2003 Water Quality Monitoring Report

Prepared for

Clearwater River Watershed District

Wenck

January 2004

2003 Water Quality Monitoring Report

Wenck File #0002-58

Prepared for:

CLEARWATER RIVER WATERSHED DISTRICT
Box 276
Annandale, MN 55389

January 2004

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Wenck

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1.0 Introduction

The Clearwater River Watershed District has conducted a stream, precipitation and lake monitoring program since 1980. The monitoring program has focused on collecting baseline data to provide long-term analysis of water quality within the District. In the past few years this was increased for more fecal and phosphorus monitoring in the watershed. However in 2003 the District returned to baseline monitoring since a Total Maximum Daily Load effort is under way in the watershed and the potential for additional funding through the Minnesota Pollution Control Agency allowed the District to focus on baseline water quality.

In 2003 the Clearwater River was monitored at two long-term stations (CR-28.2 and CR-10.5). Warner Creek was monitored near its inflow to Clearwater Lake at WR-0.2. The twelve lakes monitored were Clearwater (East and West basins), Albion, Augusta, Betsy, Caroline (Wright Soil and Water), Cedar, Clear, Grass, Louisa, Marie, Scott, and Swart Watts. Citizen volunteers collect precipitation data from three stations and Secchi depths for numerous lakes.

Figure 1 shows the baseline monitoring locations and Appendix A gives the monitoring plan.

2.0 Precipitation

Precipitation was below normal in 2003. A very dry month of August (over 3 inches below normal) was the major factor. A wetter than normal September helped ease the shortage, but the yearly totals remained below normal. Figures 2, 3, and 4, show the volunteer precipitation records for the CRWD. The Annandale station recorded 26.77 inches for the year (2.05 inches below normal), the Watkins station recorded 22.63 inches (5.0 inches below normal), and the Kimball station recorded 21.34 inches (5.13 inches below normal).

The dramatic dry conditions of August can be seen in the monthly data, shown at the top portions of Figure 2 (Annandale), Figure 3 (Watkins), and Figure 4 (Kimball).

3.0 Streams

3.1 RUNOFF AND DISCHARGE

The average stream flow at the outlet of Clearwater Lake (station CR 10.5) was about 74.6 cubic feet per second in 2003. This flow rate was equivalent to 6.5 inches of runoff from the 155-square mile watershed. The flow remained low in the fall as a result of the dry conditions.

The river elevation at CR 10.5 was high, as compared to the low flow condition. This suggests a restriction downstream that reduces discharge from the lake. Elevations at higher flows (May and June) were similar to previous years, suggesting the restriction is mostly impacting lower flows.

3.2 TOTAL PHOSPHORUS

Baseline Monitoring:

Baseline phosphorus levels in the Clearwater River remain low, especially as compared with conditions monitored in the early 1980s. The most upstream station, station CR 28.2 had flow-weighted mean total phosphorus concentration of 193 µg/l (micrograms per liter, or parts per billion). Historically this has ranged from 740 to 1,400 µg/l in the early 1980s. Sites WR-0.2 and CR-10.5 had very low flow-weighted mean concentrations of 62 µg/l and 24 µg/l, respectively. The phosphorus loadings were 3,770 pounds at CR-28.2, and 710 and 3,500 pounds, respectively, at WR-0.2 and CR-10.5.

Soluble reactive phosphorus (dissolved form of phosphorus easily utilized by algae) was also monitored and represents 68%, 22%, and 16.7 % of the total phosphorus value at the three stations CR-28.2, WR-0.2 and CR-10.5 respectively. These are similar results to 2002. The higher value at CR-28.2 may be indicative of agricultural sources. The lower percentage (22%)

at WR-0.2 is an indicator that the wetlands upstream of this sampling point are assimilating phosphorus successfully, as does Clearwater Lake (16.7% at station CR 10.5)

4.0 Water Quality of Lakes Sampled in Year 2003

Twelve lakes were sampled in 2003, with Clearwater Lake having two stations so a total of thirteen sites are sampled four times for total phosphorus and chlorophyll-*a* and a field reading of secchi depth is taken. Figure 5 displays summer mean total phosphorus concentration, chlorophyll-*a* concentration, and Secchi depth (water clarity, or transparency) for these lakes. Appendix B presents the Citizen's Lake Monitoring Program Secchi Data. Appendix C presents the 2003 Water Quality Laboratory Reports. The table below shows a comparison for the three parameters and the historical range of values. A discussion of each lake follows the table.

	Total Phosphorus µg/l		**Chlorophyll-*a* µg/l**		**Secchi Depth (feet)**	
Lake	2003 Mean	Historical Range Mean	2003 Mean	Historical Range Mean	2003 Mean (Citizen Reading)	Historical Range Mean
Albion	199	130-220	117	117-204	3.3	1.6-3.3
Augusta	42	28-300	29	4-73	4.9 (8.9)	3.5-6.3
Betsy	194	120-700	45	4.3-170	4.1 (2.6)	1.5-7.9
Caroline	66	40-300	28.6	3-55	5.1 (5.1)	2.6-5.9
Cedar	52	26-52	11	5.9-13.3	6.1 (9.3)	3.6-9.8
Clear	200	80-228	72	17-134	2.3 (1.5)	1.1-3.9
Clearwater East	22	22-130	7	3-85	7.9	3.9-9.7
Clearwater West	27	27-160	14	4-77	7.3 (7.6)	4.5-8.6
Grass	24	24-38	1	1-12	9.4 (10.2)	6.2-9.4
Louisa	100	33-440	68	4-101	3.7 (3.5)	2.0-5.0
Marie	87	70-360	81	4-153	4.4	1.4-7.6
Scott	158	158-660	66	3-223	2.5	1.6-6.2
Swart Watts	421	200-421	444	151-444	2.9	2.3-3.3

4.1 LAKE ALBION

Lake Albion's water quality was poor. The lake has been sampled during 3 years, however the total phosphorus of 199 µg/l is high, as were previous data (Figure 6). Chlorophyll – *a* was the lowest in sampling history, but still high at 117 µg/l. Secchi depth was the best in sampling history, at 3.3 feet, representative of the lower chlorophyll-*a*.

4.2 LAKE AUGUSTA

Lake Augusta's water quality was good in 2003. The clarity of Augusta (Figure 7) averaged 4.9 feet in 2003, slightly lower than the past two sampling years, for the monitoring events (June through September) and 8.9 feet by citizen data (May through October, Appendix B Figure B-2). Phosphorus was 42 µg/l, near the average over the last 10 years. Chlorophyll-*a* averaged 29 µg/l, higher than recent years, and probably causing the clarity decrease from the past few years.

4.3 LAKE BETSY

Lake Betsy's water quality was again poor (Figure 8), although the secchi depth was the best since 1982 at an average of 4.1 feet. Phosphorus was the lowest value in recent years (194 µg/l). Chlorophyll-*a* averaged 45 µg/l, near the long-term trendline, however the lake shows a great range of chlorophyll-*a* values over the 22 year monitoring history.

4.4 LAKE CAROLINE

Lake Caroline's water quality was good (Figure 9). Lake Caroline was monitored by Wright Soil and Water Conservation District and data shows that phosphorus was near the long term

trendline at 66 µg/l, as was secchi depth at 5.1 feet. Chlorophyll-*a* was lower than the long-term trendline at 28.6 µg/l.

4.5 CEDAR LAKE

Water quality in Cedar Lake was good with secchi depth of 6.1 feet. The citizen average was higher at 9.3 feet, but early spring values in May of nearly 20 feet brought the average higher (Appendix B, Figure B-3). Phosphorus was 52 µg/l the highest since sampling began in 1993 (Figure 10), and chlorophyll-*a* was 11 µg/l, near the trend line.

4.6 CLEAR LAKE

Water quality was poor with total phosphorus at 200 µg/l and chlorophyll-*a* at 72 µg/l. Secchi depth averaged 2.3 feet. The citizen reader average was lower at 1.5 feet for June through October.

4.7 CLEARWATER LAKE

Clearwater Lake is sampled in both the West and East basins every year as part of the long-term monitoring plan. Data for 2003 again showed good water quality for both basins.

<u>Clearwater East</u>:
The east bay (Figure 12) had good water quality with chlorophyll-*a* half of the 2002 value at 7 µg/l and phosphorus about one-third reduced from last year (22 µg/l). Secchi clarity showed an increase to 7.9 feet, as compared to the 2.4 feet measured in 2002. The citizen data (Figure B-4) shows clarity increased in the fall compared to 2002.

Clearwater West:

The west basin showed a similar comparison to 2002 as the East Basin (decreases in phosphorus and chlorophyll-*a* and increase in secchi). Secchi remained good at 7.3 feet and phosphorus had its lowest value in history of record at 27 µg/l (Figure 13). Chlorophyll-*a* was 14 µg/l, which is near the long-term trend line.

4.8 GRASS LAKE

Historical data for Grass Lake dates back to 1996 (Figure 14). Water quality in 2003 was very good with clarity of 9.4 feet, phosphorus of 24 µg/l, and chlorophyll-*a* at 1 µg/l. The citizen secchi data averaged 10.1 feet for June through September (see Appendix B, Figure B-4).

4.9 LAKE LOUISA

Lake Louisa water quality was fair (Figure 15), with total phosphorus at 100 µg/l, which was the highest since 1995. Chlorophyll-*a* was 68, again the highest value since 1995. Secchi depth averaged 3.7 feet for the sampling events.

4.10 LAKE MARIE

Water quality of Lake Marie was also fair (Figure 16), with phosphorus at 87 µg/l , high chlorophyll-*a* at 81 µg/l and Secchi of 4.4 feet (typical of recent years). The phosphorus was slightly lower than the upstream Lake Louisa, however the chlorophyll-*a* was higher than Lake Marie. Secchi was slightly over Louisa's value of 3.7 feet.

4.11 SCOTT LAKE

Water quality was poor, although total phosphorus was at a historical low (158 µg/l). Clarity was 2.5 feet (Figure 17), and chlorophyll-*a* was the lowest in 10 years at 66 µg/l. The lake shows a great range in historical chlorophyll-*a* values, with phosphorus decreasing over the long term sampling history.

4.12 SWART WATTS LAKE

Water quality in Swart Watts Lake was poor in 2003 (Figure 18). Secchi remained similar to the two recent years of sampling at 2.9 feet, however phosphorus was a historical high 421 µg/l, and both phosphorus and chlorophyll-*a* (444 µg/l) were the worst levels of all lakes sampled.

5.0 Conclusions

1. Precipitation for the year was low, with August having the greatest deficit from normal at approximately 3 inches. Watkins and Kimball stations were about 5 inches below normal for the year, while Annandale was 2.3 inches below normal for the year.

2. The low precipitation resulted in dry conditions with 6.5 inches of runoff, almost 2 inches below normal.

3. The Clearwater River phosphorus load was about 3,770 pounds at CR-28.2, significantly lower than previous years due primarily to lower flow conditions.

4. The water quality of Grass Lake was very good, while Augusta, Caroline, Cedar, and both bays of Clearwater Lake were good, while Marie, Louisa were fair, and Albion, Betsy, Clear, Scott and Swart Watts were poor.

6.0 Recommendations

1. Continue the District's water quality and hydrologic monitoring program and coordinate with the TMDL program.

2. Continue pursuing methods to improve the water quality of the District lakes.

3. Consider a groundwater monitoring or data collection program since fecal coliform is prevalent throughout the District and may indicate a public health concern.

4. Consider the results of Stormwater Studies around the areas of Watkins and Kimball to identify opportunities for water quality improvement projects.

5. Continue to consider enhanced phosphorus reduction methods upstream of Lake Betsy and Scott Lake to reduce phosphorus loads to the Chain of Lakes.

6. Investigate flow restrictions downstream of Clearwater Lake Dam.

Tables

TABLE 1

YEARLY PRECIPITATION AND RUNOFF TOTALS

Clearwater River Watershed District

	Precipitation (inches of water)									
YEAR	Watkins	Kingston		Maine Prairie		Corinna		Area-Weighted Average		Runoff (inches)
1981	--	--		--		--		19.76	(1)	3.6
1982	--	--		--		--		24.58	(1)	6.8
1983	46.54	--		42.32		35.02		41.78		17.4
1984	32.23	30.13		32.37		36.07		32.95		13.3
1985	40.72	39.49		45.28		--		42.22		12.0
1986	40.02	35.63		39.68		33.40		37.26		16.0
1987	18.97	15.40		19.41		16.16		17.52		1.4
1988	16.57	18.98		15.96		15.01		16.48		0.7
1989	22.13	22.68		21.80		16.96		20.68		3.0
1990	40.35	39.18		41.36		32.18		37.94		11.7
1991	41.30	45.11		43.41		36.28		41.01		20.7
1992	23.06	18.41		20.47		24.35		22.01		12.9
1993	40.17	35.27	(2)	37.54	(2)	33.33		36.71		15.5
1994	34.77	--		30.13		30.26		31.98		9.0
1995	33.80	--		33.65		28.66		32.21		8.8
1996	31.31	--		24.32	(2)	26.13	(2)	27.59		4.8
1997	24.18	--		21.90		27.37		24.43		6.3
1998	30.03	--		29.39		27.43	(2)	29.05		5.5
1999	22.08	--		22.31	(2)	27.71		23.84		3.9
2000	23.83	--		20.56		19.91		21.22		1.0
2001	31.00	--		33.56		29.57		31.28		2.8
2002	37.50			40.27		44.72		40.57		7.6
2003	22.63			21.34		26.77	(2)	23.02		6.5
						Mean		29.40		8.3
						Std. Dev.		8.3		5.7

NOTES:

Whole watershed runoff is based on time-weighted average flow at Clearwater Lake outlet (station CR 10.5), and total drainage area of 155 square miles.

(1) Data for single gauge in east-central part of watershed (Camp Heritage on Lake Caroline).

(2) Average values of other stations in District were used to fill in missing data.

TABLE 2
HISTORICAL SUMMARY OF STREAM FLOWS, PHOSPHORUS CONCENTRATIONS, AND LOADINGS

Clearwater River Watershed District

Station	Year	Average Stream Flow (cu m/sec)	Average Stream Flow (cfs)	Average Total Phosphorus Concentration (mg/l)	Total Phosphorus Load (kg)	Total Phosphorus Load (lb)
Main Stem:						
CR 28.2	1981 (1)	--	--	1.40	--	--
	1982 (1)	0.93	32.8	0.74	19,700	43,500
	1983	2.62	92.6	0.92	76,000	168,000
	1984	1.49	52.6	0.76	35,700	78,800
	1985	2.32	81.9	0.90	65,500	144,000
	1986	3.20	113	0.78	55,200	122,000
	1987	0.11	3.90	0.13	460	1,020
	1988	0.09	3.12	0.66	1,850	4,080
	1989	0.02	0.72	0.19	120	260
	1990	0.51	18.0	0.44	7,040	15,500
	1991	1.11	39.1	0.29	10,200	22,500
	1992	0.26	9.30	0.20	1,660	3,650
	1993	1.28	45.2	0.29	11,600	25,600
	1994	1.17	41.2	0.28	10,100	22,300
	1995	1.15	40.4	0.29	10,400	22,900
	1996	0.33	11.7	0.27	2,860	6,300
	1997	0.27	9.36	0.26	2,170	4,790
	1998	0.41	14.4	0.25	3,190	7,020
	1999	0.08	2.78	0.16	400	870
	2000	0.02	0.72	0.38	240	530
	2001 (4),(5)	0.27	9.46	0.51	4,309	9,500
	2002	0.47	16.50	0.29	4,290	9,460
	2003	0.28	9.92	0.19	1,710	3,770
CR 10.5	1981 (1)	1.15	40.6	0.05	2,060	4,550
	1982 (1)	2.20	77.8	0.07	4,990	11,000
	1983	5.64	199	0.10	18,500	40,800
	1984	4.28	151	0.05	6,620	14,600
	1985	3.88	137	0.14	16,700	36,800
	1986	5.52	195	0.15	23,700	52,300
	1987	0.46	16.2	0.04	600	1,320
	1988	0.23	7.95	0.04	260	580
	1989	0.97	34.2	0.08	2,340	5,150
	1990	3.77	133	0.03	3,060	6,750
	1991	6.68	236	0.05	10,500	23,200
	1992	4.16	147	0.06	8,090	17,800
	1993	5.01	177	0.04	6,330	14,000
	1994	2.92	103	0.03	2,850	6,290
	1995	2.83	100	0.03	3,040	6,710
	1996	1.53	54.2	0.04	1,970	4,350
	1997	2.06	72.8	0.04	2,690	5,940
	1998	1.78	63.0	0.04	2,330	5,120
	1999	1.25	44.1	0.04	1,520	3,350
	2000	0.31	10.8	0.03	280	610
	2001 (4),(5)	0.90	31.7	0.03	850	1,873
	2002	2.46	87.0	0.04	2,950	6,500
	2003	2.11	74.6	0.024	1,590	3,500

TABLE 2
HISTORICAL SUMMARY OF STREAM FLOWS, PHOSPHORUS CONCENTRATIONS, AND LOADINGS

Clearwater River Watershed District

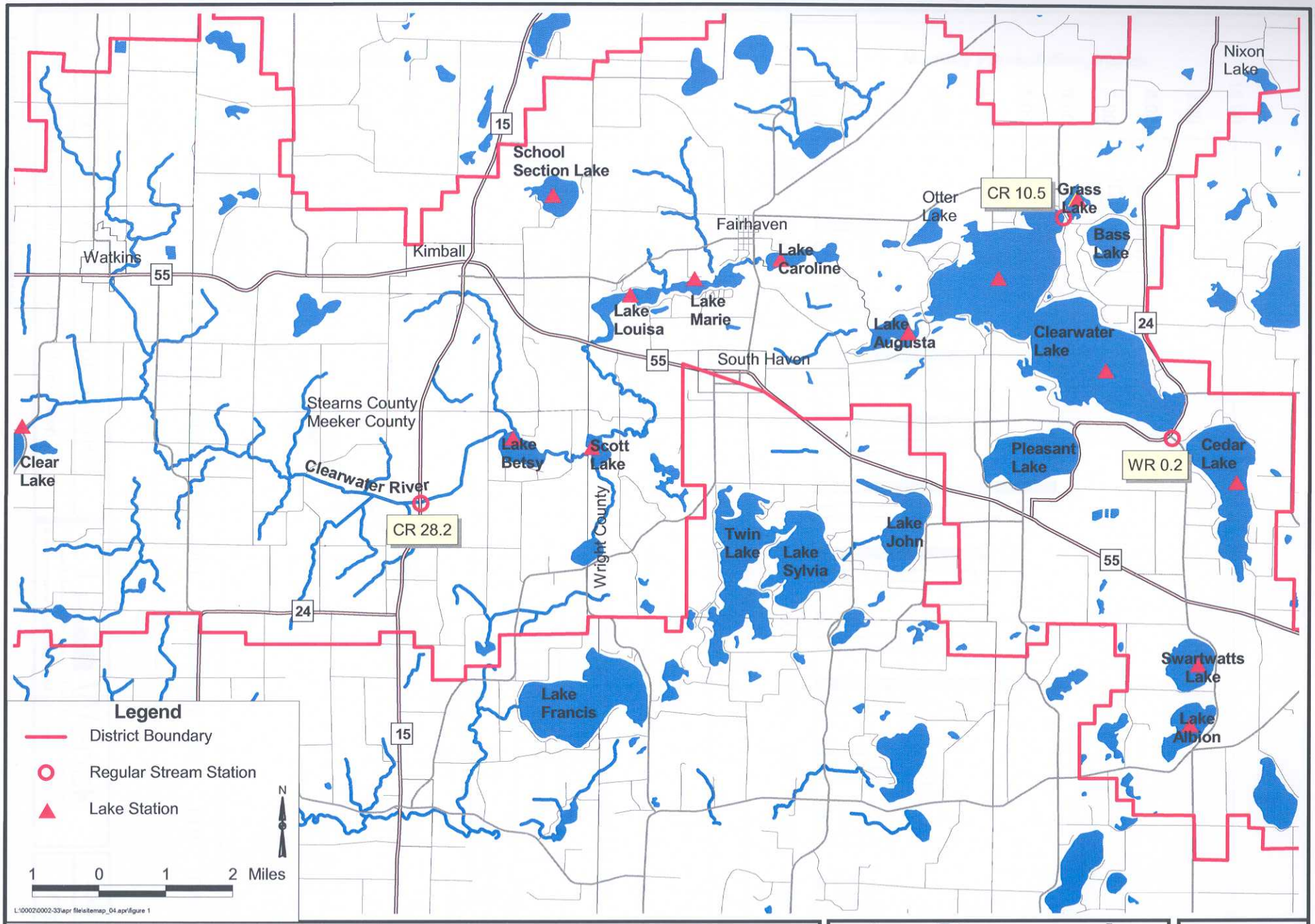
Station	Year	Average Stream Flow (cu m/sec)	Average Stream Flow (cfs)	Average Total Phosphorus Concentration (mg/l)	Total Phosphorus Load (kg)	Total Phosphorus Load (lb)
Tributaries:						
WR 0.2 (2)	1981 (1)	0.07	2.60	0.17	390	860
	1982 (1)	0.23	8.20	0.16	780	1,720
	1983	0.47	16.50	0.09	1,270	2,800
	1984	0.60	21.20	0.05	950	2,100
	1985	0.48	17.10	0.14	2,130	4,700
	1986	0.86	30.40	0.20	4,630	10,200
	1987	0.04	1.50	0.07	100	230
	1988	0.01	0.40	0.17	60	130
	1989	0.03	1.19	0.14	80	180
	1990	0.06	2.28	0.37	750	1,660
	1991	0.26	9.22	0.11	860	1,900
	1992	0.11	4.02	0.05	170	370
	1993	0.24	8.59	0.10	760	1,670
	1994	0.18	6.34	0.06	320	700
	1995	0.12	4.27	0.05	210	460
	1996	0.05	1.78	0.11	180	380
	1997	0.09	3.15	0.08	220	480
	1998	0.09	3.11	0.11	290	650
	1999	0.06	2.03	0.07	130	280
	2000 (3)	0.01	0.44	0.06	25	56
	2001 (4),(5)	0.08	2.88	0.10	257	567
	2002	0.26	9.17	0.11	930	2,060
	2003	0.16	5.79	0.062	320	710

NOTES:

Flow values are time-weighted averages unless otherwise noted.
Total phosphorus values are flow- and time-weighted averages unless otherwise noted.

(1) Values in 1981 and 1982 are arithmetic means
(2) Station WR 0.2 was designated Station WC 0.2 in 1981-1983
(3) Phosphorus values in 2000 are flow-weighted and adjusted per log-log regression on flow so as to correspond to annual mean flows.
(4) 2001 Flow and total phosphorus values are arithmetic averages.
(5) 2001 total phosphorus loads estimated from arithmetic averages of flow and total phosphorus values.

Figures



CLEARWATER RIVER WATERSHED DISTRICT

2003 Stream and Lake Monitoring Locations

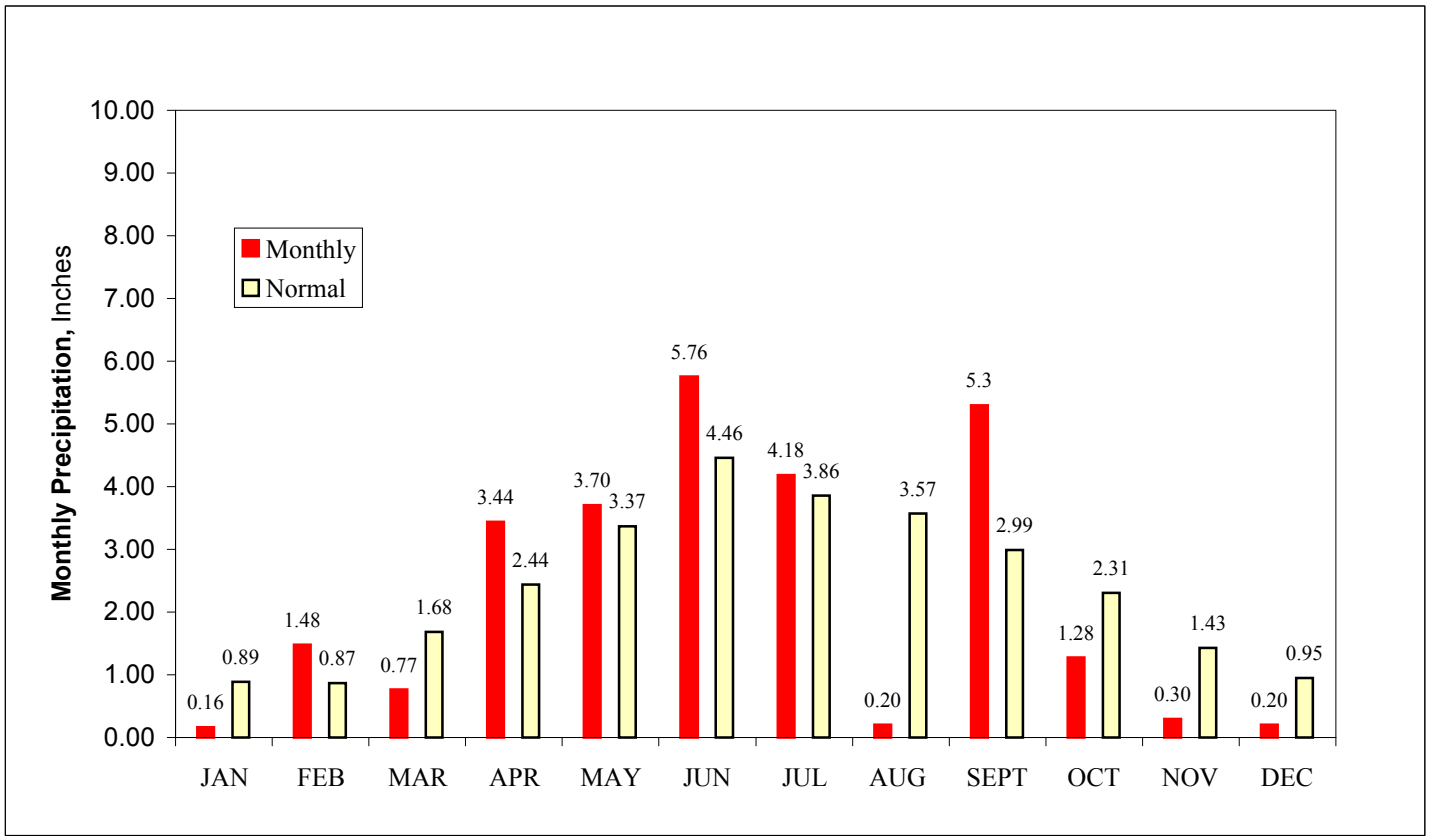
Wenck

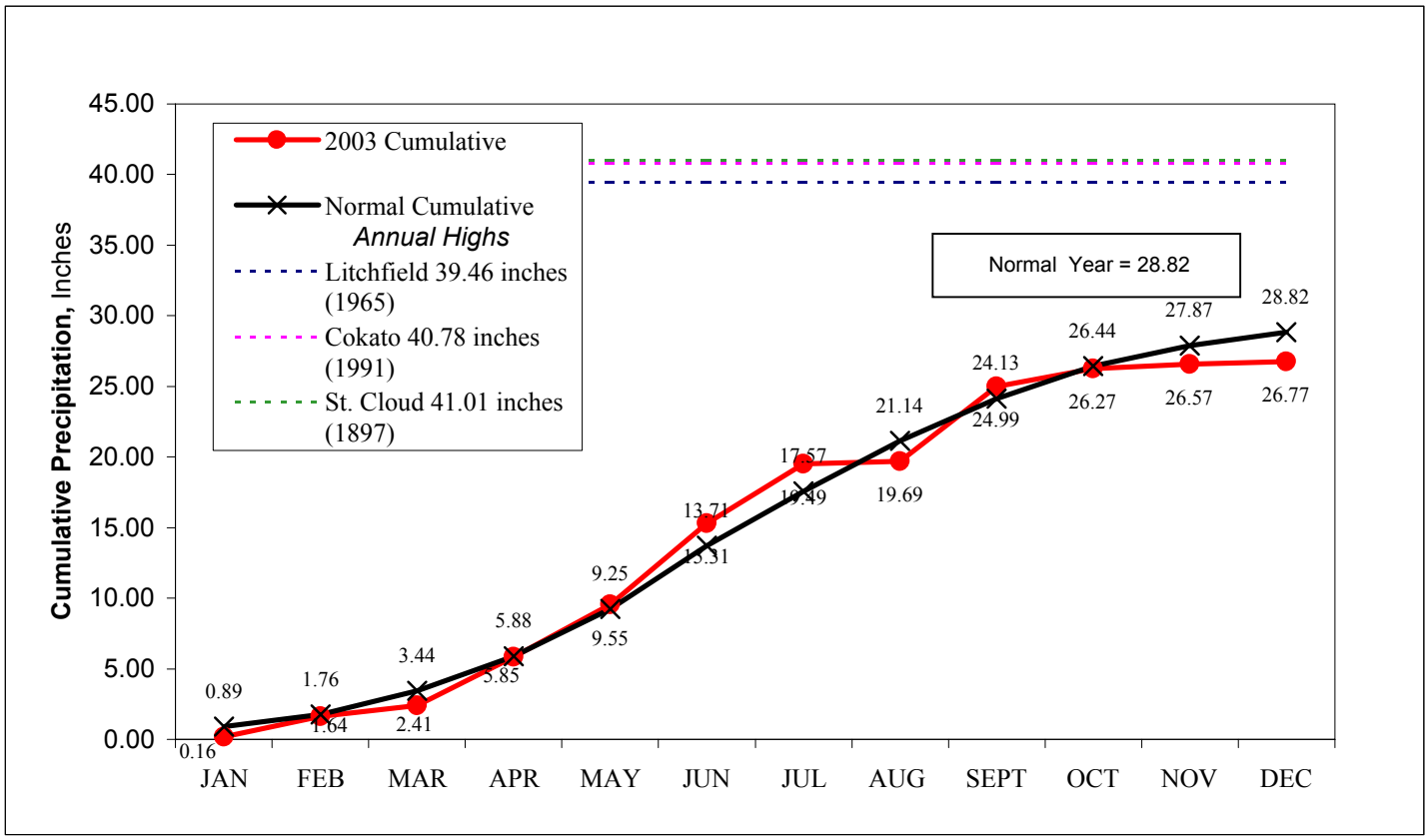
Wenck Associates, Inc.
Environmental Engineers

1800 Pioneer Creek Center
Maple Plain, MN 55359-0429

JAN 2004

Figure 1





CLEARWATER RIVER WATERSHED DISTRICT	Wenck Associates, Inc. Environmental Engineers — Wenck — 1800 Pioneer Creek Center Maple Plain, MN 55359	JAN. 2004
2003 Precipitation Data of Annandale Station		Figure 2

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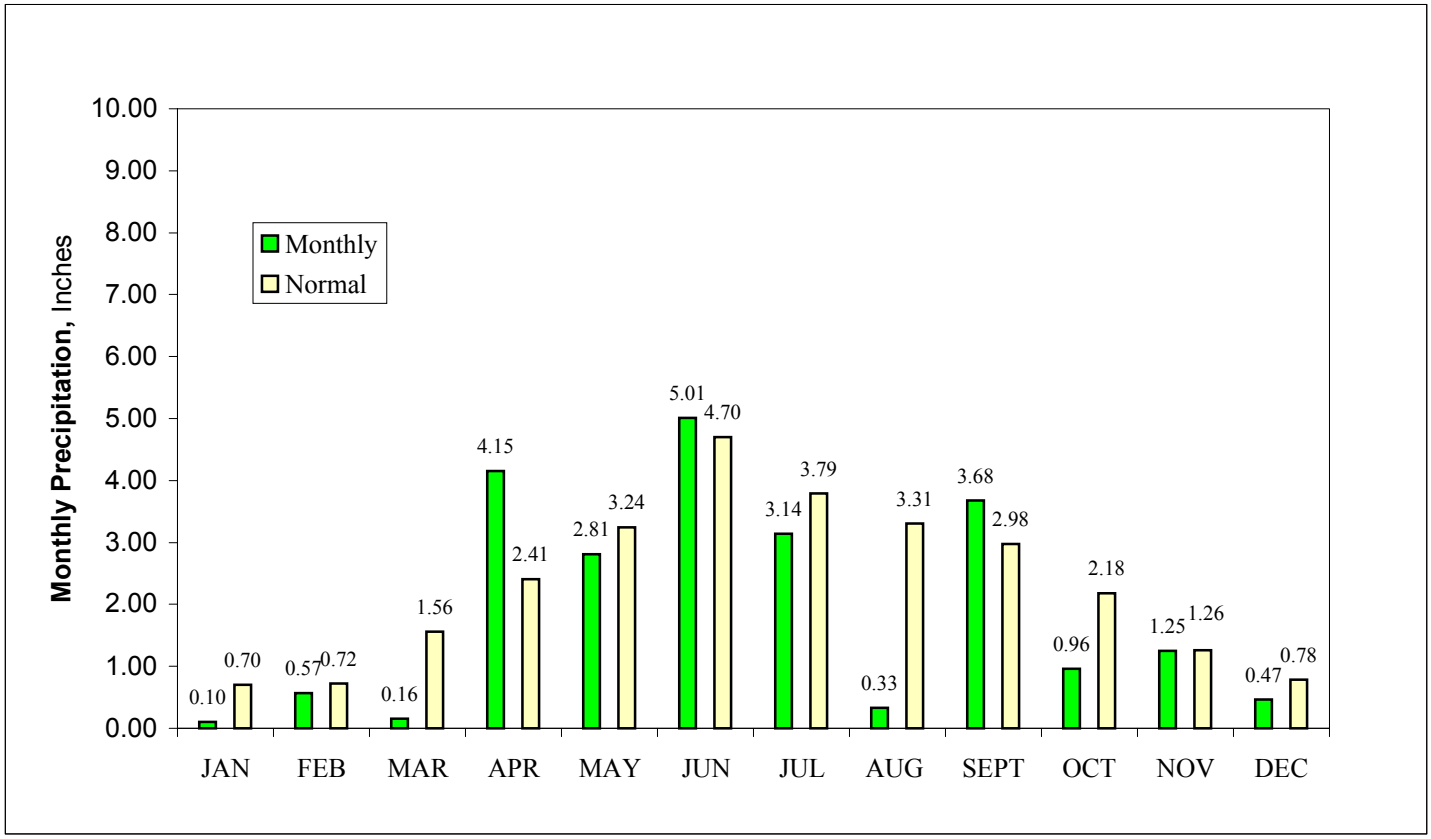

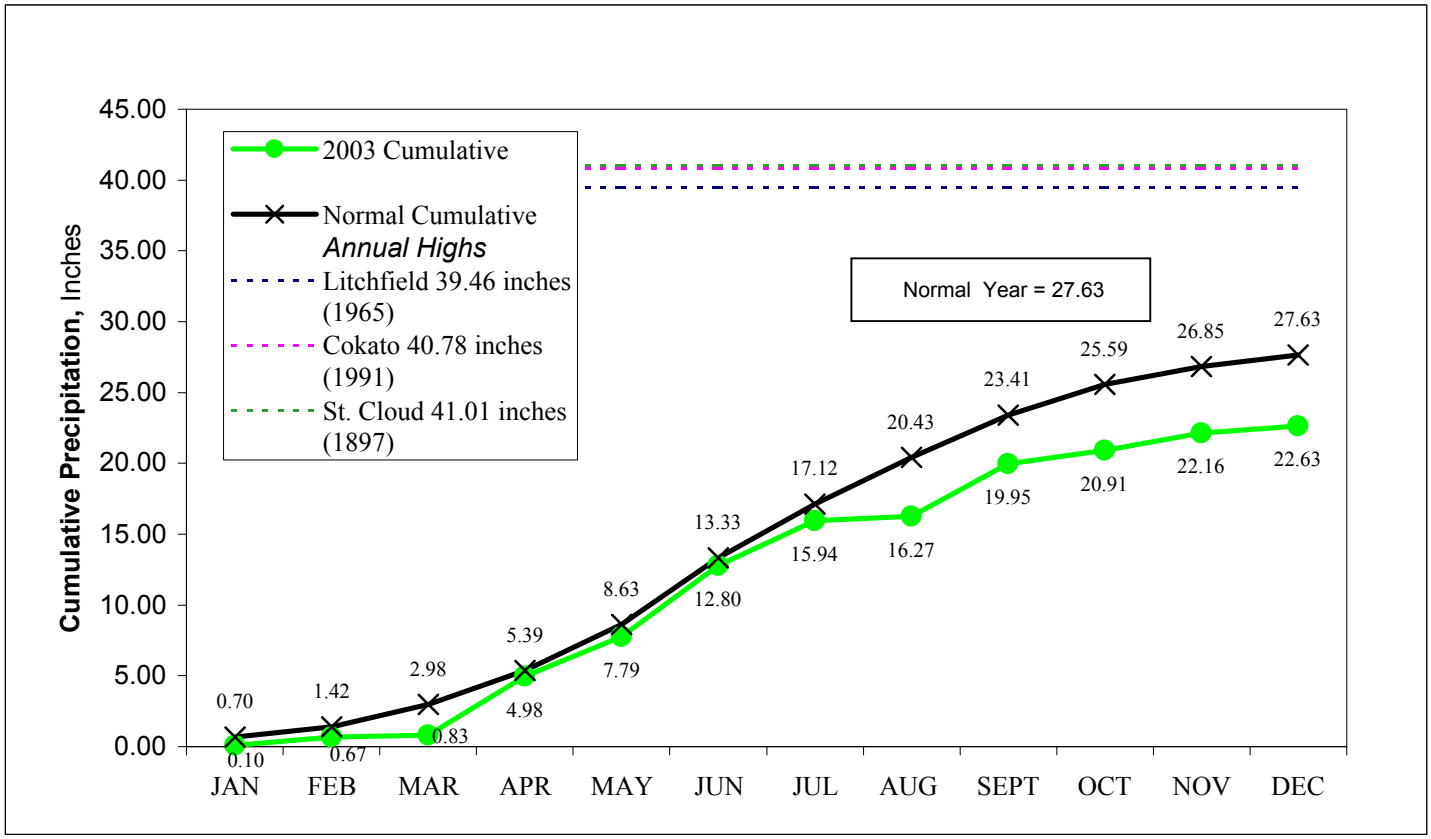

CLEARWATER RIVER WATERSHED DISTRICT	Wenck Associates, Inc. Environmental Engineers — Wenck — 1800 Pioneer Creek Center Maple Plain, MN 55359	JAN. 2004
2003 Precipitation Data of Watkins Statio		Figure 3

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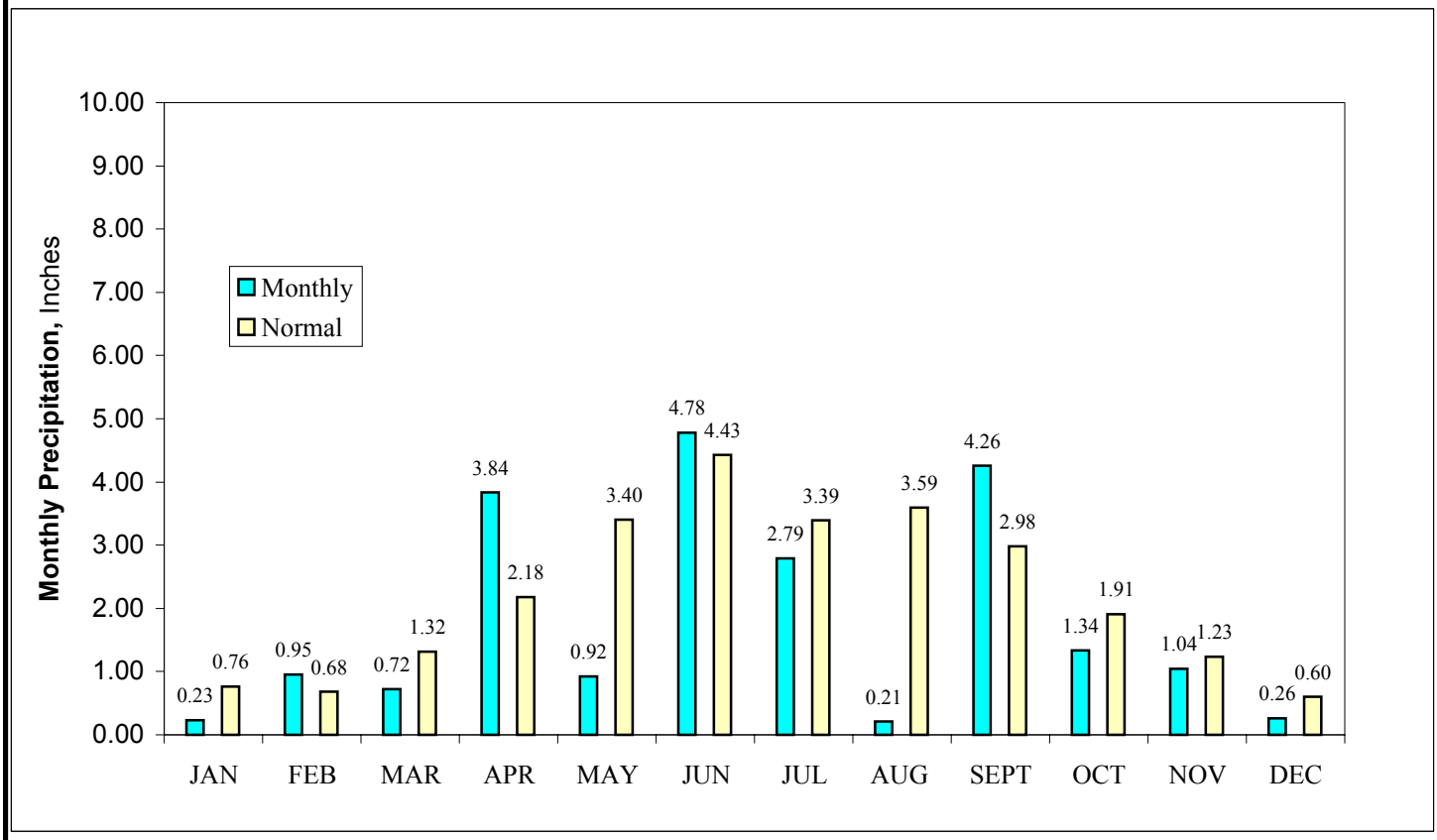

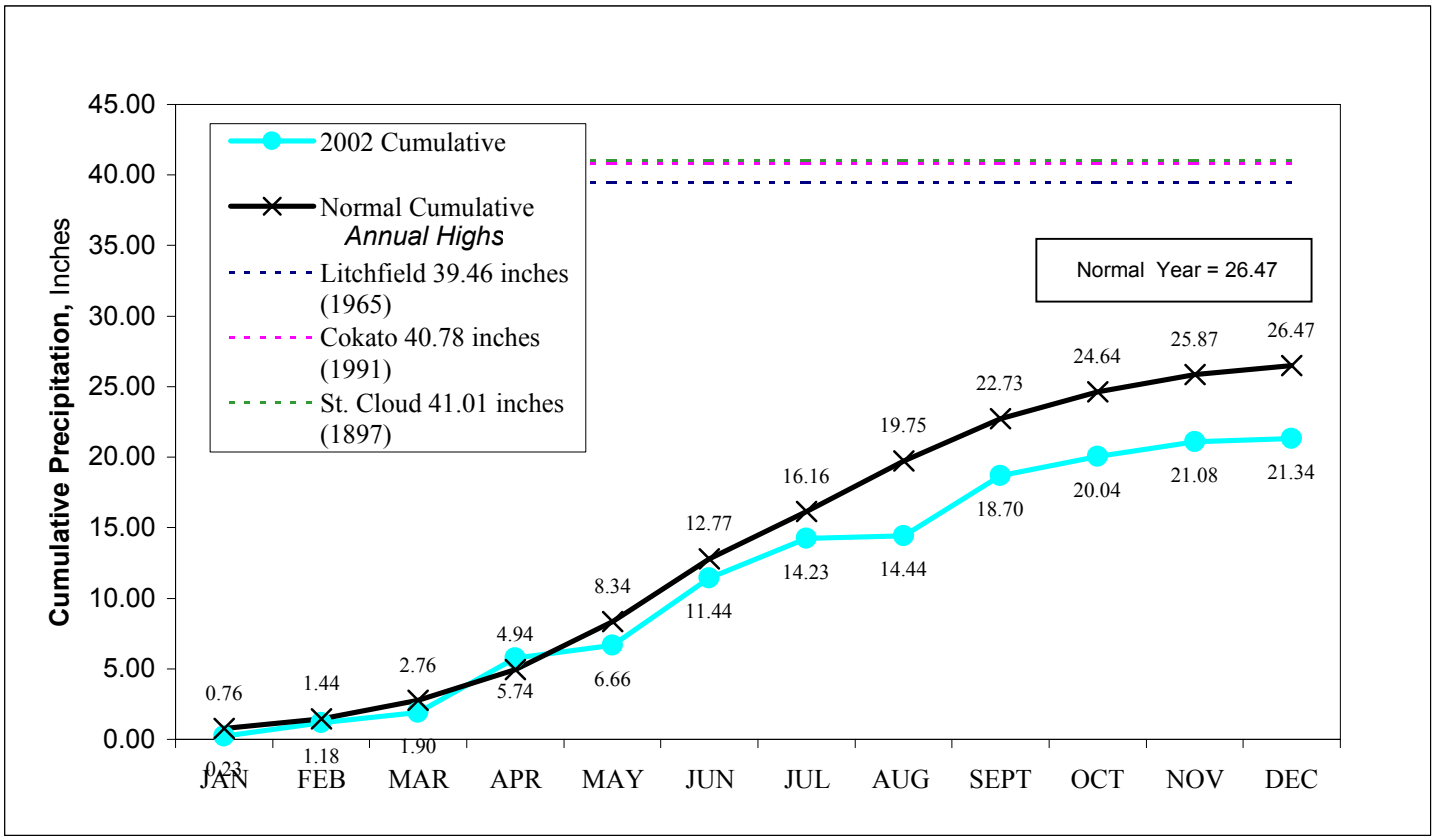

CLEARWATER RIVER WATERSHED DISTRICT	Wenck Associates, Inc. Environmental Engineers — Wenck — 1800 Pioneer Creek Center Maple Plain, MN 55359	JAN. 2004
2003 Precipitation Data of Kimball Station		Figure 4

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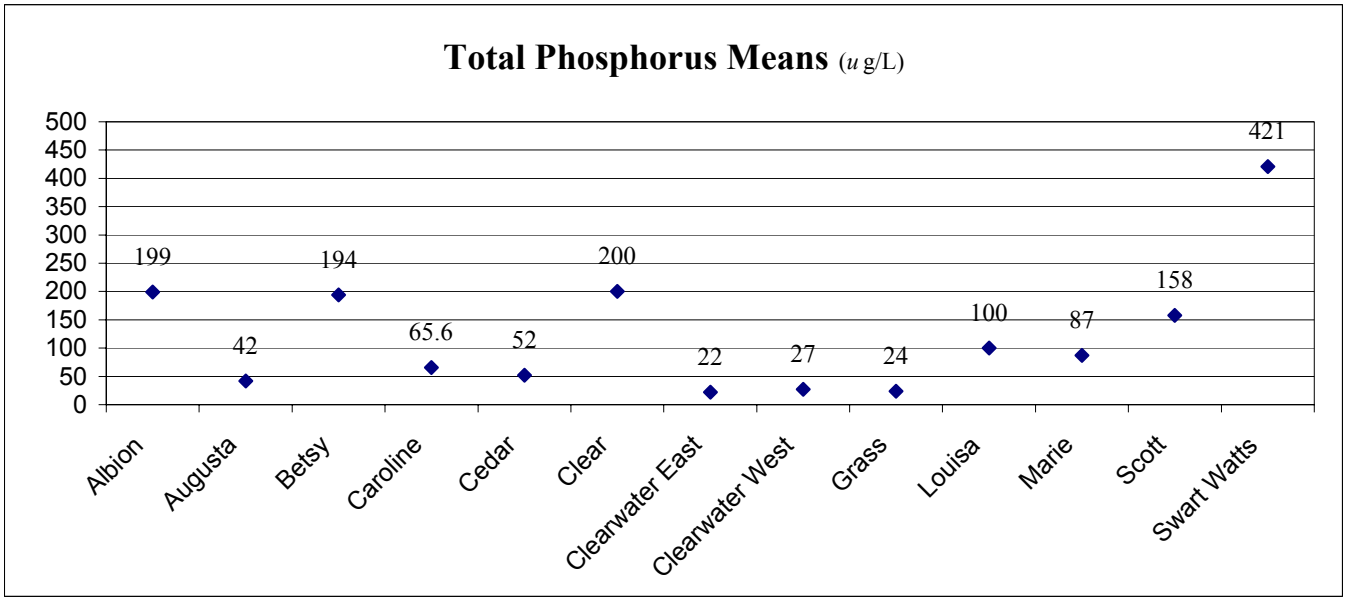
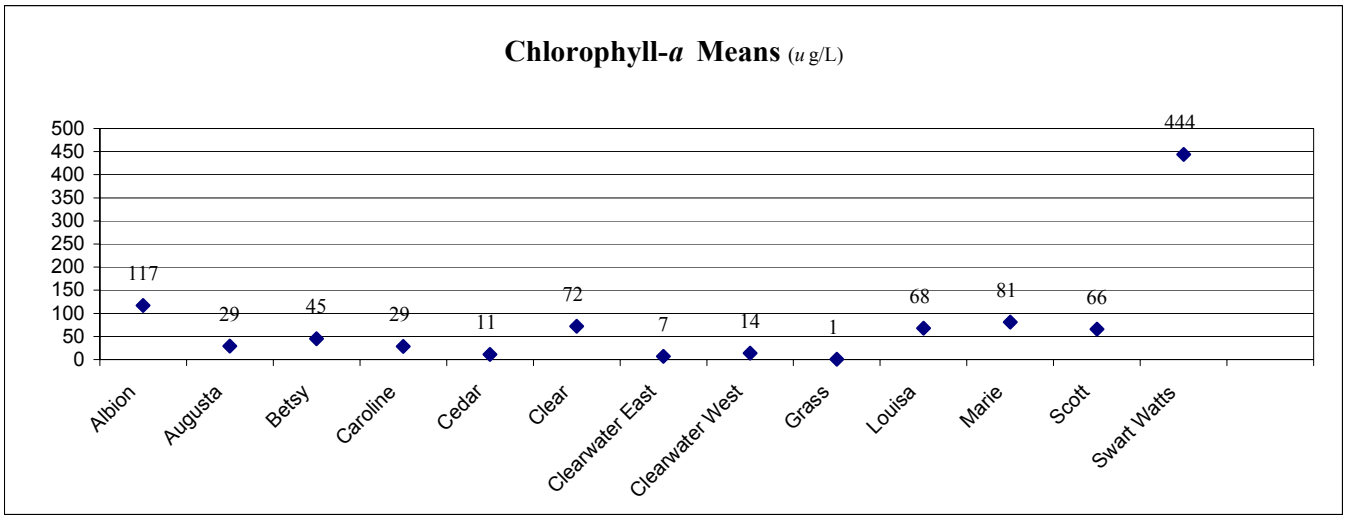
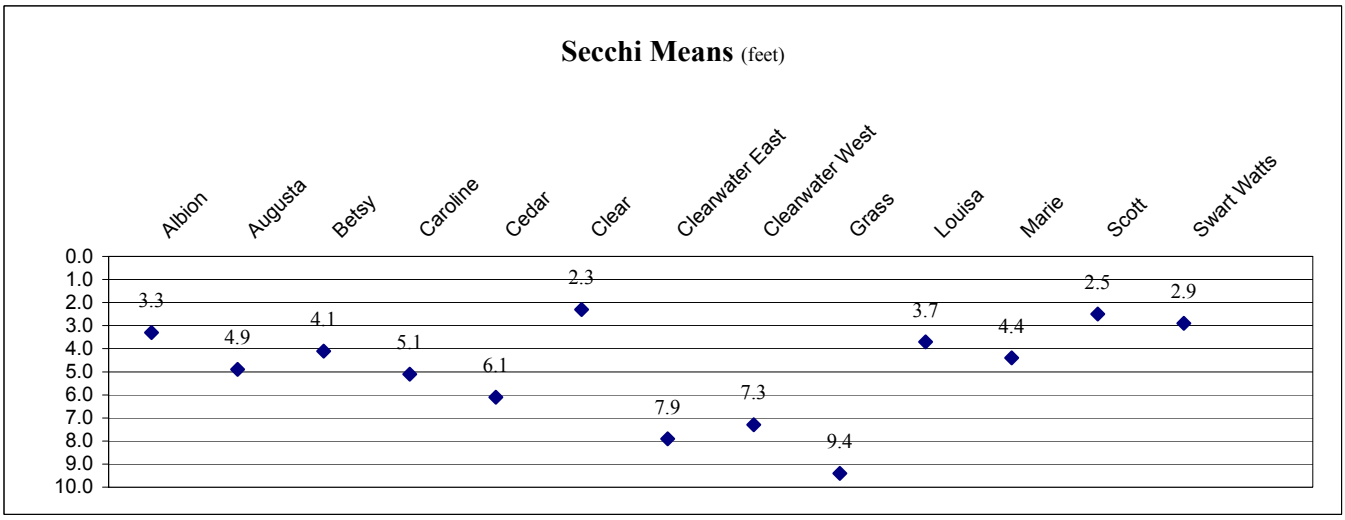
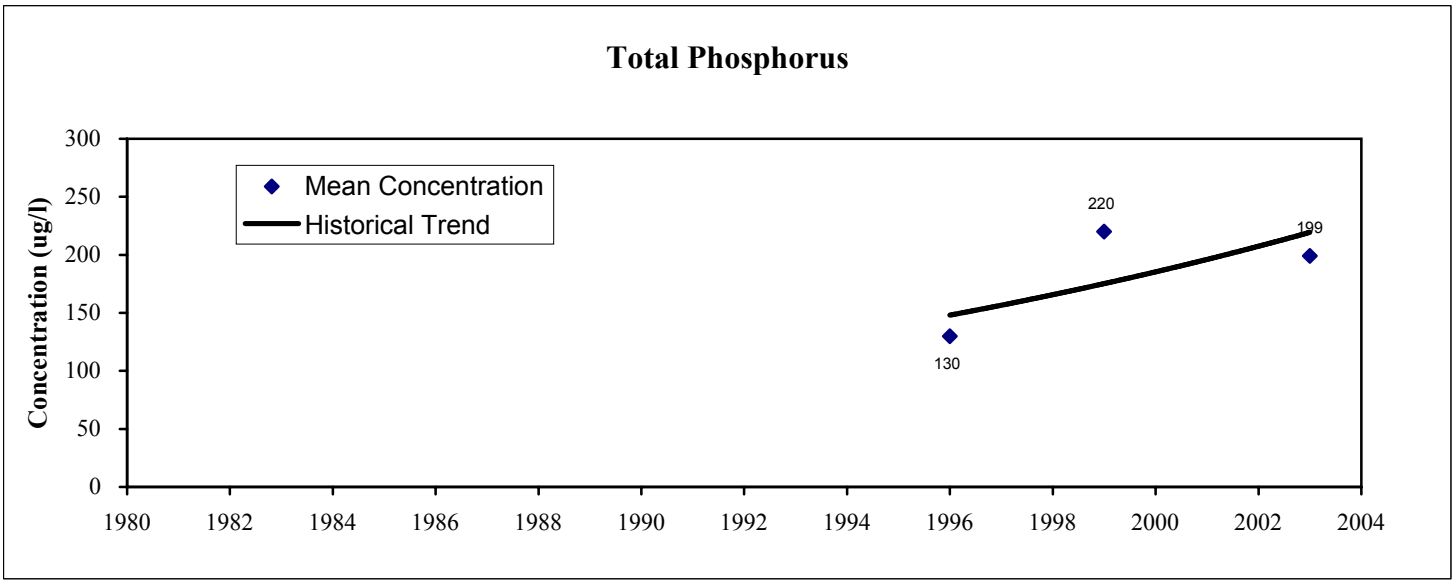


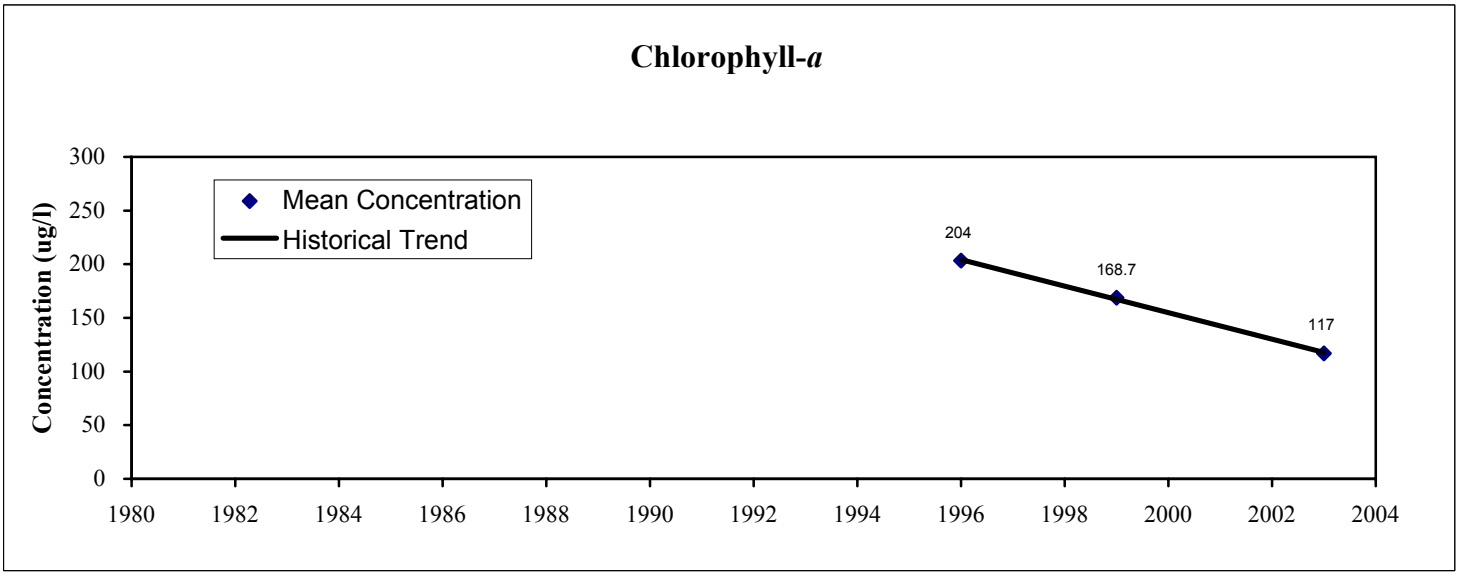


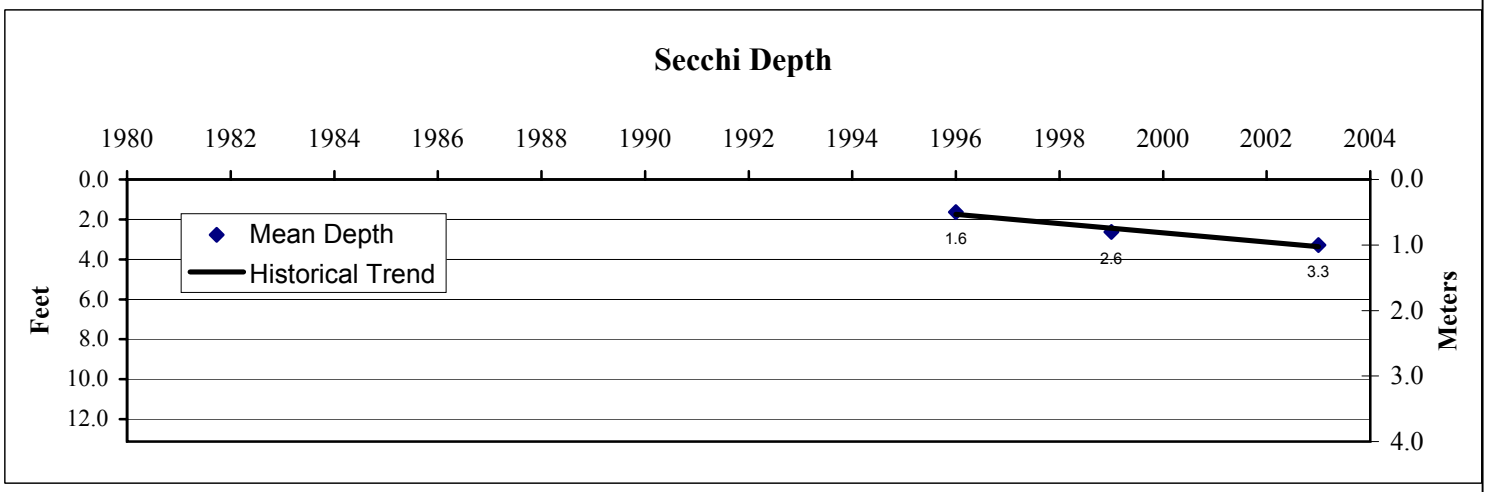


Clearwater River Watershed District	Wenck Associates, Inc. Environmental Engineers — 1800 Pioneer Creek Center Maple Plain, MN 55359	Jan 2004
2003 Graphical Summary of Lake Water Quality		Figure 5

T:\0002\58\Report\LAKE_WQ_03\Figure 5 All Lake Summary







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Lake Albion Historical Data		Figure 6

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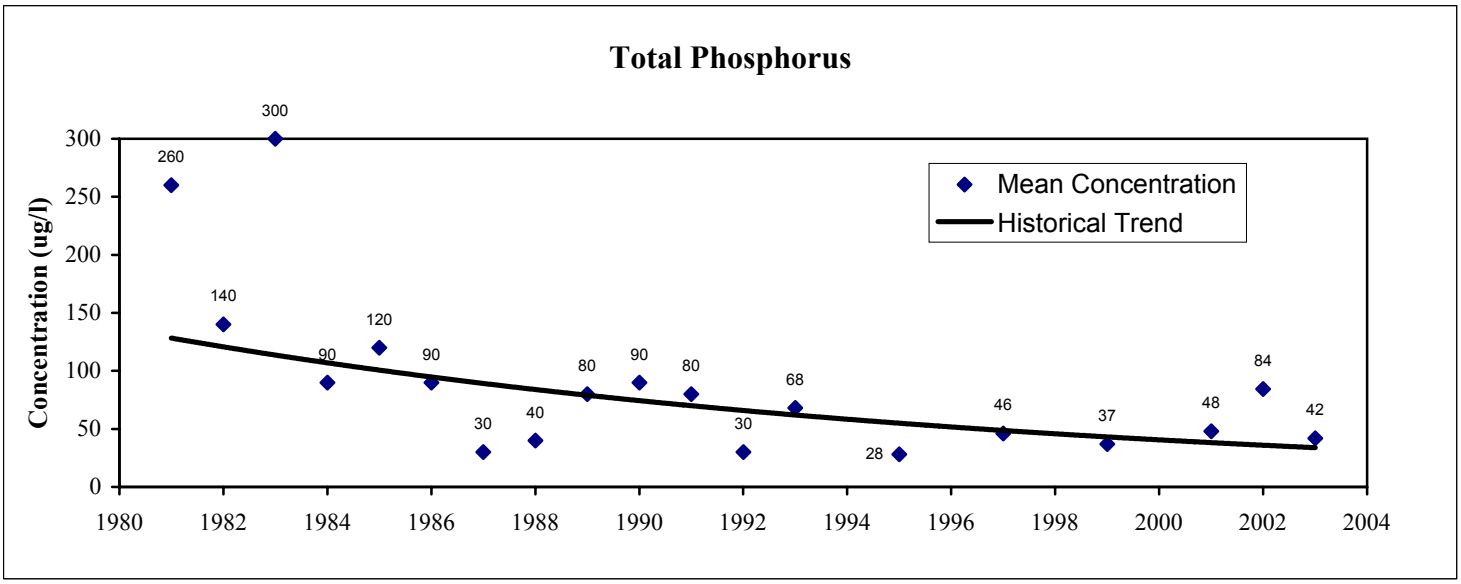
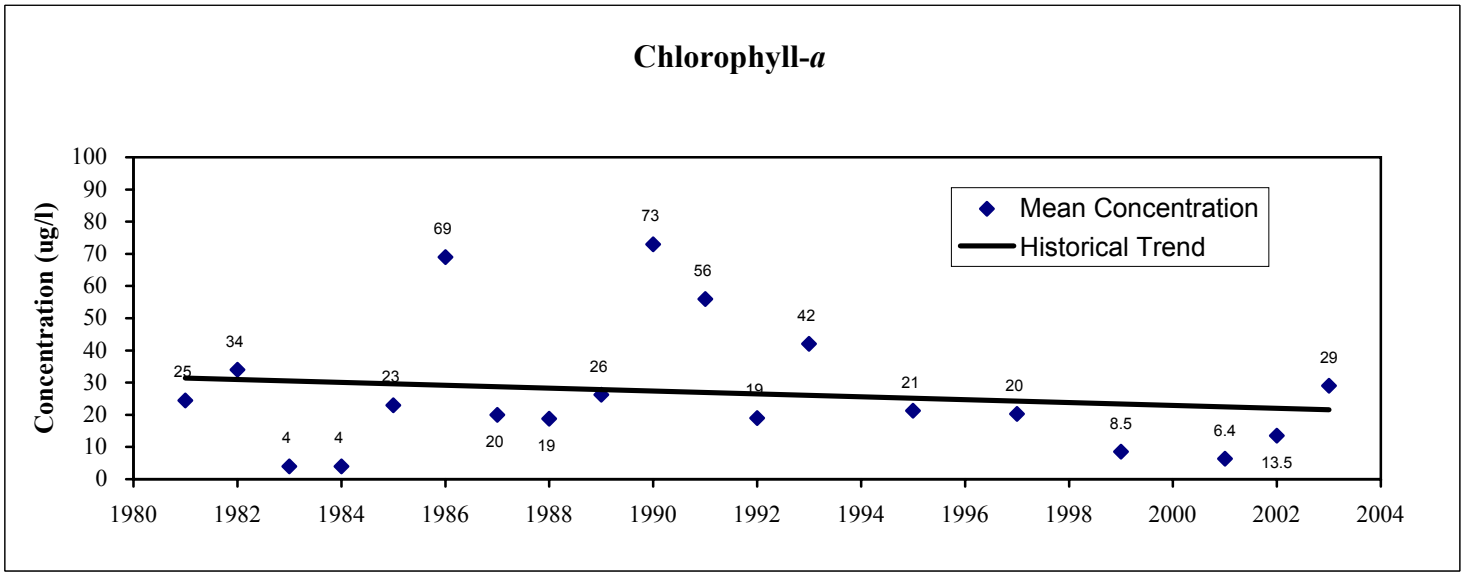
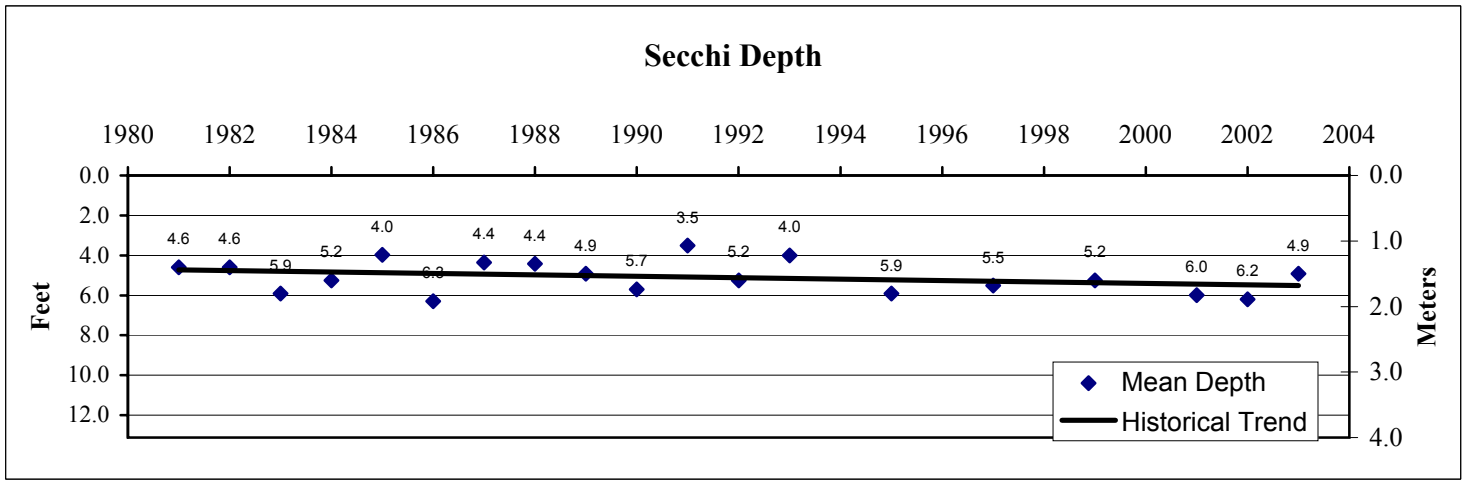
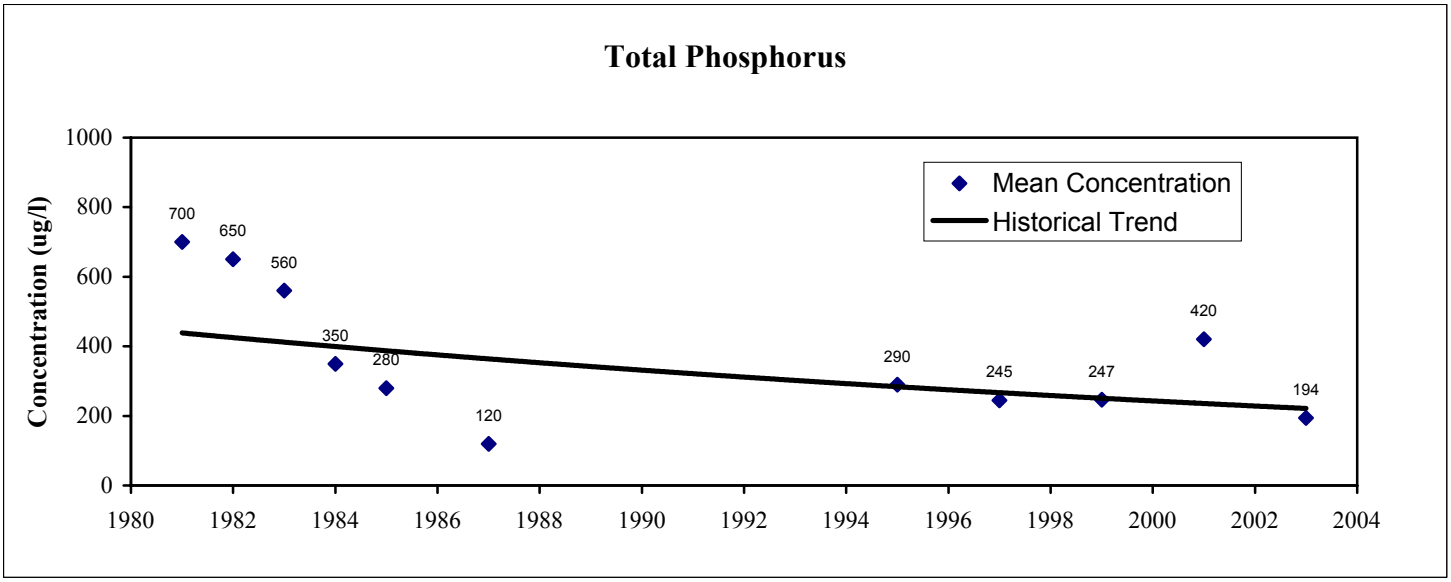


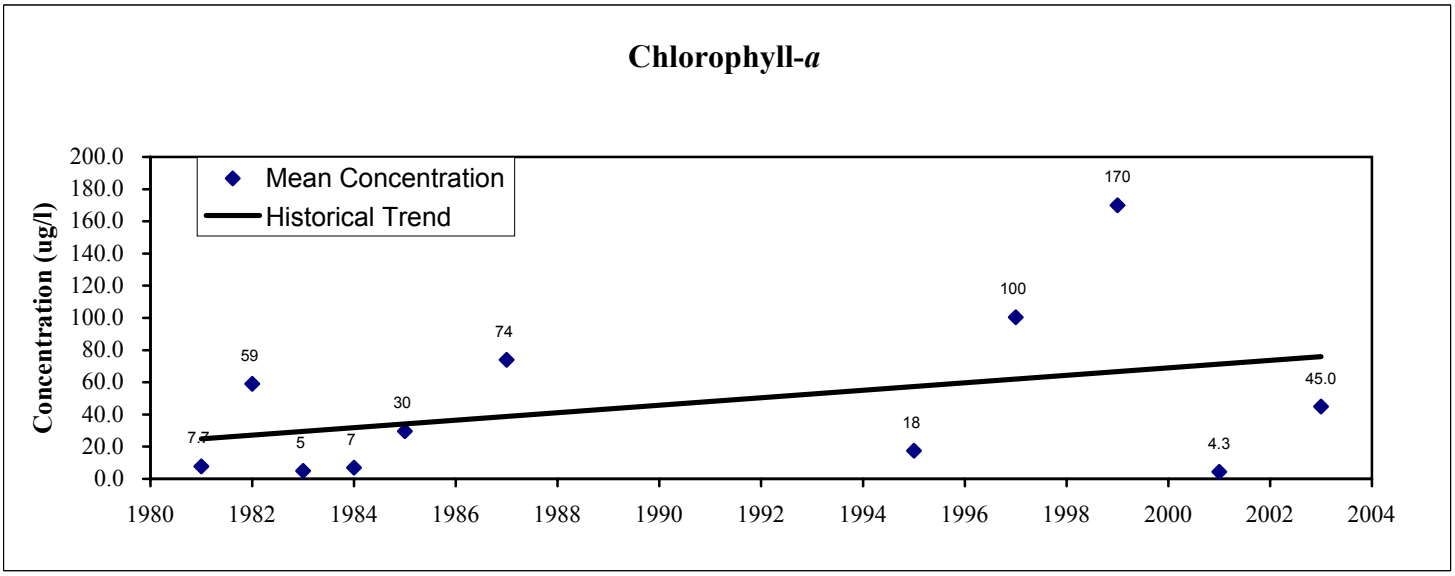


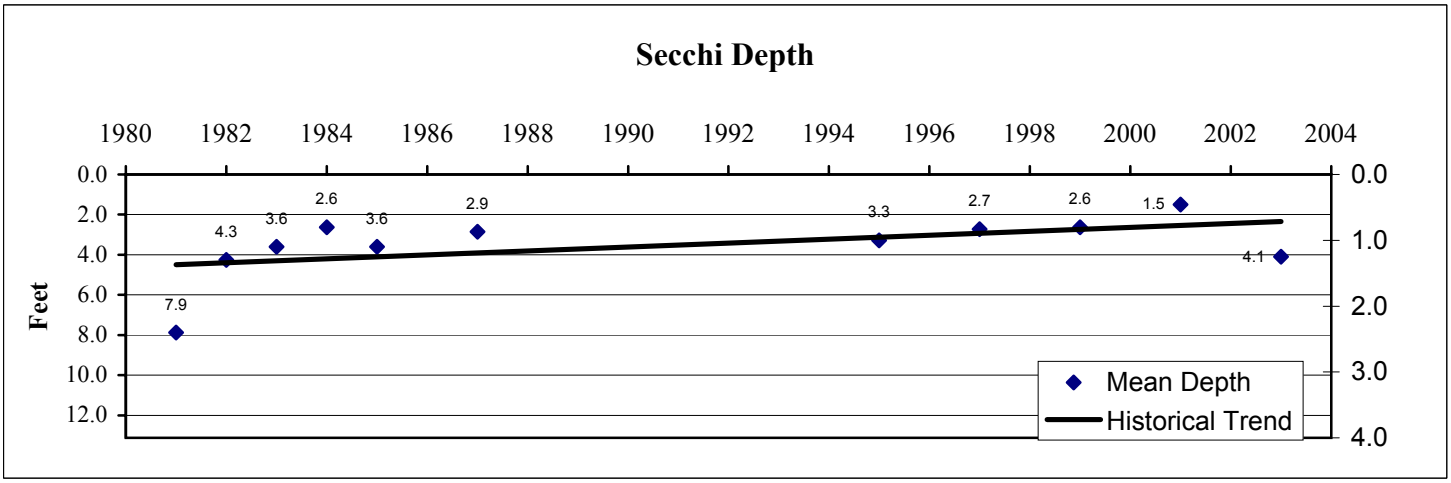


Clearwater River Watershed District	Wenck Wenck Associates, Inc. 1800 Pioneer Creek Center Environmental Engineers Maple Plain, MN 55359	Jan 2004
Lake Augusta Historical Data		Figure 7

T:\0002\58\Report\LAKE_WQ_03\Lake Augusta.xls

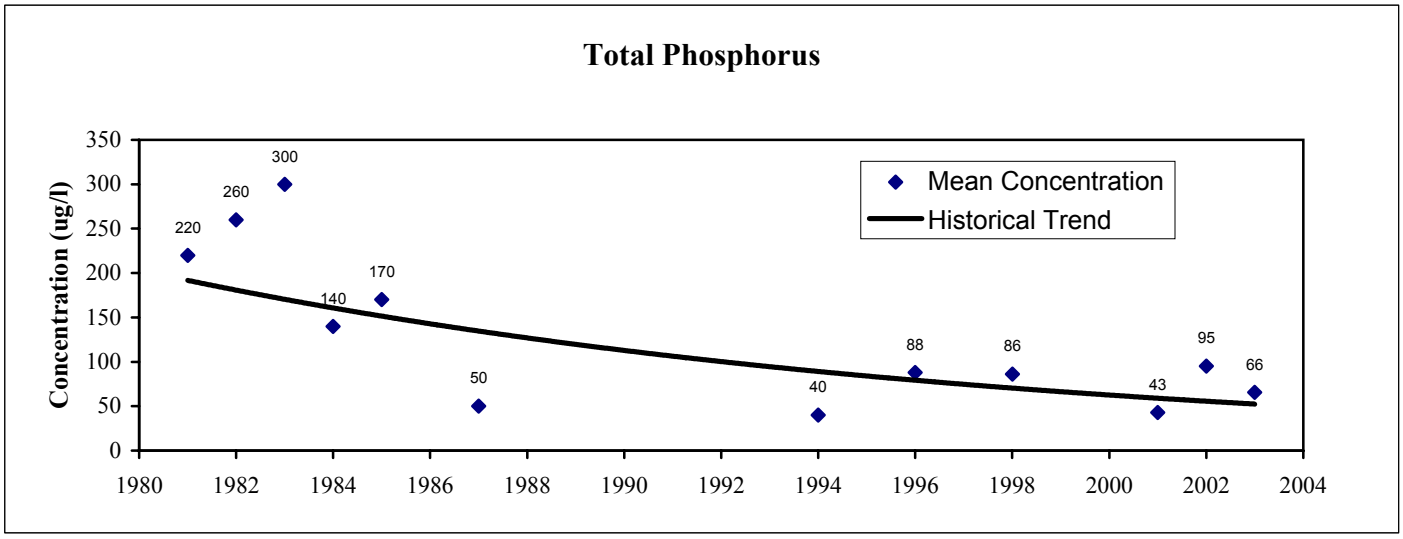


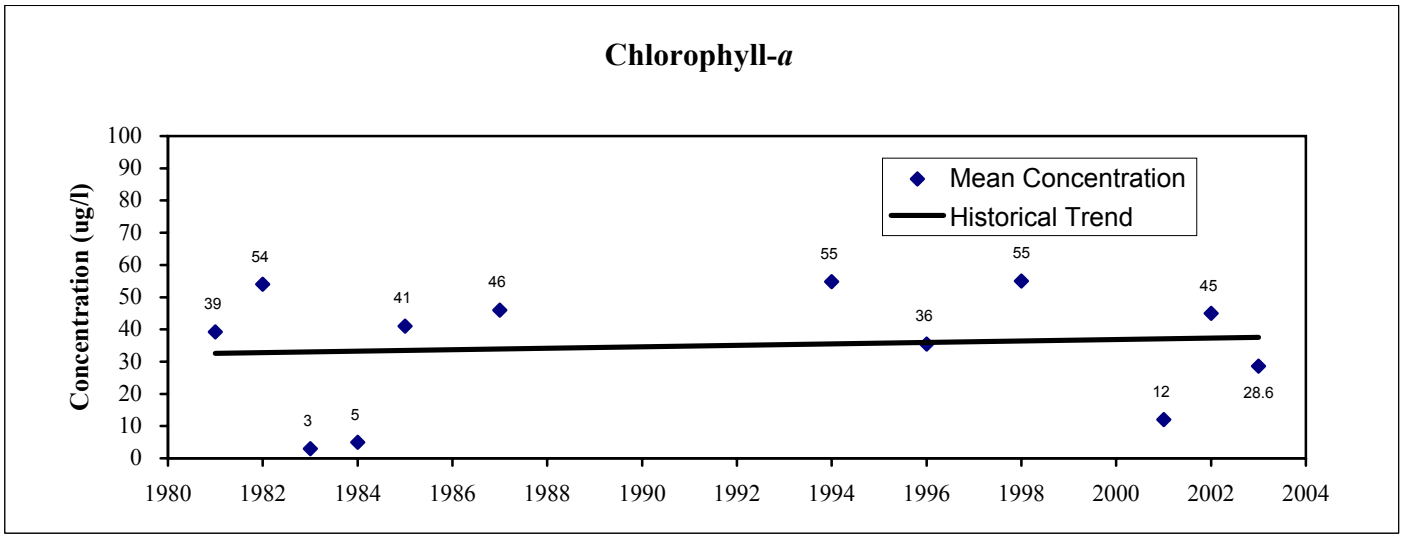


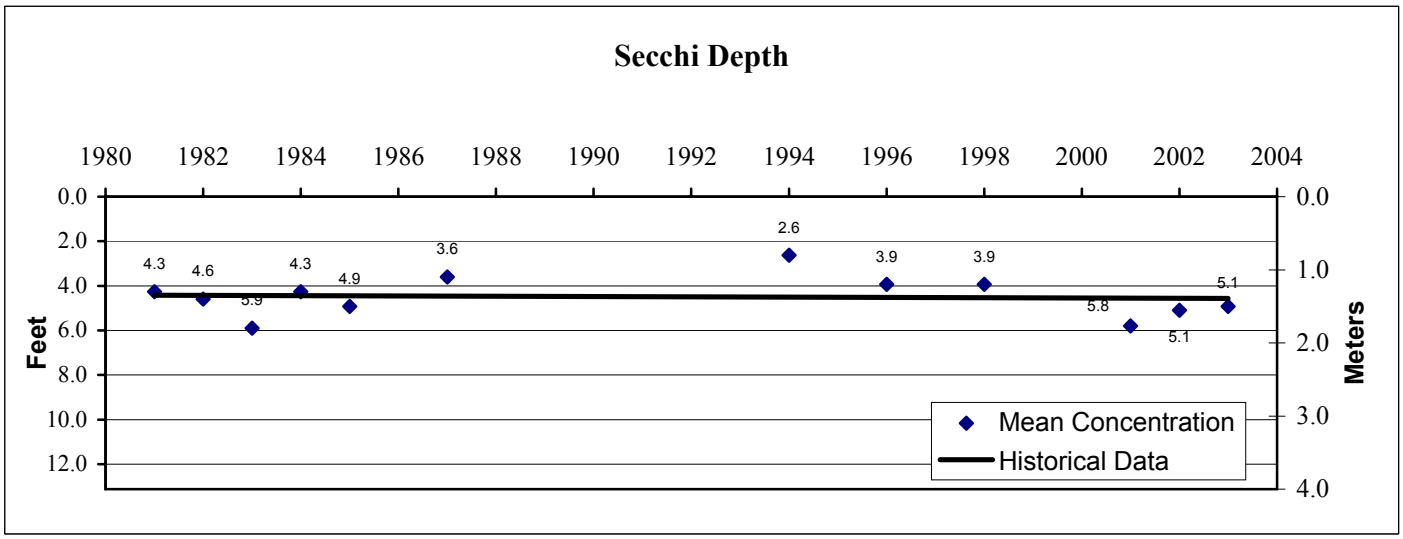


Clearwater River Watershed District	Wenck Associates, Inc. Environmental Engineers 1800 Pioneer Creek Center Maple Plain, MN 55359	Jan 2004
Lake Betsy Historical Data		Figure 8

T:\0002\58\report\LAKE_WQ_03\Lake Betsy.xls

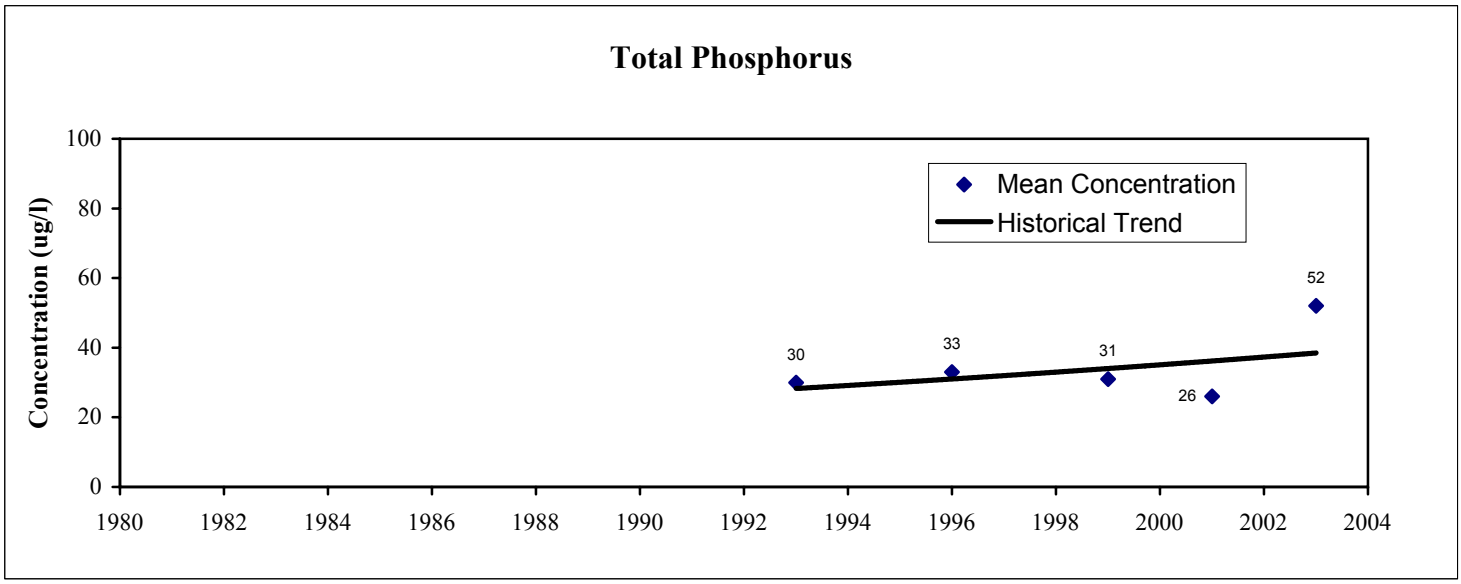


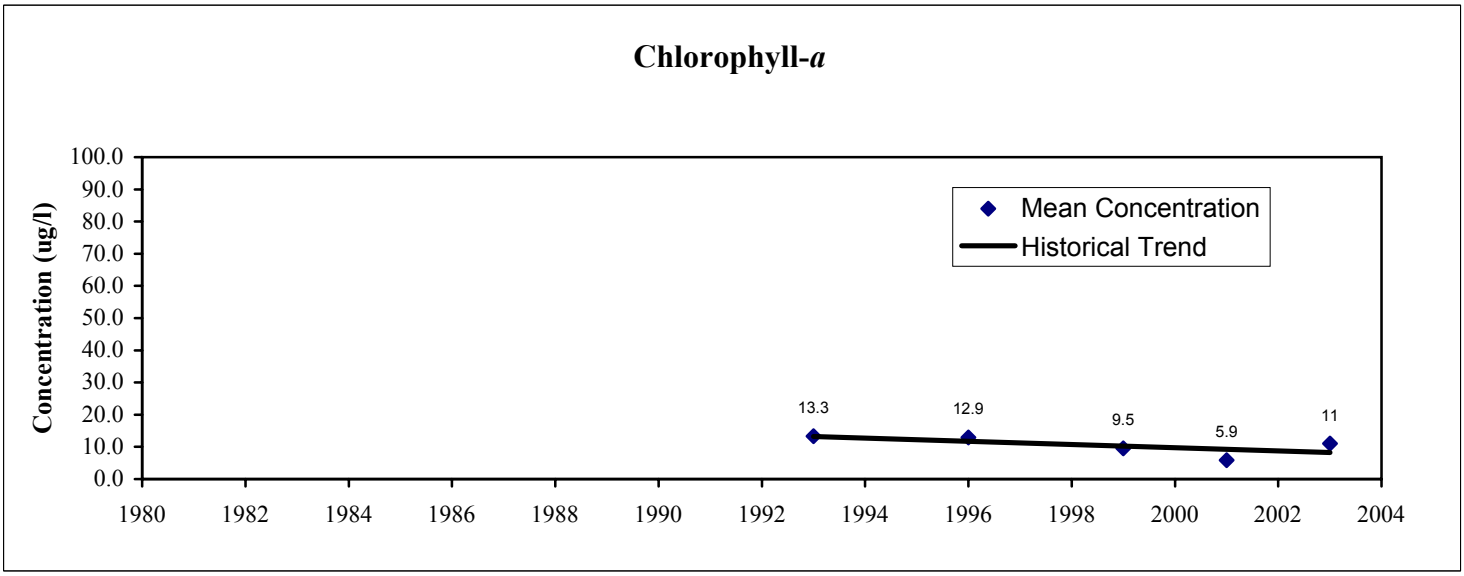


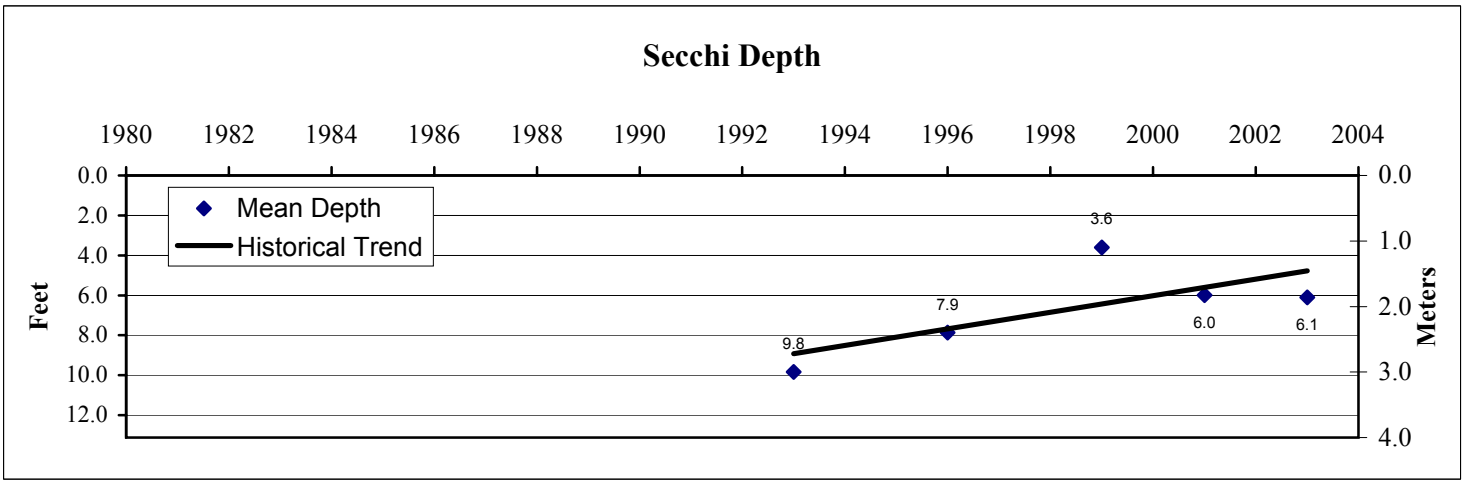


Clearwater River Watershed District	Wenck Wenck Associates, Inc. 1800 Pioneer Creek Center Environmental Engineers Maple Plain, MN 55359	Jan 2004
Lake Caroline Historical Data		Figure 9

T:\0002\58\Report\LAKE_WQ_03\Lake Caroline.xls

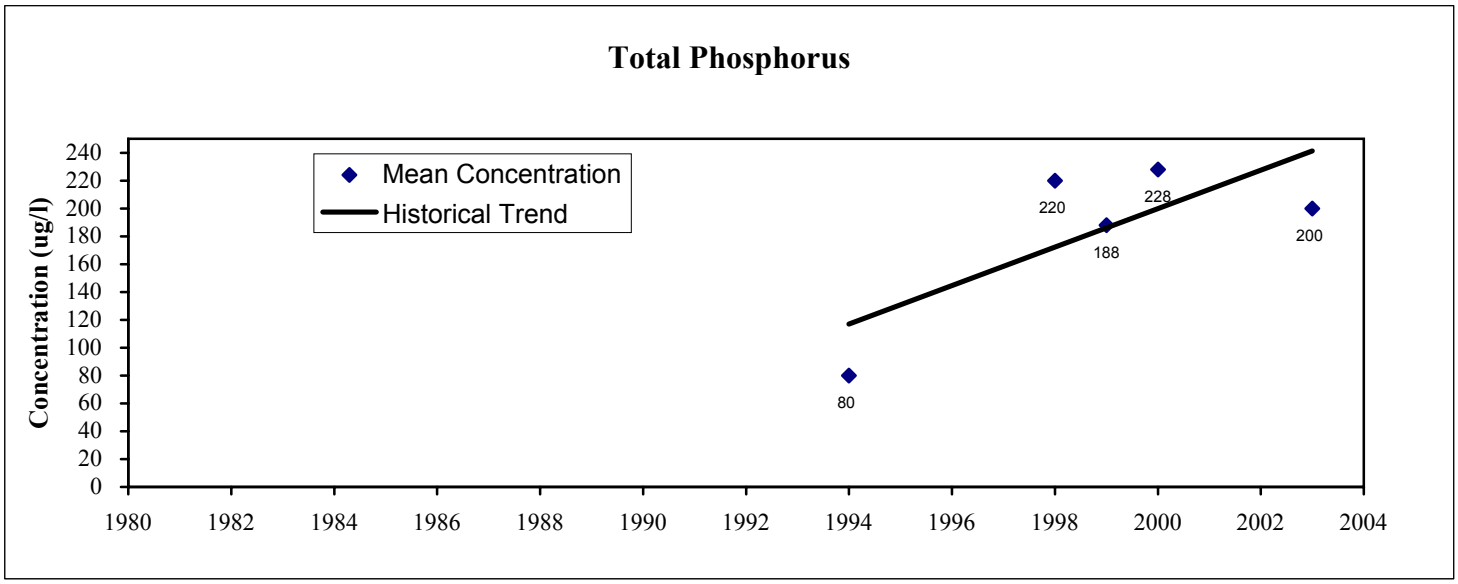


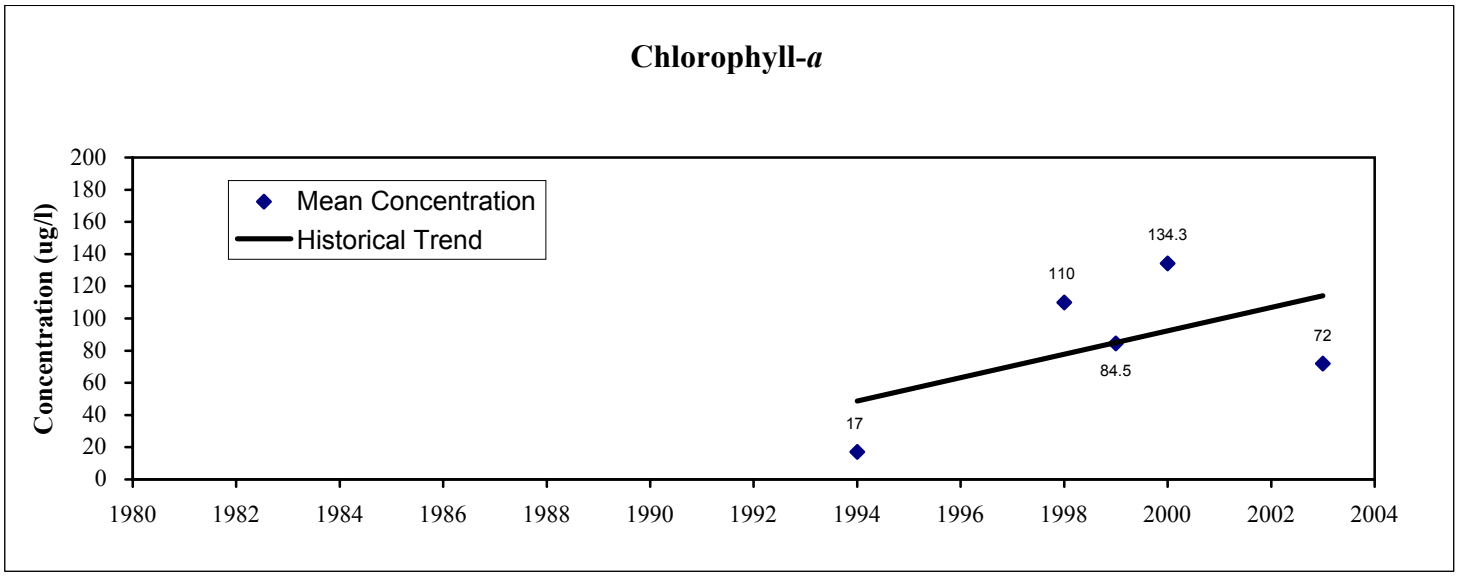


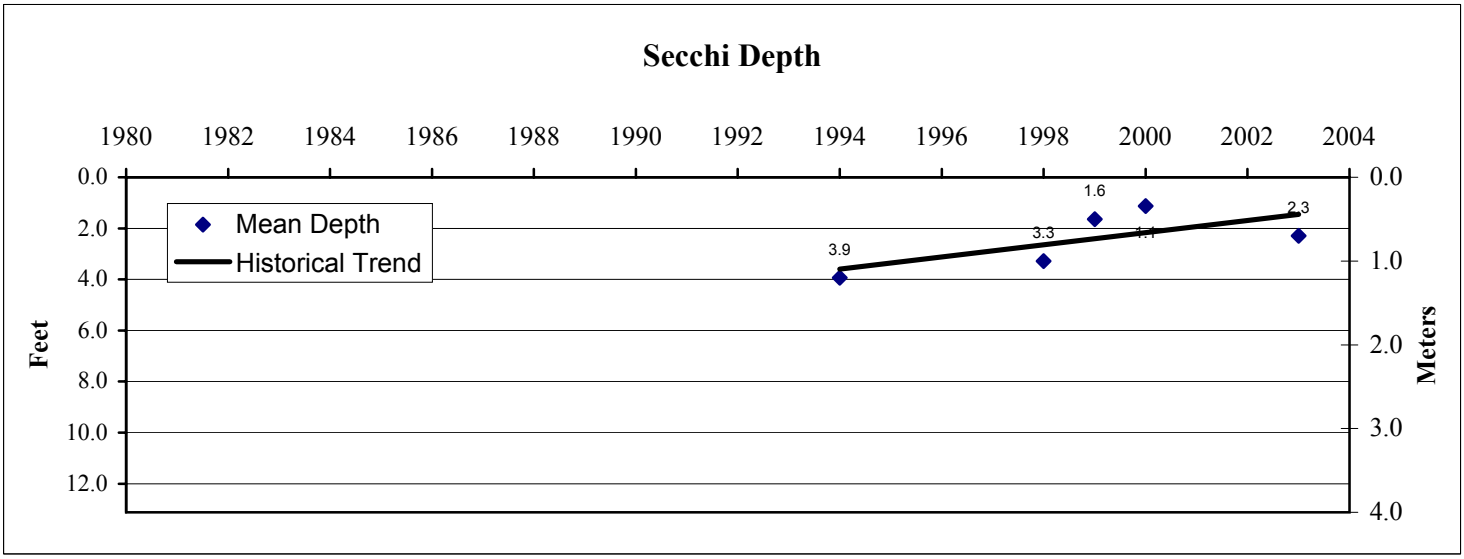


Clearwater River Watershed District	Wenck Wenck Associates, Inc. 1800 Pioneer Creek Center Environmental Engineers Maple Plain, MN 55359	Jan 2004
Cedar Lake Historical Data		Figure 10

T:\0002\58\Report\LAKE_WQ_03\Cedar Lake.xls

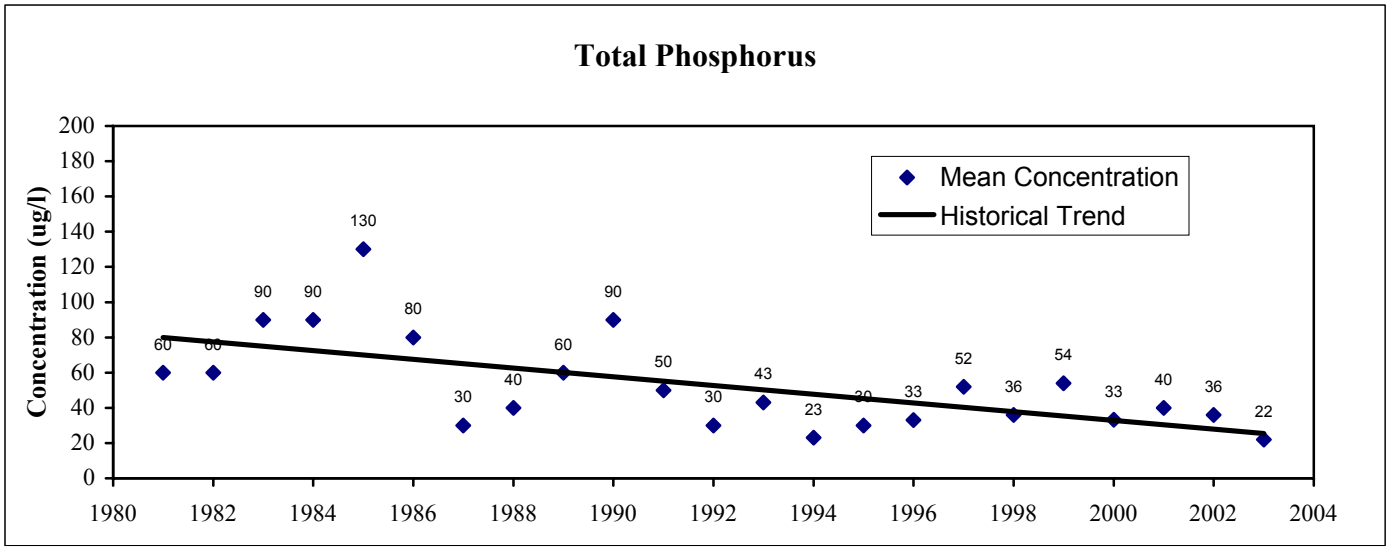


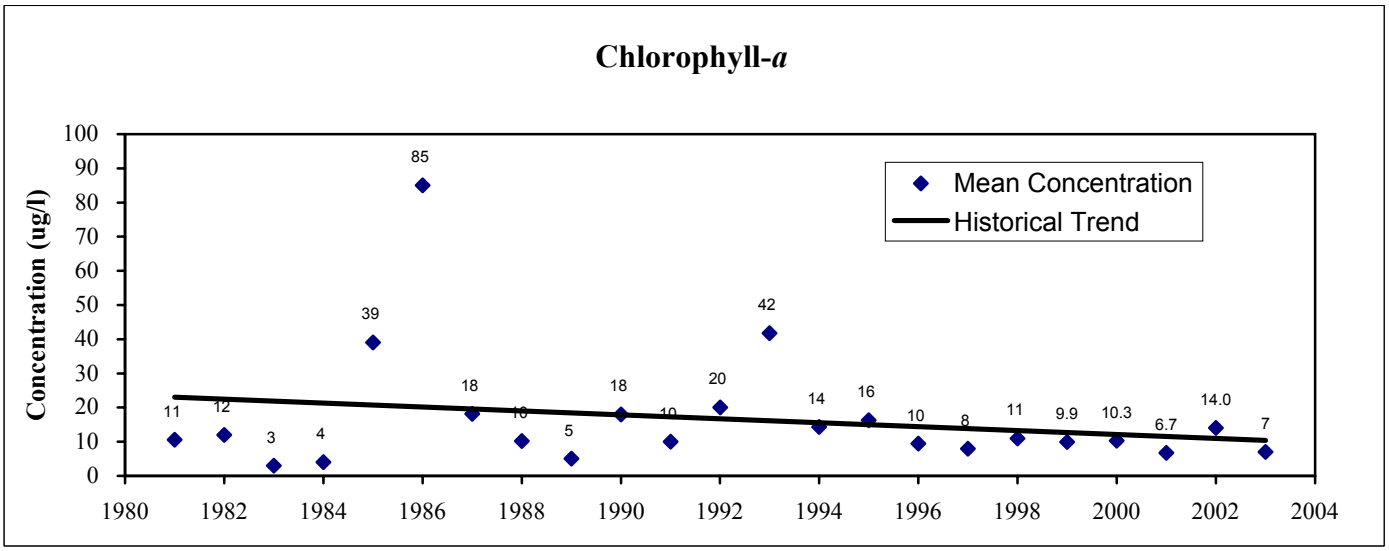


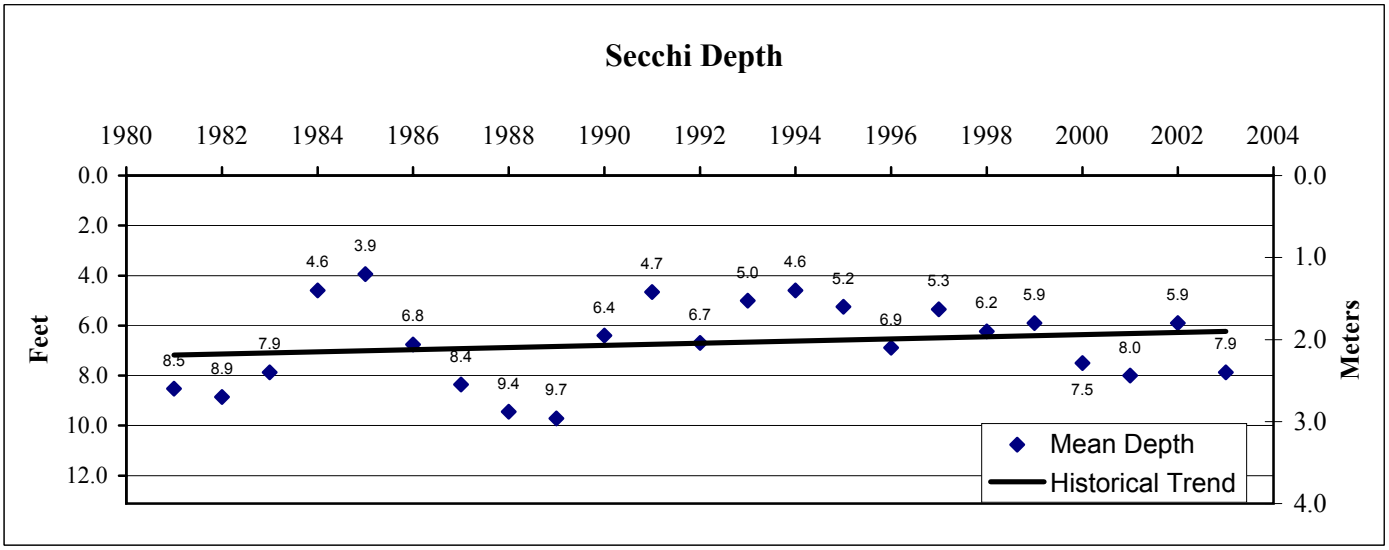


Clearwater River Watershed District	Wenck Wenck Associates, Inc. 1800 Pioneer Creek Center Environmental Engineers Maple Plain, MN 55359	Jan 2004
Clear Lake Historical Data		Figure 11

T:\0002\58\Report\LAKE_WQ_03\Clear Lake.xls



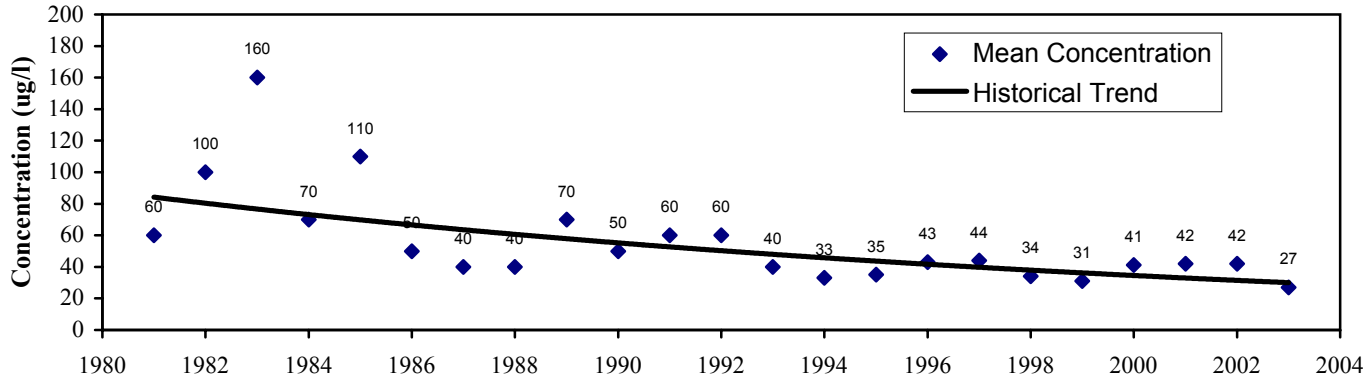




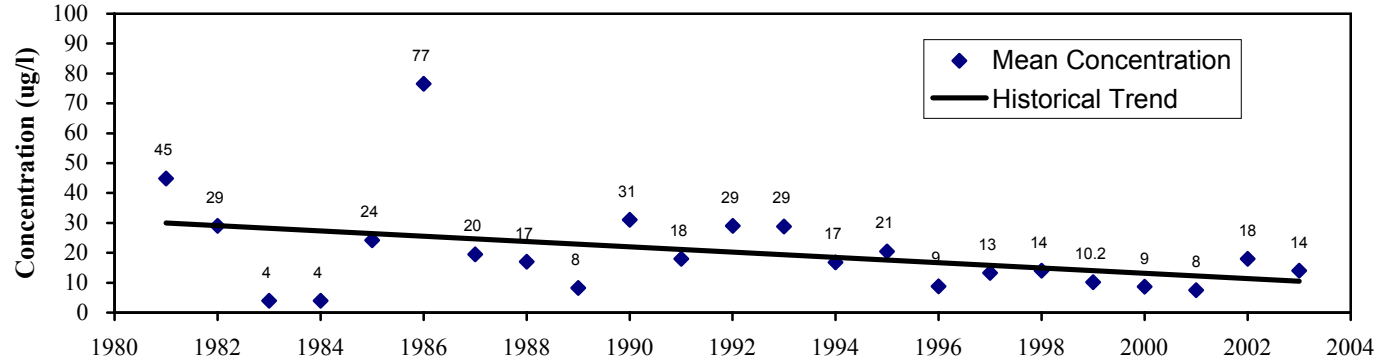
Clearwater River Watershed District	Wenck Wenck Associates, Inc. 1800 Pioneer Creek Center Environmental Engineers Maple Plain, MN 55359	Jan 2004
Clearwater Lake East Historical Data		Figure 12

T:\0002\58\Report\LAKE_WQ_03\Clearwater East.xls

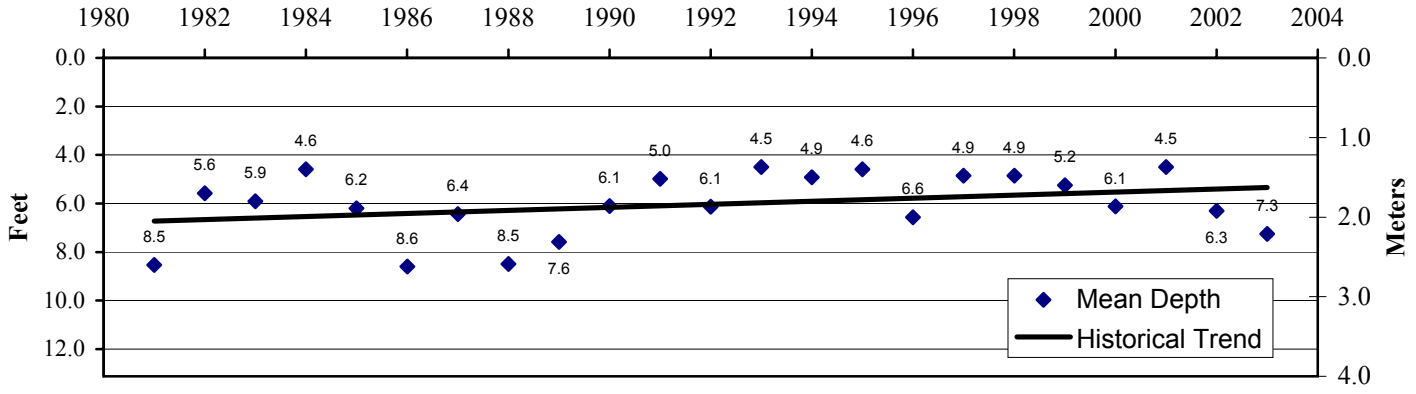
Total Phosphorus



Chlorophyll-*a*

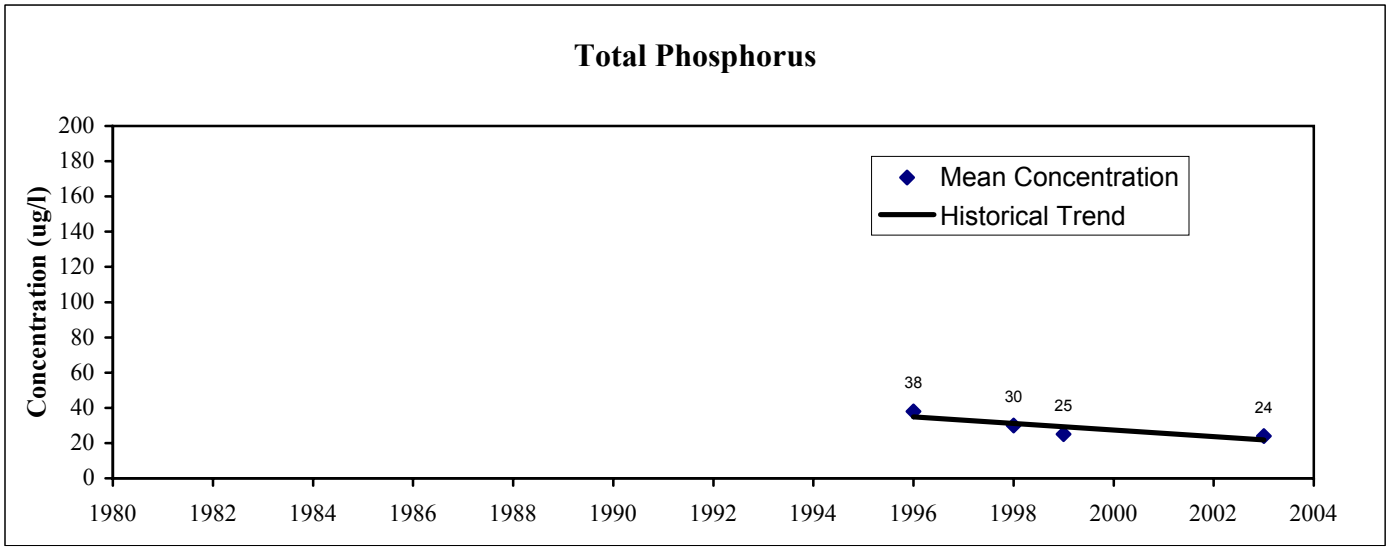


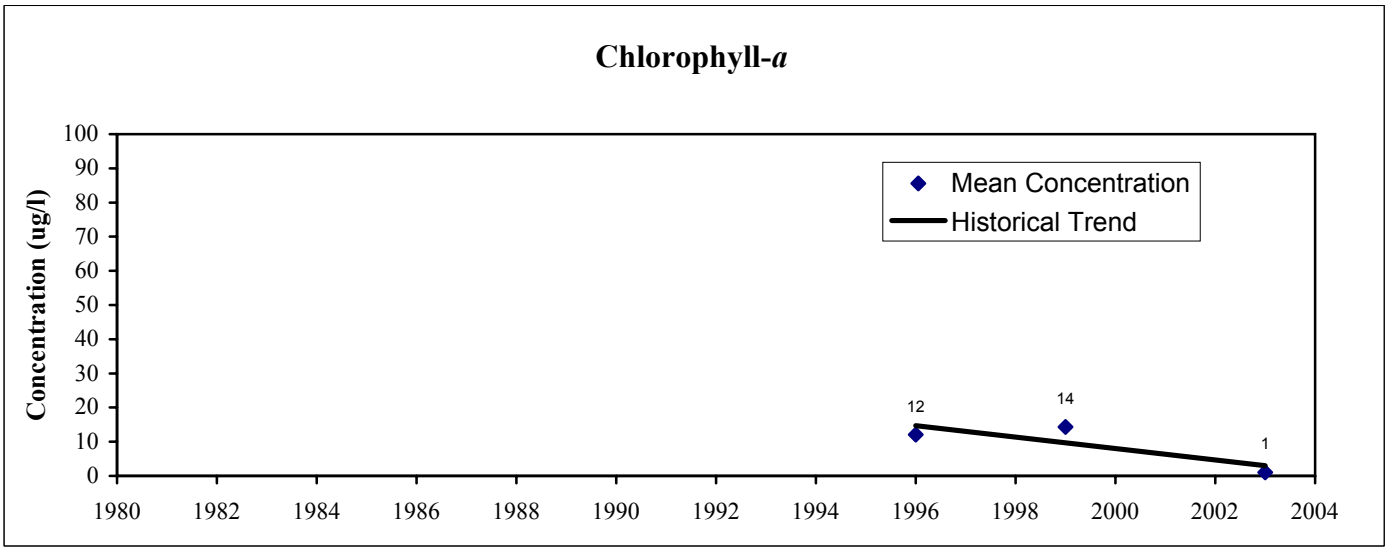
Secchi Depth

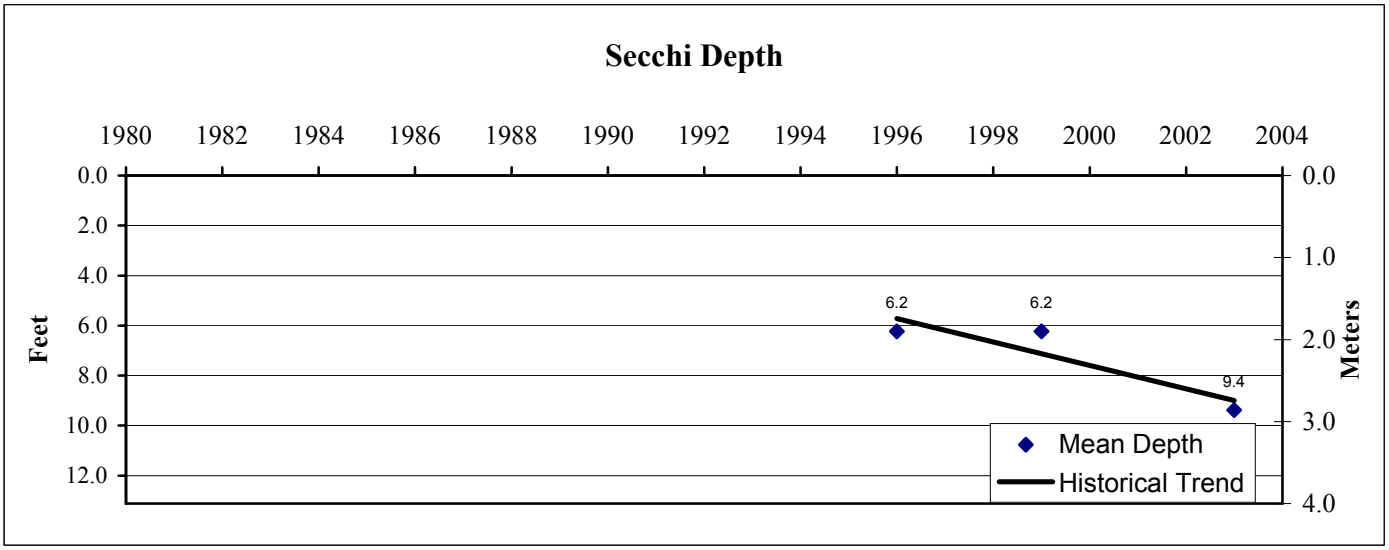


Clearwater River Watershed District	Wenck Associates, Inc. Environmental Engineers 1800 Pioneer Creek Center Maple Plain, MN 55359	Jan 2004
Clearwater Lake West Historical Data		Figure 13

T:\0002\58\Report\LAKE_WQ_03\Clearwater West.xls

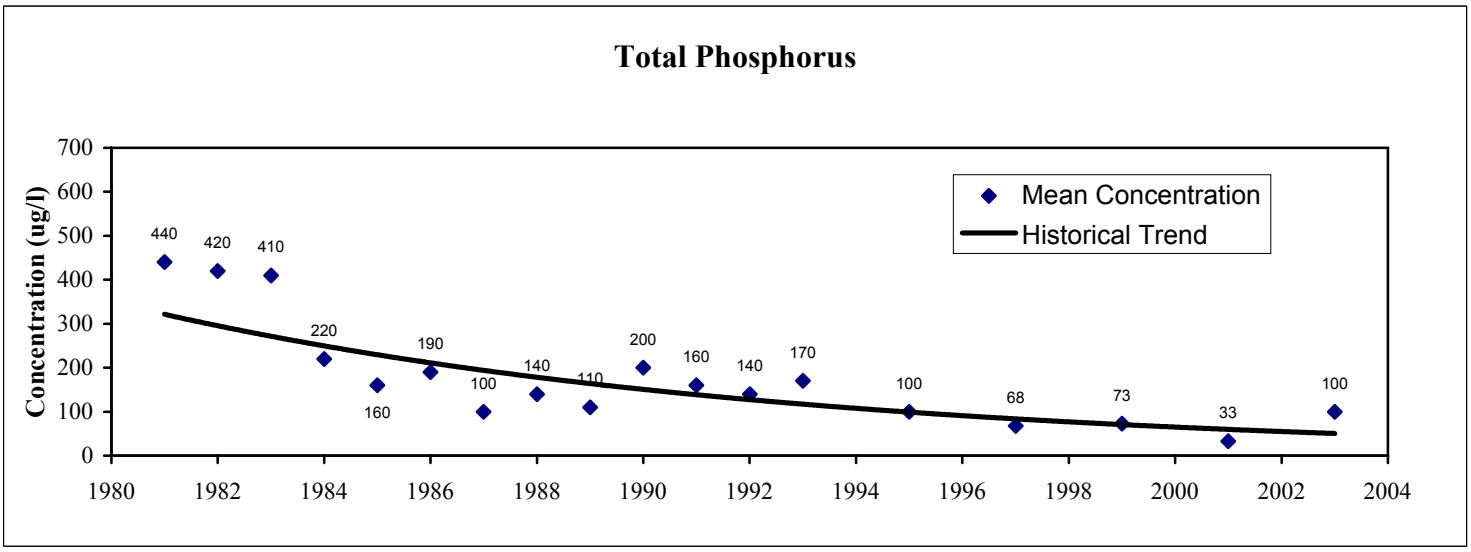


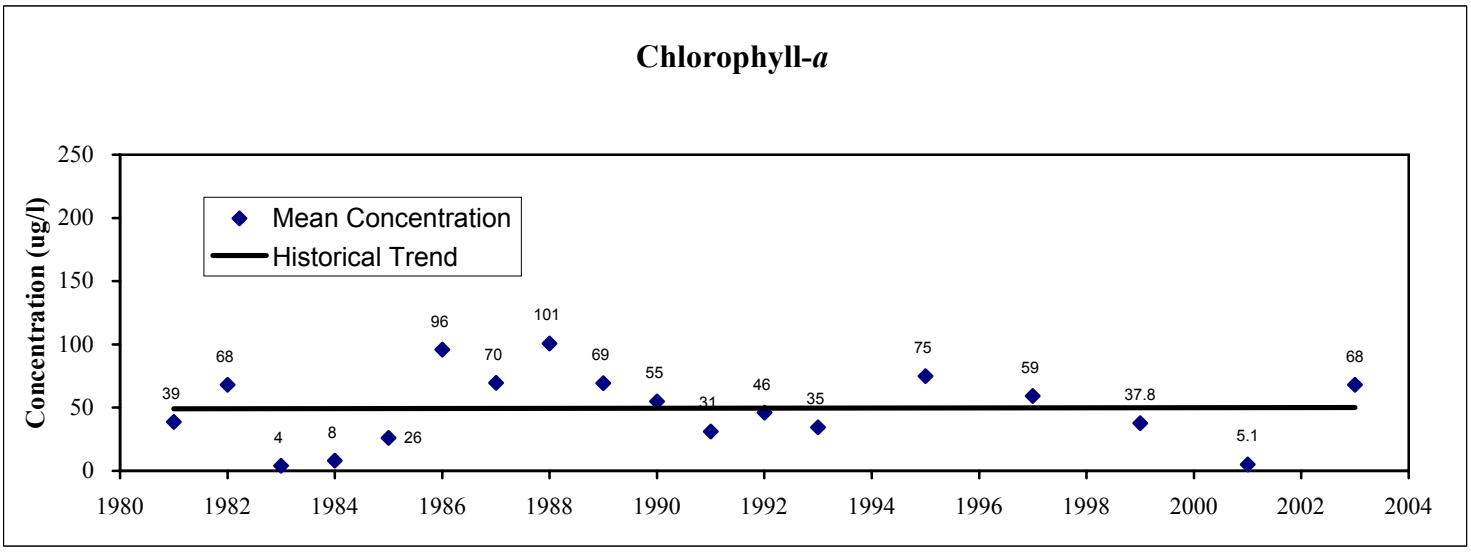


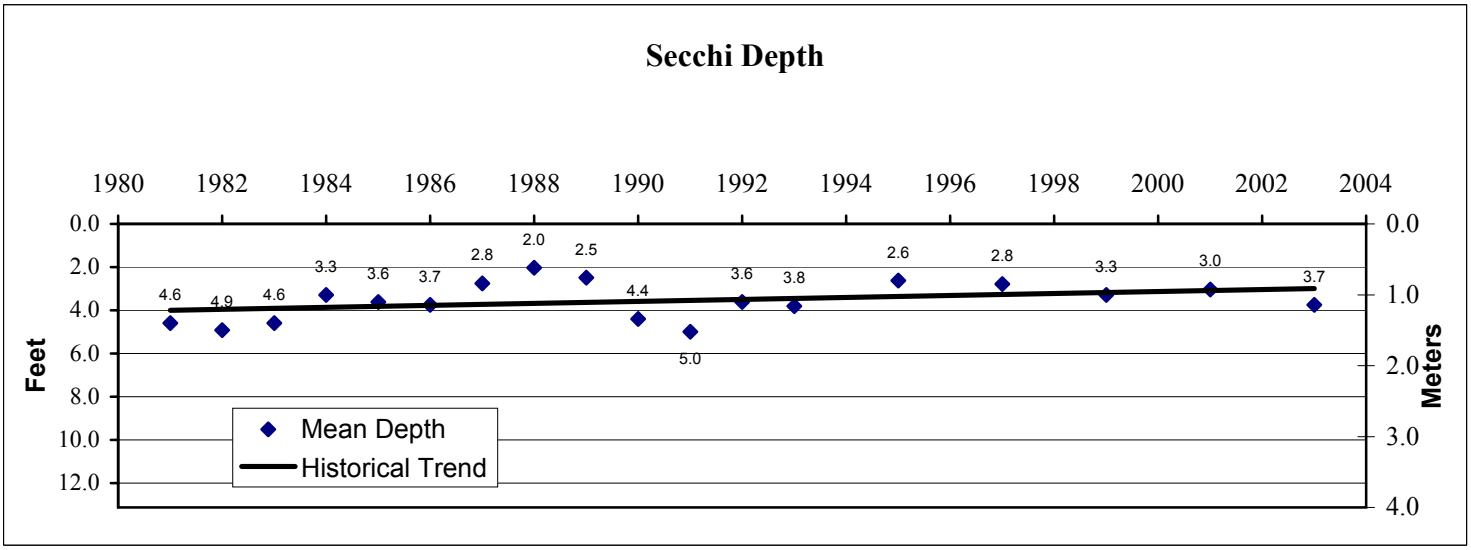


Clearwater River Watershed District	Wenck Wenck Associates, Inc. 1800 Pioneer Creek Center Environmental Engineers Maple Plain, MN 55359	Jan 2004
Grass Lake Historical Data		Figure 14

T:\0002\58\Report\LAKE_WQ_03\Grass Lake.xls



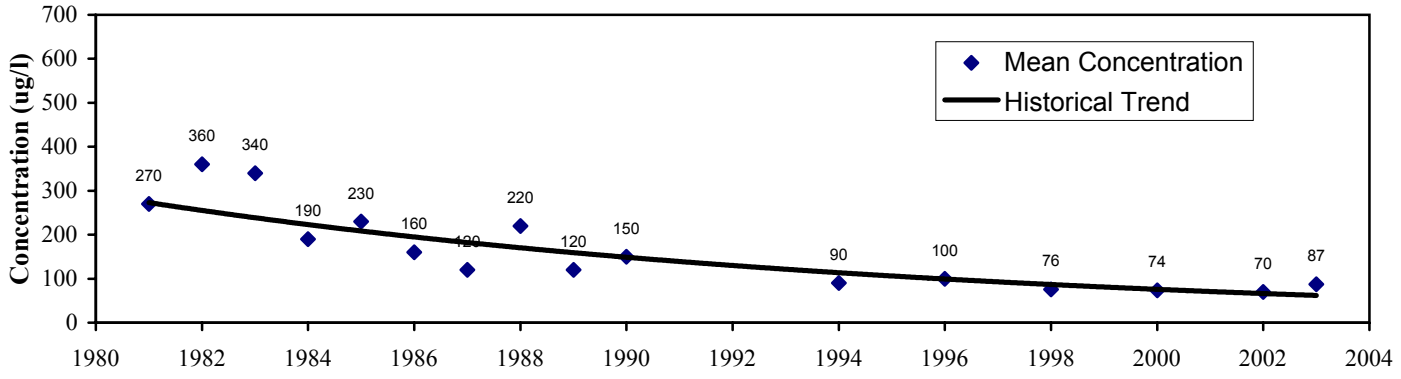




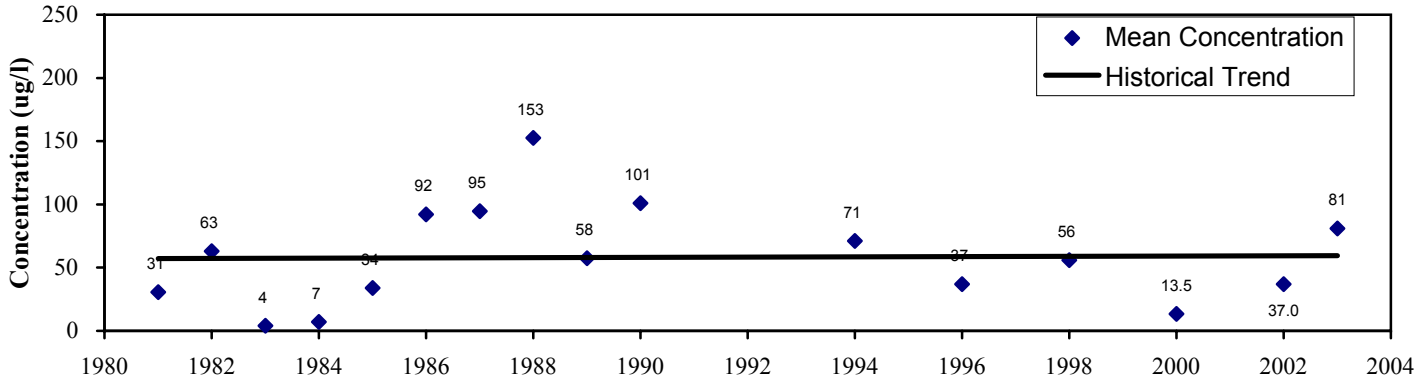
Clearwater River Watershed District	Wenck Associates, Inc. Environmental Engineers — 1800 Pioneer Creek Center Maple Plain, MN 55359	Jan 2004
Lake Louisa Historical Data		Figure 15

T:\0002\58\Report\LAKE_WQ_03\Lake Louisa.xls

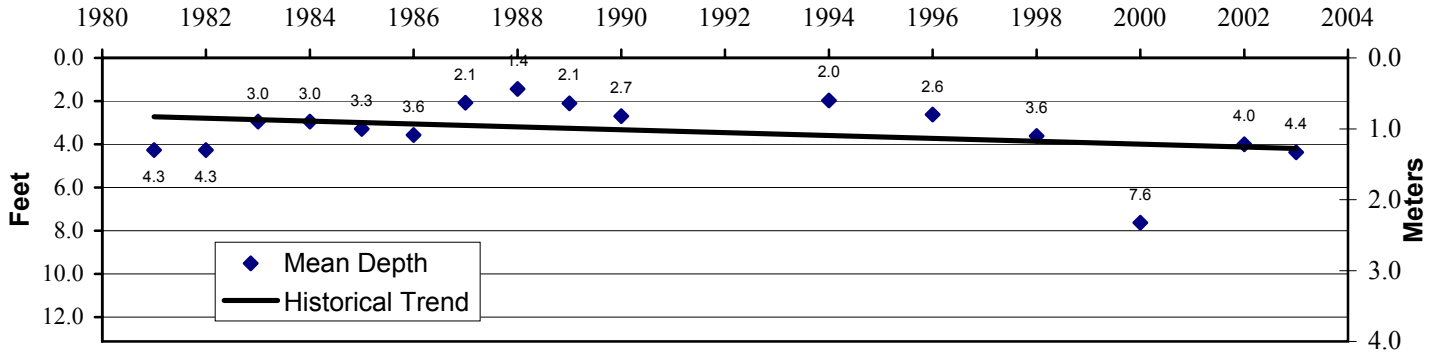
Total Phosphorus



Chlorophyll-*a*

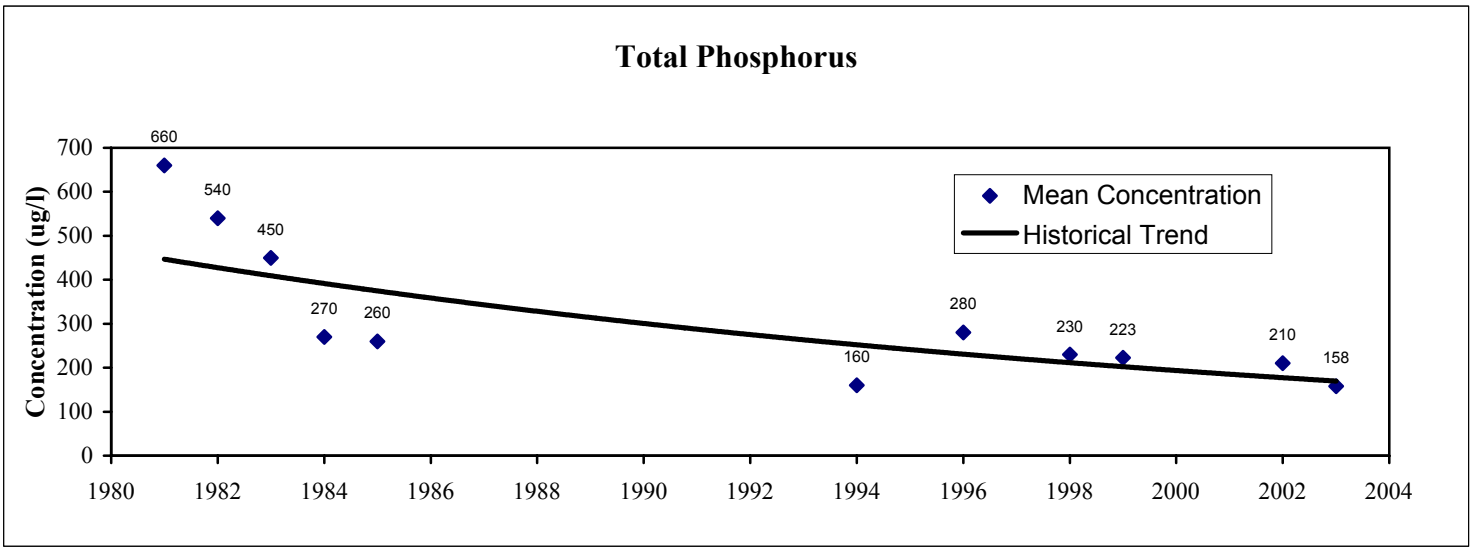


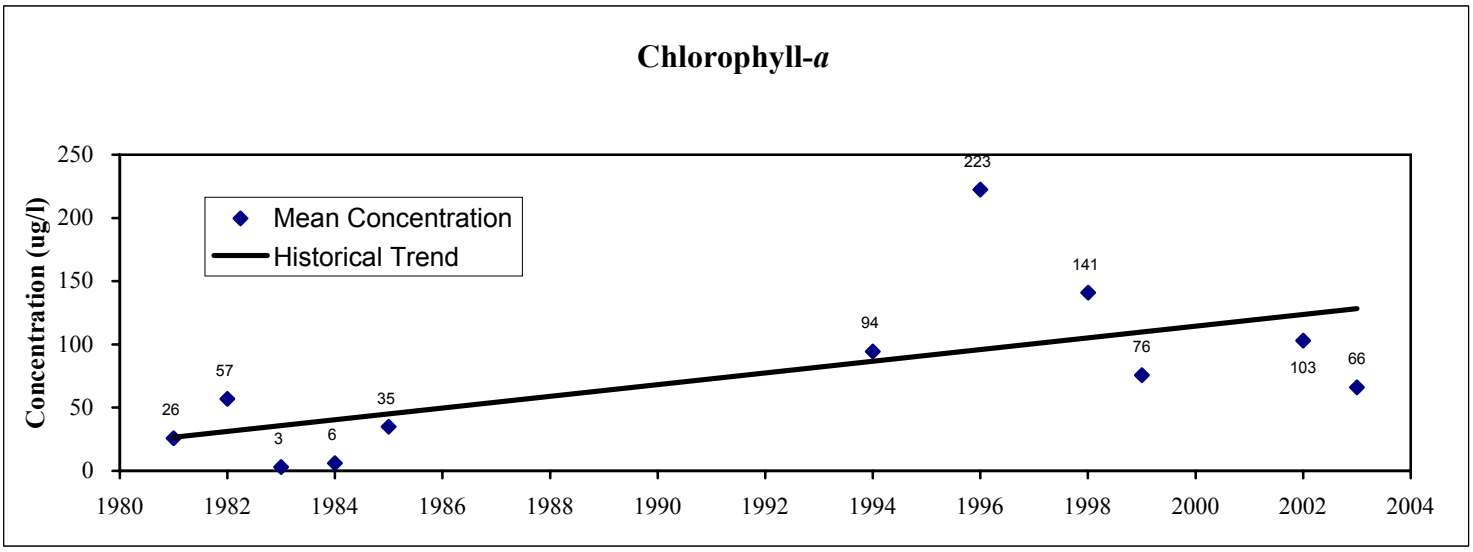
Secchi Depth

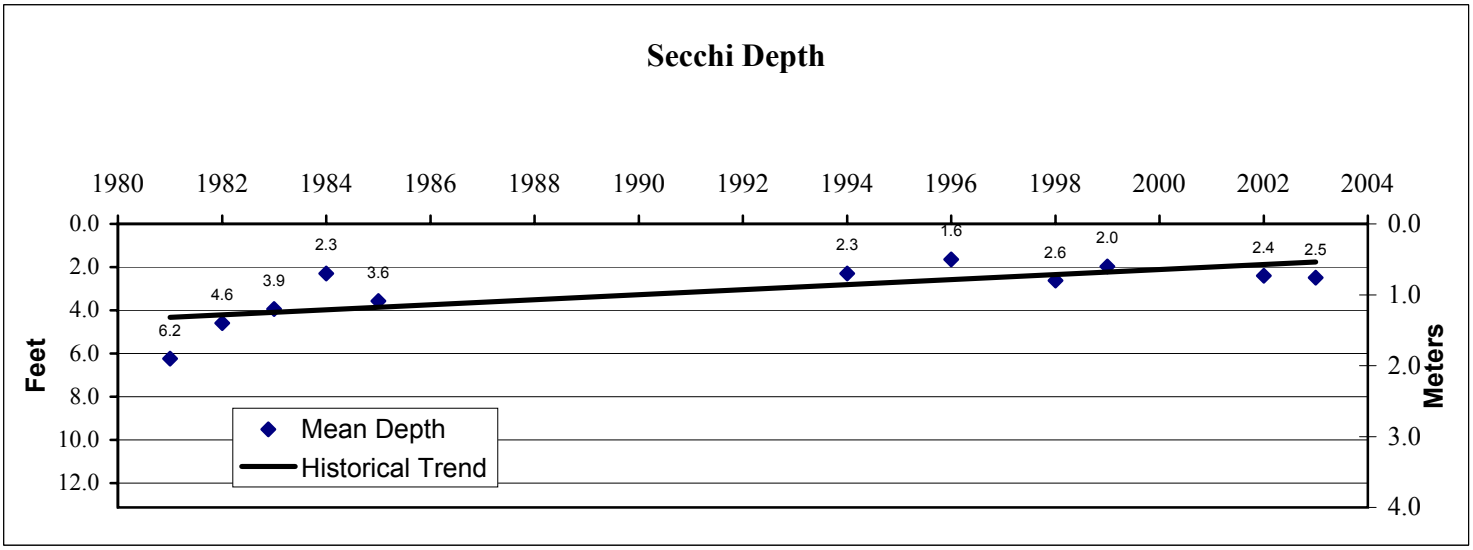


Clearwater River Watershed District	Wenck Associates, Inc. Environmental Engineers 1800 Pioneer Creek Center Maple Plain, MN 55359	Jan 2004
Lake Marie Historical Data		Figure 16

T:\0002\58\Report\LAKE_WQ_03\Lake Marie.xls

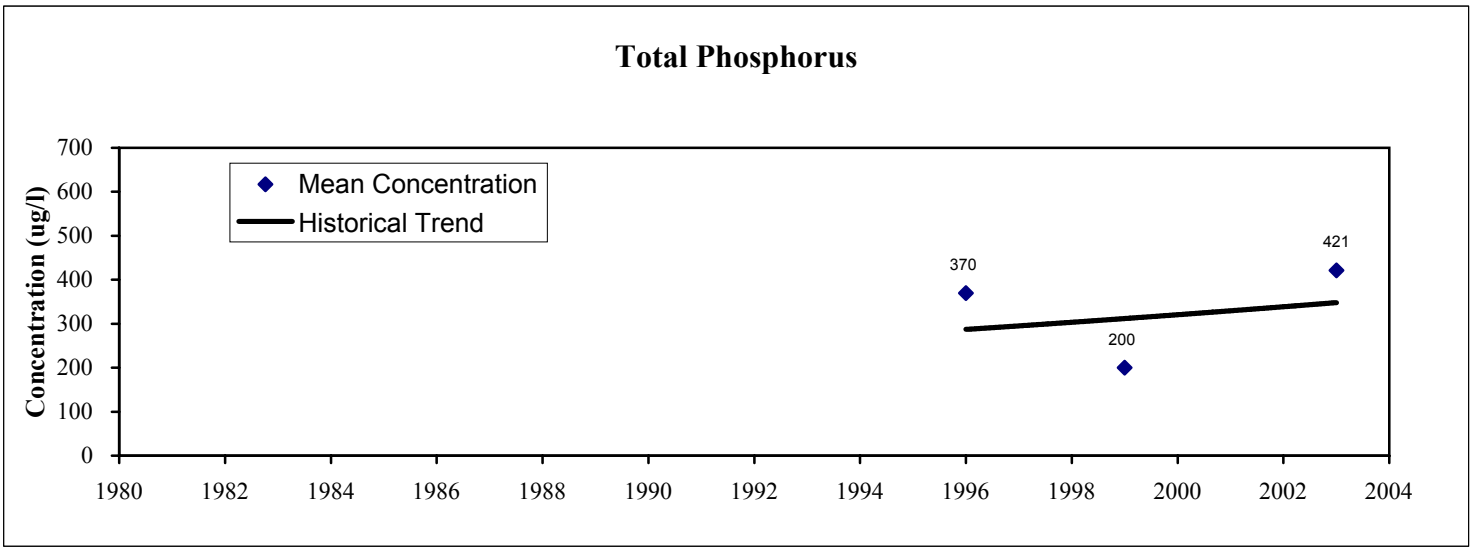


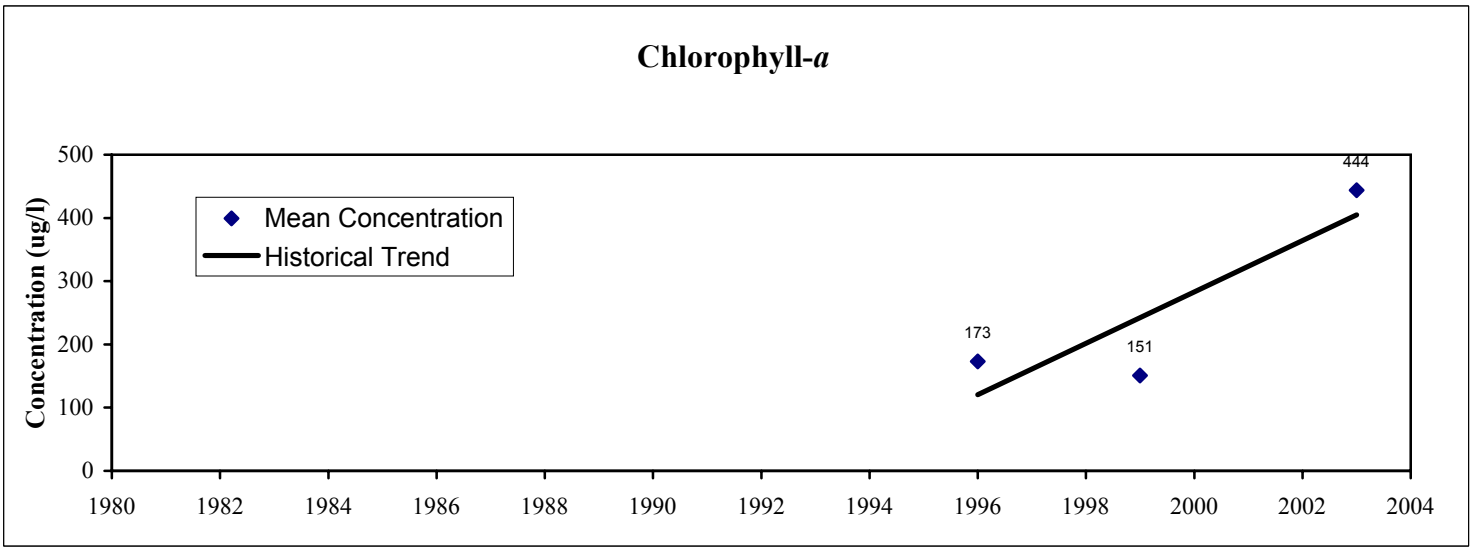


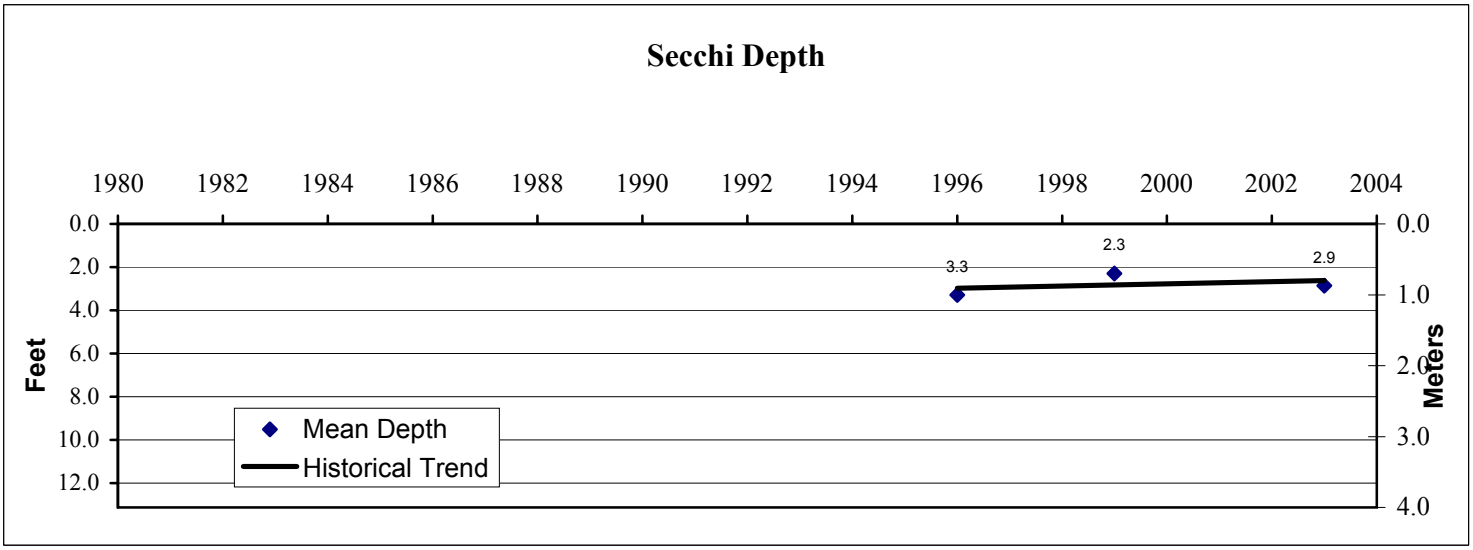


Clearwater River Watershed District	Wenck Associates, Inc. Environmental Engineers — 1800 Pioneer Creek Center, Maple Plain, MN 55359	Jan 2004
Scott Lake Historical Data		Figure 17

T:\0002\58\Report\LAKE_WQ_03\Scott.xls







Clearwater River Watershed District	Wenck Wenck Associates, Inc. Environmental Engineers 1800 Pioneer Creek Center Maple Plain, MN 55359	Jan 2004
Swart Watts Lake Historical Data		Figure 18

T:\0002\58\Report\LAKE_WQ_03\Swart Watts.xls

Appendix A

2003 Monitoring Plan

MEMORANDUM

TO: **Clearwater River Watershed District Board of Managers**

FROM: **Norman C. Wenck**
Engineer for the District

DATE: **February 7, 2003**

RE: **Proposed 2003 Water Quality Monitoring Program**

Introduction

The Clearwater River Watershed District conducts annual water quality monitoring at selected lakes and selected locations on streams. The District submitted a grant application for a TMDL program to the MPCA in September 2002, however, at a meeting with the MPCA on January 29, 2003, the September application will not be funded for the 2003 monitoring season. The MPCA has requested a greatly scaled down program and has offered some equipment and laboratory analysis, for TMDL work that might be accomplished in 2003.

Lake monitoring follows the long-term plan shown in Table 1, and stream monitoring sites together with laboratory and field parameters are shown in Table 2. Also shown in Table 2 are options for additional monitoring.

Lake Monitoring

The schedule for 2003 has Clearwater East and West being monitored and the additional main stem lakes of Scott, Betsy, Louisa (2), Marie and Augusta. Cedar, Clear, Swart Watts, Albion and Grass Lakes will also be monitored. The total number of lakes is 11 but 13 stations are monitored since Clearwater Lake and Lake Louisa each have two stations and the parameters to be monitored are shown on Table 2. Citizens monitor approximately 14 lakes for secchi depth also.

Stream Monitoring

The Clearwater River will be monitored at stations CR 28.2, CR10.5 and Warner Creek will be monitored at WR 0.2. The stations will be monitored six times for water quality and flow. Parameters are total phosphorus and soluble reactive phosphorus.

Cost

This proposed basic program is estimated to cost $13,800.

Option 1 – Additional Sample Collection for TMDL Program

The MPCA has recommended certain additional sampling for the TMDL program as shown on Table 2. The MPCA will provide the laboratory analysis and the District would collect and ship the samples. The estimated cost of this option is $2,400.

Option 2 – Fecal Coliform Monitoring at Five River Stations
Coliform contamination was found at all stations monitored during past monitoring. Monitoring is again recommended at the same stations to monitor coliform levels. The cost of this option is $3,300.

Summary
The basic monitoring program continues the program in place since 1981. The remaining options are progressive and additive and can be modified as desired after you have an opportunity to review this proposal. It is requested that a decision on the scope of the program be made at the February 12, 2003 meeting. Please feel free to call me with any questions or comments that you may have before the meeting.

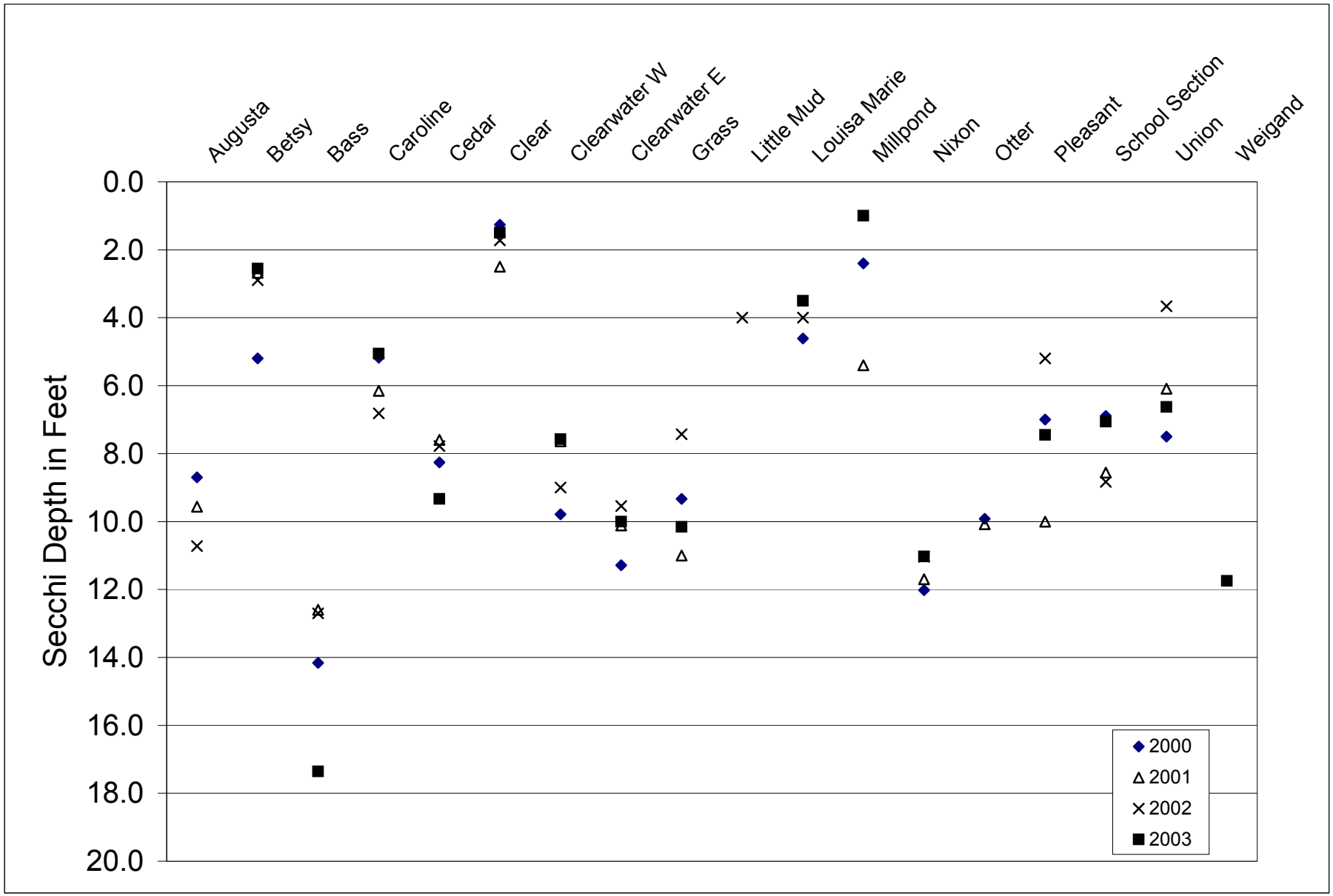
TABLE 1
PROPOSED LONG-TERM WATER QUALITY MONITORING PLAN FOR CRWD LAKES

LAKE STATIONS[1]	1997	1998	1999	2000	2001	2002	2003	2004
Clearwater Lake:								
Clearwater East	X	X	X	X	X	X	X	X
Clearwater West	X	X	X	X	X	X	X	X
Main Stem Lakes:								
Augusta	X		X		X		X	
Louisa (2)	X		X		X		X*	
Caroline		X				X		X
Scott		X	X			X	X*	X
Marie		X		X		X	X*	X
Betsy	X		X		X		X*	
Other Lakes:								
Cedar			X		X		X	
Pleasant	X		X	X				X
School Section	X		X	X				X
Nixon	X		X		X			X
Otter	X		X		X			X
Bass		X	X		X			
Clear		X	X	X			X	
Union		X	X			X		
Henshaw		X	X			X		
Little Mud			X			X		
Wiegand			X			X		
Swart Watts			X				X	
Albion			X				X	
Grass			X				X	

Note: [1]Lake selection based on total lake size ranking scores (Lake Priority Ranking, 1990)
* The MPCA to provide the analytical services as part of TMDL program.

Appendix B

Secchi Data from Citizen's Lake Monitoring Programs



CLEARWATER RIVER WATERSHED DISTRICT

Citizen Secchi Data -- 2000 through 2003

Wenck

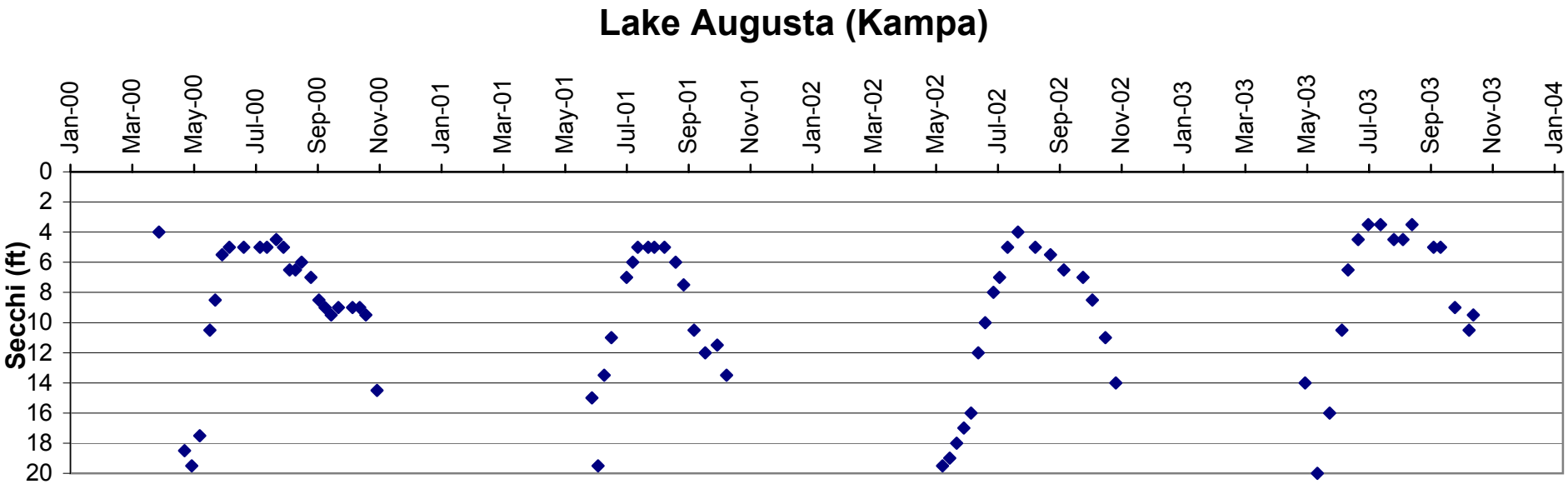
Wenck Associates, Inc. Environmental Engineers

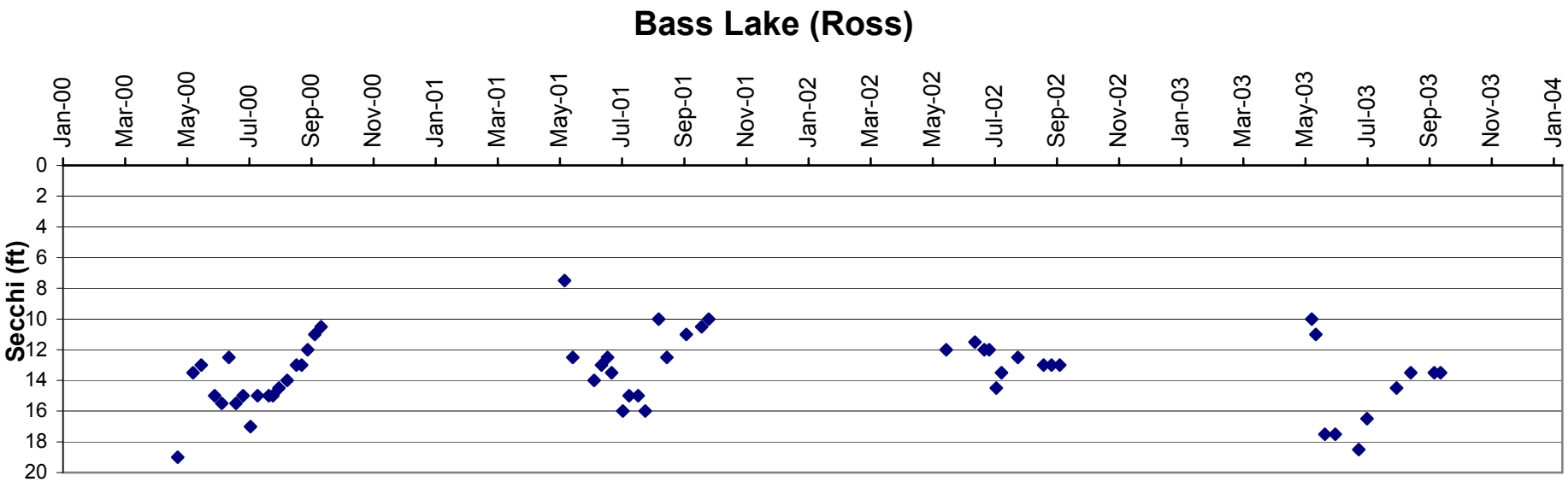
1800 Pioneer Creek Center Maple Plain, MN 55359

JAN 2004

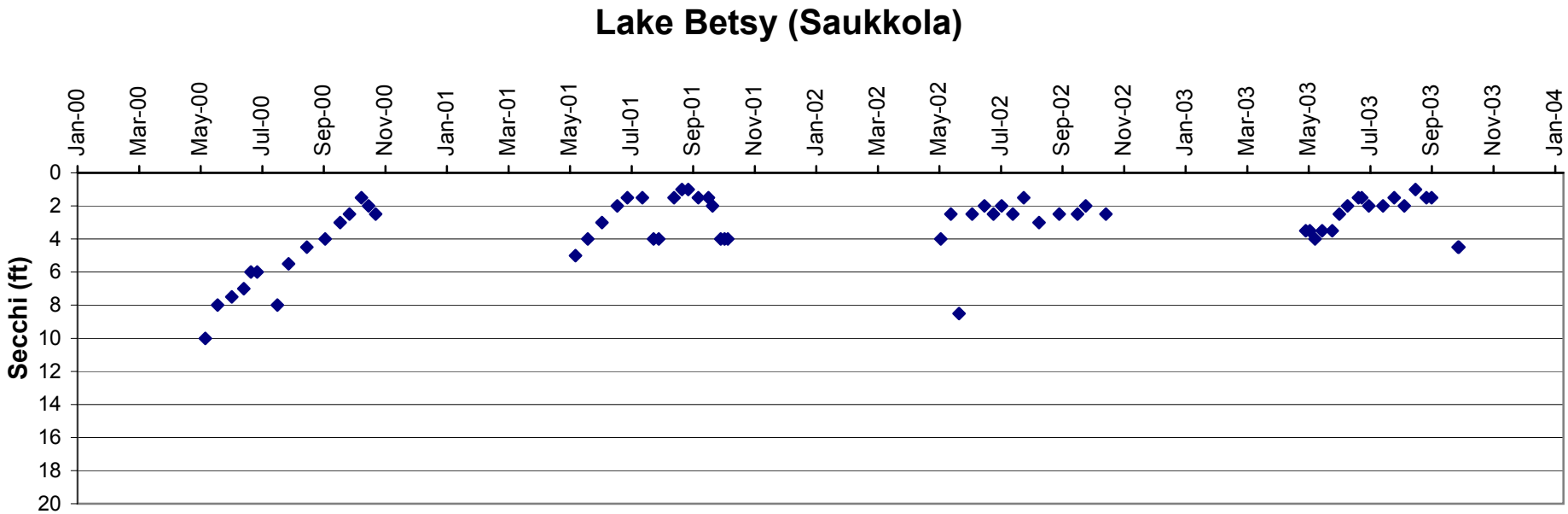
Figure B-1

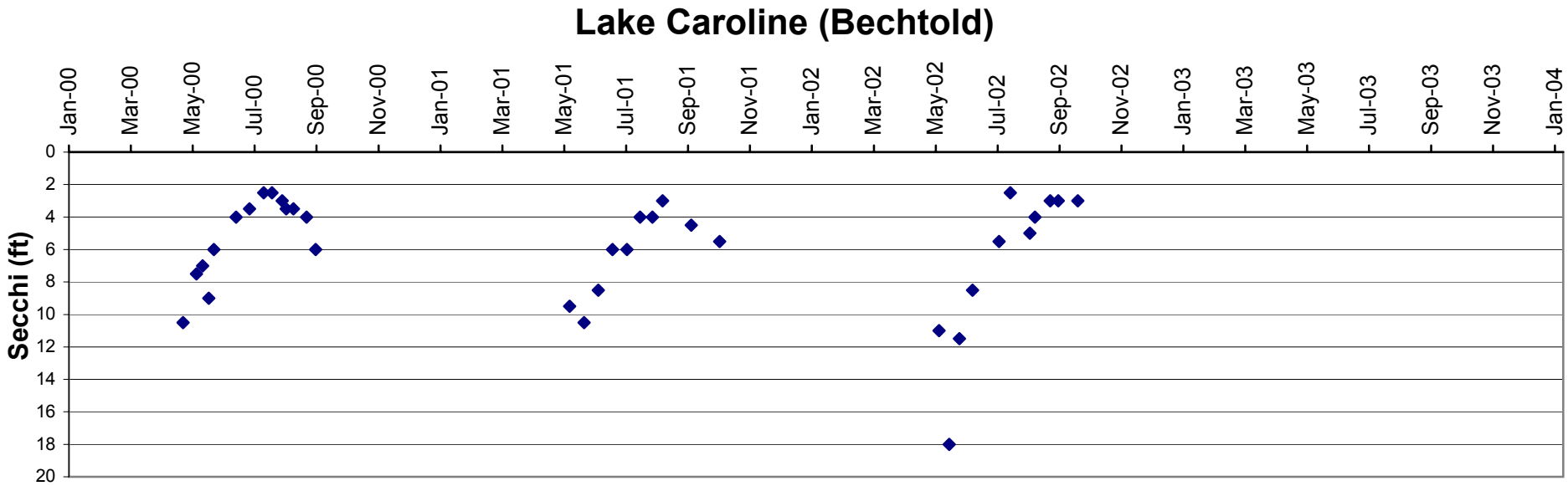
T:\0002\58\Reports\secchi_anrpt_2003\Fig B-1.xls





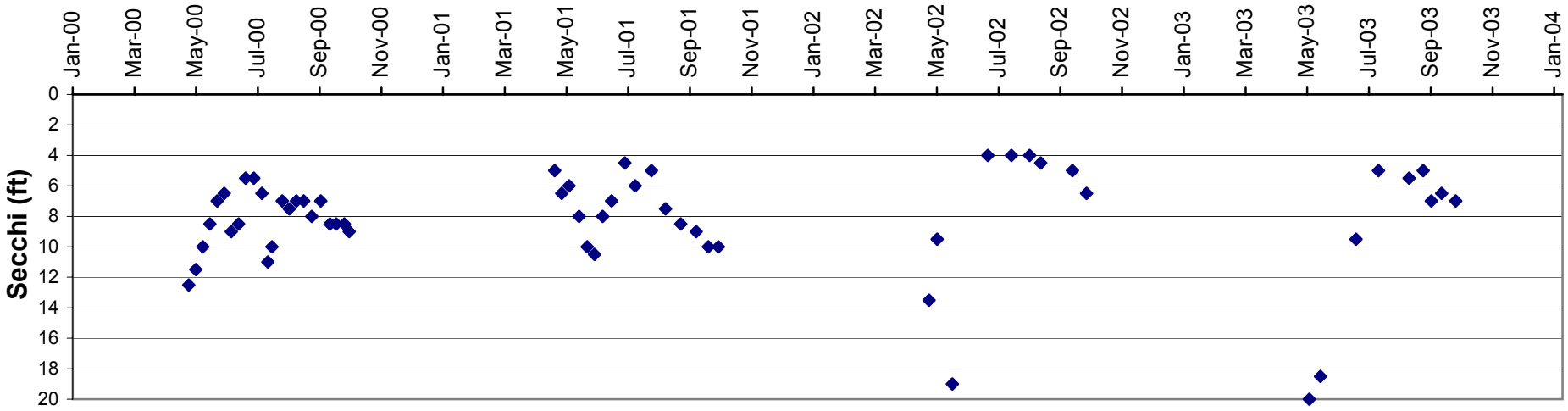
CLEARWATER RIVER WATERSHED DISTRICT	Wenck Associates, Inc. Environmental Engineers — Wenck — 1800 Pioneer Creek Center, Maple Plain, MN 55359	Jan 2004
Citizen Secchi Data - 2003		Figure B2



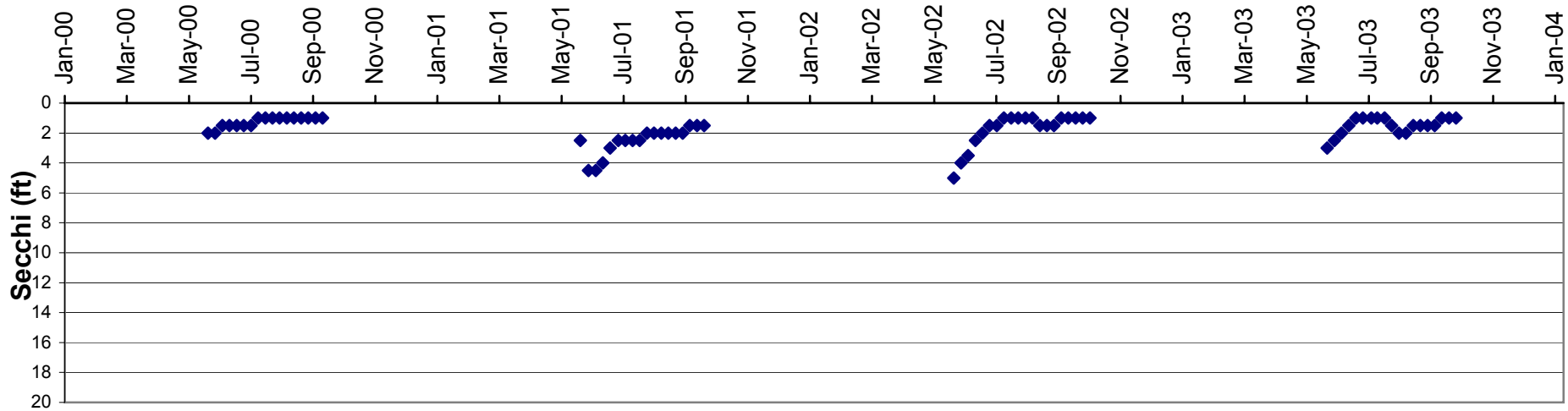


CLEARWATER RIVER WATERSHED DISTRICT	Wenck Associates, Inc. Environmental Engineers — Wenck — 1800 Pioneer Creek Center, Maple Plain, MN 55359	Jan 2004
Citizen Secchi Data - 2003		Figure B3

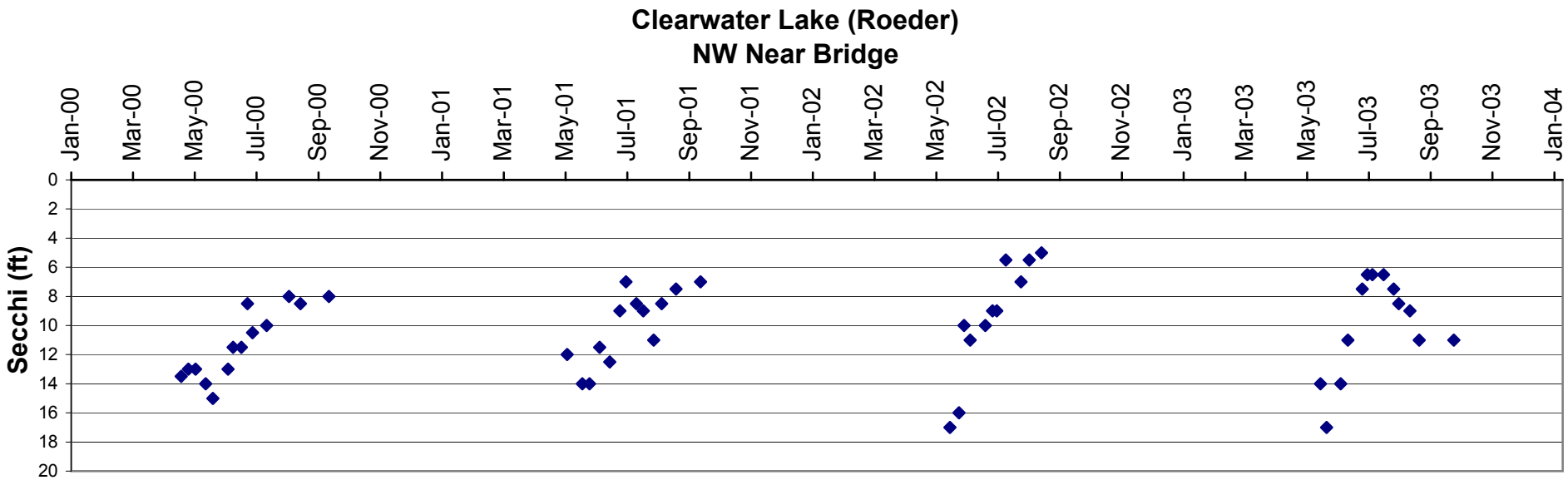
Cedar Lake (Badger and Johnson)

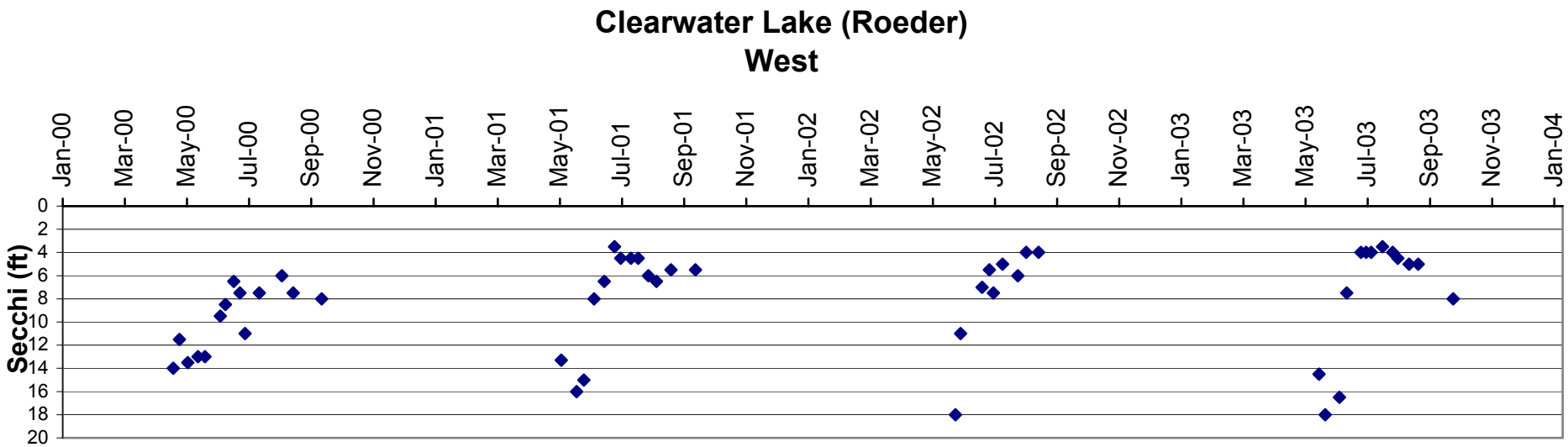


Clear Lake (Brandenburg)



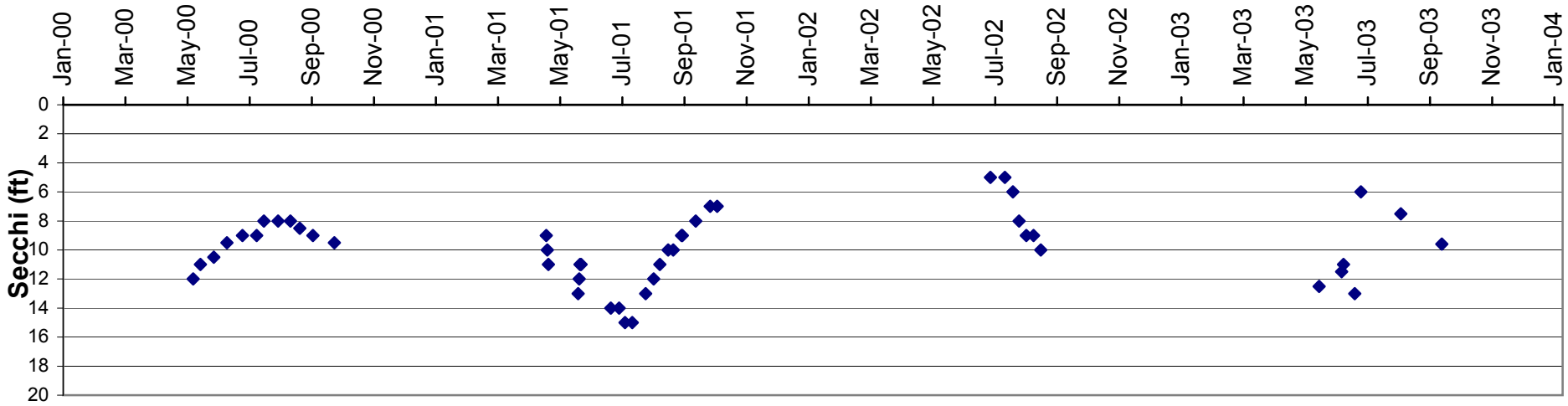
CLEARWATER RIVER WATERSHED DISTRICT	Wenck Associates, Inc. Environmental Engineers — Wenck — 1800 Pioneer Creek Center, Maple Plain, MN 55359	Jan 2004
Citizen Secchi Data - 2003		Figure B4



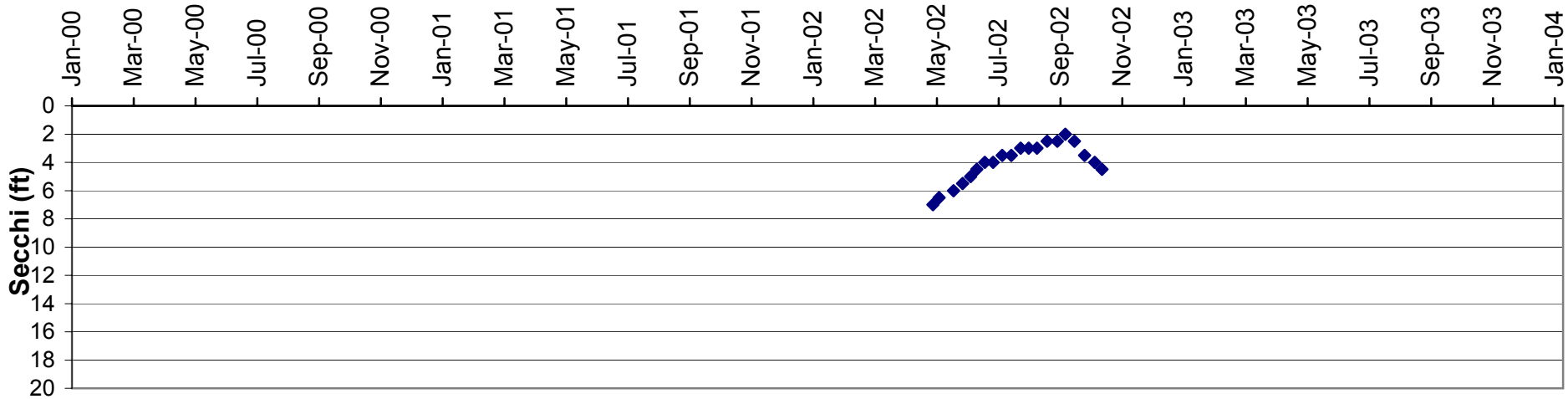


CLEARWATER RIVER WATERSHED DISTRICT	Wenck Wenck Associates, Inc. Environmental Engineers 1800 Pioneer Creek Center Maple Plain, MN 55359	Jan 2004
Citizen Secchi Data - 2003		Figure B5

Grass Lake (Derosier)

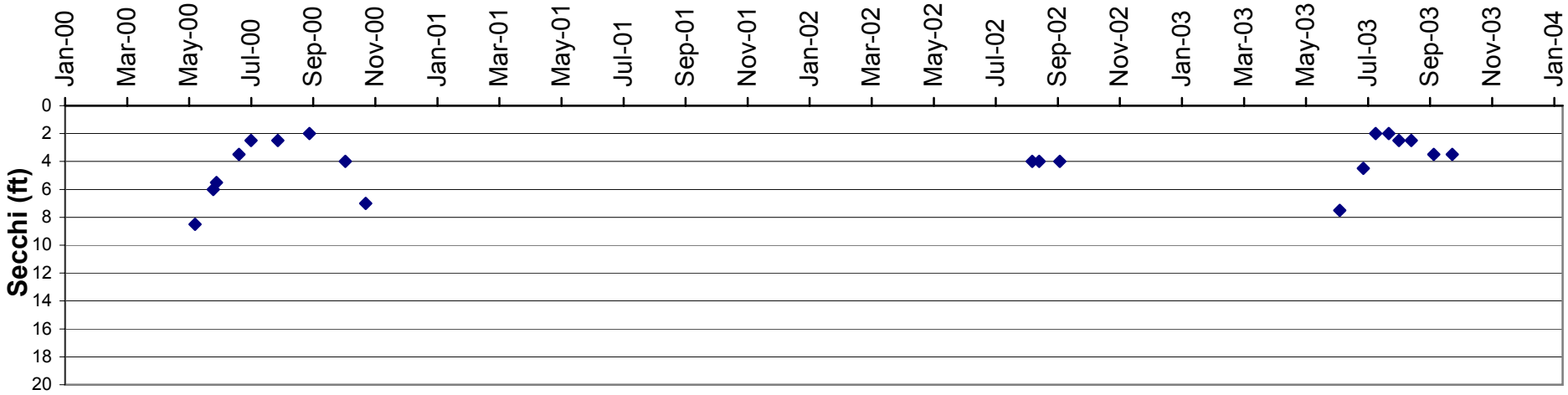


Little Mud Lake (Stenger)

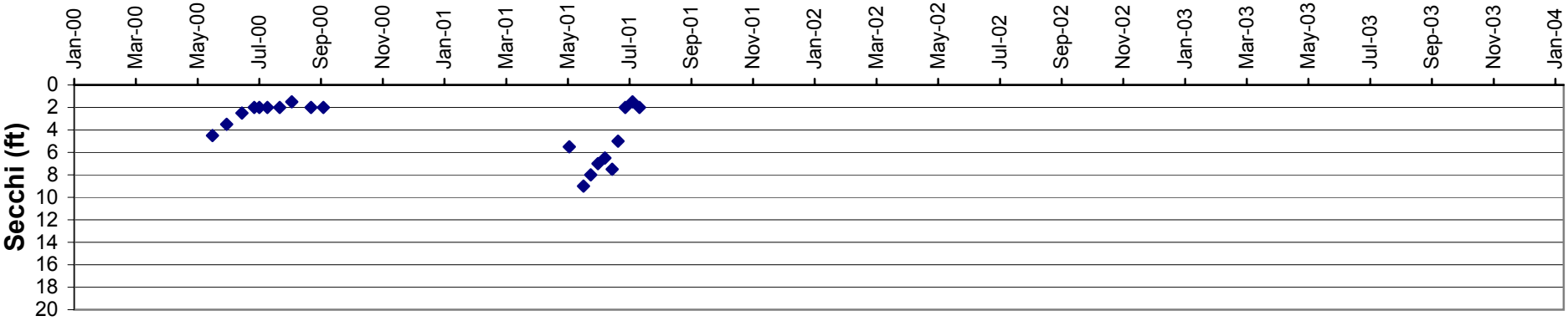


CLEARWATER RIVER WATERSHED DISTRICT	Wenck Wenck Associates, Inc. Environmental Engineers 1800 Pioneer Creek Center Maple Plain, MN 55359	Jan 2004
Citizen Secchi Data - 2003		Figure B6

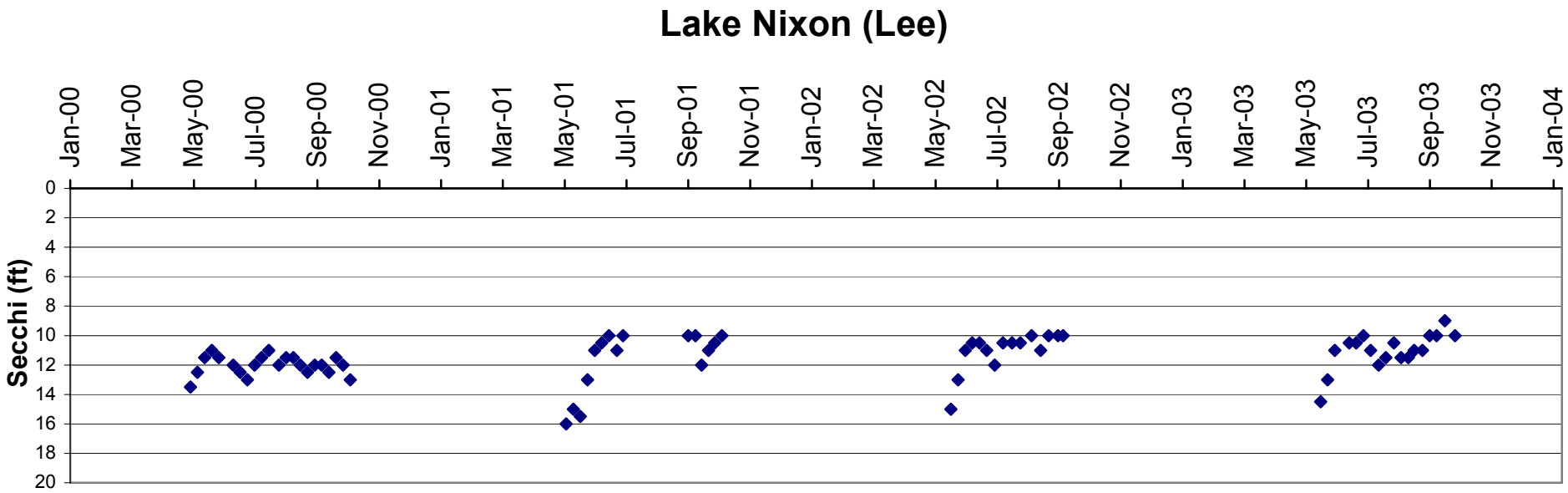
Lake Louisa (Driver)

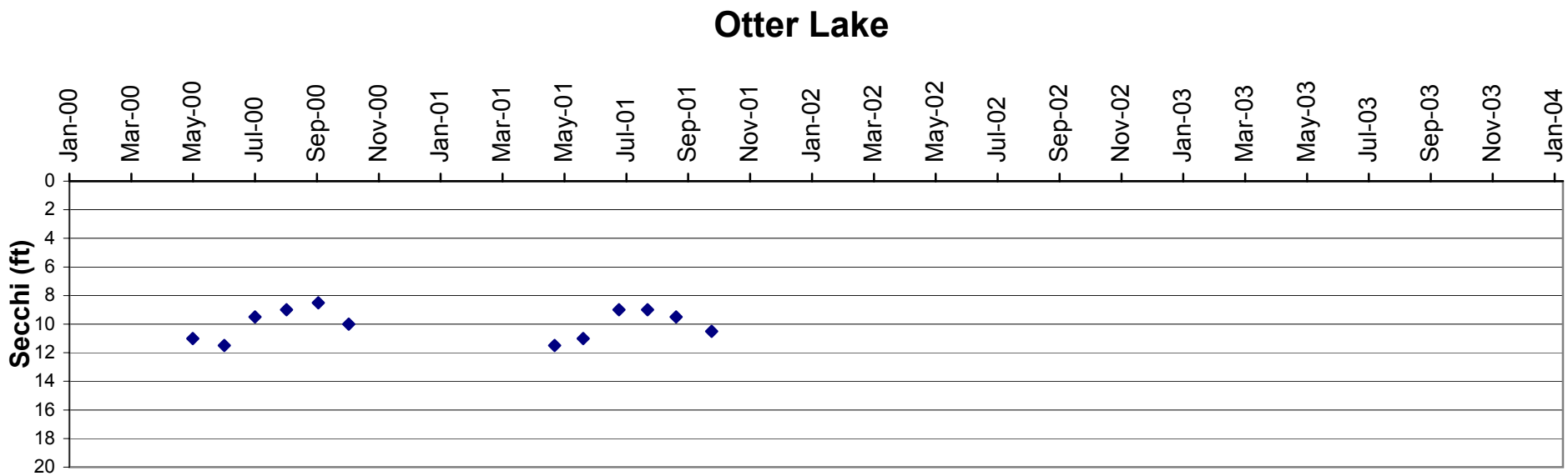


Millpond-Lake Marie (Tracy)



CLEARWATER RIVER WATERSHED DISTRICT	Wenck Wenck Associates, Inc. Environmental Engineers 1800 Pioneer Creek Center Maple Plain, MN 55359	Jan 2004
Citizen Secchi Data - 2003		Figure B7





CLEARWATER RIVER WATERSHED DISTRICT

Citizen Secchi Data - 2003

Wenck

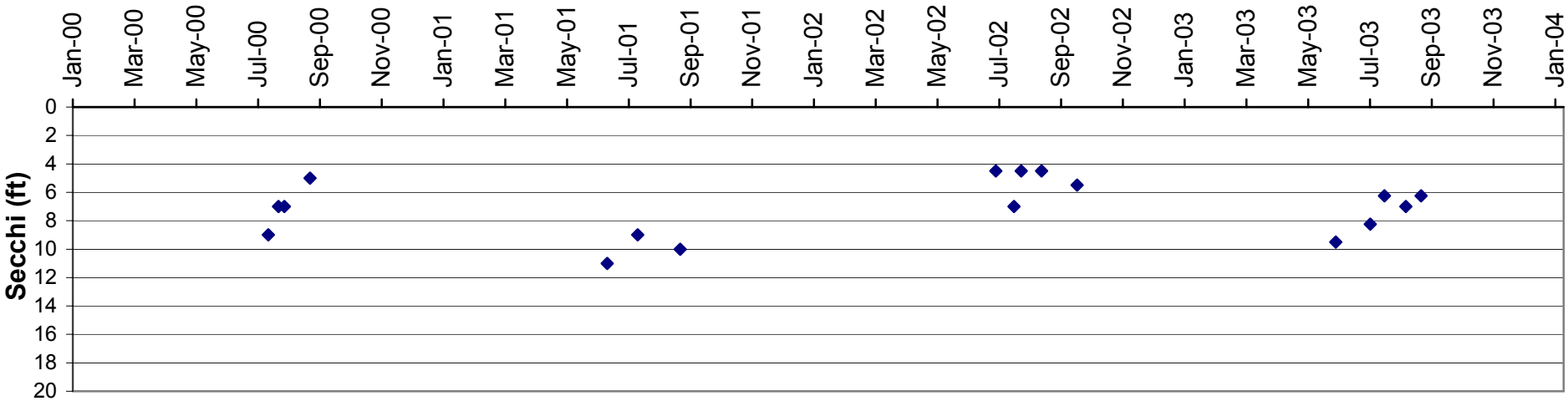
Wenck Associates, Inc.
Environmental Engineers

1800 Pioneer Creek Center
Maple Plain, MN 55359

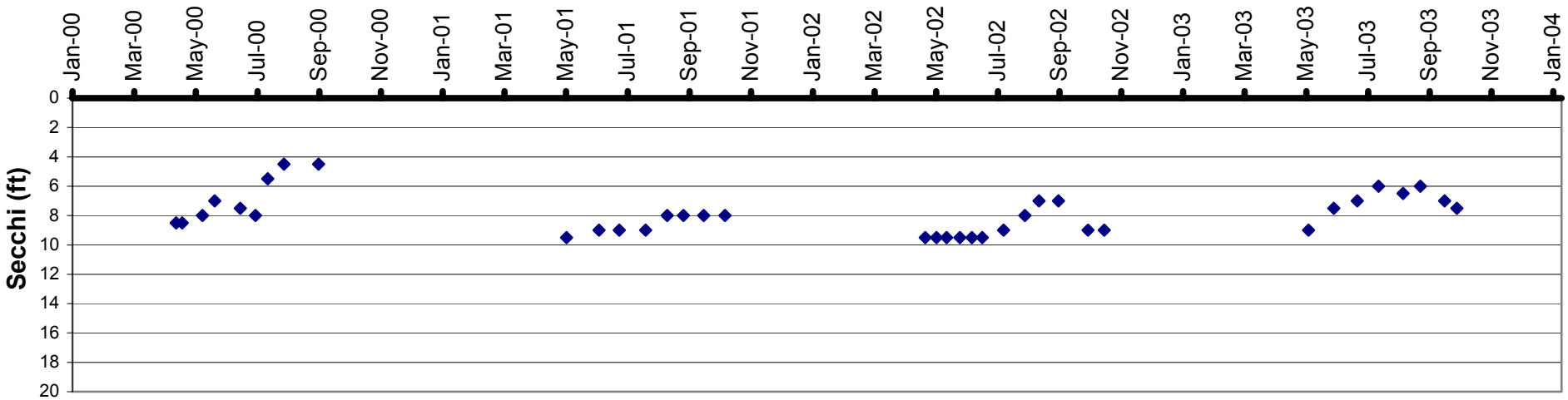
Jan 2004

Figure B8

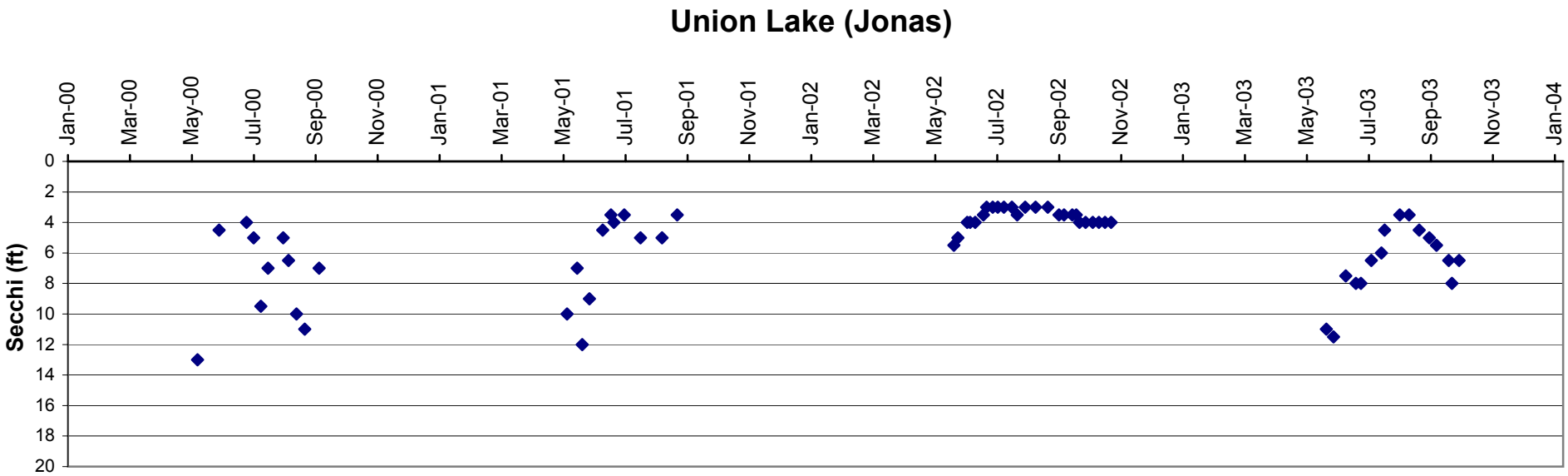
Pleasant Lake (Peterson)



School Section Lake (Eckman)



CLEARWATER RIVER WATERSHED DISTRICT	Wenck Wenck Associates, Inc. Environmental Engineers 1800 Pioneer Creek Center Maple Plain, MN 55359	Jan 2004
Citizen Secchi Data - 2003		Figure B9



CLEARWATER RIVER WATERSHED DISTRICT	Wenck Wenck Associates, Inc. Environmental Engineers 1800 Pioneer Creek Center Maple Plain, MN 55359	Jan 2004
Citizen Secchi Data - 2003		Figure B10

Appendix C

2003 Water Quality Laboratory Reports and Data

To review Analytical Data please
contact Norm Wenck at
763-479-4200

Appendix D

Field Notes and Measurements

To review Analytical Data please
contact Norm Wenck at
763-479-4200