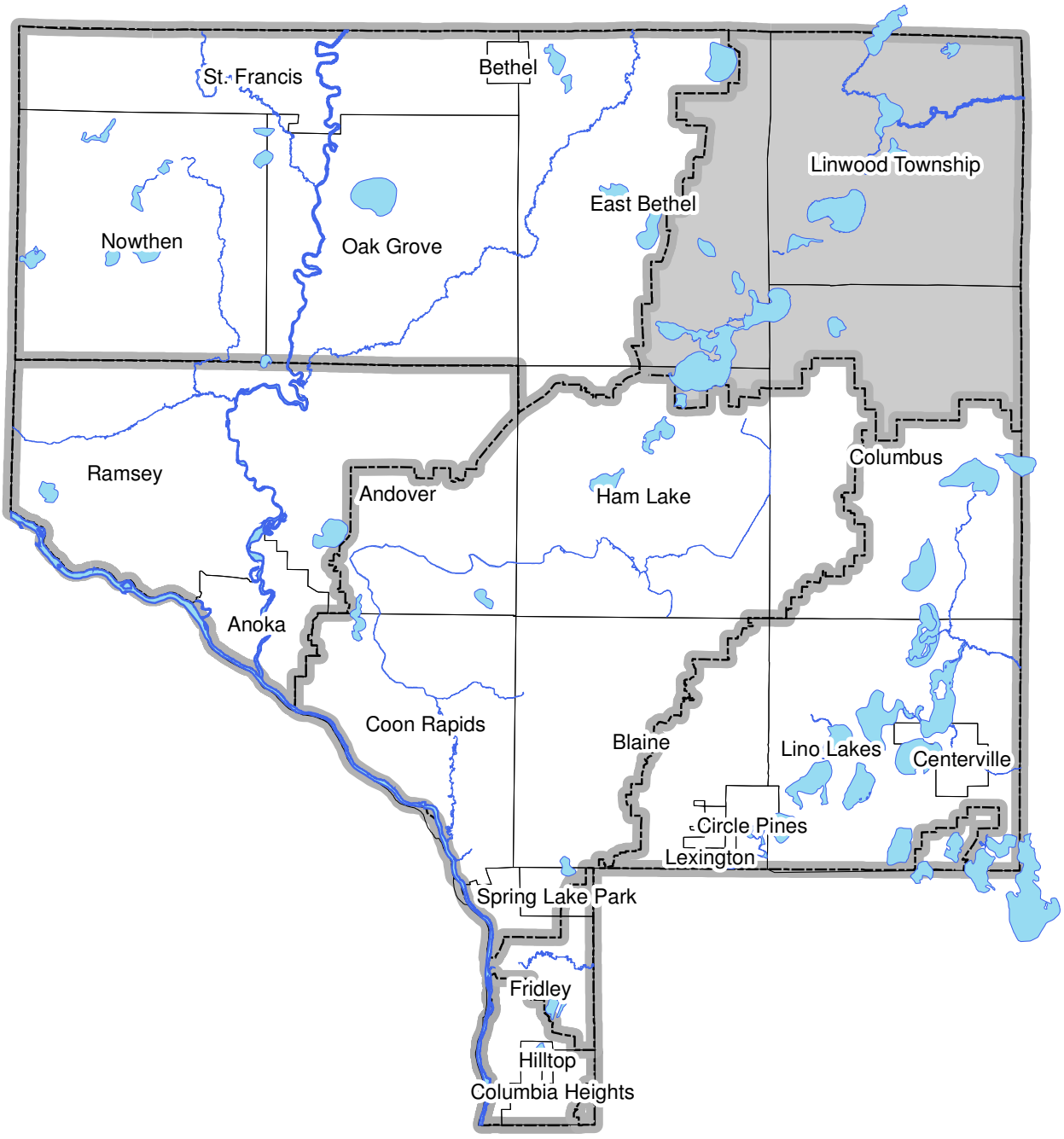
Excerpt from the
2014 Anoka Water Almanac

Chapter 2: Sunrise River Watershed



Prepared by the Anoka Conservation District

CHAPTER 2:
SUNRISE RIVER WATERSHED

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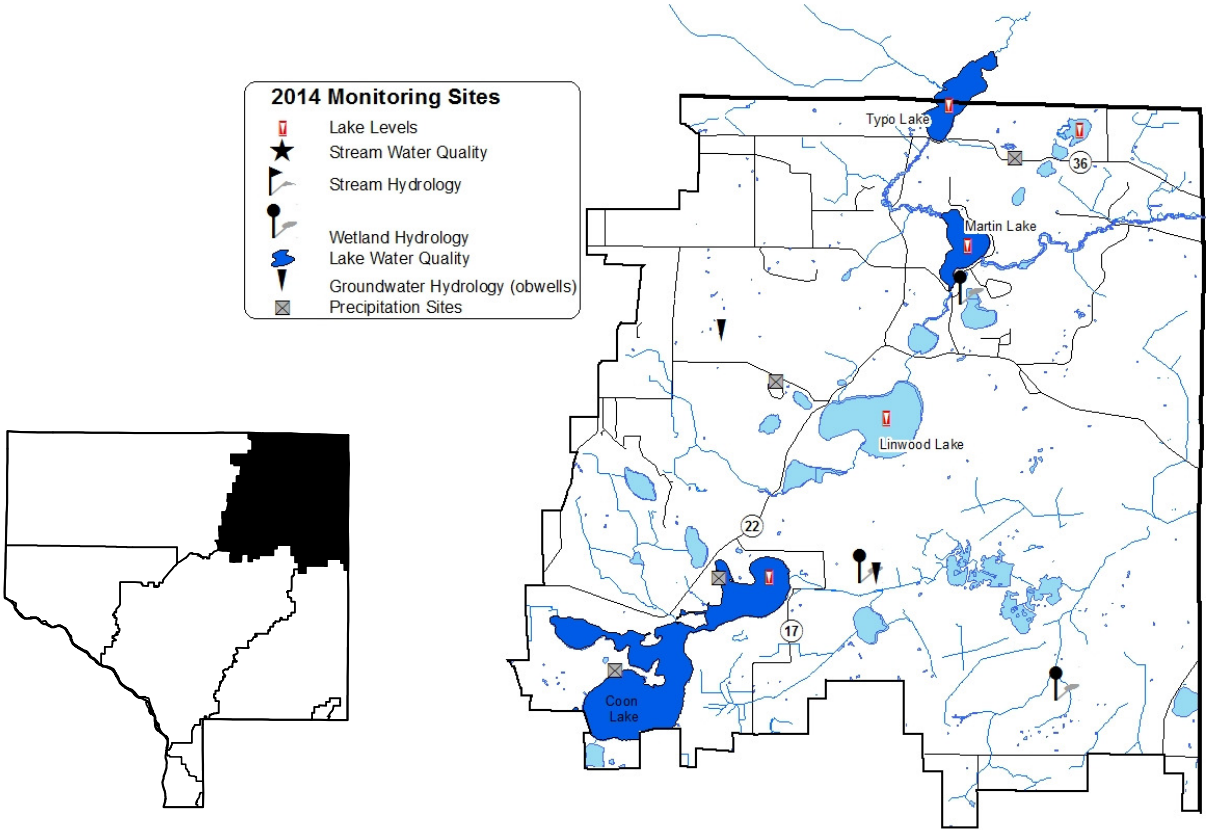
ACD = Anoka Conservation District, SRWMO = Sunrise River Watershed Management Organization, MNDNR = Minnesota Dept. of Natural Resources, ACAP = Anoka County Ag Preserves



Lake Levels

Description: Weekly water level monitoring in lakes. The past five years are shown below, and all historic data are available on the Minnesota DNR website using the "LakeFinder" feature (www.dnr.mn.us.state\lakefind\index.html).

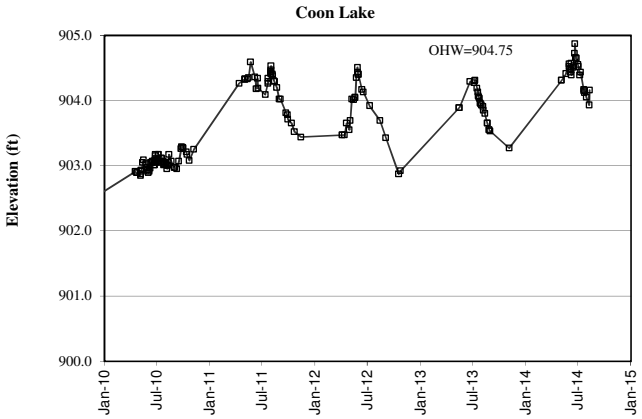
Purpose: To understand lake hydrology, including the impact of climate or other water budget changes. These data are useful for regulatory, building/development, and lake management decisions.

Locations: Coon, Fawn, Linwood, Martin, and Typo Lakes

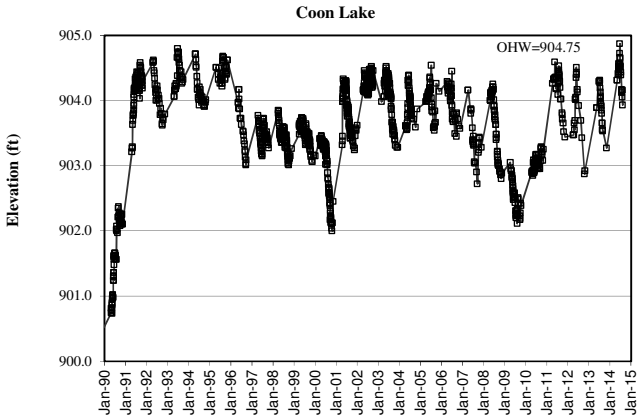
Results: Lake levels were measured by volunteers throughout the 2014 open water season. Lake gauges were installed and surveyed by the Anoka Conservation District and MN DNR. Lakes had sharply increasing water levels in spring and early summer 2014 when very heavy rainfall totals occurred. Rainfall tapered off later in the year and lake levels fell accordingly.

All lake level data can be downloaded from the MN DNR website's Lakefinder feature. Ordinary High Water Level (OHW), the elevation below which a DNR permit is needed to perform work, is listed for each lake on the corresponding graphs below.

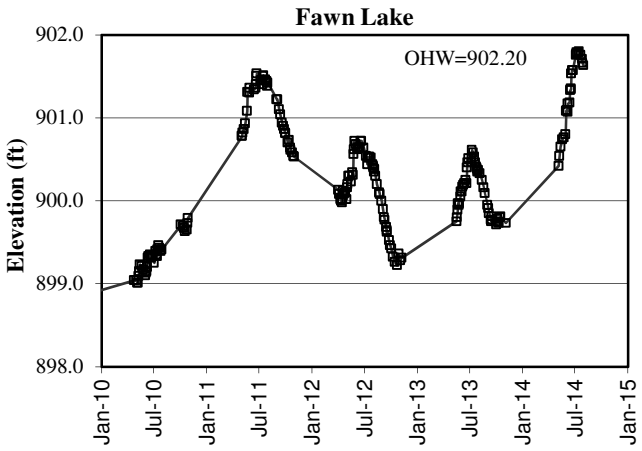
Coon Lake Levels – last 5 years



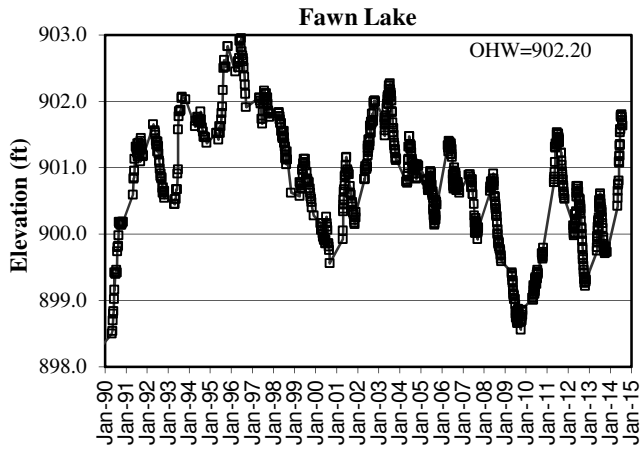
Coon Lake Levels – last 25 years



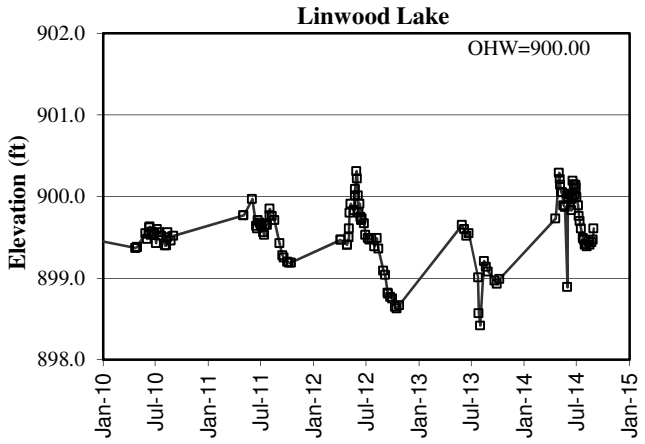
Fawn Lake Levels – last 5 years



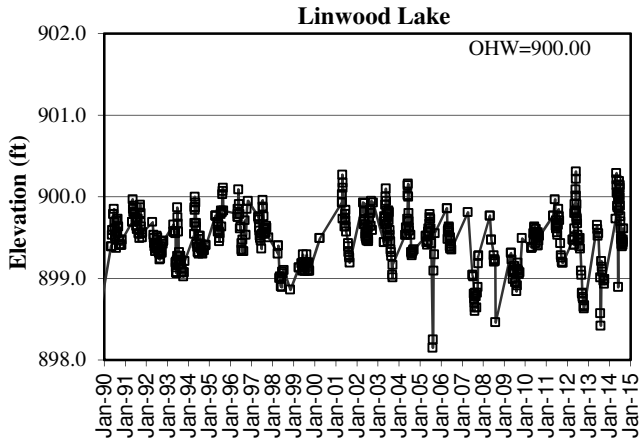
Fawn Lake Levels – last 25 years



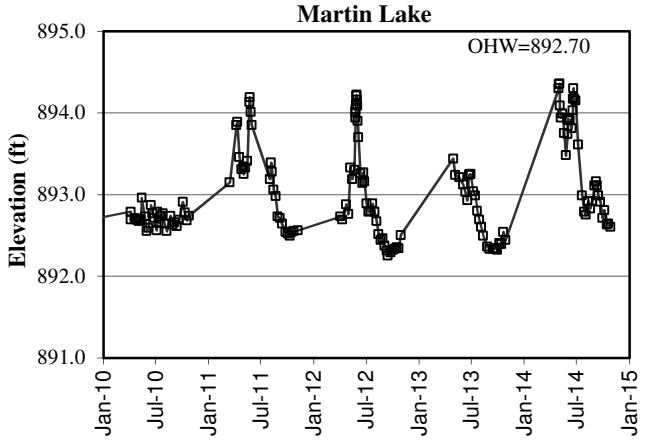
Linwood Lake Levels – last 5 years



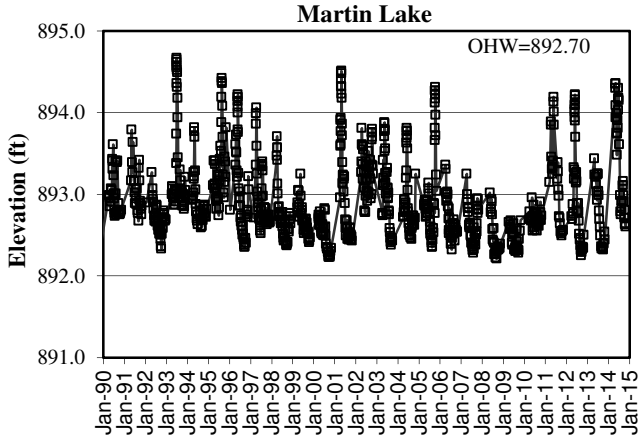
Linwood Lake Levels – last 25 years



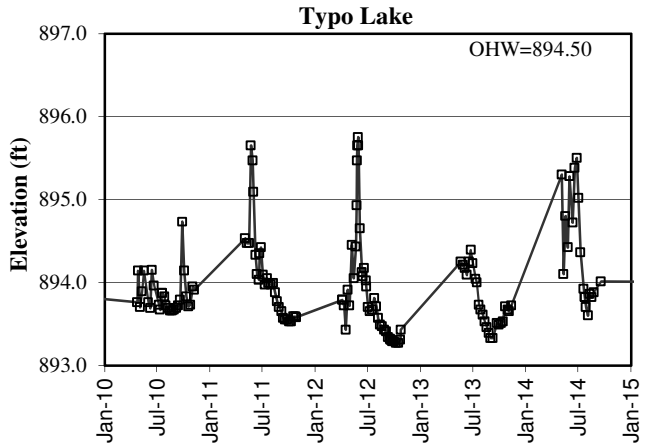
Martin Lake Levels – last 5 years



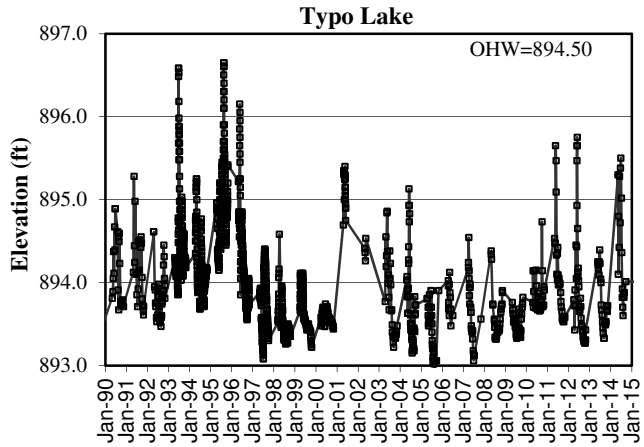
Martin Lake Levels – last 25 years



Typo Lake Levels – last 5 years



Typo Lake Levels – last 25 years



Lake Water Quality

Description: May through September every-other-week monitoring of the following parameters: total phosphorus, chlorophyll-a, secchi transparency, dissolved oxygen, turbidity, temperature, conductivity, pH, and salinity.

Purpose: To detect water quality trends and diagnose the cause of changes.

Locations: Coon Lake East Bay

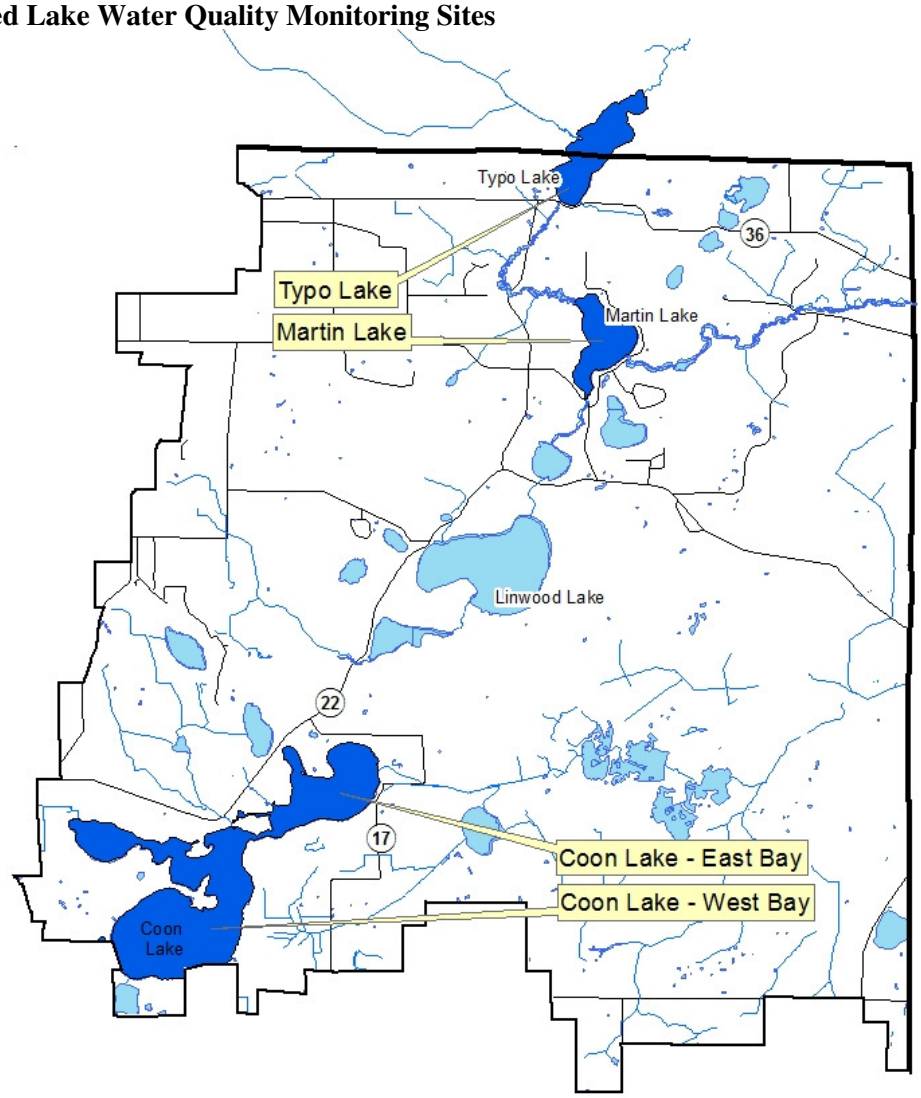
Coon Lake West Bay

Martin Lake

Typo Lake

Results: Detailed data for each lake are provided on the following pages, including summaries of historical conditions and trend analysis. Previous years' data are available from the ACD. Refer to Chapter 1 for additional information on interpreting the data and on lake dynamics.

Sunrise Watershed Lake Water Quality Monitoring Sites



Coon Lake –East and West Bays

City of East Bethel, City of Ham Lake & City of Columbus, Lake ID # 02-0042

Background

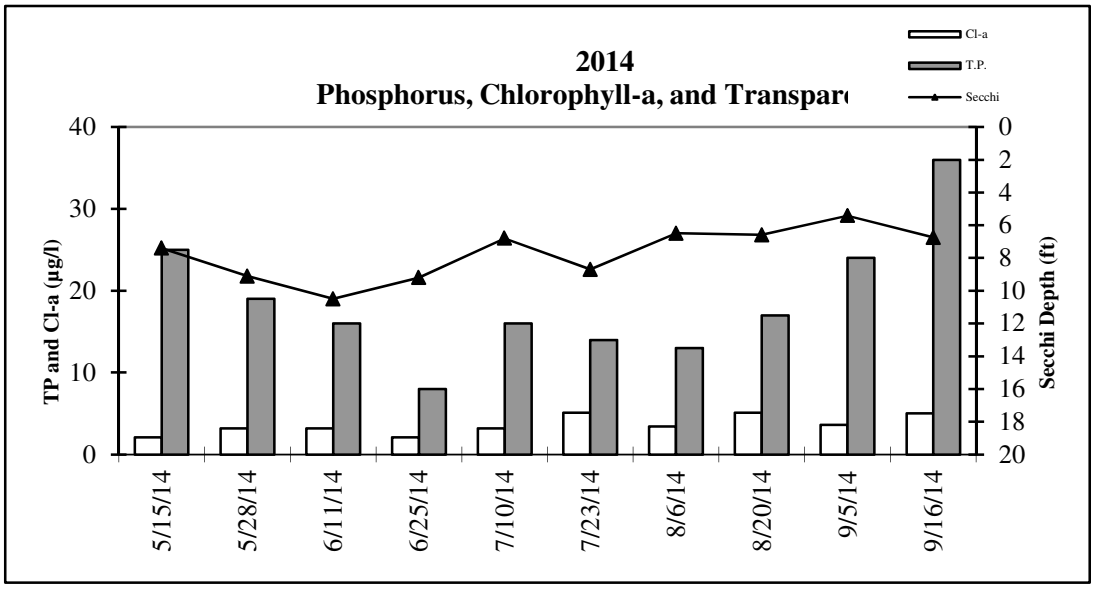
Coon Lake is located in east central Anoka County and is the county's largest lake. Coon Lake has a surface area of 1498 acres and a maximum depth of 27 feet (9 m). Public access is available at three locations with boat ramps, including one park with a swimming beach. The lake is used extensively by recreational boaters and fishers. Most of the lake is surrounded by private residences. The watershed of 6,616 acres is rural residential.

This report includes information for the East Bay (aka northeast or north bay) and West Bay (aka southwest or south bay) of Coon Lake in 2014. The 2010-14 data is from the Anoka Conservation District (ACD) monitoring at the MN Pollution Control Agency (MPCA) monitoring site #203 for the East Bay and #206 for the West Bay. Over the years, other sites have been monitored and are included in this report's trend analysis when appropriate. When making comparisons between the two bays, please consider that both bays were monitored simultaneously only in 2010, 2012 and 2014; data from other years do not lend themselves well to direct comparisons because monitoring regimes were likely different.

2014 Results – East Bay

In 2014 the East Bay was monitored every 2 weeks. The water quality is better than average for this region of the state (NCHF Ecoregion), receiving an A grade. Average values of important water quality parameters included 18.8 µg/L for total phosphorus, 3.6 µg/L chlorophyll-a, and Secchi transparency of 7.7 feet. Both Chlorophyll-a and phosphorous levels were the lowest of all monitored years. In addition, both have seen a drop in each of the last 5 years. Similarly, transparency results were the second deepest observed in all monitored years and had shown improvement in each of the last 5 monitoring years. The subjective observations of the lake's physical characteristics and recreational suitability by the ACD staff indicated that lake conditions were excellent for swimming and boating.

2014 Water Quality Results – East Bay

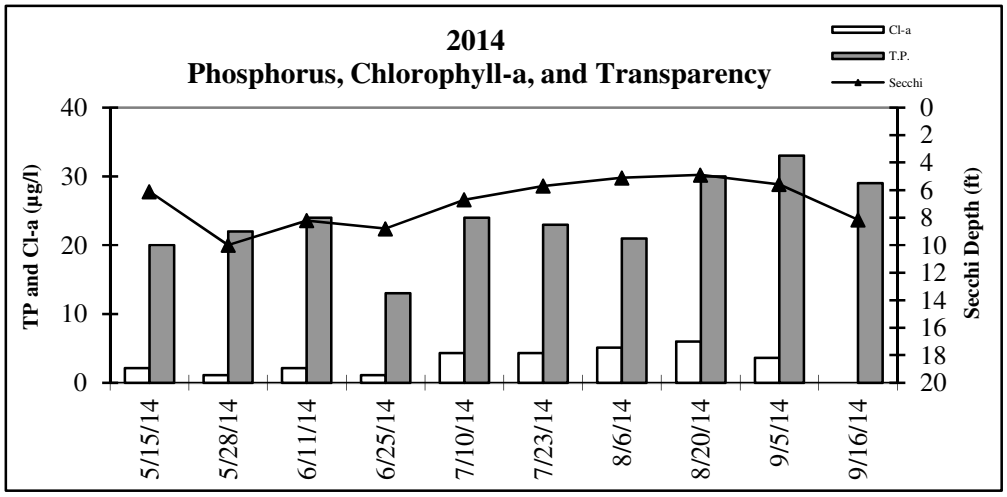


2014 Results – West Bay

In 2014 the West Bay had average water quality for this region of the state (NCHF Ecoregion), receiving a B letter grade. Average values of water quality parameters included 23.9 µg/L for total phosphorus, 3.3 µg/L chlorophyll-a, and Secchi transparency of 6.9 feet. Chlorophyll-a and phosphorus levels were the lowest of all

monitored years. Despite only receiving a B grade, Secchi transparency results were the deepest observed in over 10 years and the second deepest of all monitored years.

2014 Water Quality Results –West Bay



Comparison of the Bays

The East and West Bays of Coon Lake often have noticeably different water quality. In 2010, on every date water quality was better in the West Bay than East. In both 2012 and 2014, water quality in the two bays was more similar. The East Bay typically had lower phosphorus readings, though the average differed by only 5.1 µg/L. Chlorophyll-a readings were more frequently lower in the West bay but the average reading only differed by 0.3 µg/L. Secchi transparency was consistently deeper in the East Bay but the average reading differed by 0.77 ft.

Trend Analysis

To analyze Coon Lake trends we obtained historic monitoring data from the MPCA. Over the years water quality has been monitored at 17 sites on the lake. For the trend analysis, we pooled data from five East Bay sites (#102, 203, 208, 209, and 401) and four West Bay sites (#101, 105, 206, and 207). These sites were chosen because they were all in the bay of interest, close to each other, and distant from the shoreline. The trend analysis is based on average annual water quality data for each year with data. We used data only from years with data from every month from May to September, except we allowed one month of missing data. Only data from May to September were used. Starting in 1998 only data from ACD was used for greater comparability.

East Bay Trend Analysis

In the East Bay twenty one years of water quality data have been collected since 1978. During the most recent 13 years that were monitored (since 1996), the data collected included total phosphorus, chlorophyll-a, and Secchi transparency. For most of the other eight years (all pre-1997) only Secchi transparency data is available. This provides an adequate dataset for a trend analysis, however given that most of the data is from the last 21 years, the analysis is not strong at detecting changes that occurred prior to 1990.

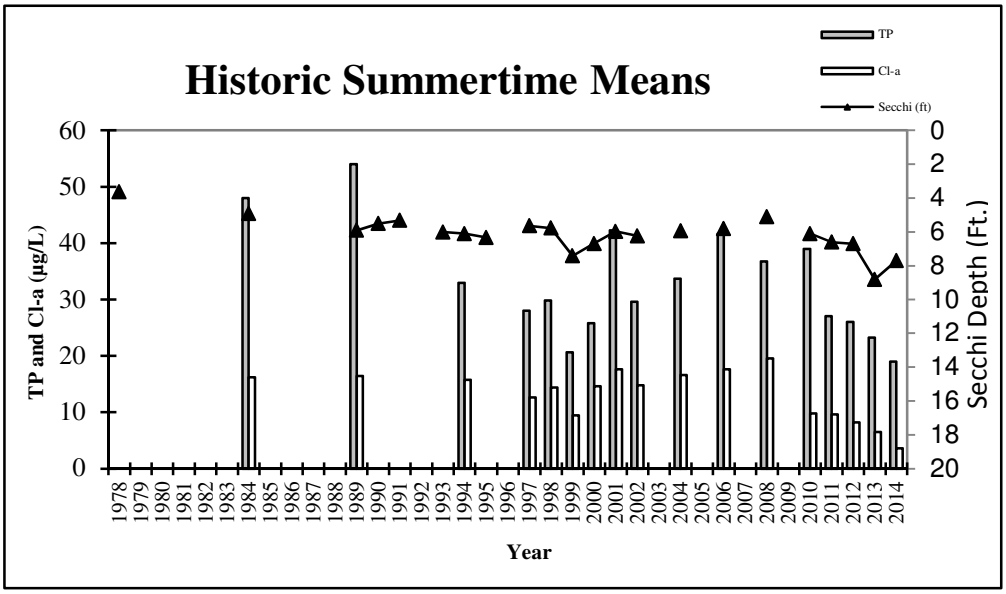
When we examined those years with total phosphorus, chlorophyll-a, and Secchi transparency, excluding the years with only Secchi transparency data an improving water quality trend does exist. The analysis was a

repeated measures MANOVA with response variables TP, Cl-a, and Secchi depth ($F_{2,14}$=4.37, p=0.03). This is our preferred approach because it examines all three parameters simultaneously.

We also examined variables TP, Cl-a, and Secchi depth across all years of existing data using a one-way ANOVA. Including all years, a significant trend of improving TP ($F_{1,16}$=7.12, p=0.02) , Cl-a ($F_{1,16}$=7.13, p=0.02), and transparency ($F_{1,20}$=11.30, p=0.0033) is found.. In summary, it appears that water quality improvements have been occuring.

It is noteworthy that a water quality improvement seems to have occurred over the last few years (see graph below). The reason for such a change, if real, is unknown.

Historic Water Quality - East Bay

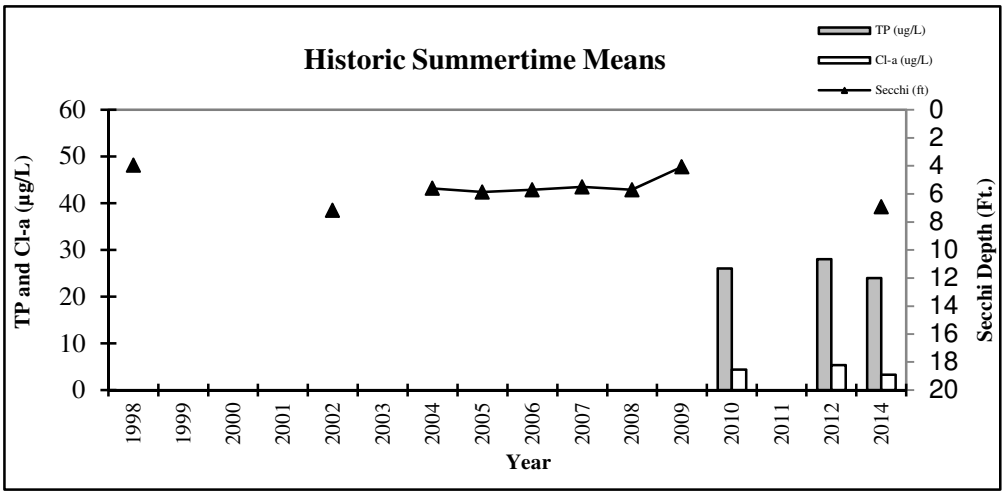


West Bay Trend Analysis

Ten years of data are available for the West Bay including only two years with phosphorus and chlorophyll-a data, so a powerful trend analysis is not possible. The dataset for Secchi transparency is longer, but data from 2010 and 2012 must be excluded because a full suite of Secchi measurements is not available due to clarity exceeding the lake depth occasionally. Therefore, a statistical analysis would not be highly meaningful. Instead, we'll use a non-analytical look at the data.

In 2014 the average secchi was 6.93 feet. For eight monitored years in 1998-2009, seven of those years had average secchi of <6 feet. It's notable that in the two most recent years the average secchi transparency was greater than in all but one of previous years. It suggests that if anything, transparency is mildly improving.

Historic Water Quality - West Bay



Discussion

While Coon Lake is not listed as "impaired" by the MN Pollution Control Agency, the East Bay has been close to the state water quality standard of 40 µg/L of phosphorus or greater in the past. In 2006 phosphorus averaged 42 µg/L, was 37 µg/L in 2008, and in 2010 was 39 µg/L. However, 2011 was the beginning of a 4 year consecutive decline in phosphorous levels. Phosphorous levels dropped to 27 µg/L in 2011, again to 26 µg/L in 2012, again to 23.2 µg/L (second lowest on record) in 2013, and in 2014 hit an all-time low of 18.8 µg/L. While recent results appear to be trending in the right direction, continued efforts to improve water quality are strongly encouraged to prevent the lake from becoming designated as "impaired." Such a designation would trigger an in-depth study under the Federal Clean Water Act.

Given the highly-developed nature of the lakeshore, the practices of lakeshore homeowners are a reasonable place to begin water quality improvement efforts. Residents should increase the use of shoreline practices that improve water quality and lake health, such as native vegetation buffers and rain gardens. Clearing of native vegetation to create a "cleaner" lakefront should be avoided because this vegetation is important to lake health and water quality. Septic system maintenance and replacement where necessary, should be a priority on an individual home basis and on a community level. This might be most beneficial in the Hiawatha Beach, Interlachen, and Coon Lake Beach neighborhoods, where the greatest frequency of septic system failures is suspected.

A final challenge for Coon Lake is the aquatic invasive species Eurasian water milfoil (EWM) and Curly Leaf Pondweed (CLP). EWM was discovered in the lake in 2003 and spread rapidly. In 2008 a Coon Lake Improvement District (CLID) was formed, with EWM management as a core of its function. EWM is actively monitored and treated with herbicide in accordance with DNR rules and a lake vegetation management plan. CLP has been present longer. CLID started treatment of CLP in 2009. In 2010 the East Bay was accepted into a five year pilot program for treatment of CLP. There is not yet enough data to say definitively, but it is possible that early season treatment of CLP could be a contributing factor in the recent decline in phosphorous levels. CLP takes up phosphorous from the soil through its root system and dies off early summer causing a spike in phosphorous. Early treatment may be shortening the time the CLP has to uptake phosphorous from the soil as well as reducing overall regrowth due to treatments occurring prior to CLP sprouting turions (a shoot vital to reproduction).

2014 Coon Lake East Bay Water Quality Data

Coon Lake East Bay
2014 Water Quality Data

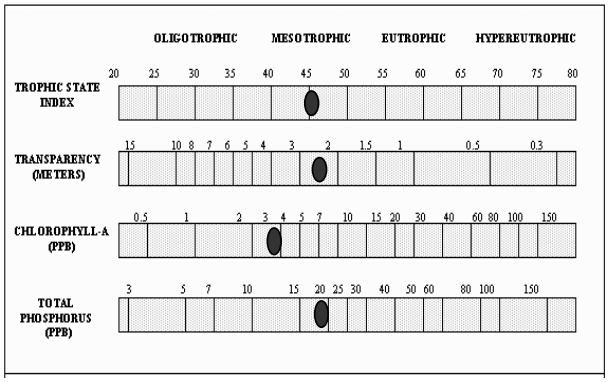
			5/15/2014	5/28/2014	6/11/2014	6/25/2014	7/10/2014	7/23/2014	8/6/2014	8/20/2014	9/5/2014	9/16/2014			
			10:15	10:55	9:50	10:30	10:20	10:30	10:15	13:20	11:00	10:55			
	Units	R.L.*	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Average	Min	Max
pH		0.1	8.41	8.3	8.61	8.62	8.63	8.84	9.15	9.28	8.10	8.92	8.69	8.10	9.28
Conductivity	mS/cm	0.01	0.213	0.21	0.205	0.203	0.202	0.212	0.221	0.217	0.239	0.217	0.214	0.202	0.239
Turbidity	NTU	1	2.9	0.4	0.8	5.3	3.6	4.4	2	2	14	8	4	0	14
D.O.	mg/L	0.01	11.86	10.22	9.96	9.6	8.68	7.83	8.88	9.10	7.17	9.70	9.30	7.17	11.86
D.O.	%	1	112%	104%	114%	106%	105%	97%	111%	114%	85%	103%	105%	85%	114%
Temp.	°C	0.1	12	20	22	24	24	25	25.1	24.6	22.0	16.9	21.5	11.9	25.1
Temp.	°F	0.1	53.4	68.2	71.9	74.6	75.1	77.2	77.2	76.3	71.6	62.3	70.8	53.4	77.2
Salinity	%	0.01	0.1	0.1	0.1	0.1	0.1	0.1	0.11	0.11	0.11	0.10	0.10	0.10	0.11
Cl-a	ug/L	0.5	2.1	3.2	3.2	2.1	3.2	5.1	3.4	5.1	3.6	5.0	3.6	2.1	5.1
T.P.	mg/L	0.010	0.025	0.019	0.016	0.008	0.016	0.014	0.013	0.017	0.024	0.036	0.019	0.008	0.170
T.P.	ug/L	10	25	19	16	8	16	14	13.0	17.0	24.0	36.0	19.0	8.0	170.0
Secchi	ft	0.1	7.4	9.11	10.5	9.2	6.8	8.7	6.5	6.6	5.4	6.8	7.7	5.4	10.5
Secchi	m	0.1	2.26	2.78	3.20	2.80	2.07	2.65	2.0	2.0	1.7	2.1	2.3	1.7	3.2
Physical			1.0	1.0	2.0	1.0	1.0	1.0	2.0	1.0	1.0	1.0	1.2	1.0	2.0
Recreational			1.0	1.0	1.0	1.0	1.0	1.0	2.0	1.0	1.0	1.0	1.1	1.0	2.0

*reporting limit

Coon Lake East Bay Historic Summertime Mean Values

Agency	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	ACD	ACD	ACD	ACD	ACD	ACD	ACD	ACD	ACD	ACD	ACD	ACD	ACD
Year	1978	1984	1989	1990	1991	1993	1994	1995	1997	1998	1999	2000	2001	2002	2004	2006	2008	2010	2011	2012	2013	2014
TP		48.0	54.0				33.0		28.0	29.8	20.6	25.8	42.3	29.6	33.7	41.7	36.8	39.0	27.0	26.0	23.2	19.0
Cl-a		16.2	16.4				15.8		12.6	14.4	9.4	14.6	17.6	14.8	16.6	17.6	19.5	9.8	9.6	8.2	6.5	3.6
Secchi (m)	1.11	1.50	1.80	1.68	1.62	1.83	1.86	1.93	1.72	1.76	2.26	2.04	1.82	1.90	1.81	1.80	1.55	1.90	2.00	2.10	2.68	2.35
Secchi (ft)	3.6	4.9	5.9	5.5	5.3	6.0	6.1	6.3	5.6	5.8	7.4	6.7	6.0	6.2	5.9	5.8	5.1	6.1	6.6	6.7	8.8	7.7
Carlsons trophic state indices																						
TSIP		60	62				55		52	53	48	51	58	53	55	58	56	57	52	51	49	47
TSIC		58	58				58		55	57	53	57	59	57	58	59	60	53	53	51	49	43
TSIS	58	54	52	53	53	51	51	51	52	52	48	50	51	51	51	52	54	51	50	49	46	48
TSI		57	57				54		53	54	50	53	56	54	55	56	57	54	51	51	48	46
Coon Lake Water Quality Report Card																						
Year	1978	1984	1989	1990	1991	1993	1994	1995	1997	1998	1999	2000	2001	2002	2004	2006	2008	2010	2011	2012	2013	2014
TP		C	C				C		B	B	A	B	C	B	C	C	C	C	B	B	B+	A
Cl-a		B	B				B		B	B	A	B	B	B	B	B	B	A	A	A	A	A
Secchi	D	C	C	C	C	C	C	C	C	C	B	C	C	C	C	C	C	C	C	C+	B	B
Overall	**D**	**C**	**C**	**C**	**C**	**C**	**C**	**C**	**B**	**B**	**A**	**B**	**C**	**B**	**C**	**C**	**C**	**B-**	**B**	**B**	**B+**	**A**

Carlson's Trophic State Index



2014 Coon Lake West Bay

Water Quality Data

Coon Lake West Bay
2014 Water Quality Data

		Date:	5/15/2014	5/28/2014	6/11/2014	6/25/2014	7/10/2014	7/23/2014	8/6/2014	8/20/2014	9/5/2014	9/16/2014			
		Time:	10:00	10:20	9:30	9:55	9:50	9:50	9:45	12:50	10:35	10:30			
	Units	R.L.*	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Average	Min	Max
pH		0.1	8.21	8.13	8.40	8.45	8.48	8.33	8.60	8.63	8.28	8.84	8.44	8.13	8.84
Conductivity	mS/cm	0.01	0.198	0.199	0.192	0.185	0.184	0.190	0.197	0.201	0.211	0.198	0.196	0.184	0.211
Turbidity	FNRU	1	1.90	0.10	1.60	7.20	5.40	10.70	12.30	3.50	13.70	4.00	6	0	14
D.O.	mg/l	0.01	11.22	11.31	9.27	9.35	7.90	6.89	7.54	8.14	8.34	10.20	9.02	6.89	11.31
D.O.	%	1	106%	96%	106%	98%	95%	185%	94%	101%	95%	105%	108%	94%	185%
Temp.	°C	0.1	12.1	20.7	22.0	24.0	23.5	24.9	25.1	24.6	21.4	15.3	21.4	12.1	25.1
Temp.	°F	0.1	53.8	69.3	71.7	75.1	74.2	76.8	77.1	76.3	70.5	59.5	70.4	53.8	77.1
Salinity	%	0.01	0.09	0.09	0.09	0.09	0.09	0.09	0.10	0.10	0.10	0.09	0.09	0.09	0.10
Cl-a	ug/L	0.5	2.1	1.1	2.1	1.1	4.3	4.3	5.1	6.0	3.6	<1.0	3.3	<1.0	6.0
T.P.	mg/l	0.010	0.020	0.022	0.024	0.013	0.024	0.023	0.021	0.030	0.033	0.029	0.024	0.013	0.033
T.P.	ug/l	10	20	22	24	13	24	23	21	30	33	29	24	13	33
Secchi	ft		6.1	10.0	8.2	8.8	6.7	5.7	5.1	4.9	5.6	8.2	6.93	4.9	10.0
Secchi	m		1.9	3.0	2.5	2.7	2.0	1.7	1.6	1.5	1.7	2.5	2.11	1.5	3.0
Physical			1	1	2	1	1	1	1	1	1	2	1.2	1.0	2.0
Recreational			1	1	1	1	1	1	1	1	1	1	1.0	1.0	1.0

*reporting limit

Coon Lake West Bay Historical Summertime Mean Values

Agency	ACD	ACD	ACD	ACD	ACD	ACD	ACD	ACD	ACD	ACD	ACD
Year	1998	2002	2004	2005	2006	2007	2008	2009	2010	2012	2014
TP									26.0	28.0	24.0
Cl-a									4.4	5.4	3.3
Secchi (m)	1.21	2.19	1.71	1.79	1.74	1.68	1.74	1.24			2.1
Secchi (ft)	3.97	7.18	5.61	5.87	5.71	5.51	5.71	4.07			6.9

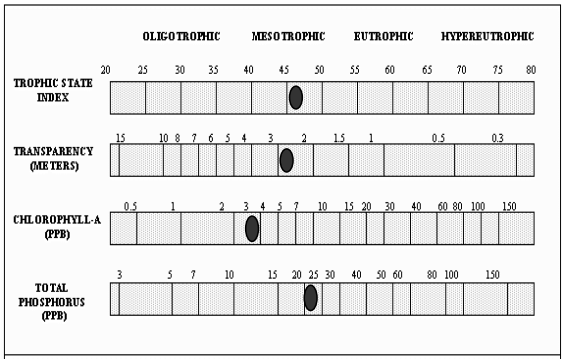
Carlson's Trophic State Index

TSIP									51	52	50
TSIC									45	47	42
TSIS	57	49	52	52	52	53	52	57			49
TSI									48	50	47

Coon Lake West Bay Water Quality Report Card

Year	1998	1999	2001	2003	2004	2006	2007	2009	2010	2012	2014
TP (µg/L)									B	B	B
Cl-a (µg/L)									A	A	A
Secchi (m)	C	C	C	C	C	C	C	C			C
Overall									**A-**	**A-**	**B**

Carlson's Trophic State Index



Typo Lake

Linwood Township, Lake ID # 03-0009

Background

Typo Lake is located in the northeast portion of Anoka County and the southeast portion of Isanti County. It has a surface area of 290 acres and maximum depth of 6 feet (1.82 m), though most of the lake is about 3 feet deep. The lake has a mucky, loose, and unconsolidated bottom in some areas, while other areas have a sandy bottom. Public access is at the south end of the lake along Fawn Lake Drive. The lake is used very little for fishing or recreational boating because of the shallow depth and extremely poor water quality. The lake's shoreline is mostly undeveloped, with only 21 homes within 300 feet of the lakeshore. The lake's watershed of 11,520 acres is 3% residential, 33% agricultural, 28% wetlands, with the remainder being forested or grassland. Typo Lake is on the Minnesota Pollution Control Agency's (MPCA) list of impaired waters for excess nutrients.

2014 Results

In 2014 Typo Lake had extremely poor water quality compared to other lakes in this region (NCHF Ecoregion), receiving an overall D- letter grade. While the overall grade is still poor, it is the best grade received in all years monitored. In addition, some of the most important parameters were the best they have ever been observed. In the worst two years of results, total phosphorus averaged 340 (2007) and 353 µg/L(2009), respectively. Total phosphorus in 2014 averaged 182 µg/L, which while still very high, but is the lowest observed since 1997. Chlorophyll-a levels were lower in 2014 (42.8 µg/L) than in any other year in monitored history. In both 2007 and 2009 a bright white Secchi disk could be seen only 5-6 inches below the surface, on average. There was a slight improvement in 2012 to 9-10 inches and a larger improvement in 2014 to 21-22 inches. The reason for the especially poor conditions in 2007 and 2009 seems to be drought-induced low water levels. To that same sentiment, it is reasonable to believe that the improvements observed in 2014 may be a result of above average rainfall.

Trend Analysis

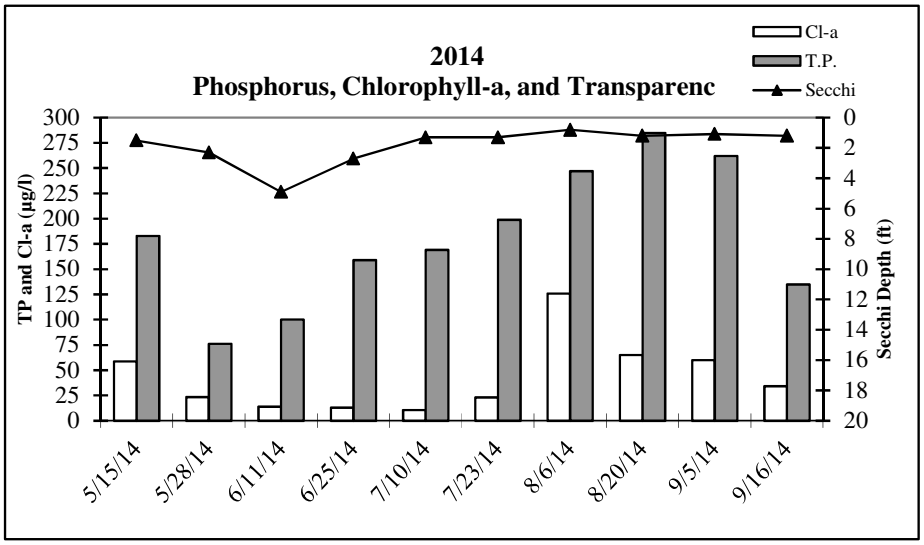
Fourteen years of water quality monitoring have been conducted by the Minnesota Pollution Control Agency (1993, '94, and '95) and the Anoka Conservation District (1997-2001, '03, '05, '07, '09, '12, '14). Water quality has significantly deteriorated from 1993 to 2014 (repeated measures MANOVA with response variables TP, Cl-a, and Secchi depth; $F_{2,11}$=4.84, p=0.03). Though, tested individually (one-way ANOVAs on the individual response variables) TP, Cl-a, and Secchi depth show no significant change. The trend toward poorer phosphorus and transparency continue to appear to be strong despite the fact that in 2012 and 2014 these parameters were slightly better than the previous years monitored.

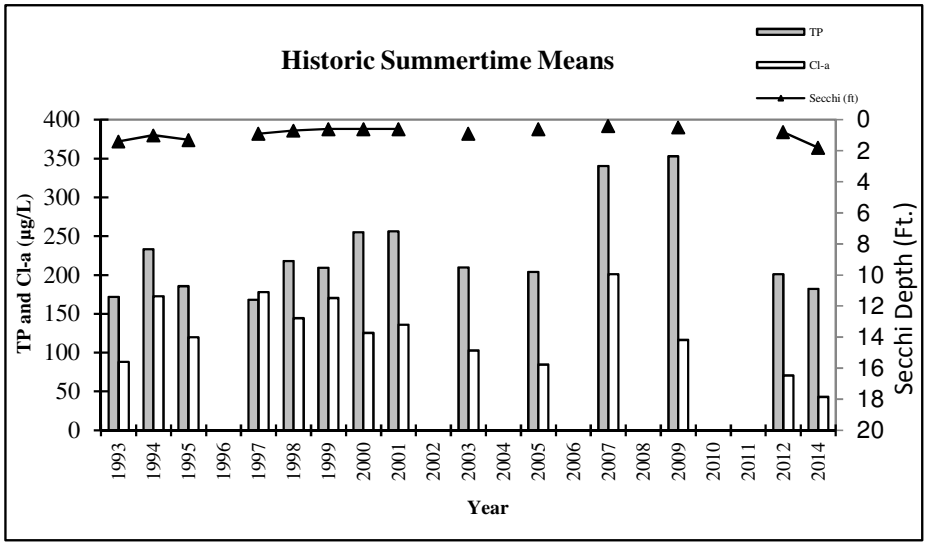
Discussion

Typo Lake, along with Martin Lake downstream, were the subject of TMDL study by the Anoka Conservation District which was approved by the State and EPA in 2012. This study documented the source of nutrients to the lake, the degree to which each is impacting the lake, and put forward lake rehabilitation strategies. Some factors impacting water quality on Typo Lake include rough fish, high phosphorus inputs from a ditched wetland west of the lake, and lake sediments. A carp barrier project between Martin and Typo lakes has been approved and funded. The first barrier was installed in 2014 with contractors set to install the final three in 2015.

Typo Lake Water Quality Results

Typo Lake		Date	5/15/2014	5/28/2014	6/11/2014	6/25/2014	7/10/2014	7/23/2014	8/6/2014	8/20/2014	9/5/2014	9/16/2014			
2014 Water Quality Data		Time	12:00	12:15	11:15	11:50	11:40	11:30	11:25	14:35	12:40	12:40			
	Units	R.L.*	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Average	Min	Max
pH		0.1	9.01	8.47	8.22	7.71	7.80	7.74	8.35	8.17	8.79	9.31	8.36	7.71	9.31
Conductivity	mS/cm	0.01	0.197	0.251	0.258	0.273	0.299	0.337	0.363	0.337	0.328	0.299	0.294	0.197	0.363
Turbidity	FNRU	1	62.30	21.70	8.70	18.30	48.20	103.00	12.10	89.80	88.40	38.60	49	9	103
D.O.	mg/l	0.01	16.65	8.66	10.64	3.90	2.82	2.54	5.33	5.74	9.18	11.85	7.73	2.54	16.65
D.O.	%	1	132%	96%	123%	46%	34%	31%	65%	65%	102%	121%	82%	31%	132%
Temp.	°C	0.1	12.5	21.1	22.8	22.0	22.7	24.7	24.0	23.7	20.1	15.1	20.87	12.53	24.71
Temp.	°F	0.1	54.6	70.0	73.0	71.5	72.9	76.5	75.3	23.7	68.1	59.1	69.6	23.7	76.5
Salinity	%	0.01	0.09	0.12	0.12	0.13	0.15	0.16	0.18	0.16	0.16	0.14	0.1	0.1	0.2
Cl-a	ug/l	0.5	58.7	23.5	13.9	12.8	10.7	23.1	126.0	65.2	59.8	34.2	42.8	10.7	126.0
T.P.	mg/l	0.010	0.183	0.076	0.100	0.159	0.169	0.199	0.247	0.285	0.262	0.135	0.182	0.076	0.285
T.P.	ug/l	10	183	76	100	159	169	199	247	285	262	135	182	76	285
Secchi	ft	0.1	1.5	2.3	4.9	2.7	1.3	1.3	0.8	1.2	1.1	1.2	1.8	0.8	4.9
Secchi	m	0.1	0.5	0.7	1.5	0.8	0.4	0.4	0.2	0.4	0.3	0.4	0.6	0.2	1.5
Physical			1.0	2.0	2.0	2.0	2.00	3.00	3.0	3.0	2.0	2.0	2.2	1.0	3.0
Recreational			1.0	2.0	1.0	2.0	2.00	3.00	3.0	3.0	1.0	3.0	2.1	1.0	3.0

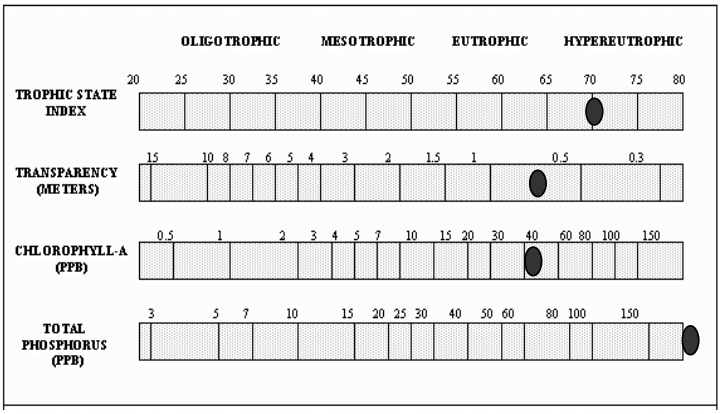




Typo Lake Historic Summertime Mean Values

Agency	CLMP	CLMP	MPCA	MPCA	MPCA	ACD	ACD	ACD	ACD	ACD	ACD	ACD	ACD	ACD	ACD	ACD
Year	1974	1975	1993	1994	1995	1997	1998	1999	2000	2001	2003	2005	2007	2009	2012	2014
TP			172.0	233.0	185.6	168.0	225.7	202.1	254.9	256.0	209.8	204	340.5	353.0	201.0	182.0
Cl-a			88.1	172.8	119.6	177.8	134.7	67.5	125.3	136.0	102.5	84.7	200.9	116.2	70.7	42.8
Secchi (m)	0.23	0.27	0.43	0.29	0.38	0.27	0.21	0.25	0.18	0.19	0.3	0.2	0.1	0.1	0.2	0.6
Secchi (ft)	0.2	0.3	1.4	1.0	1.3	0.9	0.7	0.8	0.6	0.6	0.9	0.6	0.4	0.5	0.8	1.8
Carlson's Tropic State Indices																
TSIP			78	83	79	78	82	81	83	82	81	81	88	89	81	79
TSIC			75	81	78	82	79	72	74	77	76	74	83	77	72	68
TSIS	81	79	72	78	74	79	82	80	86	85	77	83	93	93	83	67
TSI			75	81	77	79	81	78	81	81	78	79	88	86	79	71
Typo Lake Water Quality Report Card																
Year	1974	1975	1993	1994	1995	1997	1998	1999	2000	2001	2003	2005	2007	2009	2012	2014
TP			F	F	F	F	F	F	F	F	F	F	F	F	F	F
Cl-a			F	F	F	F	F	D	F	F	F	F	F	F	D	C
Secchi	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
Overall			**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**D-**

Carlson's Trophic State Index



Martin Lake

Linwood Township, Lake ID # 02-0034

Background

Martin Lake is located in northeast Anoka County. It has a surface area of 223 acres and maximum depth of 20 ft. Public access is available on the southern end of the lake. The lake is used moderately by recreational boaters and fishers, and would likely be used more if water quality improved. Martin Lake is almost entirely surrounded by private residences. The 5402 acre watershed is 18% developed; the remainder is vacant, agricultural, or wetlands. The non-native, invasive plant curly-leaf pondweed occurs in Martin Lake, but not at nuisance levels. Martin is on the Minnesota Pollution Control Agency's (MPCA) list of impaired waters for excess nutrients.

2014 Results

In 2014 Martin Lake had poor water quality compared to other lakes in the North Central Hardwood Forest Ecoregion (NCHF), receiving a C letter grade. This eutrophic lake has chronically high total phosphorus and chlorophyll-a. In 2014 total phosphorus averaged 91.0 µg/L, slightly below the lake's historical average of 92.1 µg/L but still well above the impairment threshold of 60 µg/L. Chlorophyll-a was the lowest observed in the lakes monitored history at 15.5 µg/L. Average Secchi transparency was only 3.4 feet in 2014 but slightly better than the historical average. ACD staff's subjective perceptions of the lake were that "high" algae made the lake less than desirable for swimming from July through September.

Trend Analysis

Thirteen years of water quality data have been collected by the Minnesota Pollution Control Agency (1983), Metropolitan Council (1998, 2008), and ACD (1997, 1999-2001, 2003, 2005, 2007, 2009, 2012, 2014). Citizens monitored Secchi transparency 17 other years. Anecdotal notes from DNR fisheries data indicate poor water quality back to at least 1954. A water quality change from 1983 to 2014 is detectable with statistical tests (repeated measures MANOVA with response variables TP, Cl-a, and Secchi depth; $F_{2,10}$=7.96, p=<0.01). However, further examination of the data reveals that no water quality parameter alone has changed significantly, and the direction of their changes is mixed. If the oldest year of data (1983) is excluded, there is no longer a statistically significant trend. Because the statistical trend is dependent upon one year's data and the direction of change is mixed among the parameters, the statistical trend can be largely discounted. No true trend likely exists.

Discussion

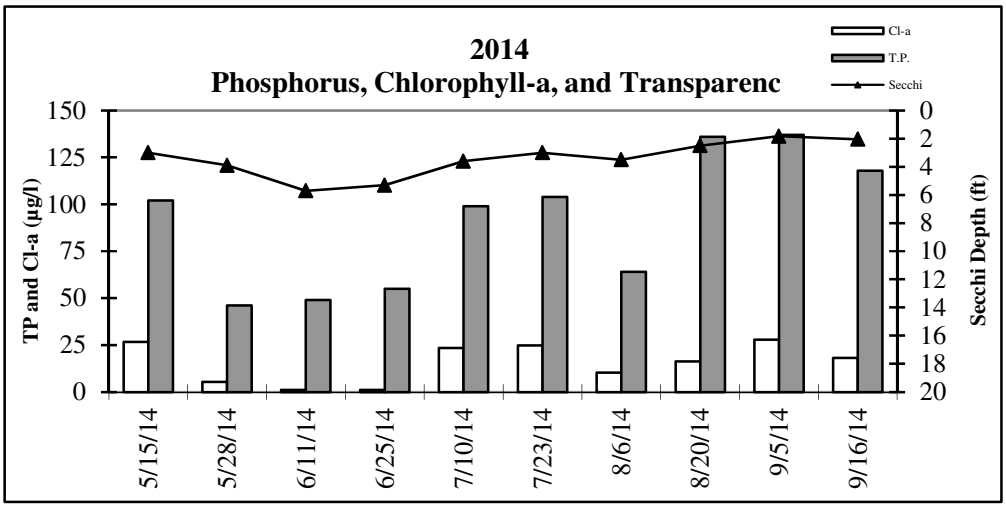
Martin Lake, along with Typo Lake upstream, were the subject of an TMDL study by the Anoka Conservation District that was approved by the State and EPA in 2012. This study documented the source of nutrients to the lake, the degree to which each is impacting the lake, and put forward lake rehabilitation strategies. Water from Typo Lake and internal loading (carp, septic systems, sediments, etc) are two of the largest negative impacts on Martin Lake water quality. A carp barrier project between Martin and Typo lakes has been approved and funded. The first barrier was installed in 2014 with contractors set to install the final two in 2015.

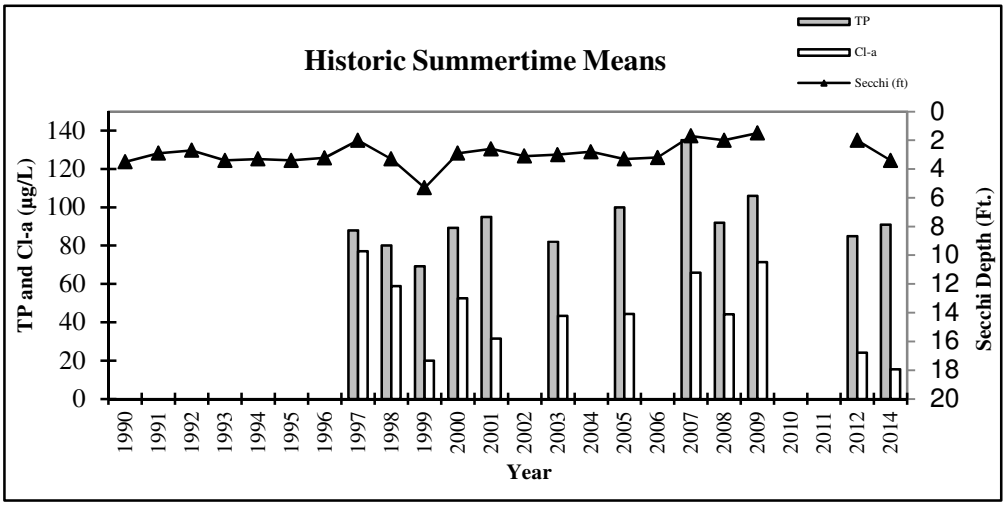
2014 Martin Lake Water Quality Data

Martin Lake			5/15/2014	5/28/2014	6/11/2014	6/25/2014	7/10/2014	7/23/2014	8/6/2014	8/20/2014	9/5/2014	9/16/2014			
2014 Water Quality Data			11:30	11:40	10:45	11:30	11:10	10:55	11:00	14:10	13:10	12:00			
	Units	R.L.*	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Average	Min	Max
pH		0.1	8.15	8.57	7.82	7.73	7.87	8.81	9.19	9.21	8.76	8.80	8.49	7.73	9.21
Conductivity	mS/cm	0.01	0.240	0.248	0.262	0.269	0.279	0.299	0.327	0.335	0.353	0.320	0.293	0.240	0.353
Turbidity	NTU	1	18.70	6.70	0.60	7.30	12.70	33.20	14.20	31.00	52.00	32.30	20.87	0.60	52.00
D.O.	mg/L	0.01	13.53	10.58	7.20	4.59	4.35	10.39	10.62	10.18	8.66	10.57	9.07	4.35	13.53
D.O.	%	1	117%	117%	83%	55%	52%	130%	131%	126%	100%	110%	102%	52%	131%
Temp.	°C	0.1	12.4	20.8	22.0	22.9	23.3	25.5	24.8	24.0	21.6	16.3	21.4	12.4	25.5
Temp.	°F	0.1	54.2	69.5	71.5	73.2	74.0	78.0	76.6	75.2	70.9	61.4	70.4	54.2	78.0
Salinity	%	0.01	0.11	0.12	0.13	0.13	0.13	0.14	0.16	0.16	0.17	0.15	0.14	0.11	0.17
Cl-a	ug/L	0.5	26.7	5.3	1.1	1.1	23.5	24.8	10.3	16.2	27.8	18.2	15.5	1.1	27.8
T.P.	mg/L	0.010	0.102	0.046	0.049	0.055	0.099	0.104	0.064	0.136	0.137	0.118	0.091	0.046	0.137
T.P.	ug/L	10	102	46	49	55	99	104	64	136	137	118	91	46	137
Secchi	ft	0.1	3.0	3.9	5.7	5.3	3.6	3.0	3.5	2.5	1.8	2.1	3.4	1.8	5.7
Secchi	m	0.1	0.9	1.2	1.7	1.6	1.1	0.9	1.1	0.8	0.6	0.6	1.0	0.6	1.7
Physical			1.0	2.0	2.0	1.0	1.0	3.0	3.0	4.0	3.0	3.0	2.3	1.0	4.0
Recreational			1.0	2.0	1.0	2.0	2.0	4.0	3.0	3.0	1.0	3.0	2.2	1.0	4.0

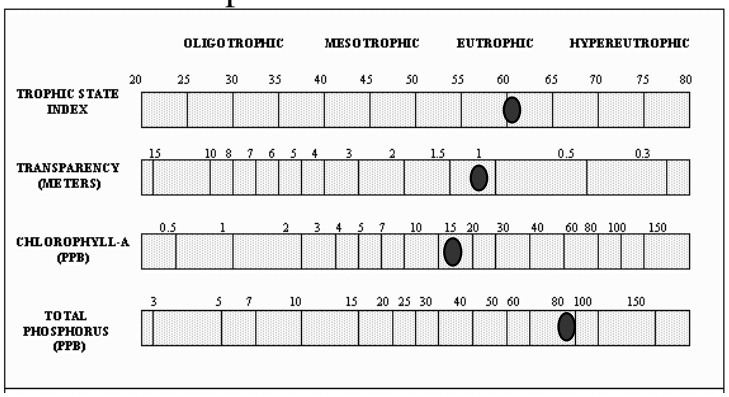
*reporting limit

Martin Lake Water Quality Results





Carlson's Trophic State Index



Martin Lake Summertime Annual Mean

Agency	CLMP	ACD	MC	ACD	ACD	ACD	CLMP	ACD	CLMP	ACD	ACD	ACD	CAMP	CAMP	ACD	ACD
Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2012	2014
TP		88.0	80.0	61.7	89.4	95.4		81.9		100.0		135.0	92.0	106.0	85.0	91.0
Cl-a		77.0	58.8	18.0	52.5	31.4		43.3		44.3		65.8	44.1	71.4	24.1	15.5
Secchi (m)	1.0	0.6	1.0	1.8	0.9	0.8	0.9	0.9	0.9	1.0	1.0	0.5	0.6	0.4	0.6	1.0
Secchi (ft)	3.2	2.0	3.3	5.3	2.9	2.6	3.1	3.0	2.8	3.3	3.2	1.7	2.0	1.5	2.0	3.4

Carlson's Tropic State Indices

TSIP		69	67	64	68	69		68		71		75	69	71	68	69
TSIC		73	71	59	67	63		68		68		72	68	73	62	58
TSIS	60	67	60	52	63	65	65	62	62	60	60	70	67	73	67	60
TSI		70	66	58	66	66		66		66		72	68	72	66	62

Martin Lake Water Quality Report Card

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2012	2014
TP		D	D	C	D	D		D		D		D	D	D	D	D
Cl-a		D	D	B	C	C		C		C		D	C	D	C	B
Secchi	D	F	D	C	D	D	D	D	D	D	D	F	F	F	F	D
Overall		**D**	**D**	**C**	**D**	**D**		**D**		**D**		**D**	**D**	**D**	**D**	**C**

WETLAND HYDROLOGY

Description: Continuous groundwater level monitoring at a wetland boundary, to a depth of 40 inches. County-wide, the ACD maintains a network of 18 wetland hydrology monitoring stations.

Purpose: To provide understanding of wetland hydrology, including the impact of climate and land use. These data aid in delineation of nearby wetlands by documenting hydrologic trends including the timing, frequency, and duration of saturation.

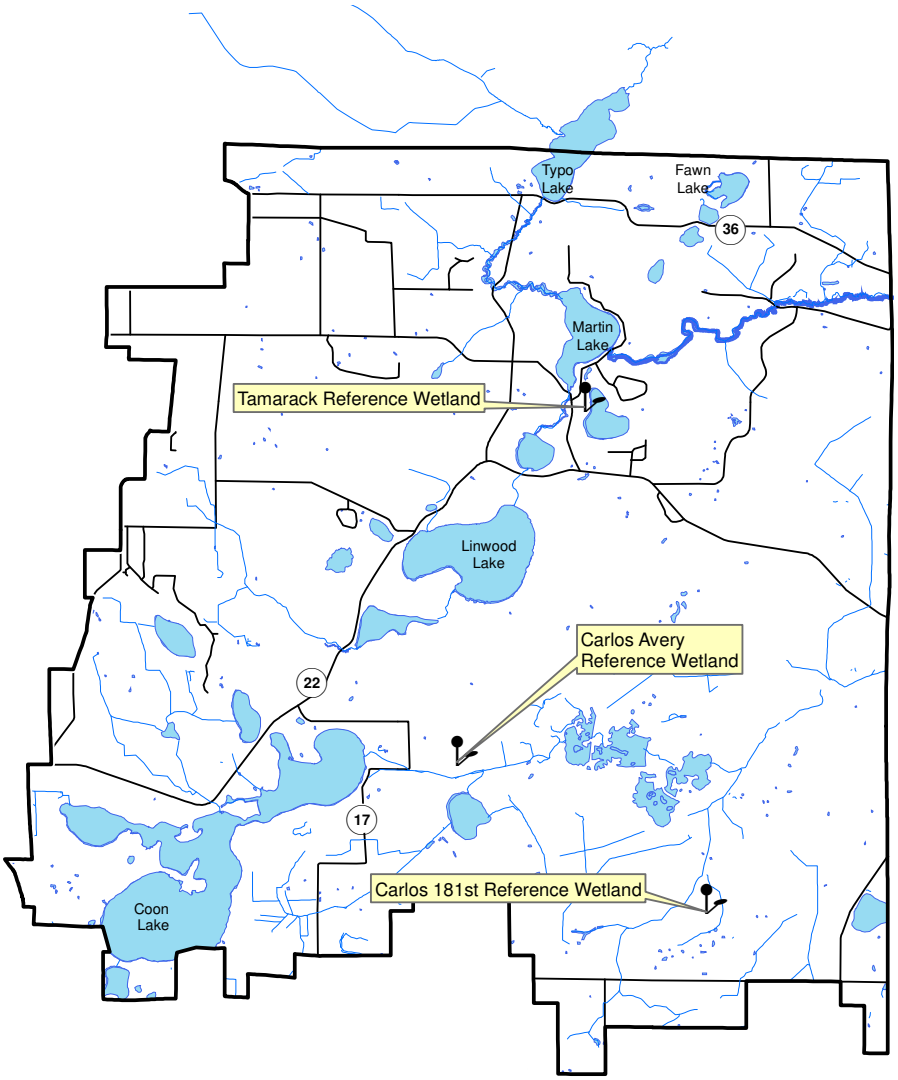
Locations: Carlos Avery Reference Wetland, Carlos Avery Wildlife Management Area, City of Columbus

Carlos 181st Reference Wetland, Carlos Avery Wildlife Management Area, City of Columbus

Tamarack Reference Wetland, Linwood Township

Results: See the following pages. Raw data and updated graphs can be downloaded from www.AnokaNaturalResources.com using the Data Access Tool.

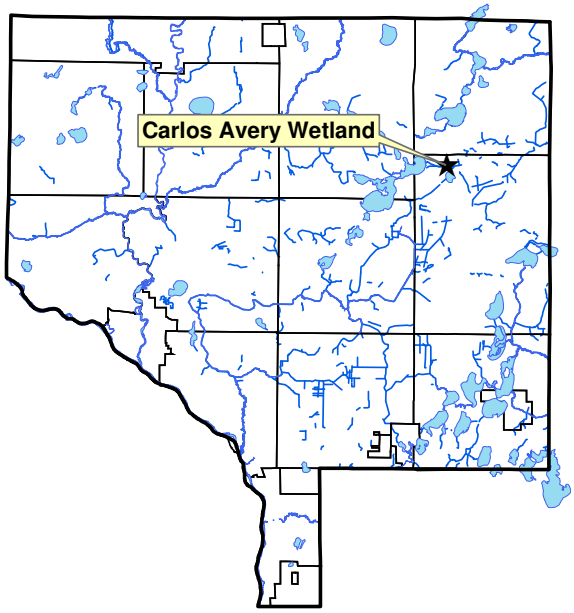
Sunrise Watershed Wetland Hydrology Monitoring Sites



CARLOS AVERY REFERENCE WETLAND

Carlos Avery Wildlife Management Area, City of Columbus

Site Information



Monitored Since: 1997

Wetland Type: 3

Wetland Size: >300 acres

Isolated Basin? No

Connected to a Ditch? Yes

Soils at Well Location:

Horizon	Depth	Color	Texture	Redox
Oa	0-4	N2/0	Organic	-
Bg	4-25	10yr 5/2	Sandy Loam	25% 10yr 5/6 with organic streaking

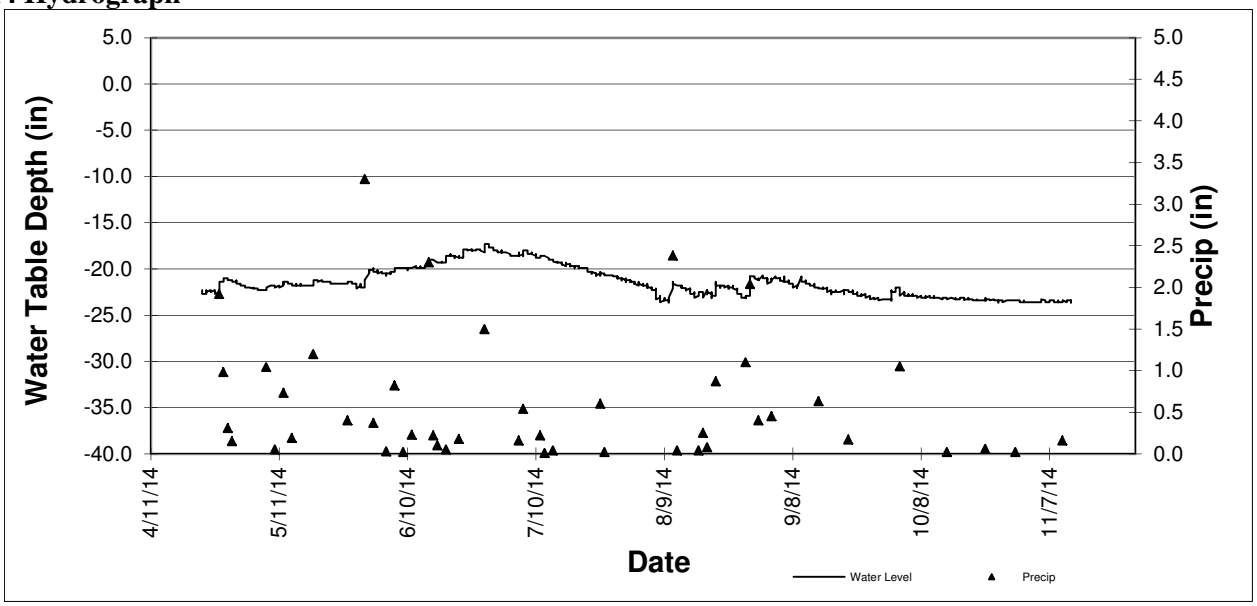
Surrounding Soils: Lino loamy fine sand

Vegetation at Well Location:

Scientific	Common	% Coverage
Phalaris arundinacea	Reed Canary Grass	80
Carex Spp	Sedge undiff.	40
Quercus macrocarpa	Bur Oak	40
Sagitaria latifolia	Broad-leaf Arrowhead	20
Cornus stolonifera	Red-osier Dogwood	20

Other Notes: This is a broad, expansive wetland within a state-owned wildlife management area. Cattails dominate within the wetland.

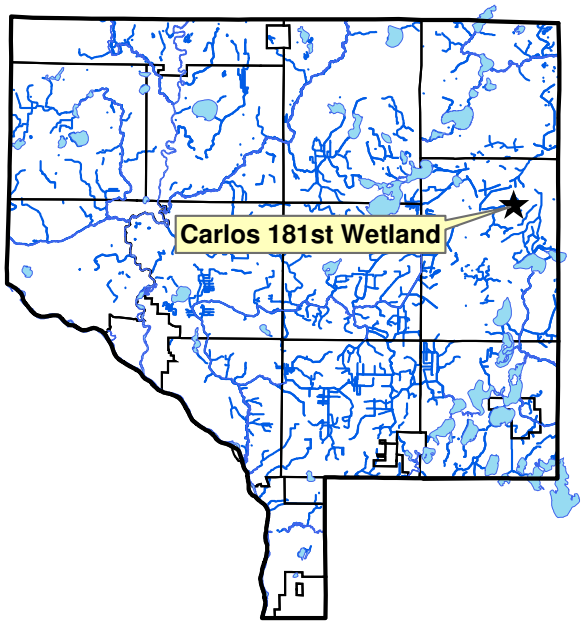
2014 Hydrograph



Well depths were 40 inches, so a reading of –40 indicates water levels were at an unknown depth greater than or equal to 40 inches.

CARLOS 181ST REFERENCE WETLAND

Carlos Avery Wildlife Management Area, City of Columbus



Site Information

Monitored Since: 2006

Wetland Type: 2-3

Wetland Size: 3.9 acres (approx)

Isolated Basin? Yes

Connected to a Ditch? Roadside swale only

Soils at Well Location:

Horizon	Depth	Color	Texture	Redox
Oa	0-3	N2/0	Sapric	-
A	3-10	N2/0	Mucky Fine Sandy Loam	-
Bg1	10-14	10yr 3/1	Fine Sandy Loam	-
Bg2	14-27	5Y 4/3	Fine Sandy Loam	-
Bg3	27-40	5y 4/2	Fine Sandy Loam	-

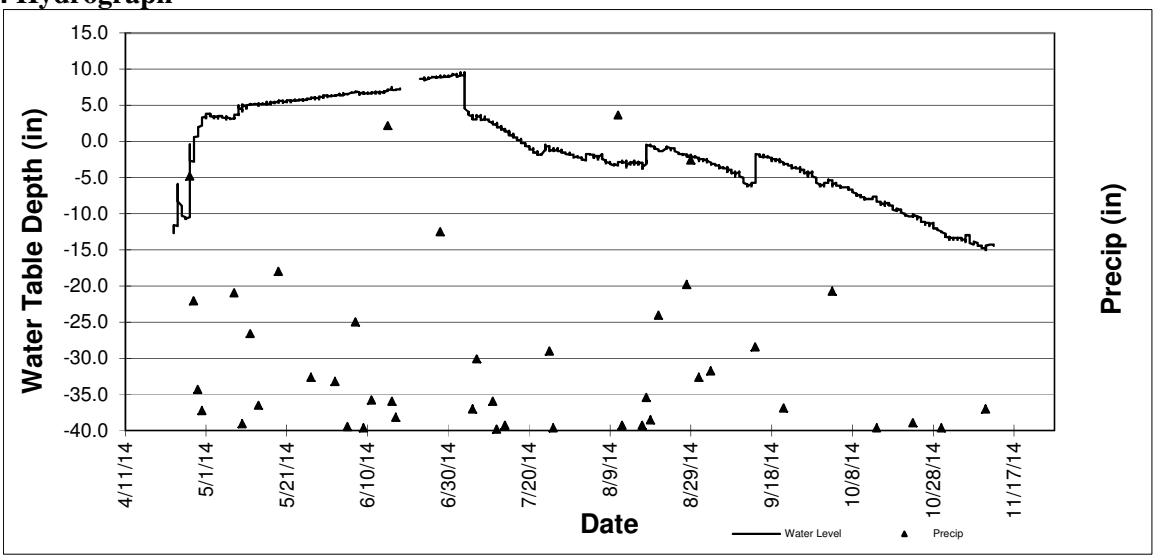
Surrounding Soils: Soderville fine sand

Vegetation at Well Location:

Scientific	Common	% Coverage
Phalaris arundinacea	Reed Canary Grass	100
Rhamnus frangula (S)	Glossy Buckthorn	40
Ulmus american (S)	American Elm	15
Populus tremulodies (T)	Quaking Aspen	10
Acer saccharum (T)	Silver Maple	10

Other Notes: The site is owned and managed by MN DNR. Access is from 181st Avenue.

2014 Hydrograph



Well depths were 40 inches, so a reading of –40 indicates water levels were at an unknown depth greater than or equal to 40 inches.

Wetland Hydrology Monitoring

TAMARACK REFERENCE WETLAND

Martin-Island-Linwood Regional Park, Linwood Township

Site Information

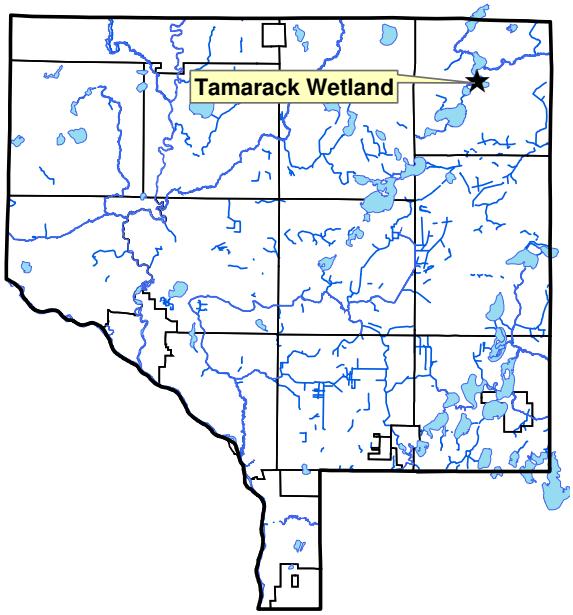
Monitored Since: 1999

Wetland Type: 6

Wetland Size: 1.9 acres (approx)

Isolated Basin? Yes

Connected to a Ditch? No



Soils at Well Location:

Horizon	Depth	Color	Texture	Redox
A	0-6	N2/0	Mucky Sandy Loam	-
A2	6-21	10yr 2/1	Sandy Loam	-
AB	21-29	10yr3/2	Sandy Loam	-
Bg	29-40	2.5y5/3	Medium Sand	-

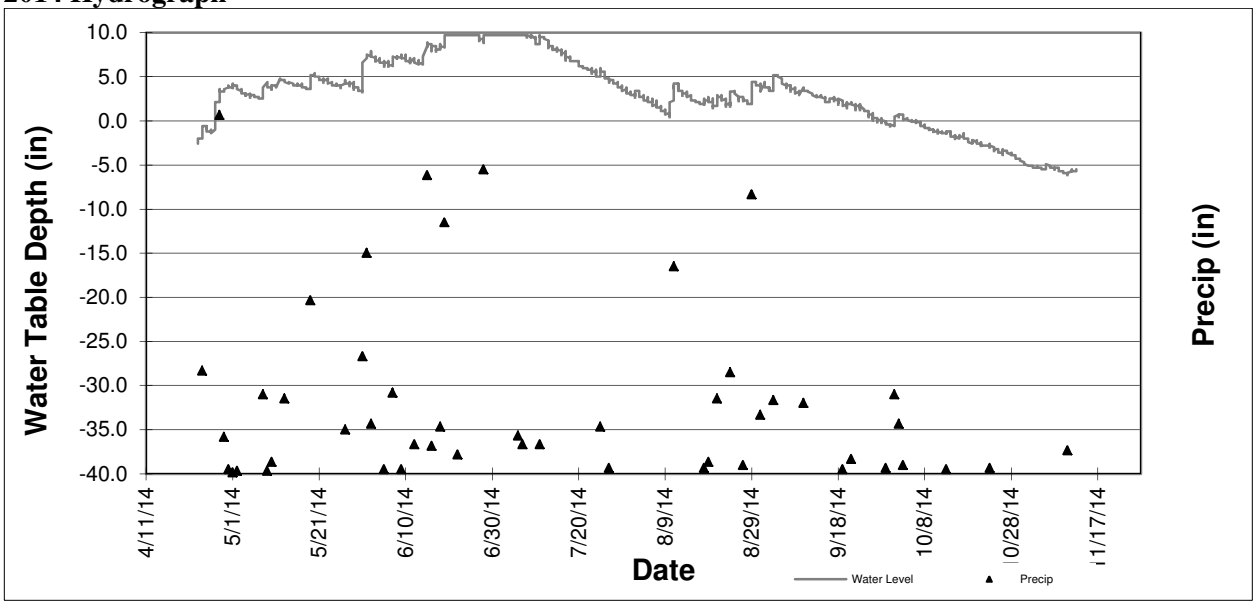
Surrounding Soils: Sartell fine sand

Vegetation at Well Location:

Scientific	Common	% Coverage
Rhamnus frangula	Common Buckthorn	70
Betula alleghaniensis	Yellow Birch	40
Impatiens capensis	Jewelweed	40
Phalaris arundinacea	Reed Canary Grass	40

Other Notes: The site is owned and managed by Anoka County Parks.

2014 Hydrograph



Well depth was 35 inches, so a reading of –35 indicates water levels were at an unknown depth greater than or equal to 35 inches.

Water Quality Grant Fund

Description: The Sunrise River Watershed Management Organization (SRWMO) offers cost share grants encourage projects that will benefit lake and stream water quality. These projects include lakeshore restorations, rain gardens, erosion correction, and others. These grants, administered by the ACD, offer 50-70% cost sharing of the materials needed for a project. The landowner is responsible for the remaining materials expenses, all labor, and any aesthetic components of the project. The ACD assists interested landowners with design, materials acquisition, installation, and maintenance.

Purpose: To improve water quality in area lakes, streams, and rivers.

Locations: Throughout the watershed.

Results: Projects reported in the year they are installed. No projects were installed in 2014.

SRWMO Cost Share Fund Summary

2005 SRWMO Contribution	+	$1,000.00
2006 SRWMO Contribution	+	$1,000.00
2006 Expense - Coon Lake, Rogers Property Project	-	$ 570.57
2007 – no expenses or contributions		$ 0.00
2008 SRWMO Contribution	+	$2,000.00
2008 Expense - Martin Lake, Moos Property Project	-	$1,091.26
2009 SRWMO Contribution	+	$2,000.00
2010 SRWMO Contribution	+	$1,840.00
2011 SRWMO Contribution	+	$2,000.00
2012 SRWMO Contribution	+	$2,000.00
2012 Expense – Linwood Lake, Gustafson Property Project	-	$ 29.43
2012 Expense – Transfer to Martin-Typo Lakes Carp Barriers	-	$4,300.00
2013 – no expenses or contributions		$ 0.00
2014 SRWMO Contribution	+	$2,000.00
Fund Balance		**$7,848.74**

Coon Lake Area Stormwater Retrofit Analysis

Description: A Stormwater Retrofit Analysis is a systematic approach of identifying opportunities for improved stormwater treatment within a subwatershed of a high priority waterbody. Once stormwater retrofit options are identified, they are modeled to determine pollutant removal benefits. Costs for each potential project are estimated. Finally, the cost effectiveness of each project is calculated and projects are ranked accordingly. The final report serves as a guide for installing water quality projects in a cost effective manner.

Purpose: To improve Coon Lake water quality.

Results: The Anoka Conservation District (ACD) was contracted to complete a Stormwater Retrofit Analysis of the Coon Lake subwatershed. ACD performed watershed-wide field reconnaissance and completed GIS analysis. Potential projects have been assembled in a comprehensive list.

This stormwater analysis focuses on "stormwater retrofitting" and ranking projects on cost effectiveness. Stormwater retrofitting refers to adding stormwater treatment to an already built-up area, where little open land exists. This process is investigative and creative. Stormwater retrofitting success is sometimes improperly judged by the number of projects installed or by comparing costs alone. Those approaches neglect to consider how much pollution is removed per dollar spent. In this stormwater analysis we estimated both costs and pollutant reductions and used them to calculate cost effectiveness of each possible project.

Areas that drain to Coon Lake were delineated using available GIS watershed information, maps of stormwater conveyance features (where available), and advanced GIS terrain analysis technologies. Those areas were then divided into 7 smaller stormwater drainage areas, or catchments. For each catchment, modeling of stormwater volume and pollutants was completed using water quality software for urban (WinSLAMM) and rural agrarian (SWAT) landscapes. Base (without any stormwater treatment) and existing (with present day stormwater treatment) conditions were modeled. In total, under existing conditions the subwatershed contributes an estimated 2,455 acre feet (ac-ft) of runoff, 809 pounds of phosphorus, and 81 tons of suspended solids each year.

Potential stormwater retrofits identified during this analysis were modeled to estimate reductions in volume, total phosphorus (TP), and total suspended solids (TSS). Finally, cost estimates were developed for each retrofit project, including up to 30 years of operations and maintenance. Projects were ranked by cost effectiveness with respect to their reduction of TP.

A variety of stormwater retrofit approaches were identified. They include:

- Maintenance of, or alterations to, existing stormwater treatment practices,
- Residential curb-cut rain gardens,
- Lakeshore restorations,
- Stabilization of erosion sites, and
- Stormwater redirection.

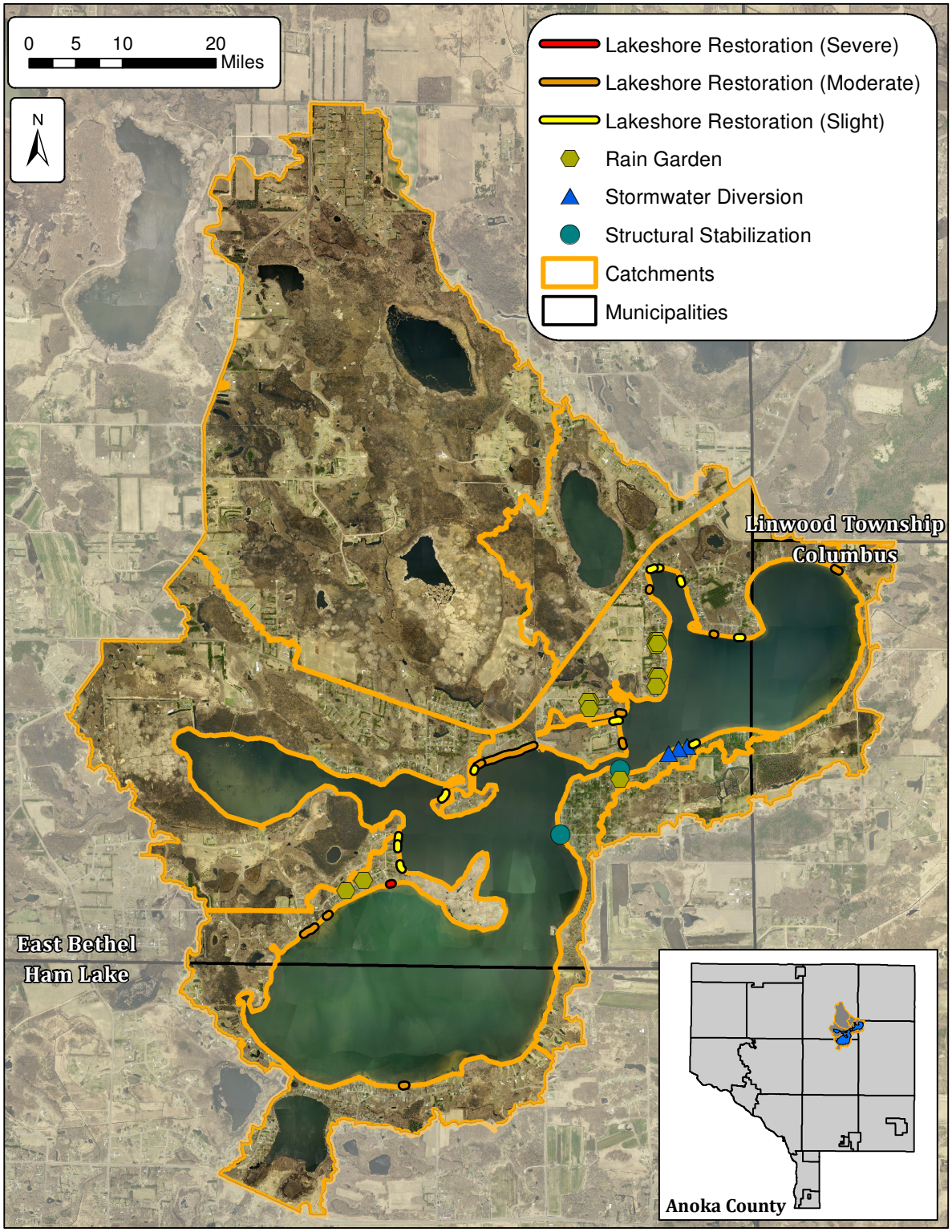
This report provides conceptual sketches or photos of recommended stormwater retrofitting projects. The intent is to provide an understanding of the approach. If a project is selected, site-specific designs must be prepared. In addition, many of the proposed retrofits will require engineered plan sets if selected. This typically occurs after

committed partnerships are formed to install the project. Committed partnerships must include willing landowners when installed on private property.

The tables on the next pages summarize 30 potential projects organized from most cost effective to least, based on cost per pound of TP removed. If all of these practices were installed, pollutant loading to Coon Lake could be reduced by 25.3 lbs of TP and 12.8 tons of TSS. The 25.3 lbs-TP reduction could potentially reduce algal growth in the lake by 6.3 tons (assuming 1 lb phosphorus = 500 lbs algae). Reported treatment levels are dependent upon optimal site selection and sizing. More detail about each project can be found in the Catchment Profile pages of this report. Projects that were deemed unfeasible due to prohibitive size, number, or were too expensive to justify installation are not included in this report.

Installing all of these projects is unlikely due to funding limitations and landowner interest. Instead, it is recommended that projects be installed in order of cost effectiveness (pounds of pollution reduced per dollar spent). Other factors, including a project's educational value, visibility, construction timing, total cost, or non-target pollutant reduction also affect project installation decisions and will need to be weighed by resource managers when selecting projects to pursue.

EXAMPLE OF PROPOSED STORMWATER RETROFITS IN THE COON LAKE SUBWATERSHED



Summary of preferred stormwater retrofit opportunities ranked by cost-effectiveness with respect to total phosphorus (TP) reduction. TSS and volume reductions are also shown. For more information on each project refer to the catchment profile pages in this report.

Project Rank	Retrofit Type (refer to catchment profile pages for additional detail)	Catchment	Projects Identified	TP Reduction (lb/yr)	TSS Reduction (lb/yr)	Volume Reduction (ac-ft/yr)	Probable Project Cost (2014 Dollars)	Estimated Annual Operations & Maintenance (2014 Dollars)	Estimated cost/ lb-TP/year (30-year)
1	Lakeshore Restoration LR-87	CL-5	1	2.6	3,683	0.1	$14,180	$122	$232
2	Lakeshore Restoration LR-28	CL-4	1	1.0	1,440	0.1	$8,105	$81	$351
3	Lakeshore Restoration LR-63	CL-4	1	1.2	1,542	0.2	$15,155	$222	$606
4	Lakeshore Restoration LR-39	CL-4	1	0.7	941	0.1	$10,555	$78	$614
5	Lakeshore Restoration LR-50	CL-4	1	0.8	941	0.1	$11,780	$155	$684
6	Lakeshore Restoration LR-95	CL-5	1	1.9	2,204	0.4	$29,705	$513	$791
7	Lakeshore Restoration LR-103	CL-5	1	0.6	774	0.1	$11,330	$146	$872
8	Lakeshore Restoration LR-61	CL-4	1	0.9	1,093	0.1	$14,625	$176	$887
9	Residential Rain Gardens	CL-4	1, 2, 4	0.6-1.9	190-592	0.4-1.4	$10,110-$34,600	$225-$900	$936-$1,081
10	King Road Stormwater Diversion	CL-6	1	0.9	290	0.7	$14,490	$365	$942
11	Laurel Road Stormwater Diversion	CL-6	1	0.9	295	0.7	$14,490	$365	$942
12	Lakeshore Restoration LR-62	CL-4	1	3.1	3,831	0.5	$64,055	$900	$979
13	Lakeshore Restoration LR-19	CL-7	1	0.6	762	0.1	$13,130	$182	$1,032
14	Maple Road Stormwater Diversion	CL-6	1	0.8	240	0.6	$14,490	$365	$1,060
15	Forest Road Boat Launch Structural Stablization	CL-6	1	0.4	550	0.0	$10,925	$75	$1,098

* Pollution reduction benefits and costs cannot be summed with other projects in the same catchment because they are alternative options for treating the same source area.

Carp Barriers Installation

Description: This project will improve water quality in Martin and Typo Lakes by controlling carp with strategically placed barriers and increased commercial harvests. Both lakes fail to meet state water quality standards due to excessive phosphorus which fuels algae blooms. As a result, the lakes are often strongly green or brown and the game fishery is depressed. Carp are a major cause of poor water quality in these lakes, diminishing their value for swimming, boating, and fishing.

Barriers are an effective strategy for carp control because Typo and Martin Lake each provide something important for carp, and moving between the lakes is important to their success. Martin Lake is deeper, and good for overwintering. Typo Lake and Typo Creek are shallow and good for spawning. Stopping migrations between the lakes with barriers will reduce overwintering survival and spawning success. Even more, barriers will allow successful commercial carp harvests.

Purpose: To improve water quality.

Results: In 2014 the SRWMO installed one carp barrier in the Martin and Typo Lake system with the approved financing and planning for three additional barriers to be installed in 2015.

During and completed installation of first barrier.

Lakeshore Landscaping Education

Description: One goal of the Sunrise River WMO is to encourage and facilitate lakeshore restorations with native plants. These projects, usually accomplished by homeowners with assistance from agencies like the SRWMO, are beneficial to overall lake health. By planting native plants at the shoreline runoff into the lake is filtered, and fish and wildlife habitat is substantially improved. To move toward its goal, the SRWMO does regular education and marketing of lakeshore restorations to homeowners.

Purpose: To improve lake water quality and lake health.

Results:

SRWMO 2014 press release, which was published in member city newsletters:

Lessons in Landscaping: The Water's Edge

When Jean and Mike Bury purchased a home on Coon Lake in 1975, their 105 feet of shoreline had a few trees. The rest was turf grass. "We spent a multitude of hours mowing to the water's edge, removing the weeds and raking the sand," explained Jean. In the years since, they've turned that blank canvas into art that seems to be equally appreciated by fellow lakeshore owners, Coon Lake visitors, and local wildlife like frogs, ducks and fish.

"In the 90's we read an article in the Star Tribune about the City of Minneapolis park system implementing several projects around the lakes and creeks, restoring them with natural vegetation and the environmental benefits in doing so," recalls Jean. "We set a goal to naturalize 80 feet of our shoreline and leave 25 feet sandy for our dock and recreation space."

The Bury's created outdoor rooms of landscaping, carpeted with turf grass but framed by warm natural areas. Their gardens have clear limits and are tidy around the edges. Farther from the edges, the gardens have a more natural appearance with tall, fountain-like grasses and colorful wildflowers. Particularly at the lakeshore, there are an abundance of native plants. Planting in groupings and curving borders ensure it is much more attractive than a simple strip along the lakeshore.

Also on Coon Lake, fellow gardener Michelle Rogers has been meeting the challenges of lakeshore landscaping with her own creative flair. In 2006 her lakeshore was turf grass too, with a two foot wide strip left unmowed at the water's edge. It stood in contrast to her flower-lined driveway that burst with color and character.

"We put together a plan to restore our lakeshore," said Rogers. "We picked a palate of mostly native plants that were adapted for either the wetter soils near the water or the drier areas higher in the yard. These are the plants to which wildlife is most adapted. We even added some logs half in the water, half out. We get tons of turtles sunning on them."

Rogers created a more formal look around the edges using flagstone borders. A path leads to the dock.

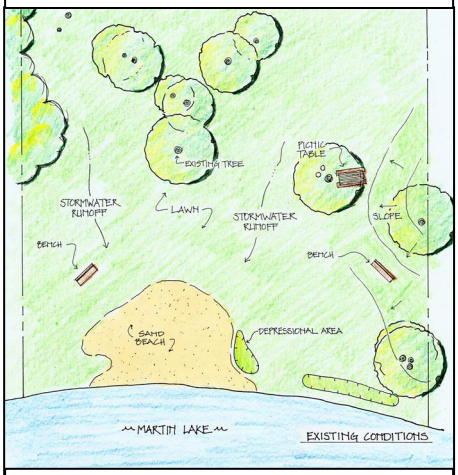
Both homeowners say a big part of the plan was to help Coon Lake. The shoreline is important for water quality, wildlife and fish. Native plants, unlike turf, help on all fronts.

Native plants grow densely to create a filter, or buffer, for any runoff before it reaches the lake. They also have deep root systems that hold the soil, protecting it from wave action. Before their shoreline restoration, the Bury's had experienced shoreline erosion.

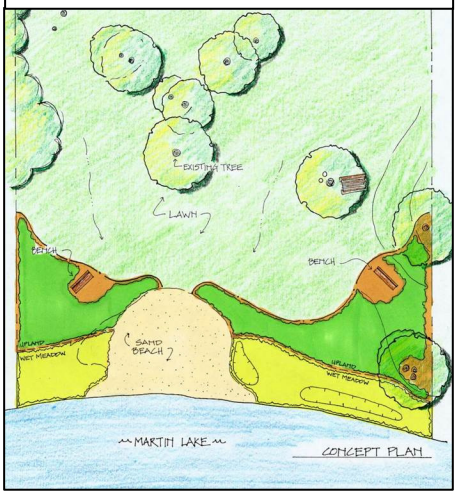
"One downside of turf grass is that its root system is only about 2 inches deep," says Jamie Schurbon, Water Resource Specialist at the Anoka Conservation District. "If it's all you've got at the water's edge, the bank is susceptible to erosion and undercutting. No one wants to watch their lakeshore wash away. And we don't want that sediment in the lake. Many native plants have root systems that grow more than five feet deep."

Some of the Roger's plantings were actually in the water, with plants like three-stem bulrush that are good fish habitat. "As any fisherman knows, aquatic plants are key fish habitat," notes Schurbon.

Typical mowed lakeshore



Lakeshore with native gardens.



The Bury's took a different approach for plants in the water. "We allowed some cattail in and through the years other native plant species like arrowhead started to grow in the water," adds Jean Bury. They were still able to maintain ample area for the dock and other active use.

Fish aren't the only wildlife. "Many of the plants attract butterflies and dragonflies. We put up bluebird, wood duck and martin houses, which are inhabited most years. We feel we have a science lab on our shoreline for our grandchildren, as we watch tadpoles develop, and explore all the wonders of the ecosystem a natural site offers, said Bury."

"I see lots of butterflies, bees, green herons, hummingbirds and other wildlife," says Rogers. "One typical evening my husband and I were sitting on the dock and watched a muskrat quietly nibble off mountain mint shoots, stack them neatly, and then swim away with them."

This harmonious scene is a far cry from the frustrating, endless battle that many lakeshore homeowners wage against muskrats who dig burrows that damage lawns and create uneven turf for their mower. When you aren't mowing at the water's edge, muskrat activity is no big deal.

Bury also notes another benefit of naturalizing the shoreline: fewer geese. "Geese are uncomfortable in and around taller vegetation because it makes it more difficult for them to see approaching predators, and does not give them a clear line of sight to the water," informs Schurbon.

Perhaps the most important selling point for native gardens that these homeowners can tout is that it looks great. "The textures of the naturalization project and other plantings reward us with year round visual interest," says Bury. "We frequently have neighbors, garden clubs and boats pulling up to our dock in the summer to view the gardens. We always inform people that it does not have to be as grand of scale as we designed ours; a smaller buffer zone on their shoreline still benefits the lake and wildlife greatly." Rogers agrees, "It's spreading."

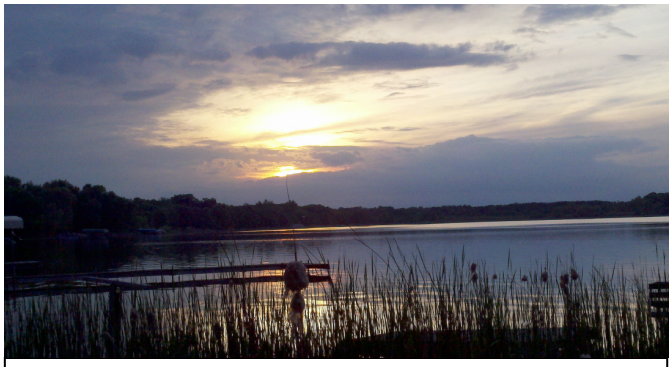
Locally, the Sunrise River Watershed Management Organization offers grants to partially pay for these projects that benefit the lake. Applications are accepted through the Anoka Conservation District, which also provides free on-site consultations and can guide homeowners through the design and budgeting process.

For more information, the "Blue Thumb – Planting for Clean Water" program is a good resource. Their website includes an interactive native plant selector tool. Input your sunlight conditions, moisture, color and even level of care to produce a custom list.

Landowners should note that permits are required from the DNR for any project below the ordinary high water mark, which is the highest level the water has been for a sufficient period of time to leave evidence on the landscape. It is often higher than most homeowners expect.

The Anoka Conservation District can be reached at 763-434-2030.

Lakeshore restoration at the Rogers Residence. Coon Lake.



Evening view over Coon Lake at the Bury residence.

Blue Thumb membership – Blue Thumb is a consortium of Minnesota agencies, plant nurseries, landscapers, and others who share resources in their efforts to promote the use of native plants to improve water quality through shoreline stabilizations, rain gardens, and native plant gardens. Resources that are shared amongst Blue Thumb members include pre-fab marketing materials, displays, how-to manuals, and others. The ACD enrolled the SRWMO in Blue Thumb and performed all necessary administration to maintain the membership and renew it in 2014.

The ACD manages the SRWMO's Blue Thumb membership by submitting annual membership applications and tracking SRWMO contributions. Maintaining a Blue Thumb membership requires an annual contribution of either $1,500 cash or 30 hours of efforts. The SRWMO chooses to meet this requirement by incorporating Blue Thumb into a variety of tasks that are already planned and benefit from Blue Thumb (including those listed above). In 2014 the SRWMO exceeded the 30 hour commitment with the following work:

- Postcard with information on grant availability
- Presentations at Linwood Family Fun Day, East Bethel Booster Days, and Columbus Arbor Day
- Grant applications for potential projects.
- Martin Lake rain garden maintenance.

Annual Education Publication

Description: An annual newsletter article about the SRWMO is required by MN Rules 8410.010 subpart 4, and planned in the SRWMO Watershed Management Plan.

Purpose: To improve citizen awareness of the SRWMO, its programs, and accomplishments.

Results: In 2014 the SRWMO contracted with the ACD to write the annual newsletter and provide it to member communities for distribution in their newsletters. Topics for annual newsletter were discussed by the SRWMO Board, wetland Protection was chosen.

Limited space in city newsletters was recognized as an issue. A poem was written and submitted to catch the reader's attention and best utilize the limited space available. It was provided to member cities for their city newsletters in June.

Mosquito Retaliation
I hate mosquitoes
With all of my heart
Buzzing and biting
Living, sucking darts
Squished ones are left on me
As bloody body art
An omen to others
To quickly depart

But yet they persist
I must give them credit
We've drained half their wetlands
If that's a hint, they don't get it
They mount up on wings
With sick humor and wit
And bite me in places
I hate to admit

They're settling the score
Retaliation – here's why
For the wetlands we've mowed, filled
Or drained completely dry
They're enlisting their friends
Like the loathsome black fly
And signing up birds
To drop bombs from the sky

Surrender - I'll never!
Mosquitoes deserve no respect
But wetlands are worthy
And useful to protect
They clean the water for free
That often we've wrecked
Are home to more good critters
Than you'd ever suspect
So please don't dig, drain or fill them
As the law does expect

This is a message from the Sunrise River Watershed Management Organization.
www.SRWMO.org
Wetlands are critical habitat for desirable wildlife, filter water before it gets to our lakes and rivers, and help prevent flooding.
Please respect the laws that prohibit filling, draining, or excavating in them. Unmowed buffers at the edge of wetlands are especially valuable.

SRWMO Website

Description: The Sunrise River Watershed Management Organization (SRWMO) contracted the Anoka Conservation District (ACD) to design and maintain a website about the SRWMO and the Sunrise River watershed.

Purpose: To increase awareness of the SRWMO and its programs. The website also provides tools and information that helps users better understand water resources issues in the area. The website serves as the SRWMO's alternative to a state-mandated newsletter.

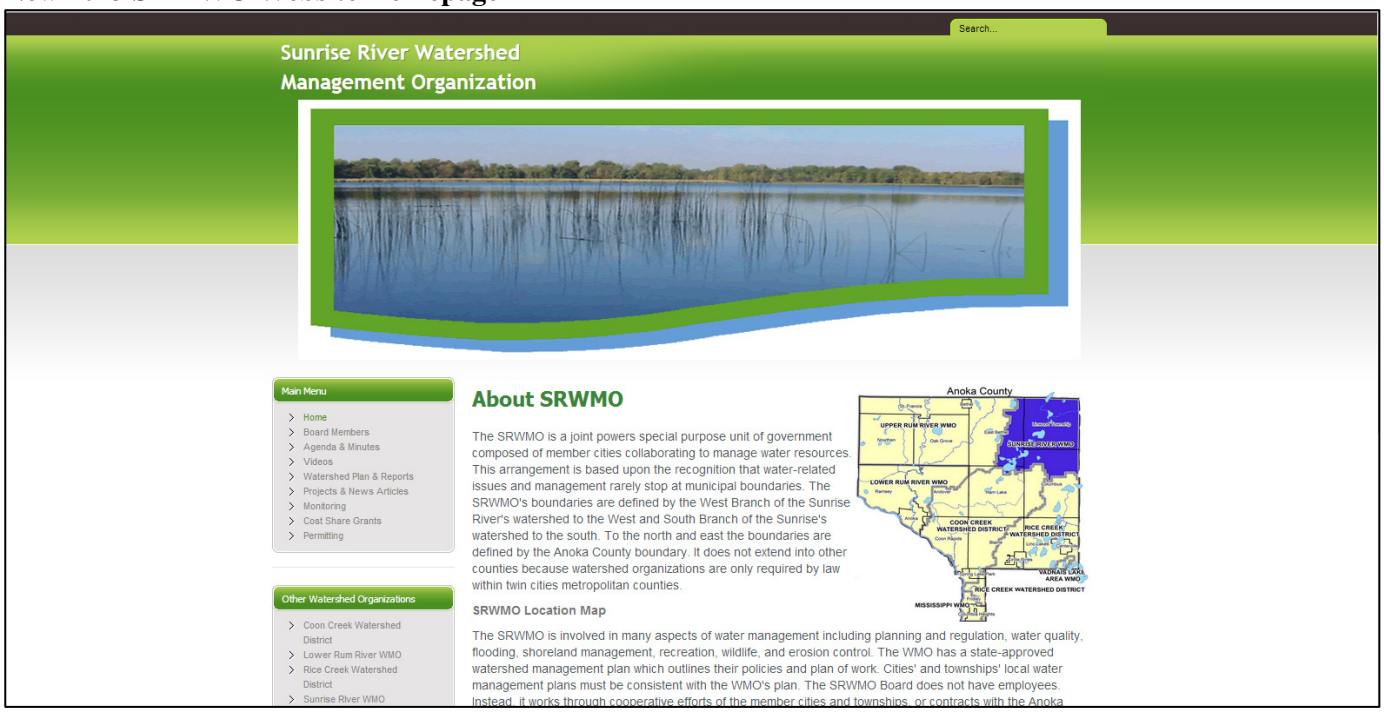
Location: www.SRWMO.org

Results: In 2013 the upgraded, redesigned, and re-launched the SRWMO website. These updates were necessary because the old website platform was incompatible with certain tablet computers and smartphones. Additionally, the old website was hosted with in the ACD website, while the new website is completely independent, offering the WMO future management choices.

Regular website updates also occurred throughout the year. The SRWMO website contains information about both the SRWMO and about natural resources in the area.
Information about the SRWMO includes:

- a directory of board members,
- meeting minutes and agendas,
- the watershed management plan and information about- plan updates,
- descriptions of work that the organization is directing,
- highlighted projects.

New 2013 SRMWO Website Homepage



Grant Searches and Applications

Description: The Anoka Conservation District (ACD) assisted the SRWMO with the preparation of grant applications. Several projects in the SRWMO Watershed Management Plan need outside funding in order to be accomplished.

Purpose: To provide funding for high priority local projects that benefit water resources.

RESULTS:

BWSR Clean Water Fund Grant Application

$73,824 grant request
$18,456 match
Outcome of application will be known January 30, 2015.

Title: Ditch 20 Wetland Restoration Feasibility Study to Benefit Downstream Water Quality

Abstract

This feasibility study will produce strategies for wetland restoration and ditch hydrology changes that improve water quality in Typo and Martin Lakes, the Sunrise River and St. Croix River. Our focus is County Ditch 20 (aka Data Cr), which drains >500 acres of wetland. 1849 land surveys show the area as "tamarack swamp." But by 1938 there were no trees, active haying and a network of ditches. Downstream waterbodies were declining. Recently, TMDL studies have found that these ditched wetlands export large amounts of phosphorus and solids.

This project is unique because it targets a pollutant source that is often overlooked but common – ditched wetlands. The Ditch 20 subwatershed has seemingly benign land uses. Yet during storms its phosphorus concentrations were 70% higher than that of neighboring Ditch 13 which is mostly agricultural. As a result, the local watershed plan and TMDLs noted this as a key area for pollutant reduction.

Mechanisms of phosphorus export from ditch 20 were studied over 6 years. Multiple mechanisms are at work, including aerobic decomposition of peat soils, periodic re-wetting, effective drainage of soil water and bank sloughing. These mechanisms can be managed through lateral ditch blocks, water level manipulation, settling basins or other measures.

A feasibility study is needed before construction. We'll use surveying, terrain analysis and hydrologic/hydraulic modeling to evaluate the scope and effects of potential projects. We'll involve landowners early. We'll evaluate the cost/benefit ratio of each project by consolidating primary literature knowledge and applying it, because pollutant models or calculators are not available for this type of project. Finally, we'll prepare designs.

We anticipate designed projects can be installed within 1-3 years after study completion. The watershed management organization plans to budget sufficient funds to match installation grants.

SRWMO 2013 Annual Report to BWSR and State Auditor

Description: The Sunrise River Watershed Management Organization (SRWMO) is required by law to submit an annual report to the Minnesota Board of Water and Soil Resources (BWSR), the state agency with oversight authorities. This report consists of an up-to-date listing of SRWMO Board members, activities related to implementing the SRWMO Watershed Management Plan, the status of municipal water plans, financial summaries, and other work results. The SRWMO bolsters the content of this report beyond the statutory requirements so that it also serves as a comprehensive annual report to SRWMO member communities. The report is due annually 120 days after the end of the SRWMO's fiscal year (April 30th).

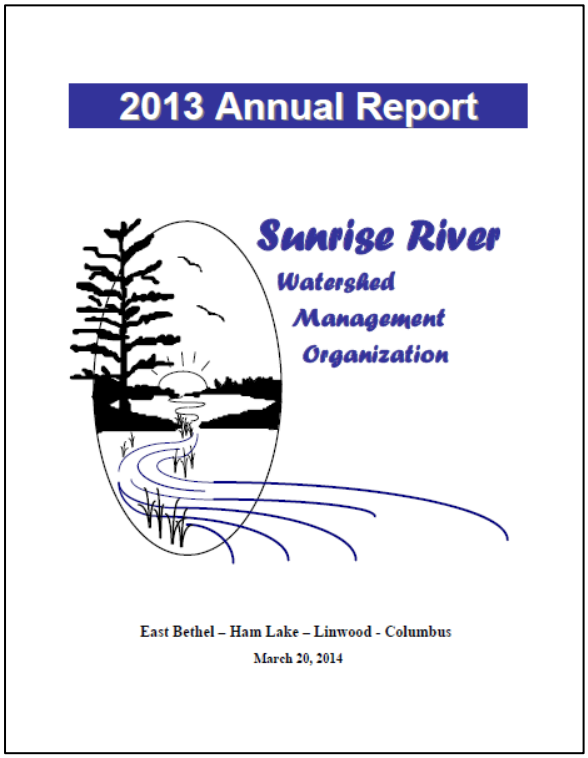
The SRWMO must also submit an annual financial report to the State Auditor. They accept unaudited financial reports for financial districts with annual revenues less than $185,000.

Purpose: To document progress toward implementing the SRWMO Watershed Management Plan and to provide transparency of government operations.

Locations: Watershed-wide

Results: Anoka Conservation District (ACD) assisted the SRWMO with preparation of a 2013 Sunrise River WMO Annual Report. ACD drafted the report and a cover letter. After SRWMO Board review the final draft was forwarded to BWSR in spring of 2014. A sufficient number of copies of the report were sent to each member community to ensure that each city council person and town board member would receive a copy. The report is available to the public on the SRWMO website.

Cover


2013 Annual Report

Sunrise River Watershed Management Organization

East Bethel – Ham Lake – Linwood - Columbus

March 20, 2014

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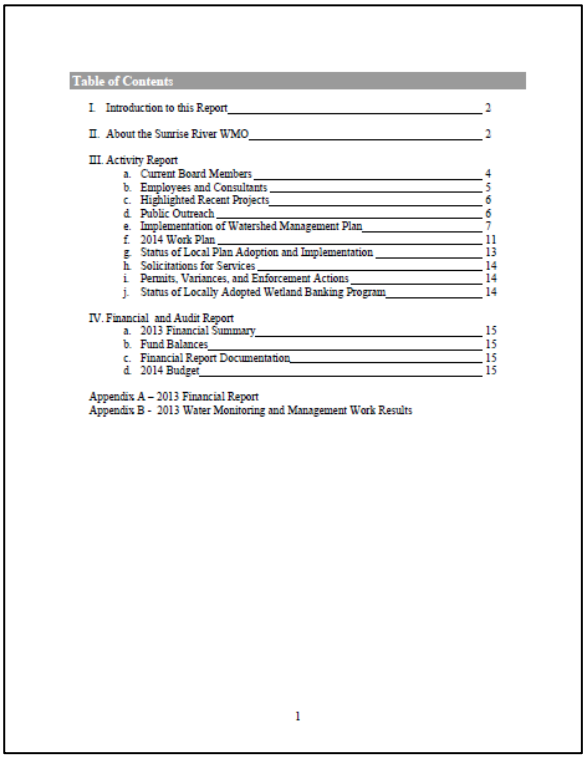
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On-call Administrative Services

Description: The Anoka Conservation District Water Resource Specialist provides limited, on-call administrative assistance to the SRWMO. Tasks are limited to those defined in a contractual agreement.

Purpose: To ensure day-to-day operations of the SRWMO are attended to between regular meetings.

Results: In 2014 a total of 24.0 hours of administrative assistance have occurred as of December 31.

The following tasks were accomplished:

- 2015 budget preparation and related questions from cities.
- 2016 draft budget preparation.
- Occasional inquiries from contractors and developers about any SRWMO permitting requirements.
- SRWMO Blue Thumb annual reporting.
- Advise the board regarding proposed revisions to MN Rules 8410 and assist in preparing an official WMO comment.
- Provide Linwood Twp with content for their website about the SRWMO, per their request.
- Notices to reschedule August mtg.
- Prepare agenda, packet, minutes for Sept meeting in the recording secretary's absence.

Financial Summary

ACD accounting is organized by program and not by customer. This allows us to track all of the labor, materials and overhead expenses for a program. We do not, however, know specifically which expenses are attributed to monitoring which sites. To enable reporting of expenses for monitoring conducted in a specific watershed, we divide the total program cost by the number of sites monitored to determine an annual cost per site. We then multiply the cost per site by the number of sites monitored for a customer.

Sunrise River Watershed Financial Summary

Sunrise River Watershed	WMO Asst (no charge)	Volunteer Precipitation	Reference Wetlands	DNR Observation Wells	Lake Levels	Lake Water Quality	WMO Admin	WMO Grant Search	SRWMO Outreach/Promo	Website Management	Martin/Typo Carp Bariers	Buckthorn Clean Sweep	Coon Lake Retrofits - CWF	Sunrise River WRAPP	Coon Lake Retrofit Analysis	Total
Revenues																
SRWMO	0	0	1725	0	1250	6400	2850	1000	1157	480	0	0	0	0	6944	21806
State	0	0	0	240	0	0	0	0	0	0	73803	1434	0	0	0	75476
Anoka Conservation District	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anoka Co. General Services	586	0	0	154	0	0	0	112	0	0	9164	1475	7574	0	4104	23170
County Ag Preserves	0	0	0	0	0	646	0	0	0	0	0	0	0	0	0	646
Regional/Local	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Service Fees	0	0	0	0	0	0	0	0	0	0	2500	0	0	1238	0	3738
BWSR Cons Delivery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BWSR Cost Share TA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Local Water Planning	0	395	241	0	0	0	455	355	0	14	0	0	0	0	0	1460
TOTAL	586	395	1966	394	1250	7046	3305	1467	1157	494	85467	2909	7574	1238	11048	126295
Expenses-																
Capital Outlay/Equip	13	9	42	9	24	116	53	32	11	9	245	63	166	27	243	1060
Personnel Salaries/Benefits	505	341	1633	339	956	4548	2064	1264	422	337	9588	2468	6520	1066	9517	41567
Overhead	34	23	110	23	64	306	139	85	28	23	644	166	438	72	639	2793
Employee Training	4	2	12	2	7	33	15	9	3	2	70	18	47	8	69	302
Vehicle/Mileage	9	6	29	6	17	81	37	22	7	6	170	44	116	19	169	738
Rent	22	15	71	15	41	196	89	55	18	15	414	107	282	46	411	1796
Program Participants	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Program Supplies	0	0	59	0	4	1767	0	0	0	0	74336	43	5	0	0	76214
McKay Expenses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	586	395	1956	394	1113	7046	2396	1467	489	391	85467	2909	7574	1238	11048	124470

Recommendations

- **Install stormwater retrofits around Coon Lake.** A stormwater assessment is being completed. It identifies and ranks stormwater retrofit projects that will benefit lake water quality. A state grant has been secured.
- **Continue efforts to secure grants.** A number of water quality improvement projects are being identified. Outside funding will be necessary for installation of most of these. These projects should be highly competitive for those grants.
- **Bolster lakeshore landscaping education efforts.** The SRWMO Watershed Management Plan sets a goal of 3 lakeshore restorations per year. Few are occurring. Fresh approaches should be welcomed.
- **Increase the use of web videos as an effective education and reporting tool.**
- **Continue the SRWMO cost share grant program** to encourage water quality projects.
- **Encourage communities to report water quality projects to the SRWMO.** An overarching goal in the SRWMO Plan is to reduce phosphorus by 20% (986 lbs). State oversight agencies will evaluate efforts toward this goal. Both WMO and municipal project benefits should be counted.