-quality analyses done by the U.S. Geological Survey National Water Quality Laboratory. Samples for determination of chlorophyll *a* concentration are collected from the top 0.5 m of the lake and analyzed by the Wisconsin State Laboratory of Hygiene.

WATER-QUALITY DATA, OCTOBER 12, 2004 TO SEPTEMBER 29, 2005

(Milligrams per liter unless otherwise indicated)

Date	Time	Gage height, feet (00065)	Trans-parency Secchi disc, meters (00078)	Sam-pling depth, meters (00098)	Temper-ature, water, deg C (00010)	Specif. conduc-tance, wat unf uS/cm 25 degC (00095)	pH, water, unfltrd field, std units (00400)	Dis-solved oxygen, mg/L (00300)	Chloro-phyll a wat unf trichr. method, uncorr, ug/L (32210)	Phos-phorus, water, unfltrd mg/L (00665)	Ortho-phos-phate, water, fltrd, mg/L as P (00671)	Total nitro-gen, water, unfltrd mg/L (00600)
OCT 2004												
12...	1020	4.49	1.80	.50	16.5	--	--	--	--	.134	--	--
21...	0925	4.43	1.40	.50	13.0	--	--	--	--	.113	--	--
27...	0915	4.53	1.50	.50	15.8	--	--	--	--	.101	--	--
NOV												
03...	1030	4.62	1.80	.50	12.0	--	--	--	--	.096	--	--
09...	1000	4.60	2.10	.50	10.0	--	--	--	--	.089	--	--
16...	1225	4.59	2.40	--	--	--	--	--	--	--	--	--
16...	1230	--	--	.50	9.0	558	8.0	10.0	8.30	.081	.047	.84
16...	1246	--	--	15.5	8.9	561	8.0	9.3	--	.087	.049	--
23...	1000	4.65	2.40	.50	8.5	--	--	--	--	.081	--	--
FEB 2005												
08...	1300	5.17	6.60	--	--	--	--	--	--	--	--	--
08...	1305	--	--	.50	.6	560	7.7	13.5	.940	.077	.055	.92
08...	1321	--	--	16.0	3.7	677	7.4	.7	--	.22	.183	--
APR												
14...	1150	5.01	2.40	--	--	--	--	--	--	--	--	--
14...	1155	--	--	.50	9.7	561	8.5	12.5	9.04	.060	.015	.84
14...	1211	--	--	16.0	8.2	566	8.3	11.5	--	.068	.023	.87
21...	1100	5.02	5.20	.50	11.5	--	--	--	--	.051	--	--
28...	1020	5.00	5.20	.50	8.3	--	--	--	--	E.059	--	--
MAY												
04...	1030	4.96	7.60	.50	10.0	--	--	--	--	.055	--	--
10...	1030	4.97	5.20	.50	13.0	--	--	--	--	.047	--	--
16...	1355	5.00	6.40	.50	13.5	--	--	--	--	.045	--	--
18...	1245	4.99	5.80	--	--	--	--	--	--	--	--	--
18...	1250	--	--	.50	13.4	548	8.4	10.4	1.28	.047	.015	.74
18...	1306	--	--	16.0	11.1	557	8.0	6.6	--	.084	.044	--
24...	1030	5.03	6.10	.50	15.0	--	--	--	--	.046	--	--

423556088365001 DELAVAN LAKE AT CENTER NEAR DELAVAN LAKE, WI

WATER-QUALITY DATA, OCTOBER 12, 2004 TO SEPTEMBER 29, 2005--CONTINUED

(Milligrams per liter unless otherwise indicated)

Date	Time	Gage height, feet (00065)	Trans-parency Secchi disc, meters (00078)	Sam-pling depth, meters (00098)	Temper-ature, water, deg C (00010)	Specif. conduc-tance, wat unf uS/cm 25 degC (00095)	pH, water, unfltrd field, std units (00400)	Dis-solved oxygen, mg/L (00300)	Chloro-phyll a wat unf trichr. method, uncorr, ug/L (32210)	Phos-phorus, water, unfltrd mg/L (00665)	Ortho-phos-phate, water, fltrd, mg/L as P (00671)	Total nitro-gen, water, unfltrd mg/L (00600)
JUN												
03...	1400	4.98	6.40	.50	19.0	--	--	--	--	.045	--	--
07...	0835	5.04	4.90	.50	20.5	--	--	--	--	.048	--	--
16...	1355	5.07	3.80	--	--	--	--	--	--	--	--	--
16...	1400	--	--	.50	22.9	560	8.4	7.6	3.04	.054	.014	--
16...	1405	--	--	5.0	21.8	559	8.3	7.3	--	.052	.014	--
16...	1412	--	--	12.0	13.3	556	7.7	2.6	--	.106	.073	--
16...	1416	--	--	16.0	12.4	559	7.5	.1	--	.191	.151	--
22...	1110	4.98	3.50	.50	23.5	--	--	--	--	.043	--	--
29...	0825	4.93	2.10	.50	26.5	--	--	--	--	.21	--	--
JUL												
07...	1045	4.92	2.30	.50	24.0	--	--	--	--	.175	--	--
13...	1305	4.87	2.70	--	--	--	--	--	--	--	--	--
13...	1310	--	--	.50	25.1	557	8.5	9.0	3.56	.030	<.006	--
13...	1316	--	--	6.0	24.7	559	8.5	8.4	--	.029	<.006	--
13...	1323	--	--	13.0	13.0	601	7.6	.2	--	.27	.228	--
13...	1326	--	--	16.0	12.2	614	7.4	.2	--	.46	.410	--
19...	1130	4.80	3.50	.50	27.0	--	--	--	--	.026	--	--
28...	0945	4.80	3.80	.50	25.0	--	--	--	--	.033	--	--
AUG												
04...	0830	4.70	4.00	.50	25.0	--	--	--	--	.032	--	--
10...	0845	4.64	3.80	.50	26.0	--	--	--	--	.029	--	--
16...	1040	4.67	1.80	.50	25.0	--	--	--	--	.029	--	--
16...	1210	4.67	1.80	--	--	--	--	--	--	--	--	--
16...	1215	--	--	.50	26.1	550	8.6	9.3	13.9	.032	E.005	--
16...	1226	--	--	7.0	25.2	552	8.4	6.5	--	.03	<.006	--
16...	1227	--	--	8.0	23.6	562	7.7	.1	--	.03	--	--
16...	1229	--	--	10.0	16.1	567	7.5	.1	--	.16	--	--
16...	1231	--	--	12.0	13.2	575	7.5	.0	--	.32	.277	--
16...	1233	--	--	14.0	12.5	590	7.3	.0	--	.49	--	--
16...	1234	--	--	15.0	12.3	595	7.3	.0	--	.61	--	--
16...	1235	--	--	16.0	12.3	599	7.2	.0	--	.63	.591	--
25...	0945	4.63	2.90	.50	23.5	--	--	--	--	.026	--	--
31...	0950	4.59	2.40	.50	23.5	--	--	--	--	.029	--	--

423556088365001 DELAVAN LAKE AT CENTER NEAR DELAVAN LAKE, WI

WATER-QUALITY DATA, OCTOBER 12, 2004 TO SEPTEMBER 29, 2005--CONTINUED

(Milligrams per liter unless otherwise indicated)

Date	Time	Gage height, feet (00065)	Trans-parency Secchi disc, meters (00078)	Sam-pling depth, meters (00098)	Temper-ature, water, deg C (00010)	Specif. conduc-tance, wat unf uS/cm 25 degC (00095)	pH, water, unfltrd field, std units (00400)	Dis-solved oxygen, mg/L (00300)	Chloro-phyll a wat unf trichr. method, uncorr, ug/L (32210)	Phos-phorus, water, unfltrd mg/L (00665)	Ortho-phos-phate, water, fltrd, mg/L as P (00671)
SEP 2005											
07...	1100	4.50	2.70	.50	23.5	--	--	--	--	.027	--
15...	1345	4.40	2.70	.50	22.0	--	--	--	--	.033	--
20...	1325	4.38	1.90	--	--	--	--	--	--	--	--
20...	1330	--	--	.50	23.0	545	8.5	9.3	14.8	.037	<.006
20...	1339	--	--	9.0	22.1	547	8.3	6.9	--	.037	E.004
20...	1343	--	--	13.0	13.3	586	7.2	.2	--	.55	.492
20...	1346	--	--	16.0	12.4	600	7.1	.1	--	.68	.629
29...	1400	4.63	3.20	.50	19.0	--	--	--	--	.060	--

Date	Sam-pling depth, meters (00098)	Ammonia water, fltrd, mg/L as N (00608)	Ammonia + org-N, water, unfltrd mg/L as N (00625)	Nitrite + nitrate water fltrd, mg/L as N (00631)	Color, water, fltrd, Pt-Co units (00080)	Hard-ness, water, mg/L as CaCO3 (00900)	Calcium water, fltrd, mg/L (00915)	Magnes-ium, water, fltrd, mg/L (00925)	Sodium, water, fltrd, mg/L (00930)	Potas-sium, water, fltrd, mg/L (00935)	ANC, wat unf fixed end pt, lab, mg/L as CaCO3 (90410)	Chlor-ide, water, fltrd, mg/L (00940)
NOV 2004												
16...	--	--	--	--	--	--	--	--	--	--	--	--
16...	.50	.136	.74	.103	--	--	--	--	--	--	--	--
16...	15.5	--	--	--	--	--	--	--	--	--	--	--
FEB 2005												
08...	--	--	--	--	--	--	--	--	--	--	--	--
08...	.50	.135	.71	.211	--	--	--	--	--	--	--	--
08...	16.0	--	--	--	--	--	--	--	--	--	--	--

423556088365001 DELAVAN LAKE AT CENTER NEAR DELAVAN LAKE, WI

WATER-QUALITY DATA, NOVEMBER 16, 2004 TO SEPTEMBER 20, 2005--CONTINUED

(Milligrams per liter unless otherwise indicated)

Date	Sampling depth, meters (00098)	Ammonia water, fltrd, mg/L as N (00608)	Ammonia + org-N, water, unfltrd mg/L as N (00625)	Nitrite + nitrate water fltrd, mg/L as N (00631)	Color, water, fltrd, Pt-Co units (00080)	Hardness, water, mg/L as CaCO3 (00900)	Calcium water, fltrd, mg/L (00915)	Magnesium, water, fltrd, mg/L (00925)	Sodium, water, fltrd, mg/L (00930)	Potassium, water, fltrd, mg/L (00935)	ANC, wat unf fixed end pt, lab, mg/L as CaCO3 (90410)	Chloride, water, fltrd, mg/L (00940)
APR												
14...	--	--	--	--	--	--	--	--	--	--	--	--
14...	.50	.023	.73	.110	12	230	37.7	33.8	26.9	2.85	172	57.8
14...	16.0	.061	.72	.147	12	230	37.7	34.0	26.9	2.84	172	58.0
MAY												
18...	--	--	--	--	--	--	--	--	--	--	--	--
18...	.50	.066	.66	.079	--	--	--	--	--	--	--	--
18...	16.0	--	--	--	--	--	--	--	--	--	--	--
JUN												
16...	--	--	--	--	--	--	--	--	--	--	--	--
16...	.50	.075	.68	E.010	--	--	--	--	--	--	--	--
16...	5.0	--	--	--	--	--	--	--	--	--	--	--
16...	12.0	--	--	--	--	--	--	--	--	--	--	--
16...	16.0	--	--	--	--	--	--	--	--	--	--	--
JUL												
13...	--	--	--	--	--	--	--	--	--	--	--	--
13...	.50	.020	.69	E.012	--	--	--	--	--	--	--	--
13...	6.0	--	--	--	--	--	--	--	--	--	--	--
13...	13.0	--	--	--	--	--	--	--	--	--	--	--
13...	16.0	--	--	--	--	--	--	--	--	--	--	--
AUG												
16...	--	--	--	--	--	--	--	--	--	--	--	--
16...	.50	.034	.70	E.011	--	--	--	--	--	--	--	--
16...	7.0	--	--	--	--	--	--	--	--	--	--	--
16...	8.0	--	--	--	--	--	--	--	--	--	--	--
16...	10.0	--	--	--	--	--	--	--	--	--	--	--
16...	12.0	--	--	--	--	--	--	--	--	--	--	--
16...	14.0	--	--	--	--	--	--	--	--	--	--	--
16...	15.0	--	--	--	--	--	--	--	--	--	--	--
16...	16.0	--	--	--	--	--	--	--	--	--	--	--
SEP												
20...	--	--	--	--	--	--	--	--	--	--	--	--
20...	.50	.030	.69	E.008	--	--	--	--	--	--	--	--
20...	9.0	--	--	--	--	--	--	--	--	--	--	--
20...	13.0	--	--	--	--	--	--	--	--	--	--	--
20...	16.0	--	--	--	--	--	--	--	--	--	--	--

423556088365001 DELAVAN LAKE AT CENTER NEAR DELAVAN LAKE, WI

WATER-QUALITY DATA, NOVEMBER 16, 2004 TO SEPTEMBER 20, 2005--CONTINUED

(Milligrams per liter unless otherwise indicated)

Date	Sampling depth, meters (00098)	Sulfate water, fltrd, mg/L (00945)	Fluoride, water, fltrd, mg/L (00950)	Silica, water, fltrd, mg/L (00955)	Iron, water, fltrd, ug/L (01046)	Manganese, water, fltrd, ug/L (01056)	Residue on evap. at 180degC wat flt mg/L (70300)	BOD, water, unfltrd 5 day, 20 degC mg/L (00310)	Sampling method, code (82398)
NOV 2004									
16...	--	--	--	--	--	--	--	--	--
16...	.50	--	--	--	--	--	--	--	100
16...	15.5	--	--	--	--	--	--	--	100
FEB 2005									
08...	--	--	--	--	--	--	--	--	--
08...	.50	--	--	--	--	--	--	--	100
08...	16.0	--	--	--	--	--	--	--	100
APR									
14...	--	--	--	--	--	--	--	--	--
14...	.50	24.7	.2	<.2	<6	1.0	302	<2.0	100
14...	16.0	24.6	.2	.2	<6	1.7	300	<2.0	100
MAY									
18...	--	--	--	--	--	--	--	--	--
18...	.50	--	--	--	--	--	--	--	100
18...	16.0	--	--	--	--	--	--	--	100
JUN									
16...	--	--	--	--	--	--	--	--	--
16...	.50	--	--	--	--	--	--	--	100
16...	5.0	--	--	--	--	--	--	--	100
16...	12.0	--	--	--	--	--	--	--	100
16...	16.0	--	--	--	--	--	--	--	100
JUL									
13...	--	--	--	--	--	--	--	--	--
13...	.50	--	--	--	--	--	--	--	100
13...	6.0	--	--	--	--	--	--	--	100
13...	13.0	--	--	--	--	--	--	--	100
13...	16.0	--	--	--	--	--	--	--	100

423556088365001 DELAVAN LAKE AT CENTER NEAR DELAVAN LAKE, WI

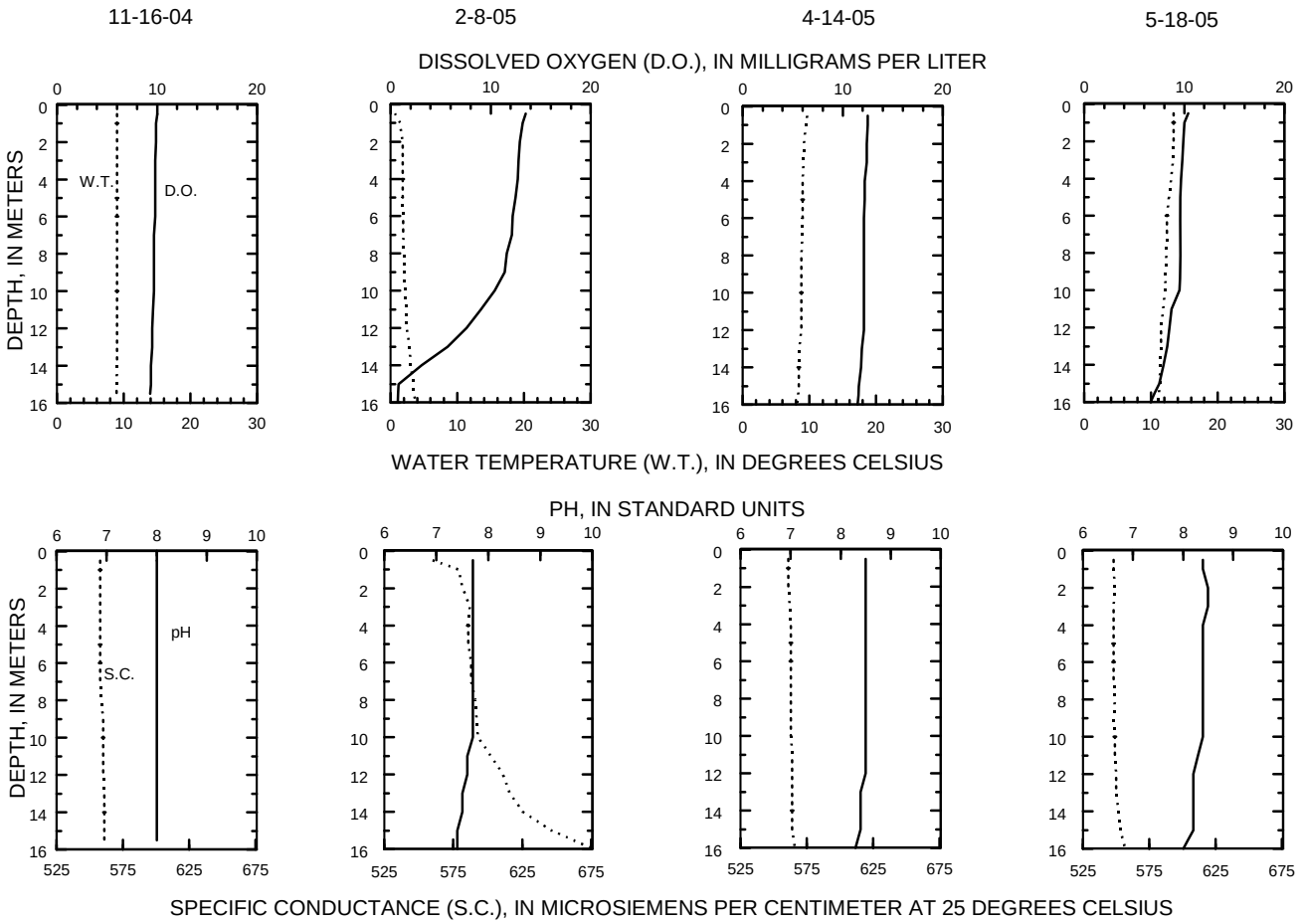
WATER-QUALITY DATA, NOVEMBER 16, 2004 TO SEPTEMBER 20, 2005--CONTINUED

(Milligrams per liter unless otherwise indicated)

Date	Sampling depth, meters (00098)	Sulfate water, fltrd, mg/L (00945)	Fluoride, water, fltrd, mg/L (00950)	Silica, water, fltrd, mg/L (00955)	Iron, water, fltrd, ug/L (01046)	Manganese, water, fltrd, ug/L (01056)	Residue on evap. at 180degC wat flt mg/L (70300)	BOD, water, unfltrd 5 day, 20 degC mg/L (00310)	Sampling method, code (82398)
AUG									
16...	--	--	--	--	--	--	--	--	--
16...	.50	--	--	--	--	--	--	--	--
16...	7.0	--	--	--	--	--	--	--	100
16...	8.0	--	--	--	--	--	--	--	100
16...	10.0	--	--	--	--	--	--	--	100
16...	12.0	--	--	--	--	--	--	--	100
16...	14.0	--	--	--	--	--	--	--	100
16...	15.0	--	--	--	--	--	--	--	100
16...	16.0	--	--	--	--	--	--	--	100
SEP									
20...	--	--	--	--	--	--	--	--	--
20...	.50	--	--	--	--	--	--	<2.0	100
20...	9.0	--	--	--	--	--	--	--	100
20...	13.0	--	--	--	--	--	--	--	100
20...	16.0	--	--	--	--	--	--	--	100

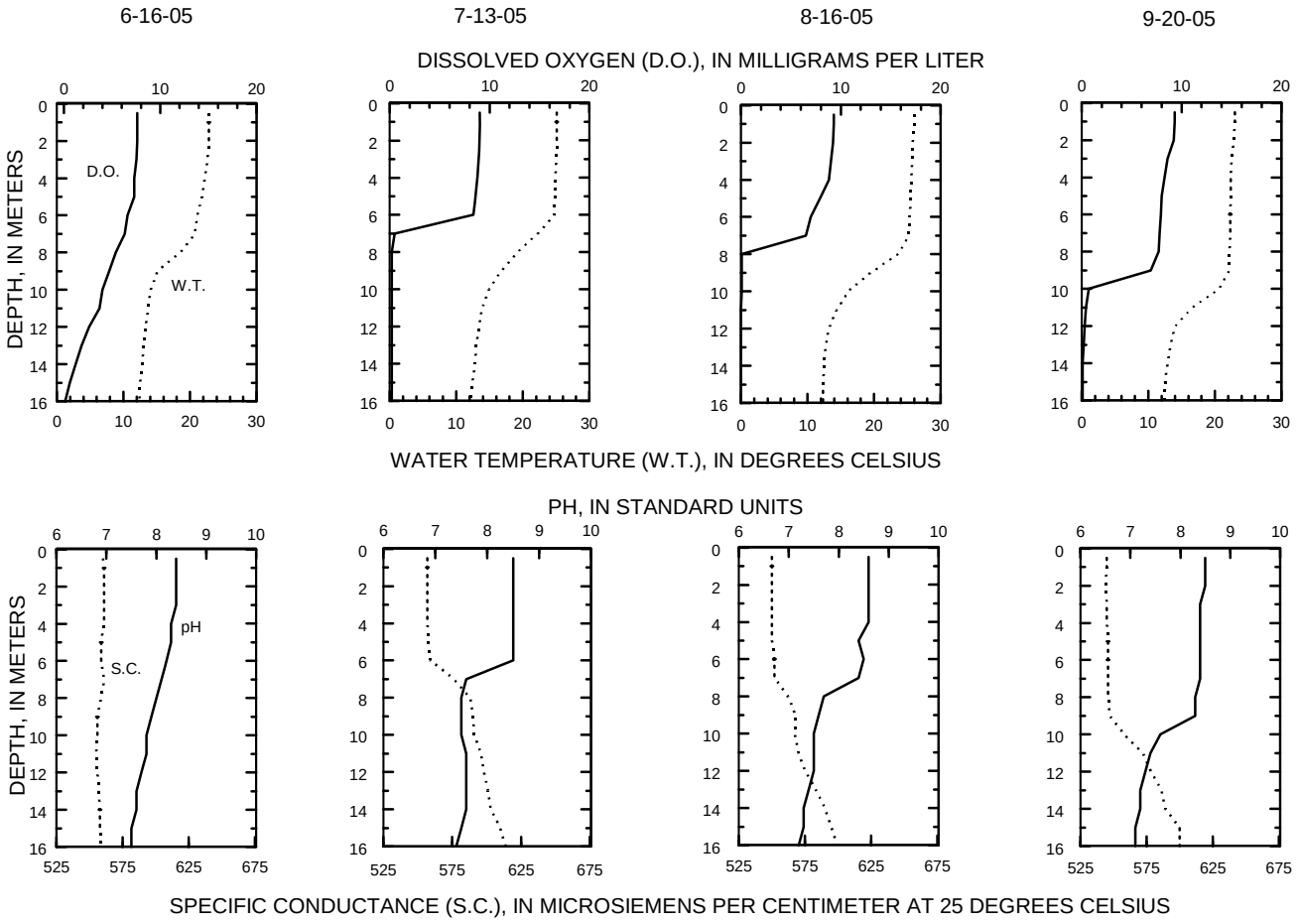
423556088365001 DELAVAN LAKE AT CENTER NEAR DELAVAN LAKE, WI

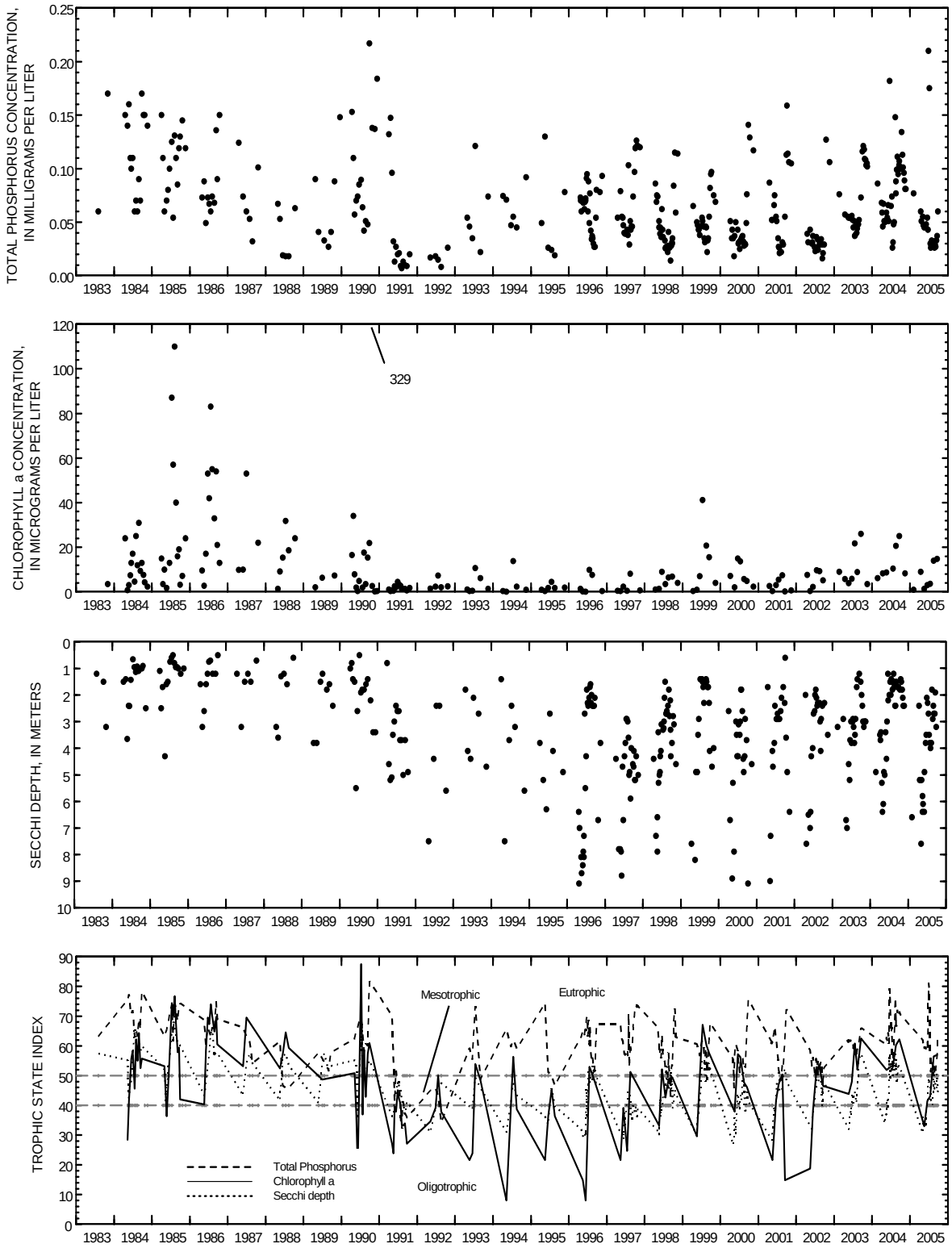
LAKE-DEPTH PROFILES, NOVEMBER 16, 2004 TO MAY 18, 2005



423556088365001 DELAVAN LAKE AT CENTER NEAR DELAVAN LAKE, WI

LAKE-DEPTH PROFILES, JUNE 16 TO SEPTEMBER 20, 2005





Surface total phosphorus, chlorophyll a concentrations, Secchi depths, and TSI data for Delavan Lake, at Center, near Delavan, Wisconsin.

423659088354401 DELAVAN LAKE, AT NORTH END, NEAR LAKE LAWN, WI

LOCATION.--Lat 42°36'59", long 88°35'44", in NW ¼ SW ¼ sec.22, T.2 N., R.16 E., Walworth County, Hydrologic Unit 07090001, 2.6 mi southeast of Delavan.

DRAINAGE AREA.--41.4 mi^2, of which 2.3 mi^2 is non-contributing.

PERIOD OF RECORD.--October 1983 to current year.

Date	Time	Transparency Secchi disc, meters (00078)
APR 2005		
14...	1310	3.00
MAY		
18...	0900	5.30
JUN		
16...	1520	4.40
AUG		
16...	1415	1.90

423526088380101 DELAVAN LAKE, AT SW END, NEAR DELAVAN LAKE, WI

LOCATION.--Lat 42°35'26", long 88°38'01", in SE ¼ NW ¼ sec.32, T.2 N., R.16 E., Walworth County, Hydrologic Unit 07090001, 2.6 mi southeast of Delavan.

DRAINAGE AREA.--41.4 mi^2, of which 2.3 mi^2 is non-contributing.

PERIOD OF RECORD.--October 1983 to current year.

Date	Time	Transparency Secchi disc, meters (00078)
APR 2005		
14...	1300	2.60
MAY		
18...	1330	5.60
JUN		
16...	1500	3.50
AUG		
16...	1320	1.80

05404500 DEVILS LAKE NEAR BARABOO, WI

LOCATION.--Lat 43°25'35", long 89°43'40", in SW ¼ SE ¼ sec.13, T.11 N., R.6 E., Sauk County, Hydrologic Unit 07070004, in Devils Lake State Park, 3.5 mi south of Baraboo.

DRAINAGE AREA.--4.79 mi^2. Area of Devils Lake, 361 acres.

PERIOD OF RECORD.--June 1922 to August 1930, June to August 1932, June 1934 to September 1981, October 1984 to June 1991 (fragmentary), July 1991 to current year. Unpublished daily stage records from October 1981 to September 1984 in District files.

REVISED RECORDS.--WDR WI-78-1: Drainage area.

GAGE.--Water-stage recorder installed July 17, 1991. Datum of gage is 955.00 ft, above NGVD of 1929.

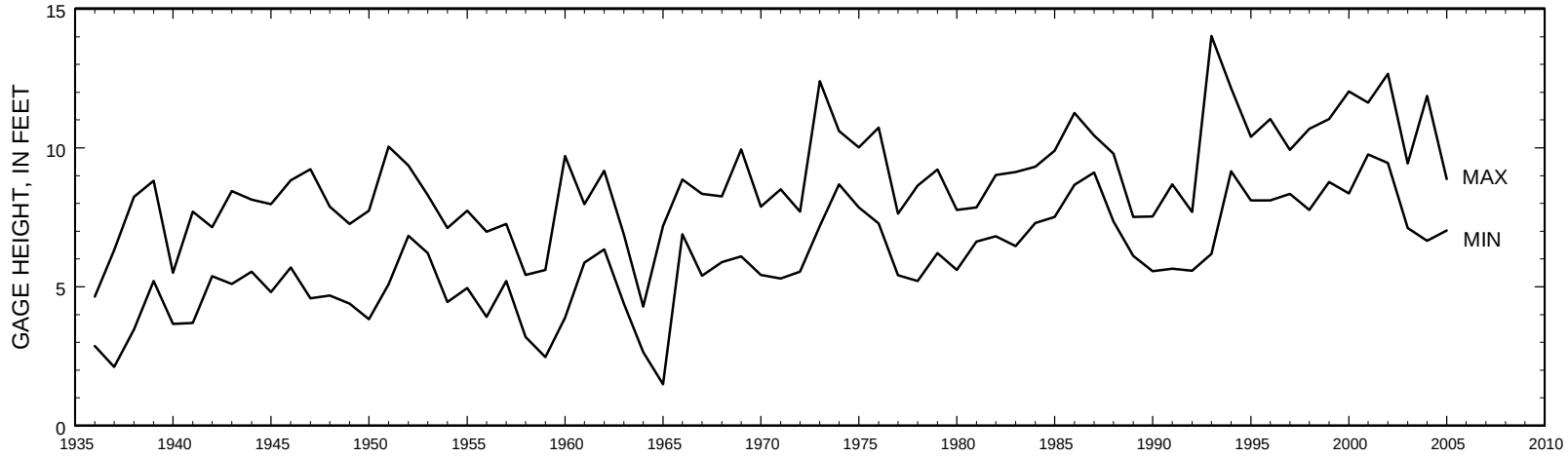
REMARKS.--Lake has no surface outlet. Water removed from lake by pumping or siphon Oct. 1-15 and Sept. 8-30.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height observed, 14.13 ft, July 18, 1993; minimum observed, 1.49 ft, Feb. 8, 1965.

EXTREMES FOR CURRENT YEAR.--Maximum recorded gage height, 8.95 ft, Apr. 11, 12-14; minimum recorded, 7.01 ft, Sept. 30.

GAGE HEIGHT, FEET
WATER YEAR OCTOBER 2004 TO SEPTEMBER 2005
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	8.74	8.12	7.90	7.90	8.01	8.15	8.74	8.68	8.66	8.29	7.95	7.70
2	8.71	8.14	7.89	7.95	8.00	8.15	8.78	8.66	8.64	8.27	7.93	7.67
3	8.66	8.13	7.88	7.95	8.00	8.15	8.81	8.64	8.62	8.24	7.91	7.65
4	8.60	8.11	7.87	7.95	8.00	8.15	8.83	8.63	8.60	8.25	7.90	7.63
5	8.55	8.10	7.86	7.96	8.00	8.14	8.85	8.61	8.61	8.23	7.88	7.61
6	8.49	8.08	7.88	8.00	8.00	8.14	8.86	8.61	8.59	8.21	7.85	7.59
7	8.45	8.06	7.93	8.01	8.03	8.16	8.87	8.61	8.57	8.19	7.83	7.55
8	8.45	8.05	7.95	8.00	8.04	8.16	8.88	8.60	8.55	8.18	7.81	7.51
9	8.41	8.04	7.95	8.00	8.05	8.16	8.88	8.61	8.55	8.15	7.79	7.48
10	8.37	8.01	7.99	7.99	8.05	8.18	8.87	8.61	8.56	8.13	7.78	7.45
11	8.33	8.00	8.02	7.99	8.05	8.19	8.87	8.69	8.54	8.11	7.78	7.42
12	8.29	7.99	8.01	8.00	8.05	8.20	8.88	8.71	8.54	8.08	7.85	7.39
13	8.25	7.97	7.99	8.00	8.07	8.20	8.88	8.76	8.58	8.06	7.83	7.37
14	8.20	7.96	7.98	7.99	8.11	8.20	8.88	8.78	8.64	8.04	7.81	7.34
15	8.16	7.95	7.98	7.99	8.12	8.19	8.87	8.77	8.64	8.02	7.79	7.31
16	8.12	7.95	7.96	7.99	8.12	8.19	8.86	8.77	8.61	8.00	7.77	7.27
17	8.10	7.95	7.96	7.98	8.12	8.19	8.86	8.77	8.58	7.98	7.75	7.23
18	8.08	7.94	7.95	7.98	8.12	8.22	8.86	8.77	8.56	7.95	7.83	7.19
19	8.07	7.95	7.93	7.97	8.12	8.25	8.85	8.78	8.53	7.91	7.97	7.22
20	8.06	7.96	7.92	7.98	8.14	8.25	8.84	8.78	8.51	7.92	7.95	7.22
21	8.05	7.95	7.92	7.99	8.15	8.25	8.83	8.77	8.49	7.96	7.93	7.19
22	8.05	7.94	7.91	8.04	8.15	8.25	8.82	8.76	8.46	7.97	7.90	7.19
23	8.15	7.93	7.91	8.03	8.15	8.24	8.79	8.74	8.43	7.96	7.87	7.16
24	8.16	7.91	7.90	8.03	8.15	8.24	8.77	8.73	8.40	7.96	7.85	7.13
25	8.15	7.90	7.90	8.03	8.15	8.25	8.75	8.72	8.41	7.96	7.83	7.12
26	8.14	7.89	7.89	8.03	8.14	8.25	8.74	8.70	8.40	8.09	7.81	7.11
27	8.14	7.91	7.89	8.02	8.14	8.25	8.74	8.70	8.39	8.06	7.80	7.09
28	8.14	7.92	7.89	8.02	8.15	8.27	8.72	8.68	8.36	8.04	7.78	7.08
29	8.14	7.92	7.88	8.01	---	8.33	8.71	8.67	8.34	8.01	7.76	7.06
30	8.14	7.91	7.88	8.01	---	8.47	8.69	8.69	8.35	7.99	7.74	7.03
31	8.13	---	7.89	8.01	---	8.67	---	8.67	---	7.97	7.72	---
MEAN	8.27	7.99	7.92	7.99	8.09	8.23	8.82	8.70	8.52	8.07	7.84	7.33
MAX	8.74	8.14	8.02	8.04	8.15	8.67	8.88	8.78	8.66	8.29	7.97	7.70
MIN	8.05	7.89	7.86	7.90	8.00	8.14	8.69	8.60	8.34	7.91	7.72	7.03



Annual minimum and maximum water levels for Devils Lake, 1936-2005.

433632088100200 FOREST LAKE NEAR DUNDEE, WI

LOCATION.--Lat 43°36'32", long 88°10'02", in SW ¼ NE ¼ sec.12, T.13 N., R.19 E., Fond du Lac County, Hydrologic Unit 04040003, 3 mi south of Dundee.

PERIOD OF RECORD.--March 1994 to August 1996, May to August 2004, February to August 2005.

REMARKS.--Lake sampled near center at the deep hole. Lake ice-covered during February sampling. Water-quality analyses done by Wisconsin State Laboratory of Hygiene.

WATER-QUALITY DATA, FEBRUARY 23 TO AUGUST 23, 2005
(Milligrams per liter unless otherwise indicated)

Date	Time	Gage height, feet (00065)	Transparency Secchi disc, meters (00078)	Sampling depth, meters (00098)	Temperature, water, deg C (00010)	Specif. conductance, wat unf uS/cm 25 degC (00095)	pH, water, unfltrd field, std units (00400)	Dissolved oxygen, mg/L (00300)	Chlorophyll a wat unf trichr. method, uncorr, ug/L (32210)	Phosphorus, water, unfltrd mg/L (00665)	Orthophosphate, water, fltrd, mg/L as P (00671)
FEB 2005											
23...	1450	--	--	.50	1.2	241	7.5	12.9	--	.021	--
23...	1459	--	--	9.0	5.0	304	7.0	.7	--	.032	--
APR											
19...	1020	--	--	.50	15.6	243	7.9	10.9	1.29	.019	.006
19...	1029	--	--	9.0	6.4	292	6.9	.3	--	.053	--
19...	1045	--	4.50	--	--	--	--	--	--	--	--
JUN											
09...	1520	--	--	.50	26.9	238	8.6	11.2	2.31	.017	--
09...	1528	--	--	8.0	9.9	297	7.3	2.6	--	.048	--
09...	1530	8.72	3.85	--	--	--	--	--	--	--	--
JUL											
19...	1300	--	--	.50	28.3	200	8.8	10.0	2.87	.014	--
19...	1313	--	--	9.0	10.7	315	7.1	.3	--	.111	--
19...	1315	8.18	4.15	--	--	--	--	--	--	--	--
AUG											
23...	1130	--	--	.50	23.5	202	8.9	7.3	5.48	.017	--
23...	1140	--	--	8.5	11.3	320	6.9	.1	--	.049	--
23...	1145	--	2.65	--	--	--	--	--	--	--	--

WATER-QUALITY DATA, FEBRUARY 23 TO AUGUST 23, 2005--CONTINUED
(Milligrams per liter unless otherwise indicated)

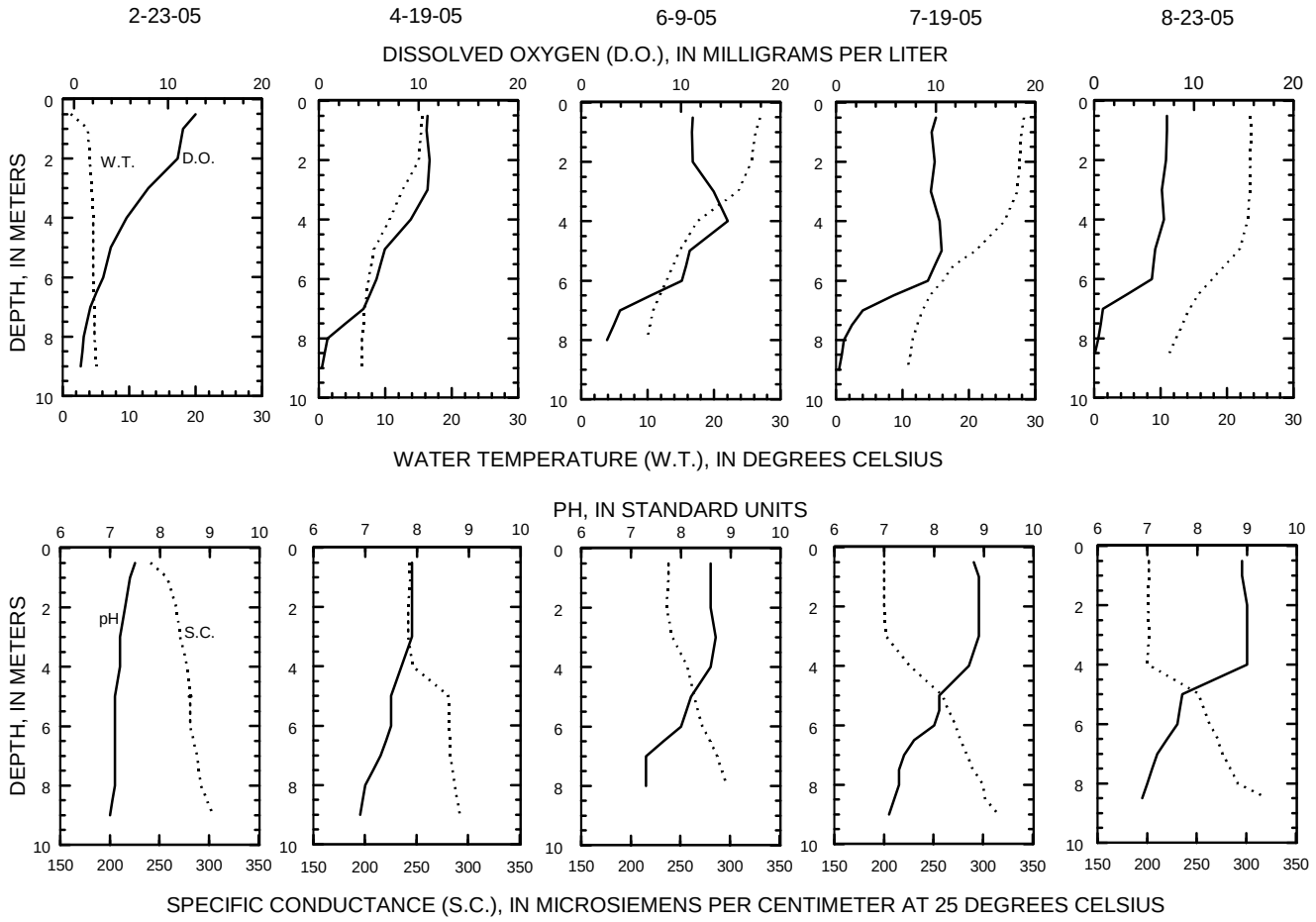
Date	Sampling depth, meters (00098)	Ammonia water, fltrd, mg/L as N (00608)	Ammonia + org-N, water, unfltrd mg/L as N (00625)	Nitrite + nitrate water fltrd, mg/L as N (00631)	Turbidity, NTU (00076)	Apparent color, water, unfltrd Pt-Co units (00081)	Hardness, water, mg/L as CaCO3 (00900)	Calcium water, fltrd, mg/L (00915)	Magnesium, water, fltrd, mg/L (00925)	Sodium, water, fltrd, mg/L (00930)	Potassium, water, fltrd, mg/L (00935)
FEB 2005											
23...	.50	--	--	--	--	--	--	--	--	--	--
23...	9.0	--	--	--	--	--	--	--	--	--	--
APR											
19...	.50	.016	.58	<.019	<1.0	15	130	27.1	15.0	2.90	<1.00
19...	9.0	--	--	--	--	--	--	--	--	--	--
19...	--	--	--	--	--	--	--	--	--	--	--
JUN											
09...	.50	--	--	--	--	--	--	--	--	--	--
09...	8.0	--	--	--	--	--	--	--	--	--	--
09...	--	--	--	--	--	--	--	--	--	--	--
JUL											
19...	.50	--	--	--	--	--	--	--	--	--	--
19...	9.0	--	--	--	--	--	--	--	--	--	--
19...	--	--	--	--	--	--	--	--	--	--	--
AUG											
23...	.50	--	--	--	--	--	--	--	--	--	--
23...	8.5	--	--	--	--	--	--	--	--	--	--
23...	--	--	--	--	--	--	--	--	--	--	--

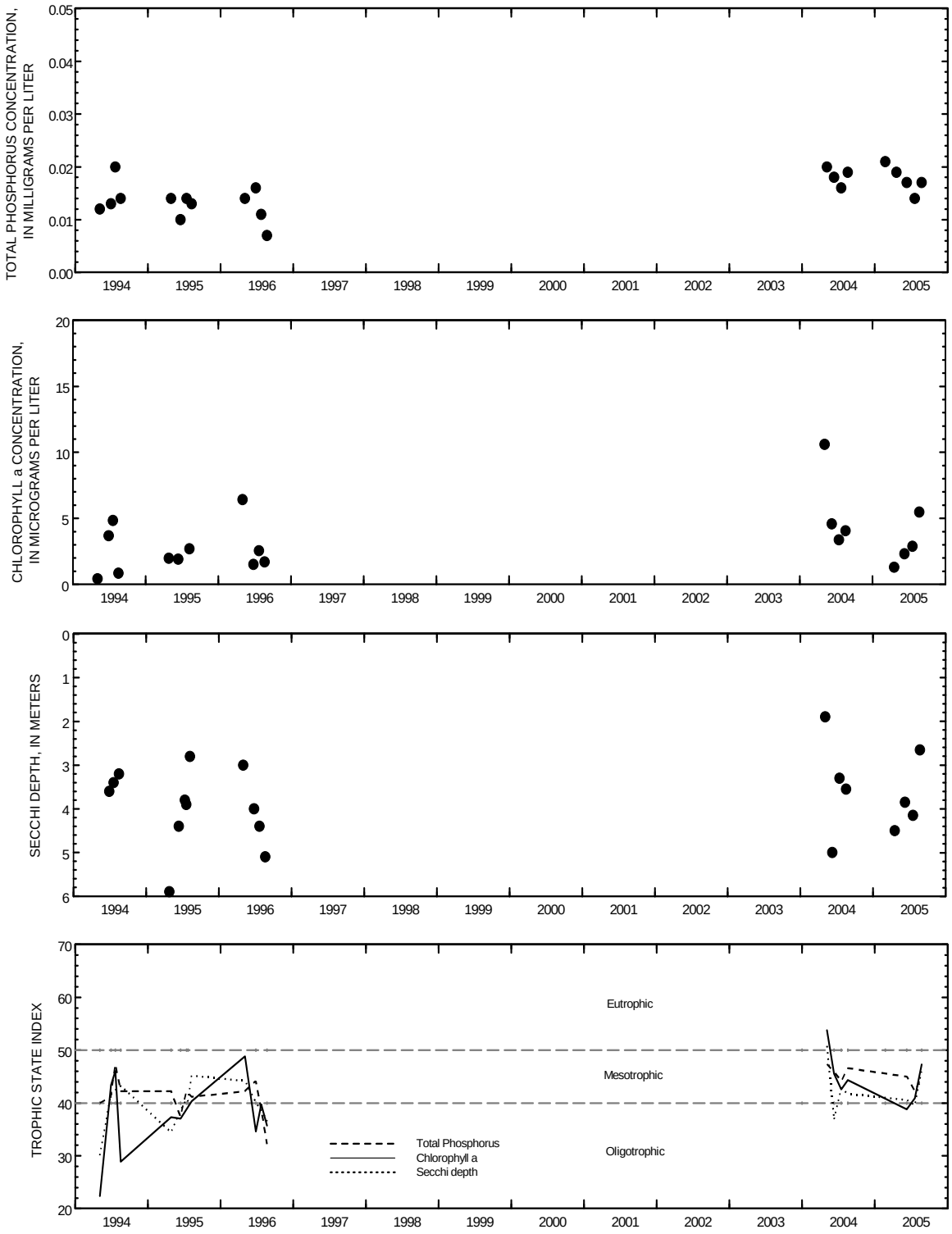
WATER-QUALITY DATA, FEBRUARY 23 TO AUGUST 23, 2005--CONTINUED
(Milligrams per liter unless otherwise indicated)

Date	Sampling depth, meters (00098)	ANC, wat unf fixed end pt, lab, mg/L as CaCO3 (00417)	Chloride, water, fltrd, mg/L (00940)	Sulfate water, fltrd, mg/L (00945)	Silica, water, fltrd, mg/L (00955)	Iron, water, fltrd, ug/L (01046)	Manganese, water, fltrd, ug/L (01056)	Residue on evap. at 180degC wat flt mg/L (70300)	Sampling method, code (82398)
FEB 2005									
23...	.50	--	--	--	--	--	--	--	100
23...	9.0	--	--	--	--	--	--	--	100
APR									
19...	.50	113	5.4	<4.5	.108	<100	M	138	100
19...	9.0	--	--	--	--	--	--	--	100
19...	--	--	--	--	--	--	--	--	--
JUN									
09...	.50	--	--	--	--	--	--	--	100
09...	8.0	--	--	--	--	--	--	--	100
09...	--	--	--	--	--	--	--	--	--
JUL									
19...	.50	--	--	--	--	--	--	--	100
19...	9.0	--	--	--	--	--	--	--	100
19...	--	--	--	--	--	--	--	--	--
AUG									
23...	.50	--	--	--	--	--	--	--	100
23...	8.5	--	--	--	--	--	--	--	100
23...	--	--	--	--	--	--	--	--	--

433632088100200 FOREST LAKE NEAR DUNDEE, WI

LAKE-DEPTH PROFILES, FEBRUARY 23 TO AUGUST 23, 2005





Surface total phosphorus, chlorophyll a concentrations, Secchi depths, and TSI data for Forest Lake near Dundee, Wisconsin.

423525088260400 GENEVA LAKE AT LAKE GENEVA, WI

LOCATION.--Lat 42°35'25", long 88°26'04" in SE ¼ NW ¼ sec.36, T.2 N., R.17 E., Walworth County, Hydrologic Unit 07120006, at Geneva Lake dam at Center Street at Lake Geneva.

DRAINAGE AREA.--28.7 mi^2. Area of Geneva Lake, 5,262 acres.

PERIOD OF RECORD.--October 1997 to August 2002, December 2002 to current year.

GAGE.--Water-stage recorder. Datum of gage is 862.08 ft above NGVD of 1929. Intermittent staff-gage readings January to February.

REMARKS.--Gage-height telemeter at station.

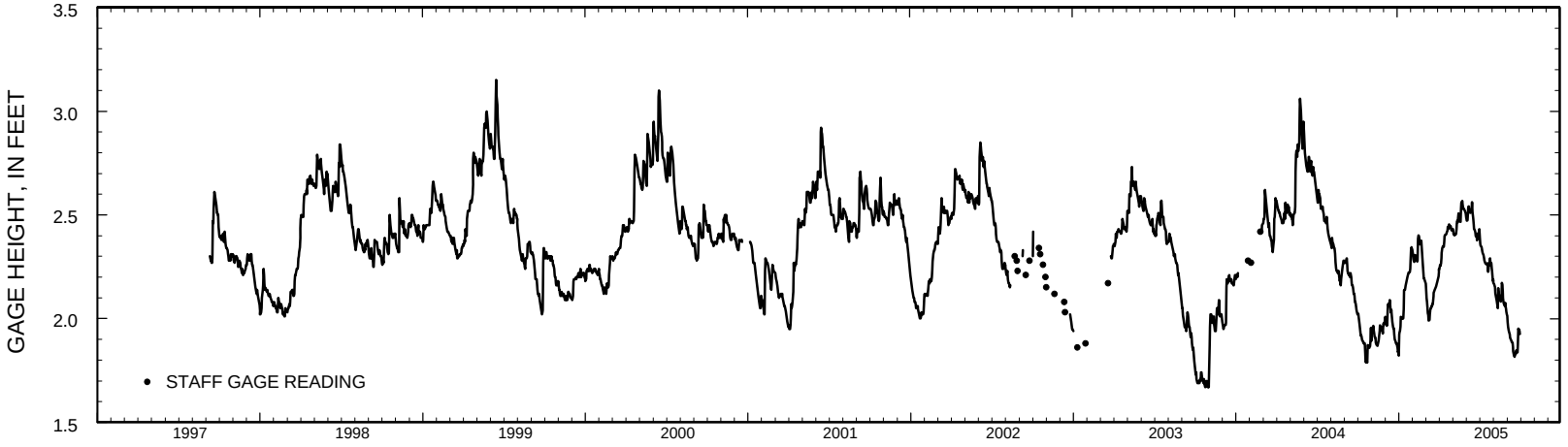
EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 3.29 ft, June 13, 2000; minimum gage height, 1.50 ft, Oct. 11, 2003 (affected by wind).

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 2.85 ft, May 13; minimum gage height, 1.53 ft, Dec. 30.

GAGE HEIGHT, FEET
WATER YEAR OCTOBER 2004 TO SEPTEMBER 2005
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.02	1.90	2.01	1.82	2.33	2.17	2.24	2.43	2.48	2.39	2.17	2.01
2	2.02	1.95	2.00	1.92	2.32	e2.13	2.25	2.42	2.47	2.36	2.17	1.98
3	2.01	1.94	1.99	1.93	e2.31	e2.10	2.26	2.41	2.47	2.35	2.16	1.96
4	1.97	1.96	2.00	1.94	2.29	e2.08	2.26	2.40	2.48	2.35	2.15	1.95
5	1.96	1.97	1.97	1.96	2.27	2.05	2.27	2.40	2.54	2.34	2.12	1.94
6	1.94	1.94	1.99	2.01	2.27	2.03	2.28	2.41	2.54	2.32	2.11	1.93
7	1.92	1.93	2.05	2.01	2.30	2.02	2.33	2.41	2.52	2.31	2.10	1.92
8	1.92	1.91	2.07	2.00	2.31	1.99	2.34	2.41	2.52	2.31	2.09	1.91
9	1.91	1.91	2.06	2.00	2.30	1.99	2.35	2.43	2.51	2.30	2.08	1.90
10	1.90	1.91	2.06	2.00	2.30	2.02	2.35	2.46	2.51	2.30	2.06	1.90
11	1.89	1.88	2.07	2.00	2.29	2.04	2.35	2.47	2.52	2.28	2.05	1.89
12	1.89	1.88	2.09	2.05	2.27	e2.05	2.37	2.47	2.53	2.27	2.15	1.89
13	1.89	1.87	2.04	2.14	2.28	e2.05	2.40	2.49	2.53	2.27	2.12	1.88
14	1.88	1.87	2.03	2.14	2.39	e2.06	2.40	2.51	2.56	2.26	2.11	1.86
15	1.88	1.87	2.04	2.14	2.40	e2.06	2.40	2.49	2.51	2.26	2.10	1.83
16	1.88	1.89	2.01	e2.15	2.40	e2.07	2.41	2.47	2.48	2.26	2.09	1.83
17	1.83	1.90	1.99	e2.16	2.39	e2.07	2.41	2.47	2.45	2.27	2.08	1.82
18	1.79	1.90	1.98	e2.17	e2.37	2.08	2.41	2.47	2.43	2.27	2.10	1.82
19	1.79	1.93	1.96	e2.18	2.36	2.12	2.42	2.53	2.43	2.23	2.10	1.83
20	1.80	1.97	1.95	e2.19	2.36	2.14	2.44	2.56	2.43	2.23	2.17	1.83
21	1.79	1.96	1.95	e2.20	2.37	2.14	2.43	2.56	2.42	2.26	2.16	1.83
22	1.79	1.96	1.92	2.21	2.35	2.14	2.45	2.57	2.40	2.26	2.13	1.85
23	1.87	1.96	e1.90	2.22	2.31	2.15	2.45	2.55	2.40	2.26	2.10	1.84
24	1.87	1.94	e1.89	2.22	2.28	2.16	2.44	2.54	2.40	2.29	2.08	1.84
25	1.86	1.95	e1.88	2.22	2.26	2.16	2.45	2.53	2.38	2.27	2.06	1.87
26	1.86	1.93	e1.88	2.22	2.22	2.17	2.44	2.53	2.41	2.27	2.06	1.95
27	1.86	1.97	e1.88	e2.24	2.19	2.18	2.44	2.53	2.41	2.24	2.08	1.94
28	1.87	1.98	e1.87	e2.28	2.19	2.18	2.43	2.52	2.41	2.23	2.06	1.95
29	1.90	1.97	1.86	2.33	---	2.19	2.43	2.51	2.39	2.20	2.05	1.94
30	1.96	1.98	1.84	2.34	---	2.20	2.43	2.50	2.43	2.18	2.03	1.93
31	1.89	---	1.84	2.34	---	2.24	---	2.49	---	2.19	2.02	---
MEAN	1.89	1.93	1.97	2.12	2.31	2.10	2.38	2.48	2.47	2.28	2.10	1.89
MAX	2.02	1.98	2.09	2.34	2.40	2.24	2.45	2.57	2.56	2.39	2.17	2.01
MIN	1.79	1.87	1.84	1.82	2.19	1.99	2.24	2.40	2.38	2.18	2.02	1.82

e Estimated



Stage hydrograph for Geneva Lake, 1997-2005.