Searing

LPL 013
W.Q.

Little Green Lake near Markesan, Wisconsin
Water-Quality Data Summary

(NO PDF files available)

This summary covers the period October 1990 to September 1996, which is the period of water-quality monitoring of Little Green Lake by the U.S. Geological Survey (USGS). Emphasis in this summary is on data collected during 1996. All data collected during 1996 is included. Data from previous years is included in graphs to illustrate changes or trends.

In reviewing the data, it may be helpful to refer to the methods and explanations of physical and chemical characteristics sections in the USGS annual lake data report "Water-Quality and Lake-Stage Data for Wisconsin Lakes, Water Year 1996" and to Shaw and others (1994) "Understanding Lake Data."

Lake description and sampling locations:

Little Green Lake is classified as a seepage lake, with 2 intermittent inlets and 1 intermittent outlet. The average depth of Little Green Lake is 10 feet, the surface area is 466 acres (.728 square miles), and the lake's watershed area is 3.33 square miles. The water-quality sampling site is located at the deepest point in the lake at a depth of about 27 feet. Lake stage was monitored along the southern shoreline. The locations of the monitoring sites are shown in Figure 1.

Hydrologic conditions during water year 1996:

Annual variability in lake condition often reflects variability in climatic and hydrologic conditions. Air temperature in central Wisconsin was, on the average, 2.5 °F cooler than normal for the period December 1995 through March 1996; April and May was 3.7 °F cooler than normal; and the period June through August was 0.5 °F cooler than normal (National Oceanic and Atmospheric Administration "Climatological Data--Wisconsin"). Precipitation during water year 1996 was 99 percent of normal precipitation for central Wisconsin (Pamela Naber-Knox, UW-Extension, Geological and Natural History Survey, written commun., 1996). Watershed runoff in the region of Little Green Lake was between 120 and 140 percent of long-term average runoff (Holmstrom and others, 1997, "Water Resources Data--Wisconsin").

Lake Data for 1996:

The following summarizes some highlights of data given in the tables and shown in the figures.

Lake-stage fluctuations:

Lake stages were measured by the USGS on sampling dates. The stages ranged from 6.14 feet on August 22 to 6.51 feet on July 22. This range of fluctuation is less than average from the previous 5 years of monitoring. Stage values are shown in the table on the top half of Figure 2.

Lake-depth profiles:

Vertical profiles of water temperature, dissolved oxygen, pH, and specific conductance exhibit a pattern that can be expected for a medium-depth lake that only marginally stratifies. The profiles for 1996 which were measured over the deepest point in the lake, are listed in Table 1 and shown in Figure 2. During the February through August sampling period, complete water-column mixing was observed on May 2. By the June 6 sampling date only slight thermal stratification was evident. The lake became thermally stratified through the summer. In July the lower 6 feet were anoxic (devoid of oxygen) and by August the lower 10.5 feet were anoxic. The anoxic zone is unable to support fish. The pH, which ranged between 7.2 and 8.8, is common for southeastern Wisconsin lakes and poses no problems for aquatic life.

Chemical constituents:

Analyses of water samples collected on May 2 for selected chemical constituents for chemical characterization of the lake are shown in Figure 2. Samples collected at 1.5 and 26-foot depths show similar constituent concentrations, as would be expected under mixed water column conditions. The constituent values for color, chlorophyll a, chloride, calcium, magnesium, pH, alkalinity, total-nitrogen, and total-phosphorus are within regional values for this area as described by Lillie and Mason in "Limnological Characteristics of Wisconsin Lakes," 1983, Technical Bulletin No. 138, Department of Natural Resources.

The ratio of dissolved-nitrogen to dissolved-phosphorus was 22.:1, based on the surface concentrations on May 2. This ratio suggests the lake is phosphorus limited, which means algal growth is dependent on the amount of available phosphorus rather than nitrogen.

Three common measures of water quality used as indices are concentrations of near-surface total-phosphorus and chlorophyll a, and Secchi depth. Total-phosphorus concentrations ranged from 0.040 mg/L on May 2 to 0.124 mg/L on August 22, chlorophyll a ranged from 3.9 µg/L on June 6 to 59.0 µg/L on August 22, and Secchi depths ranged from 1.1 m on August 22 to 4.8 m on June 6.

Surface total-phosphorus and chlorophyll a concentrations, and Secchi depths for the 1991 -96 period are shown on Figure 3. No clear year-to-year trend toward increasing or decreasing total phosphorus concentration is apparent in the data. However, there may be a slight trend toward decreasing chlorophyll a and increasing Secchi depths during the 6-year period. In all years there is a seasonal pattern of increasing total phosphorus and chlorophyll a concentration and decreasing Secchi depth through the summer. Intermittent mixing of hypolimnetic and eplimnetic waters is the likely cause of this seasonal pattern. acts like shallow system

Total-phosphorus concentration 1.5 feet above the lake bottom at the center site ranged from 0.040 mg/L on May 2 to 1.1 mg/L on August 22. These total-phosphorus concentrations observed during anoxic periods are indicative of large phosphorus release from the bottom sediments.

Lake condition:

Water-quality index:

Lillie and Mason (1983) classified all Wisconsin lakes using a random data set collected in the summer (July and August). The index, shown on page 12 of "Water-Quality and Lake-Stage data for Wisconsin Lakes, Water Year 1996," is based on surface total-phosphorus and chlorophyll a concentrations, and Secchi depths. According to the index, surface total-phosphorus and chlorophyll a concentrations in Little Green Lake indicate "very poor" water quality, and Secchi depths indicate "poor" water quality.

Lillie and Mason (1983) also provided a means of comparing the condition of Little Green Lake with other lakes in southeastern Wisconsin. The comparison on Table 3 shows the percentage distribution of southeastern Wisconsin lakes within each condition group and the relative position of Little Green Lake.

Trophic status:

Another means of assessing the nutrient, or trophic, status of a lake is to use Carlson's Trophic State Index (TSI). The 1996 TSI data is listed in Table 2. Figure 4 is a graphical illustration of the variation in Trophic State Indices for Little Green Lake during the 6 year study period. The data from 1996 show the lake to be meso-eutrophic, or a lake with moderate to high nutrient levels.

Table 1. Lake-depth profiles for Little Green Lake near Markesan, Wisconsin, 1996

DATE	SAMPLING DEPTH (FEET) (00003)	TEMPERATURE WATER (DEG C) (00010)	SPECIFIC CONDUCTANCE (US/CM) (00095)	PH WATER WHOLE FIELD (STANDARD UNITS) (00400)	OXYGEN, DISSOLVED (MG/L) (00300)
FEB 1996					
13...	3.00	2.0	406	7.6	10.3
13...	6.00	2.5	407	7.7	9.7
13...	9.00	2.5	409	7.7	8.3
13...	12.0	3.0	409	7.7	7.6
13...	15.0	3.0	411	7.6	4.6
13...	18.0	3.5	420	7.6	2.1
13...	21.0	3.5	425	7.5	0.6
13...	24.0	4.0	433	7.5	0.2
13...	26.0	--	--	--	--
MAY					
02...	1.50	9.0	344	8.2	10.4
02...	3.00	9.0	343	8.2	10.3
02...	6.00	9.0	342	8.2	10.2
02...	9.00	9.0	343	8.2	10.4
02...	12.0	9.0	342	8.2	10.7
02...	15.0	9.0	343	8.2	10.5
02...	18.0	9.0	342	8.2	10.1
02...	21.0	9.0	342	8.2	9.9
02...	24.0	9.0	343	8.2	9.7
02...	25.5	9.0	343	8.2	9.7
02...	27.0	--	--	--	--
JUN					
06...	1.50	17.5	311	8.4	8.9
06...	3.00	17.0	311	8.4	8.9
06...	6.00	17.0	310	8.4	8.8
06...	9.00	17.0	312	8.4	9.1
06...	12.0	16.5	312	8.4	9.4
06...	15.0	16.5	314	8.2	7.6
06...	18.0	16.5	316	8.1	6.8
06...	21.0	16.0	320	7.8	3.9
06...	24.0	15.0	329	7.5	1.7
06...	25.5	14.5	337	7.5	0.7
06...	27.0	--	--	--	--
JUL					
22...	1.50	23.5	337	8.6	7.7
22...	3.00	23.5	337	8.6	7.7
22...	6.00	23.5	337	8.6	7.8
22...	9.00	23.5	337	8.6	8.1
22...	12.0	23.5	337	8.6	8.3
22...	15.0	23.0	336	8.6	7.4
22...	18.0	22.5	343	8.3	3.6
22...	21.0	21.5	356	8.0	0.4
22...	24.0	18.0	391	7.9	0.1
22...	25.5	17.5	410	7.8	0.1
22...	27.0	--	--	--	--
AUG					
22...	1.50	24.5	315	8.8	8.9
22...	3.00	24.5	314	8.8	8.8
22...	6.00	24.5	316	8.8	8.7
22...	9.00	24.0	318	8.7	8.1
22...	12.0	23.5	323	8.6	5.3
22...	15.0	23.0	339	8.2	0.5
22...	18.0	23.0	343	8.2	0.2
22...	21.0	22.0	372	7.8	0.1
22...	24.0	20.5	422	7.2	0.1
22...	25.5	--	--	--	--

Table 3. Regional lake condition and percentage distribution of southeastern lakes

Parameter		Percentage distribution of lakes in southeast Wisconsin within parameter ranges	
	Total-phosphorus (mg/L)		
	<0.010	best condition	7
	0.010-0.020		21
	0.020-0.030		15
	0.030-0.050		21
	0.050-0.100		21
	0.100-0.150		3
Little Green Lake Values	>0.150	worst condition	12
	Chlorophyll a (µg/L)		
	0-5	best condition	22
	5-10		31
	10-15		14
	15-30		12
Little Green Lake Values	>30	worst condition	22
	Secchi depth (feet)		
	>19.7	best condition	1
	9.8-19.7		9
	6.6-9.8		26
Little Green Lake Values	3.3-6.6		31
	<3.3	worst condition	33

96

Table 2.--Water clarity and water-quality analyses and their associated Trophic State Indices (TSI) for Little Green Lake, 1996 water year

[- indicates not applicable; -- indicates no data available]

Date	Secchi Disk			Sampling	Total Phosphorus			Chlorophyll a		Dissolved Ortho-phosphate Phosphorus
	Depth (meters)	Depth (feet)	T.S.I.	Depth (feet)	Conc. (mg/L)	Conc. (µg/L)	T.S.I	Conc. (µg/L)	T.S.I.	Conc. (mg/L)
05/02/96	3.3	10.8	43	1.5	0.040	40	57	9.4	52	0.004
	-	-	-	26	0.040	40	-	-	-	0.005
06/06/96	4.8	15.7	37	1.5	0.043	43	57	3.8	45	--
	-	-	-	26	0.116	116	-	-	-	--
07/22/96	2.3	7.5	48	1.5	0.187	187	69	24	59	--
	-	-	-	26	0.523	522	-	-	-	--
08/22/96	1.1	3.6	59	1.5	0.124	124	66	59	66	--
	-	-	-	24	1.100	1100	-	-	-	--

accumulating [P]

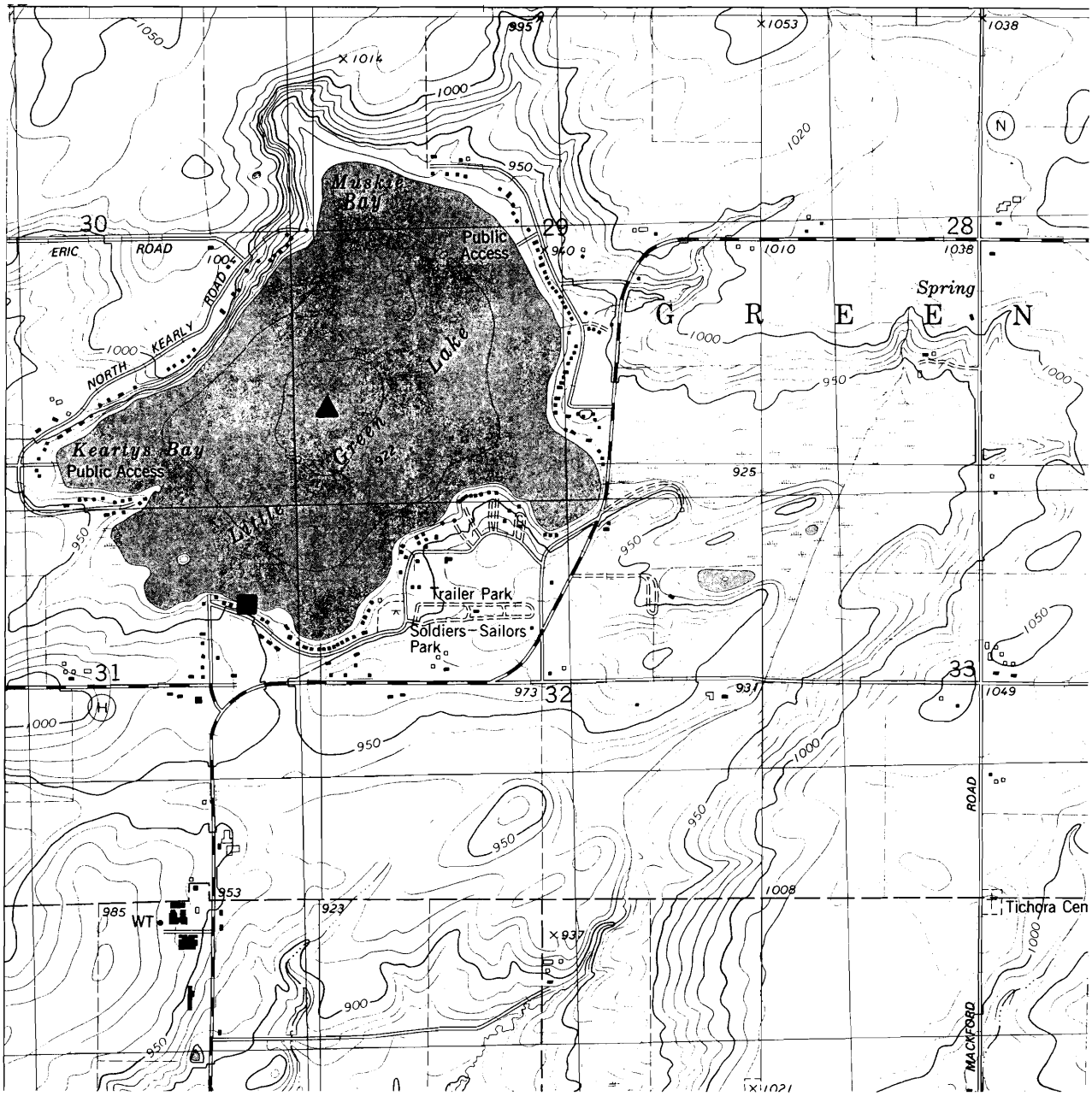


Figure 1. Locations of water-quality and lake-stage monitoring sites on Little Green Lake near Markesan, Wisconsin.

LOCATION--Lat 43°44'12", long 88°59'07", in SW 1/4 SW 1/4 sec.29, T.15 N., R.13 E., Green Lake County, Hydrologic Unit 04030201, 2 mi north of Markesan.

PERIOD OF RECORD.--February 1991 to current year.

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

WATER-QUALITY DATA, FEBRUARY 13 TO AUGUST 22, 1996

(Milligrams per liter unless otherwise indicated)

	Feb. 13		May 02		June 06		July 22		Aug. 22	
Depth of sample (ft)	3.0	24	1.5	26	1.5	26	1.5	26	1.5	24
Lake stage (ft)	---		6.47		6.39		6.51		6.24	
Specific conductance (µS/cm)	406	433	344	343	311	337	337	410	315	422
pH (units)	7.6	7.5	8.2	8.2	8.4	7.5	8.6	7.8	8.8	7.2
Water temperature (°C)	2.0	4.0	9.0	9.0	17.0	14.5	23.5	17.5	24.5	20.5
Color (Pt-Co. scale)	---	---	10	15	---	---	---	---	---	---
Turbidity (NTU)	---	---	1.00	1.4	---	---	---	---	---	---
Secchi-depth (meters)	---		3.3		4.8		2.3		1.1	
Dissolved oxygen	10.3	0.2	10.4	9.7	8.9	0.7	7.7	0.1	8.9	0.1
Hardness, as CaCO3	---	---	160	160	---	---	---	---	---	---
Calcium, dissolved (Ca)	---	---	31	31	---	---	---	---	---	---
Magnesium, dissolved (Mg)	---	---	21	21	---	---	---	---	---	---
Sodium, dissolved (Na)	---	---	7.0	6.6	---	---	---	---	---	---
Potassium, dissolved (K)	---	---	4	4	---	---	---	---	---	---
Alkalinity, as CaCO3	---	---	160	160	---	---	---	---	---	---
Sulfate, dissolved (SO4)	---	---	9.0	9.0	---	---	---	---	---	---
Chloride, dissolved (Cl)	---	---	15	15	---	---	---	---	---	---
Fluoride, dissolved (F)	---	---	0.1	0.1	---	---	---	---	---	---
Silica, dissolved (SiO2)	---	---	1.0	1.0	---	---	---	---	---	---
Solids, dissolved, at 180°C	---	---	196	196	---	---	---	---	---	---
Nitrogen, NO2 + NO3, diss. (as N)	---	---	0.06	0.06	---	---	---	---	---	---
Nitrogen, ammonia, dissolved (as N)	---	---	<0.03	<0.03	---	---	---	---	---	---
Nitrogen, amm. + org., total (as N)	---	---	0.70	0.70	---	---	---	---	---	---
Nitrogen, total (as N)	---	---	0.76	0.76	---	---	---	---	---	---
Phosphorus, total (as P)	---	---	0.040	0.040	0.046	0.116	0.187	0.522	0.124	1.1
Phosphorus, ortho, dissolved (as P)	---	---	0.004	0.005	---	---	---	---	---	---
Iron, dissolved (Fe) µg/L	---	---	<10	<10	---	---	---	---	---	---
Manganese, dissolved (Mn) µg/L	---	---	1	1	---	---	---	---	---	---
Chlorophyll a, phytoplankton (µg/L)	---	---	9.4	---	3.9	---	24	---	59	---

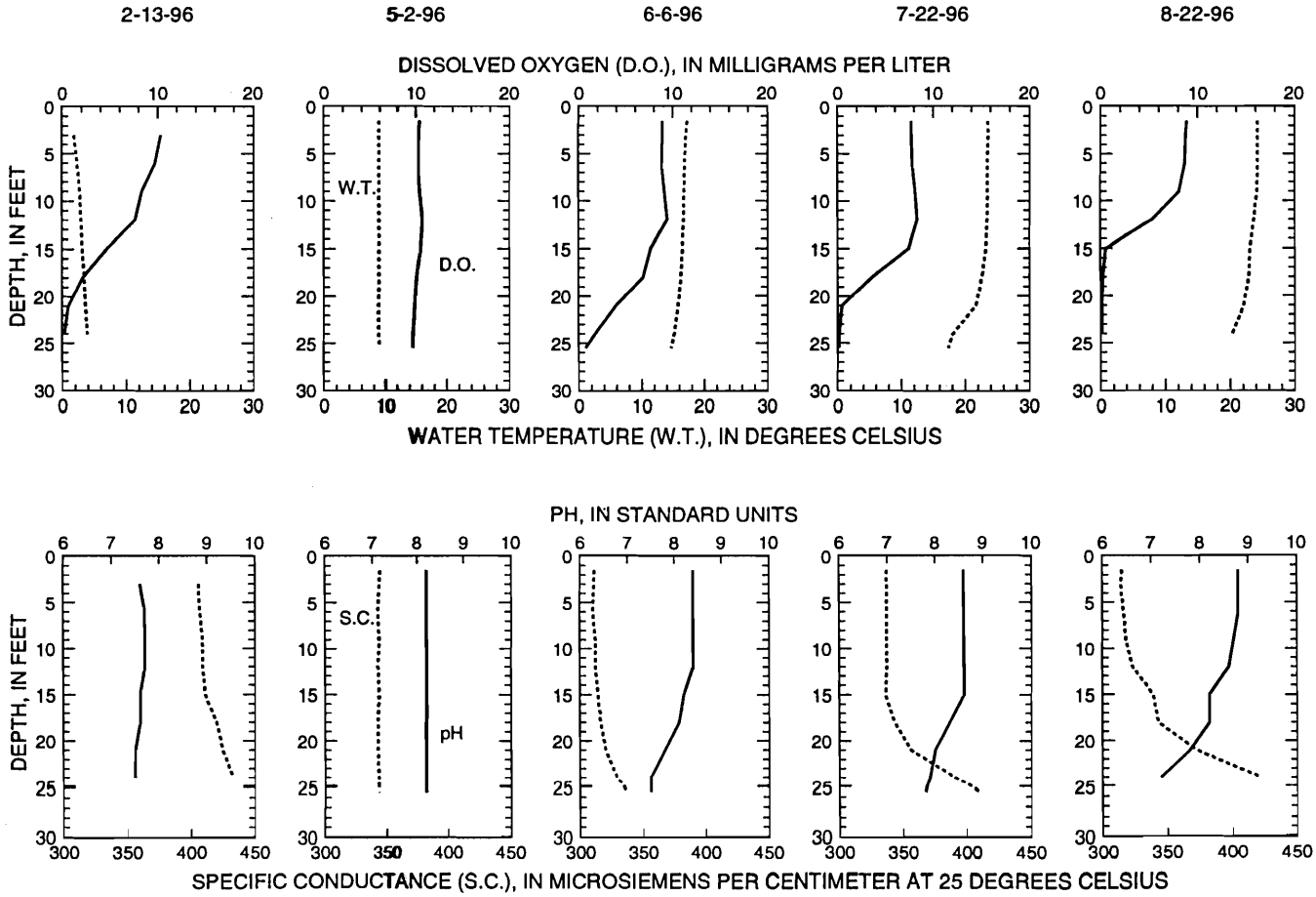


Figure 2. Water-quality data and depth profiles for Little Green Lake near Markesan, Wisconsin, 1996

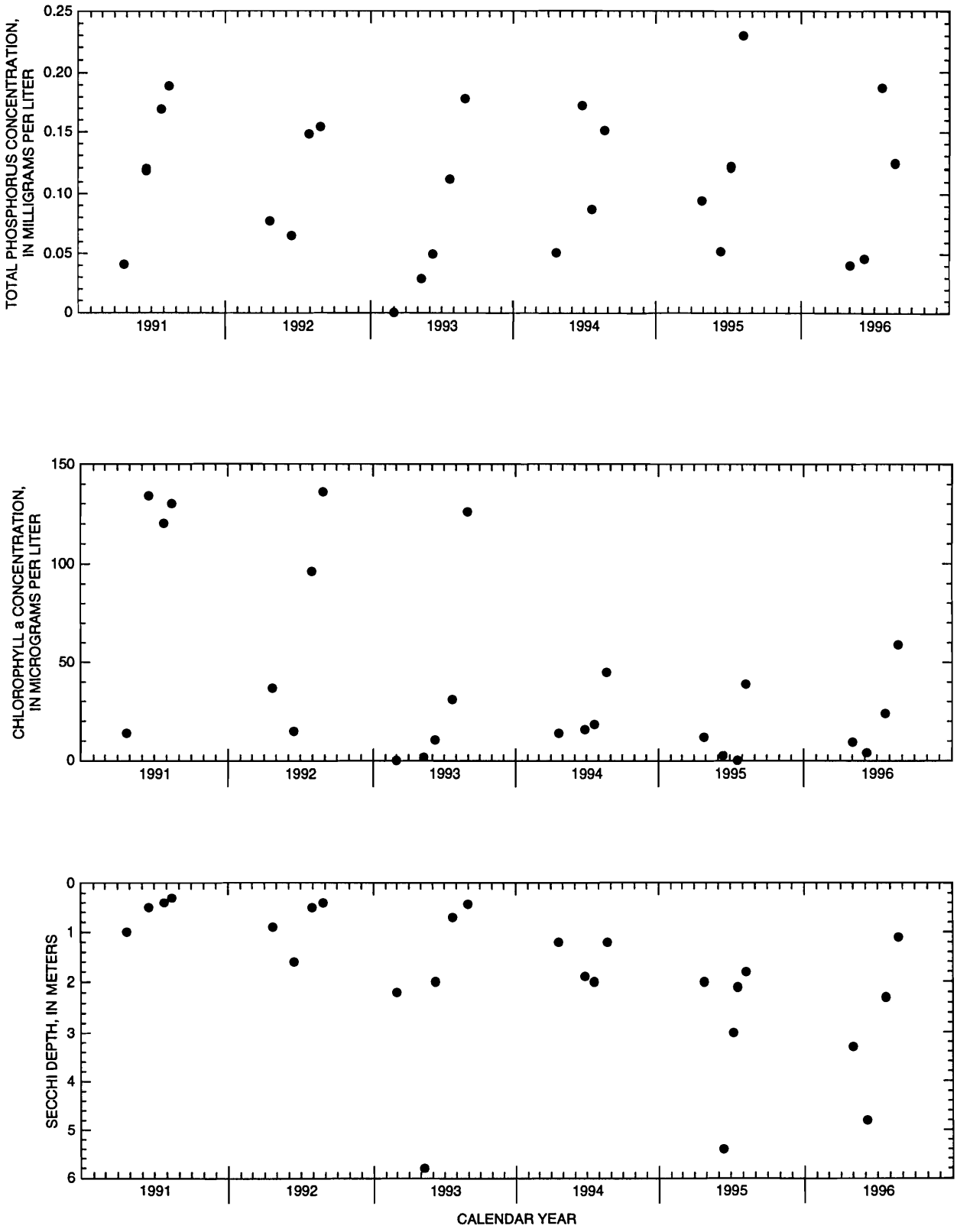


Figure 3. Surface total phosphorus and chlorophyll a concentrations, and Secchi depths for Little Green Lake near Markesan, Wisconsin.

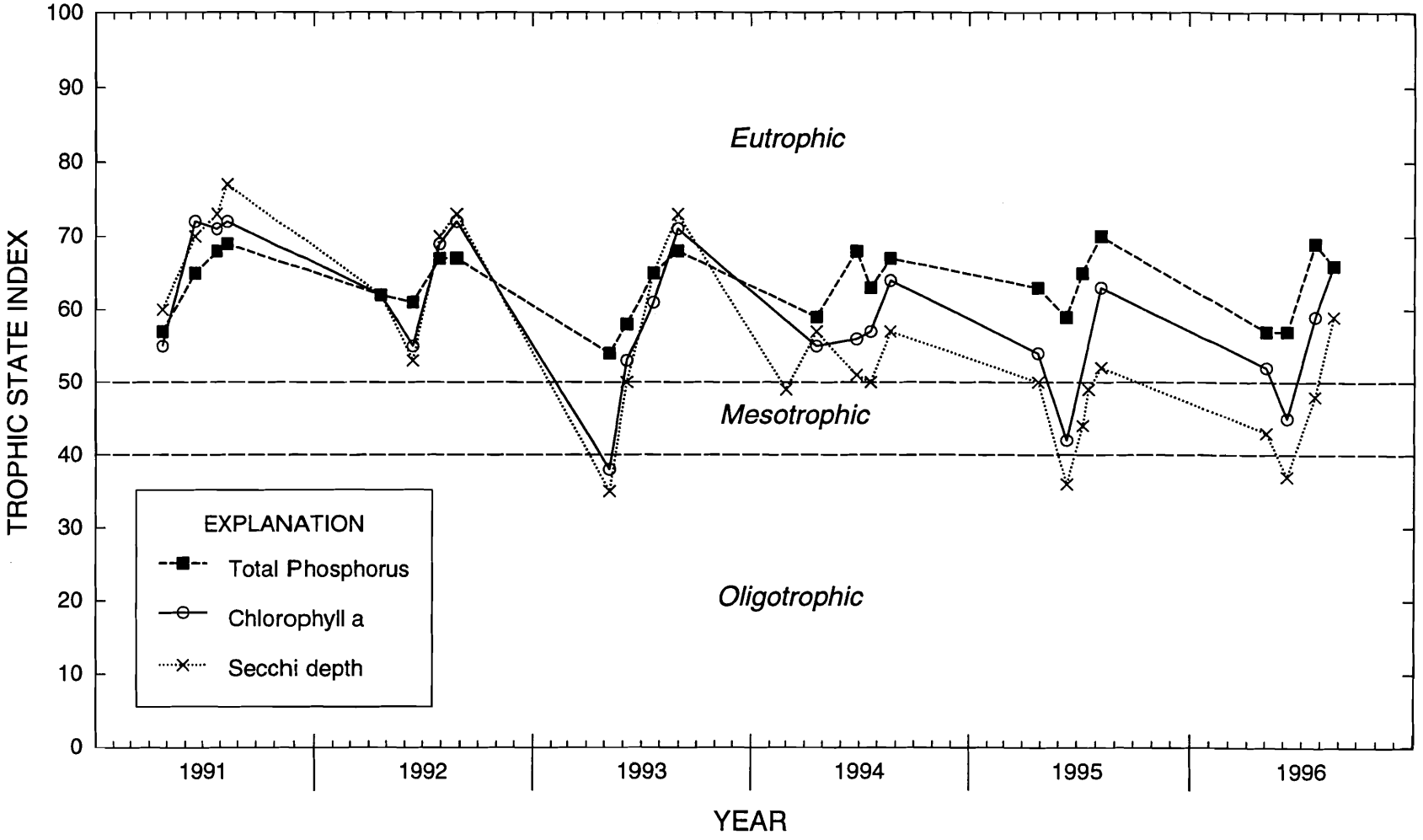


Figure 4. Trophic state indices for Little Green Lake near Markesan, Wisconsin

L. Green fill

LPL 013
W.Q.

United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Water Resources Division
6417 Normandy Lane
Madison, Wisconsin 53719-1133
608 274-3535 (Fax 608 276-3817)

June 16, 1997

Joyce Harttert, Secretary
Little Green Lake Protection and Rehabilitation District
P.O. Box 212
Markesan, Wisconsin 53946
Dear Ms. Harttert:

Enclosed is the data summary and evaluation of the water quality of Little Green Lake. The summary focuses primarily on data collected during 1996. Data from previous years are included in graphs to illustrate changes or trends. I will be making the presentation at your annual meeting on June 21.

If you have questions regarding this summary, please feel free to contact me. Our office is moving the week of June 23, 1997. Before June 23 my phone number is 608 276-3834; after June 23 the number is 608 821-3834. Our new address after the move will be as follows.

U.S. Geological Survey
8505 Research Way
Middleton, Wisconsin 53562

Sincerely,

William J. Rose

William J. Rose

Enclosures

cc: Mark Sesing, DNR, Horicon

LPL-013

W.Q.

United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Water Resources Division
6417 Normandy Lane
Madison, Wisconsin 53719-1133
608 274-3535 (Fax 608 276-3817)

258-2728

September 16, 1996

Ms. Joyce Harttert, Secretary
Little Green Lake Protection and Rehabilitation District
P.O. Box 212
Markesan, Wisconsin 53946

Dear Ms.Harttert:

This letter describes the progress on the evaluation of the water quality of Little Green Lake according to the data collected from October 1994 to September 1995 as stated in our agreement. The format for this progress report is different from that of previous years, but it contains essentially the same type of information.

In reviewing the data, it may be helpful to refer to the methods and explanations of physical and chemical characteristics sections in the USGS annual lake data report "Water-Quality and Lake-Stage Data for Wisconsin Lakes, Water Year 1995" and to Shaw and others (1994) "Understanding Lake Data."

Hydrologic conditions during water year 1995:

Annual variability in lake condition often reflects variability in climatic and hydrologic conditions. Air temperature in central Wisconsin was, on the average, 4.2 °F warmer than normal for the period December 1994 through March 1995; April and May was 3.0 °F cooler than normal; and the period June through August was 4.1 °F warmer than normal (National Oceanic and Atmospheric Administration "Climatological Data--Wisconsin"). Precipitation during water year 1995 was 90 percent of normal precipitation for central Wisconsin (Pamela Naber-Knox, UW-Extension, Geological and Natural History Survey, written commun., 1995). Watershed runoff in the region of Little Green Lake was between 100 and 120 percent of long-term average runoff (Holmstrom and others, 1996, "Water Resources Data--Wisconsin").

Lake description and sampling locations:

Little Green Lake is classified as a seepage lake, with two intermittent inlets and one intermittent outlet. Little Green Lake has a mean depth of 10 feet, a surface area of 466 acres (0.728 square miles), and a watershed area of 3.33 square miles. The water-quality sampling site is located at the deepest point at

a depth of about 26 feet. Lake stage was monitored along the southern shoreline. The locations of the monitoring sites are shown in Figure 1.

Lake Data for 1995:

Data collected during the year, as published in the lake data report are enclosed. The following summary presents some highlights from the tables and figures.

Lake-stage fluctuations:

Lake stages were measured by the USGS on sampling dates. The stages ranged from 5.94 feet on July 10 to 6.37 feet on April 27. This range of fluctuation is less than the average fluctuation during the previous 4 years of monitoring. Stage values are shown in the table on the top half of Figure 2.

Lake-depth profiles:

Vertical profiles of water temperature, dissolved oxygen, pH, and specific conductance exhibit no abnormalities and are similar to those from the previous years. These profiles, which were measured over the deepest point in the lake, are listed in Table 1 and shown in Figure 2. During the February through August sampling period, complete water-column mixing was observed on April 27. The lake became weakly thermally stratified through the summer. In June the lower 2.5 feet of water was anoxic (devoid of oxygen), and by August the lower 5.0 feet of water was anoxic. The anoxic zone is unable to support fish. The pH, which ranged between 7.3 and 8.5, is common for southeastern Wisconsin lakes and poses no problems for aquatic life.

Chemical constituents:

Analyses of water samples collected on April 27 for selected chemical constituents for chernical characterization of the lake are shown in Figure 2. Samples collected at 1.5 and 24-foot depths show similar constituent concentrations, as would be expected under mixed water column conditions. The constituent values for color, chlorophyll a, chloride, calcium, magnesium, pH, alkalinity, total-nitrogen, and total-phosphorus are within regional values for this area as described by Lillie and Mason in "Limnological Characteristics of Wisconsin Lakes," 1983, Technical Bulletin No. 138, Department of Natural Resources.

The ratio of dissolved-nitrogen to dissolved-phosphorus was 20:1, based on the surface concentrations on April 27. This ratio suggests the lake is phosphorus limited, which means algal growth is dependent on the amount of available phosphorus rather than nitrogen.

Three common measures of water quality used as indices are concentrations of near-surface total-phosphorus and chlorophyll a, and Secchi depth. Total-phosphorus concentrations ranged from 0.052 mg/L on June 14 to 0.230 mg/L on August 10, chlorophyll a ranged from 0.1 µg/L on July 20 to 39 µg/L on August 10, and Secchi depths ranged from 1.8 m on August 10 to 5.4 m on June 14.[1]

Surface total-phosphorus and chlorophyll a concentrations, and Secchi depths for the 1991-95 period are shown on Figure 3. There appears to be no year-to-year trends in the data except for secchi depths which have increased since 1993. There appears to be a general seasonal trend of decreasing water quality from spring through summer. This trend, along with the temperature profiles indicating weak stratification, suggests that there may be intermittent breakdown of stratification allowing phosphorus-rich water from the hypolimnion to mix with the epilimnion.

Total-phosphorus concentration 1.5 feet above the lake bottom at the center site ranged from 0.038 mg/L on April 27 to 1.4 mg/L on August 10. The high total-phosphorus concentrations observed during anoxic periods are indicative of large phosphorus release from the bottom sediments.

Lake condition:

Water-quality index:

Lillie and Mason (1983) classified all Wisconsin lakes using a random data set collected in the summer (July and August). The index, shown on page 12 of "Water-Quality and Lake-Stage data for Wisconsin Lakes, Water Year 1995," is based on surface total-phosphorus and chlorophyll a concentrations, and Secchi depths. According to the index, surface total-phosphorus and chlorophyll a concentrations in Little Green Lake indicate "poor-to-very poor" water quality, and Secchi depths indicate "fair-to-good" water quality.

Lillie and Mason (1983) also provided a means of comparing the condition of Little Green Lake with other lakes in southeastern Wisconsin. The comparison on page 4 shows the percentage distribution of southeastern Wisconsin lakes within each condition group and the relative position of Little Green Lake.

---

1. The extremely low chlorophyll a value for July 20 is believed to be erroneous and the result of laboratory error. Abnormally low chlorophyll a values were obtained for samples from numerous other lakes during a two week period in July. These low chlorophyll a values were not accompanied by corresponding decreases in total-phosphorus or increases in Secchi depth as would generally be expected.

	Parameter		Percentage distribution of lakes in southeast Wisconsin within parameter ranges
	Total-phosphorus (mg/L)		
	<0.010	best condition	7
	0.010-0.020	↓	21
	0.020-0.030	↓	15
	0.030-0.050	↓	21
	0.050-0.100	↓	21
	0.100-0.150	↓	3
Little Green Lake Values	>0.150	worst condition	12
	Chlorophyll a (µg/L)		
	0-5	best condition	22
	5-10	↓	31
	10-15	↓	14
	15-30	↓	12
Little Green Lake Values	>30	worst condition	22
	Secchi depth (feet)		
	>19.7	best condition	1
	9.8-19.7	↓	9
Little Green Lake Values	6.6-9.8	↓	26
	3.3-6.6	↓	31
	<3.3	worst condition	33

Trophic status:

Another means of assessing the nutrient, or trophic, status of a lake is to use Carlson's Trophic State Index (TSI). The 1995 TSI data is listed in Table 2. Figure 4 is a graphical illustration of the variation in Trophic State Indices for Little Green Lake during the 5 year study period. The chlorophyll a value(s) for July 1995 is not included in Figure 4. The phosphorus index for 1995 shows the lake to be eutrophic. The chlorophyll a and Secchi depth indices show the lake to be meso-eutrophic, or a lake with moderate to high nutrient levels.

The data that have been collected for Little Green Lake from 1991-1995 are useful for understanding the lake's water quality, and for managing the lake. These data define the present water quality of the lake and provide a basis for assessing trends or changes in water quality in the future. Continued monitoring will help to build on this valuable data base.

If you have questions regarding this evaluation, please contact me at (608) 276-3834.

Sincerely,

William J. Rose

William Rose
Hydrologist

Enclosures

cc: Mark Sesing, DNR, Horicon

Table 1. Lake-depth profiles for Little Green Lake near Markesan, Wisconsin, 1995 water year

WATER-QUALITY DATA

DATE	SAMPLING DEPTH (FEET) (00003)	TEMPERATURE WATER (DEG C) (00010)	SPECIFIC CONDUCTANCE (US/CM) (00095)	PH WATER WHOLE FIELD (STANDARD UNITS) (00400)	OXYGEN, DISSOLVED (MG/L) (00300)
FEB 1995					
23...	1.50	3.0	392	8.1	10.2
23...	3.00	3.0	403	8.1	10.1
23...	6.00	3.5	400	8.1	9.6
23...	9.00	4.0	400	8.1	9.4
23...	12.0	4.0	403	8.1	9.0
23...	15.0	4.0	414	7.9	6.5
23...	18.0	4.5	415	7.9	5.4
23...	21.0	4.5	415	7.9	4.9
23...	24.0	4.5	430	7.8	4.2
23...	25.0	--	--	--	--
APR					
27...	1.50	9.0	342	8.1	10.4
27...	3.00	9.0	343	8.1	10.3
27...	6.00	9.0	343	8.1	10.1
27...	9.00	9.0	343	8.1	10.3
27...	12.0	9.0	343	8.1	10.6
27...	15.0	9.0	343	8.1	10.5
27...	18.0	9.0	344	8.1	10.2
27...	21.0	9.0	343	8.1	10.0
27...	24.5	9.0	343	8.1	9.9
27...	26.0	--	--	--	--
JUN					
14...	1.50	20.5	312	8.3	8.6
14...	3.00	20.5	311	8.3	8.6
14...	6.00	20.5	311	8.3	8.7
14...	9.00	20.0	312	8.3	8.4
14...	12.0	19.5	317	7.9	5.3
14...	15.0	19.0	316	7.8	4.4
14...	18.0	18.5	318	7.7	2.6
14...	21.0	18.0	329	7.6	1.5
14...	24.0	17.5	336	7.5	0.2
14...	25.0	17.0	340	7.5	0.1
14...	26.5	--	--	--	--
JUL					
10...	1.50	23.5	340	8.2	9.5
10...	3.00	23.5	339	8.2	9.4
10...	6.00	23.0	339	8.2	9.7
10...	9.00	23.0	339	8.2	10.0
10...	12.0	23.0	339	8.2	10.1
10...	15.0	21.5	342	7.7	5.3
10...	18.0	21.0	346	7.5	2.2
10...	21.0	20.5	353	7.4	0.2
10...	24.0	19.0	375	7.6	0.1
10...	25.5	--	--	--	--
AUG					
10...	1.50	25.0	335	8.4	6.2
10...	3.00	25.0	336	8.4	5.9
10...	6.00	25.0	336	8.3	5.0
10...	9.00	25.0	337	8.3	5.2
10...	12.0	25.0	338	8.3	5.3
10...	15.0	25.0	336	8.2	4.3
10...	18.0	25.0	350	8.0	1.2
10...	21.0	22.0	410	7.6	0.2
10...	24.5	20.0	440	7.3	0.3
10...	26.0	--	--	--	--

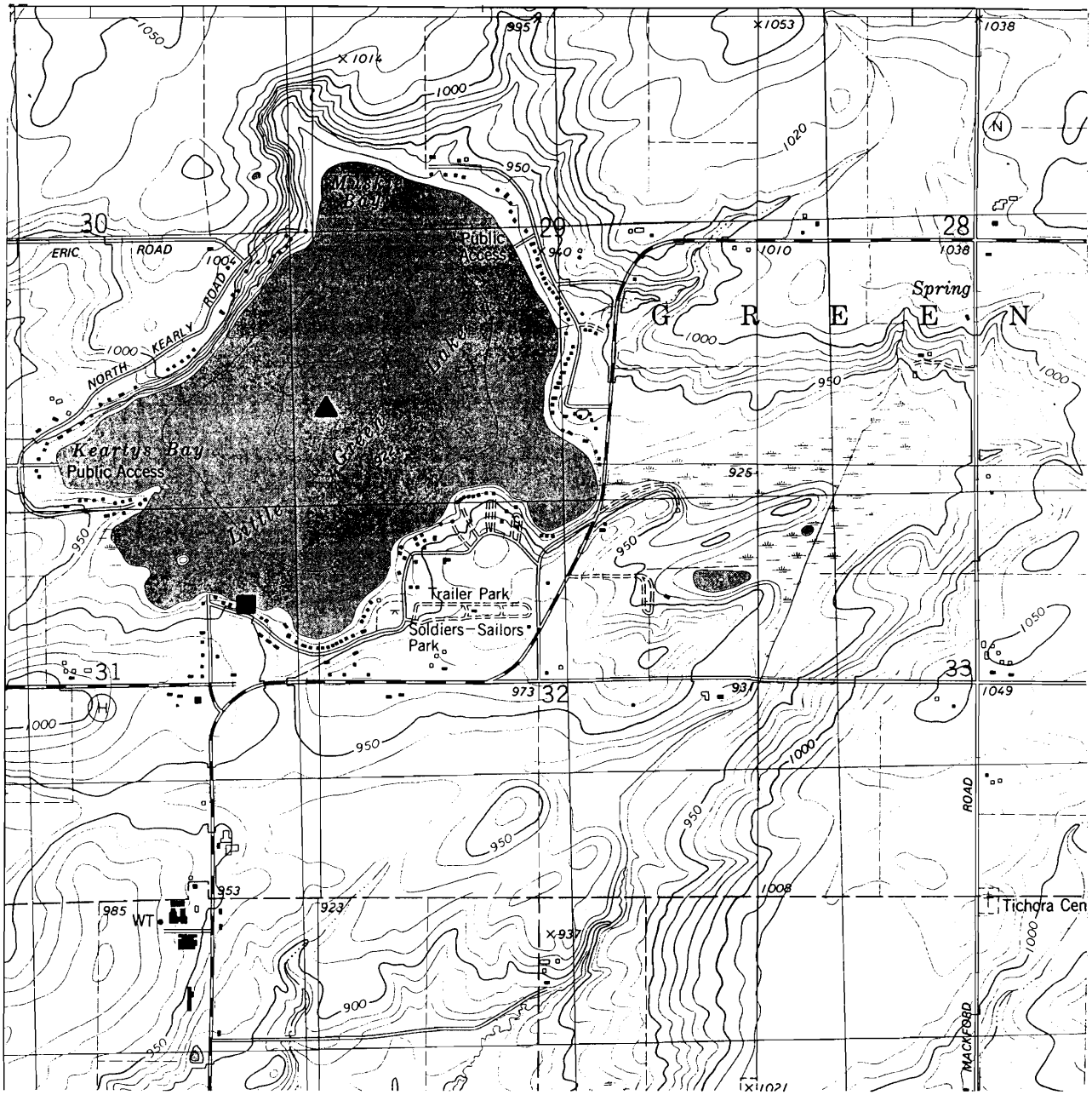
95

Table 2.--Water clarity and water-quality analyses and their associated Trophic State Indices (TSI) for Little Green Lake, 1995 water year

[- indicates not applicable; -- indicates no data available]

Date	Secchi Disk			Sampling	Total Phosphorus			Chlorophyll a		Dissolved Ortho-phosphate Phosphorus
	Depth (meters)	Depth (feet)	T.S.I.	Depth (feet)	Conc. (mg/L)	Conc. (µg/L)	T.S.I	Conc. (µg/L)	T.S.I.	Conc. (mg/L)
04/27/95	2.0	6.6	50	1.5	0.094	94	63	12	54	<0.002
	-	-	-	24	0.038	38	-	-	-	<0.002
06/14/95	5.4	17.7	36	1.5	0.052	52	59	2.5	42	--
	-	-	-	25	0.192	192	-	-	-	--
07/10/95	3.0	9.8	44	1.5	0.121	121	65	--	--	--
	-	-	-	24	0.365	365	-	-	-	--
07/20/95	2.1	6.9	49	1.5	--	--	--	0.1	17	--
08/10/95	1.8	5.9	52	1.5	0.230	230	70	39	63	--
	-	-	-	24	1.400	1400	-	-	-	--

accumulating [P] in hypolimnion



EXPLANATION

▲ Water-quality monitoring site

■ Lake-stage monitoring site

Figure 1. Locations of water-quality and lake-stage monitoring sites on Little Green Lake near Markesan, Wisconsin.

LOCATION--Lat 43°44'12", long 88°59'07", in SW 1/4 SW 1/4 sec.29, T.15 N., R.13 E., Green Lake County, Hydrologic Unit 04030201, 2 mi north of Markesan.

PERIOD OF RECORD.--February 1991 to current year.

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

WATER-QUALITY DATA, FEBRUARY 23 TO AUGUST 10, 1995
(Milligrams per liter unless otherwise indicated)

	Feb. 23		Apr. 27		June 14		July 10		July 20	Aug. 10	
Depth of sample (ft)	1.5	24	1.5	24	1.5	25	1.5	24	1.5	1.5	24
Lake stage (ft)	6.12		6.37		6.28		5.94		---	6.06	
Specific conductance (µS/cm)	392	430	342	343	312	340	340	375	339	335	440
pH (units)	8.1	7.8	8.1	8.1	8.3	7.5	8.2	7.6	8.5	8.4	7.3
Water temperature (°C)	3.0	4.5	9.0	9.0	20.5	17.0	23.5	19.0	25.0	25.0	20.5
Color (Pt-Co. scale)	---	---	10	10	---	---	---	---	---	---	---
Turbidity (NTU)	---	---	1.5	1.3	---	---	---	---	---	---	---
Secchi-depth (meters)	---		2.0		5.4		3.0		2.1	1.8	
Dissolved oxygen	10.2	4.2	10.4	9.9	8.6	0.1	9.5	0.1	7.6	6.2	0.3
Hardness, as CaCO3	---	---	170	170	---	---	---	---	---	---	---
Calcium, dissolved (Ca)	---	---	33	33	---	---	---	---	---	---	---
Magnesium, dissolved (Mg)	---	---	22	22	---	---	---	---	---	---	---
Sodium, dissolved (Na)	---	---	6.8	6.7	---	---	---	---	---	---	---
Potassium, dissolved (K)	---	---	4	4	---	---	---	---	---	---	---
Alkalinity, as CaCO3	---	---	150	150	---	---	---	---	---	---	---
Sulfate, dissolved (SO4)	---	---	12	12	---	---	---	---	---	---	---
Chloride, dissolved (Cl)	---	---	15	15	---	---	---	---	---	---	---
Fluoride, dissolved (F)	---	---	<0.1	<0.1	---	---	---	---	---	---	---
Silica, dissolved (SiO2)	---	---	<0.1	0.1	---	---	---	---	---	---	---
Solids, dissolved, at 180°C	---	---	188	190	---	---	---	---	---	---	---
Nitrogen, NO2 + NO3, diss. (as N)	---	---	<0.01	<0.01	---	---	---	---	---	---	---
Nitrogen, ammonia, dissolved (as N)	---	---	<0.03	<0.03	---	---	---	---	---	---	---
Nitrogen, organic, total (as N)	---	---	0.80	0.80	---	---	---	---	---	---	---
Nitrogen, amm. + org., total (as N)	---	---	0.80	0.80	---	---	---	---	---	---	---
Nitrogen, total (as N)	---	---	0.80	0.80	---	---	---	---	---	---	---
Phosphorus, total (as P)	---	---	0.094	0.038	0.052	0.192	0.121	0.365	---	0.230	1.4
Phosphorus, ortho, dissolved (as P)	---	---	<0.002	<0.002	---	---	---	---	---	---	---
Iron, dissolved (Fe) µg/L	---	---	<10	<10	---	---	---	---	---	---	---
Manganese, dissolved (Mn) µg/L	---	---	<0.4	0.4	---	---	---	---	---	---	---
Chlorophyll a, phytoplankton (µg/L	---	---	12	---	2.5	---	---	---	0.1	39	---
	2-23-95		4-27-95		6-14-95		7-10-95			8-10-95	

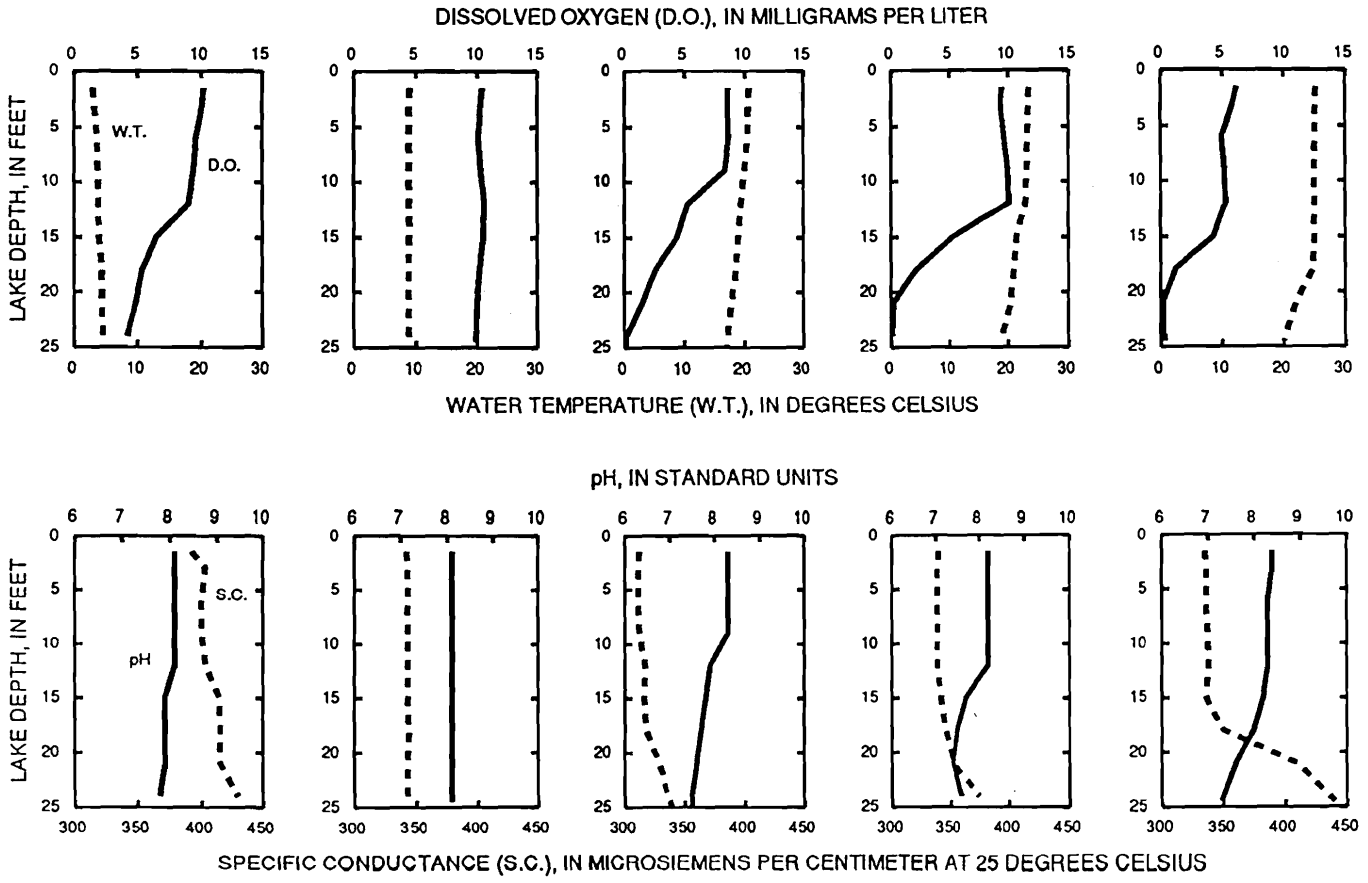


Figure 2. Water-quality data and depth profiles for Little Green Lake near Markesan, Wisconsin, 1995 water year

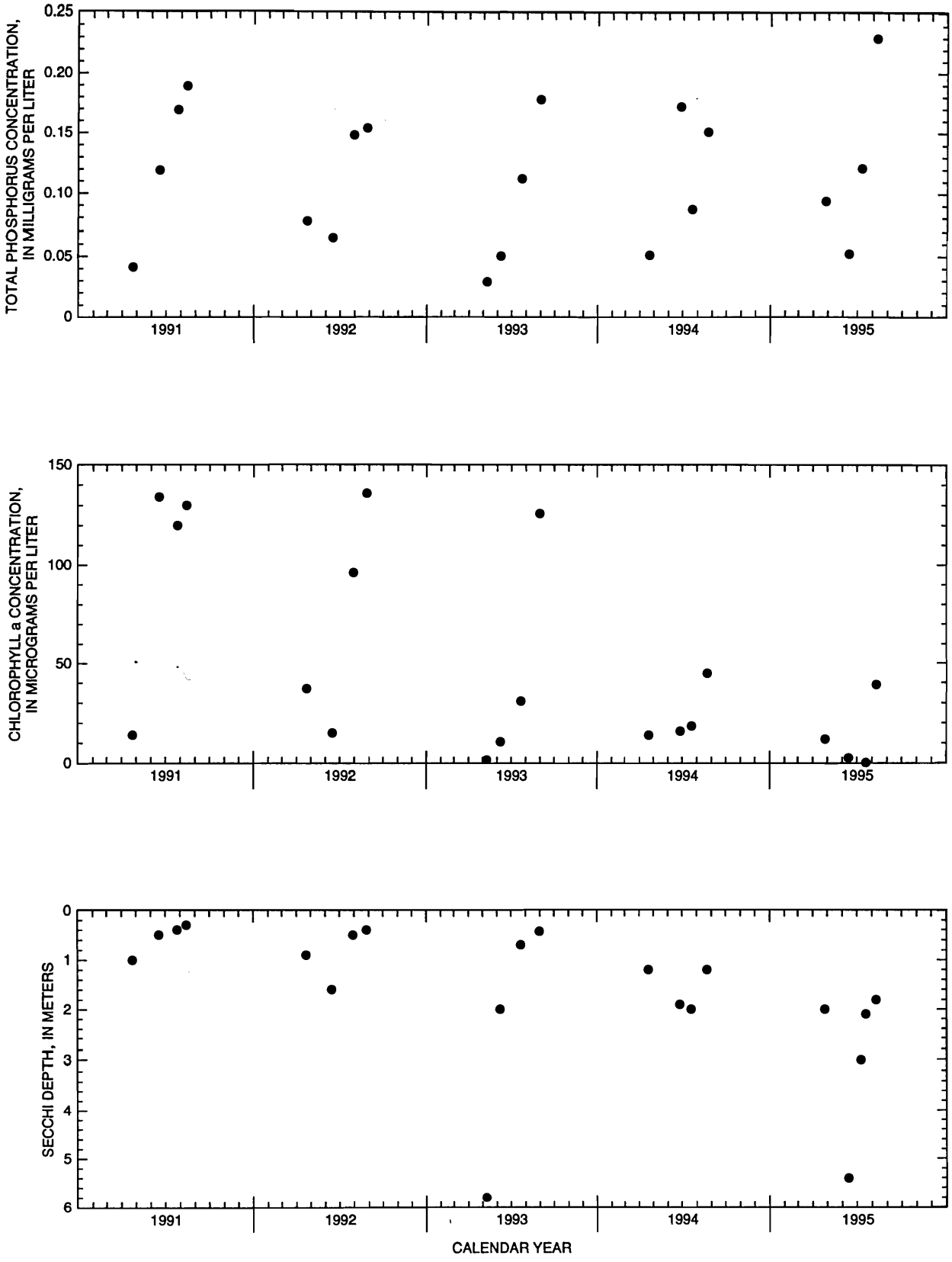


Figure 3. Surface total phosphorus and chlorophyll a concentrations, and Secchi depths for Little Green Lake near Markesan, Wisconsin.

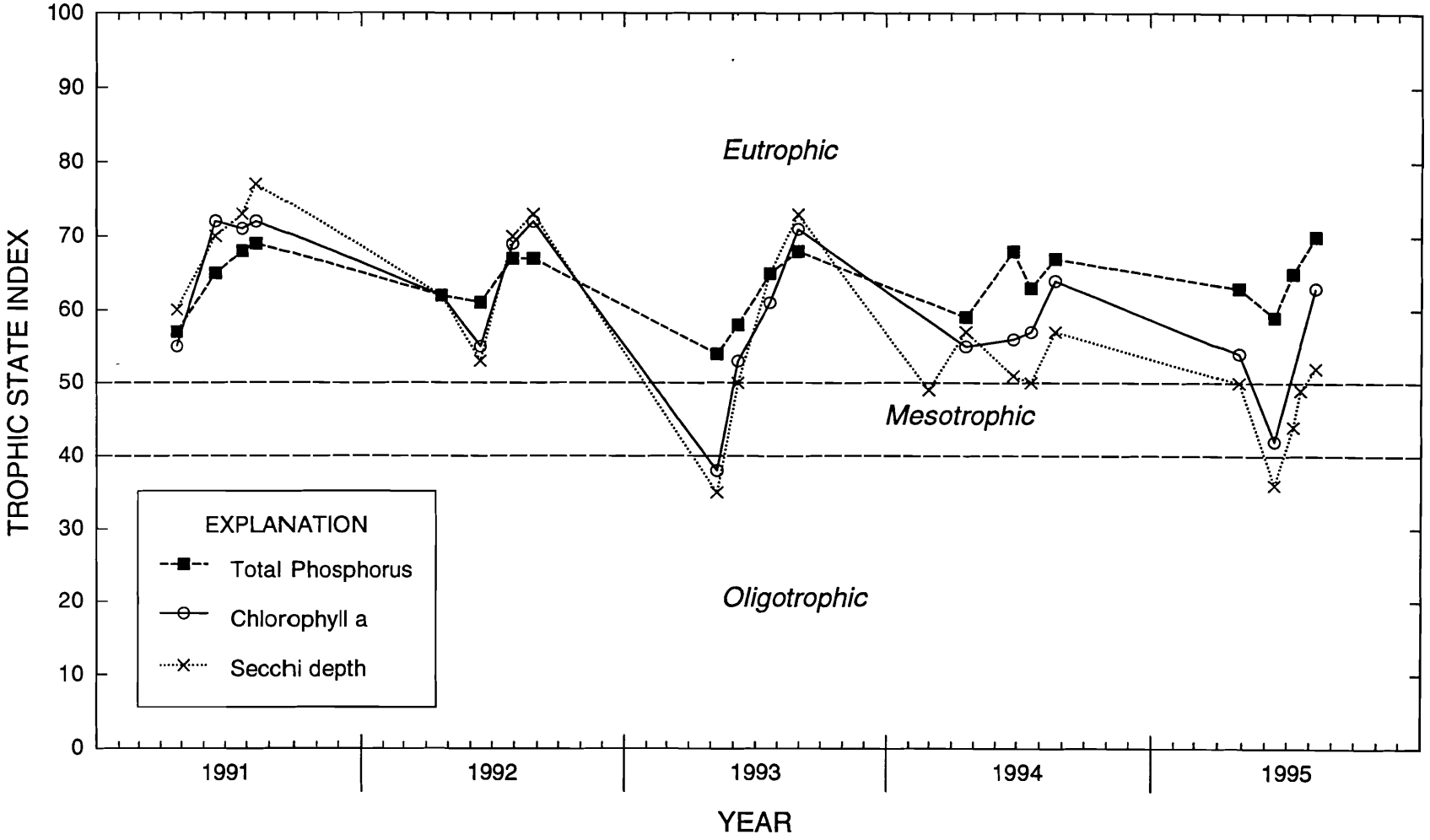


Figure 4. Trophic state indices for Little Green Lake near Markesan, Wisconsin