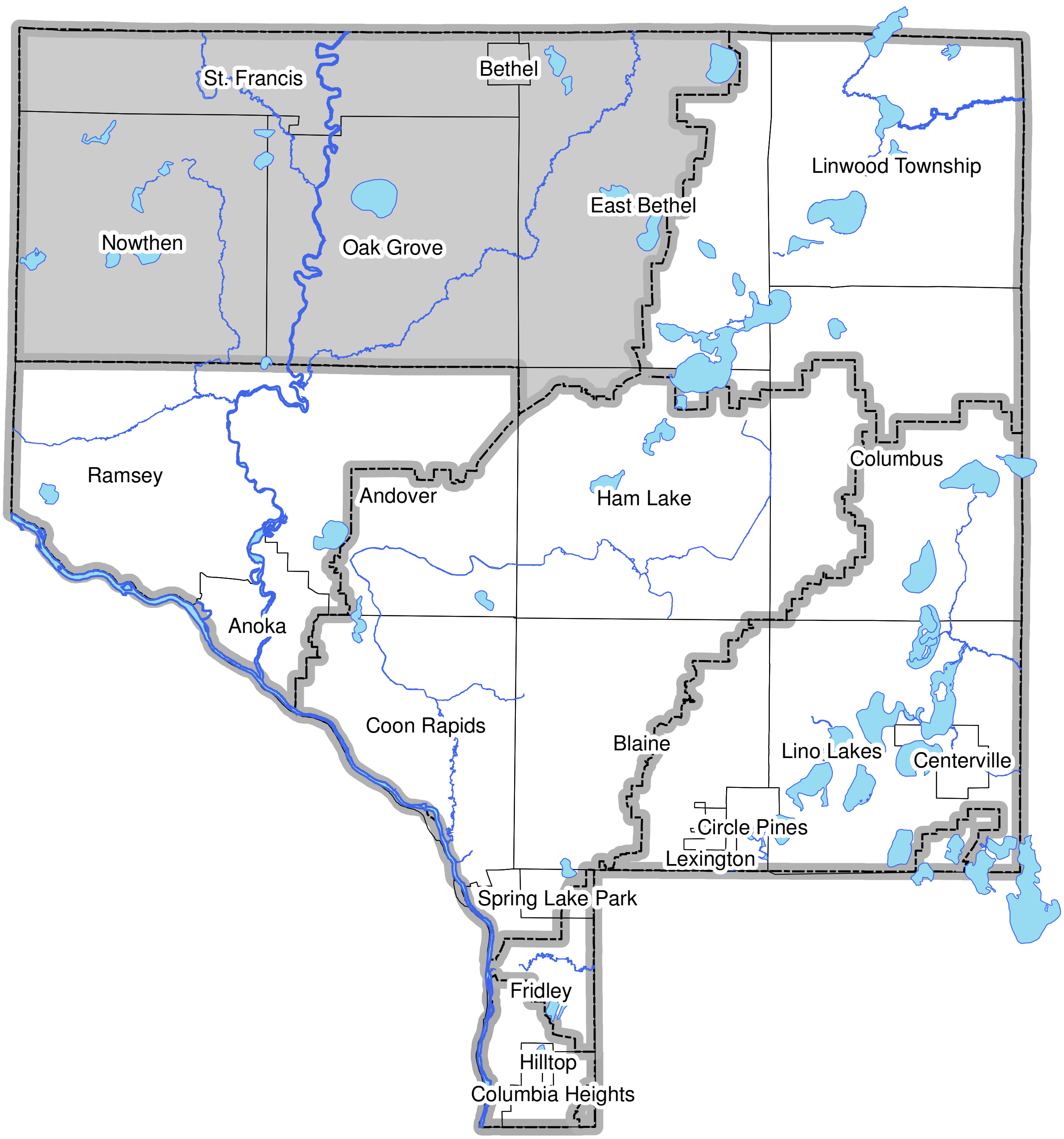
Excerpt from the
2017 Anoka Water Almanac

Chapter 3: Upper Rum River Watershed



Prepared by the Anoka Conservation District

CHAPTER 3: UPPER RUM RIVER WATERSHED

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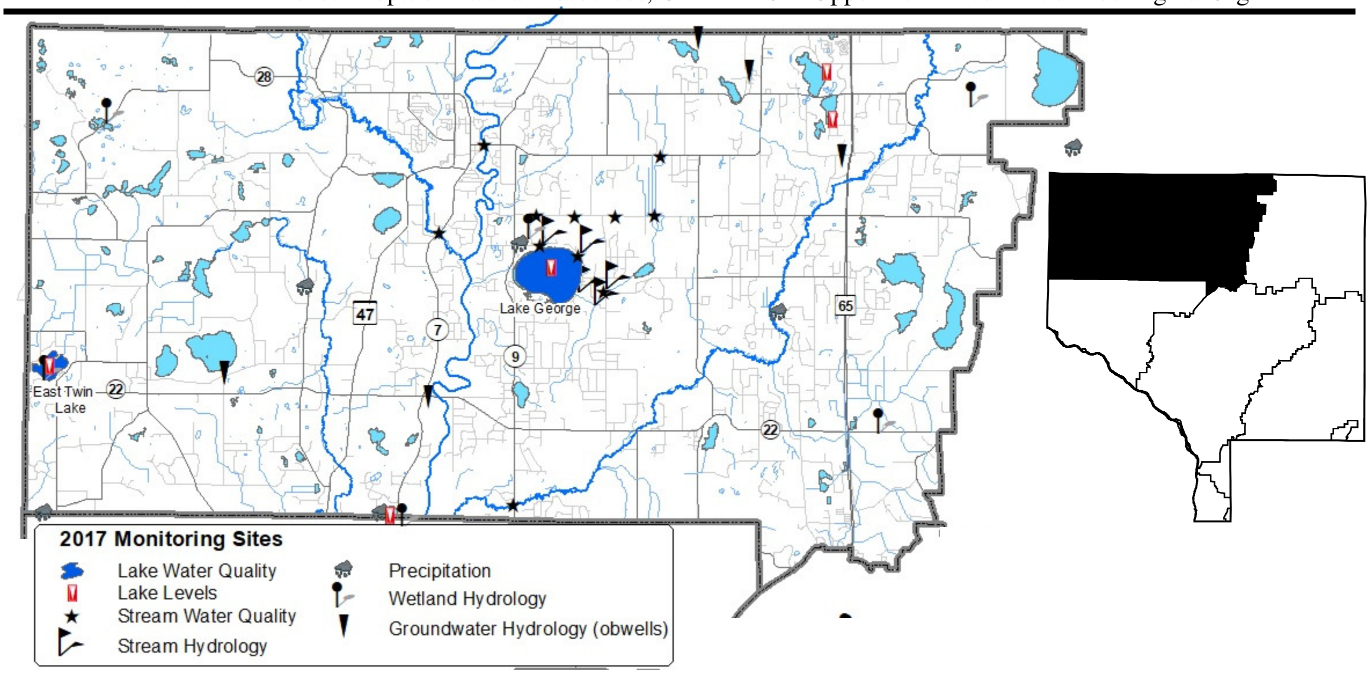
ACAP = Anoka County Ag Preserves, ACD = Anoka Conservation District, LID= Lake Improvement District
LRRWMO = Lower Rum River Watershed Mgmt. Org, MC = Metropolitan Council
MNDNR = Minnesota Dept. of Natural Resources, URRWMO = Upper Rum River Watershed Mgmt. Org



Lake Levels

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

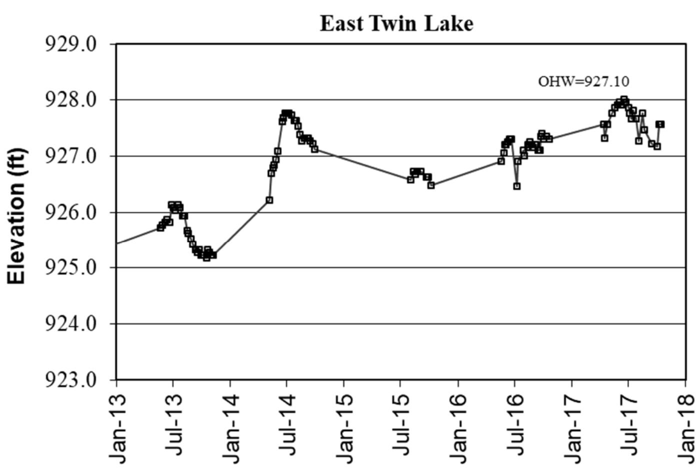
Purpose: To understand lake hydrology, including the impact of climate or other water budget changes. These data are useful for regulatory, building/development, and lake management decisions.

Locations: East Twin Lake, Lake George, Rogers Lake, Minard Lake, Coopers Lake

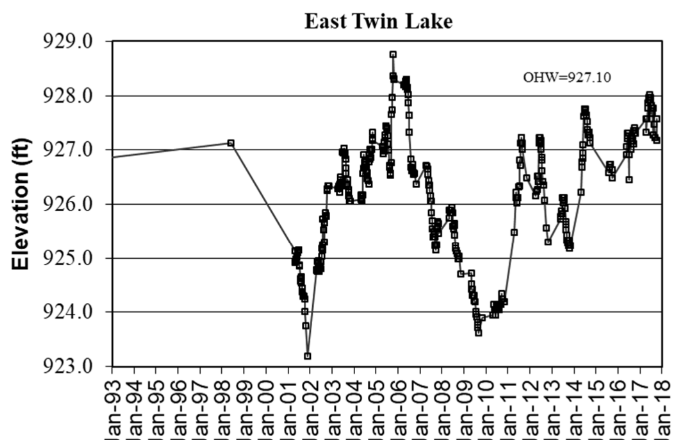
Results: Lake levels were measured by volunteers throughout the 2017 open water season. Lake gauges were installed and surveyed by the Anoka Conservation District and MN DNR. Lakes generally followed the expected trend of increasing water levels in spring and early summer and declining levels by mid-summer. A resurgence of rainfall late into fall, especially the largest storm of the year in early October, caused a small rebound in lake levels at the end of the year. Overall lake levels were near or slightly above average.

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.

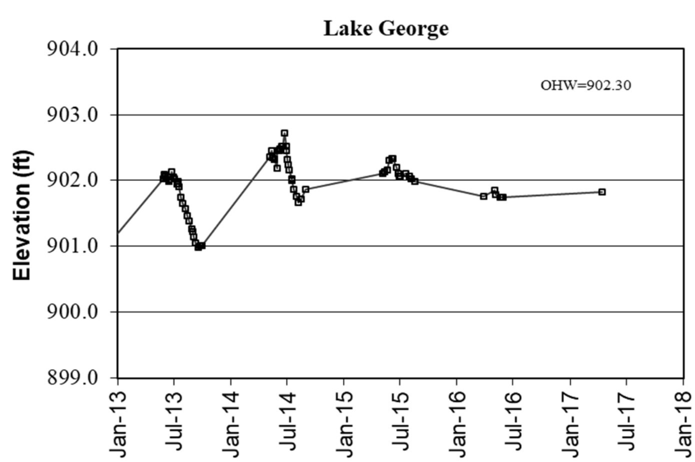
East Twin Lake Levels – last 5 years



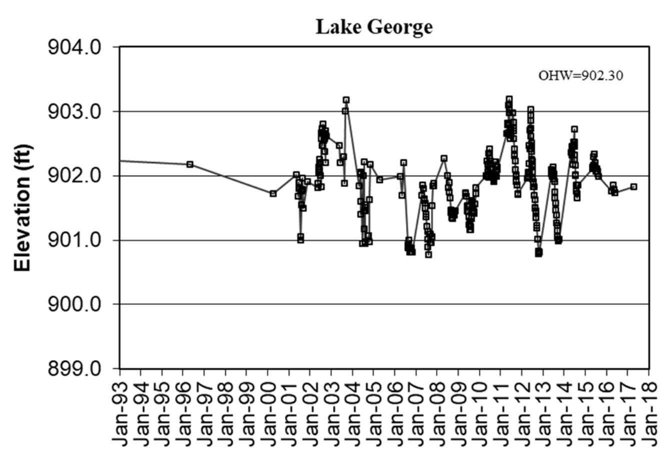
East Twin Lake Levels – last 25 years



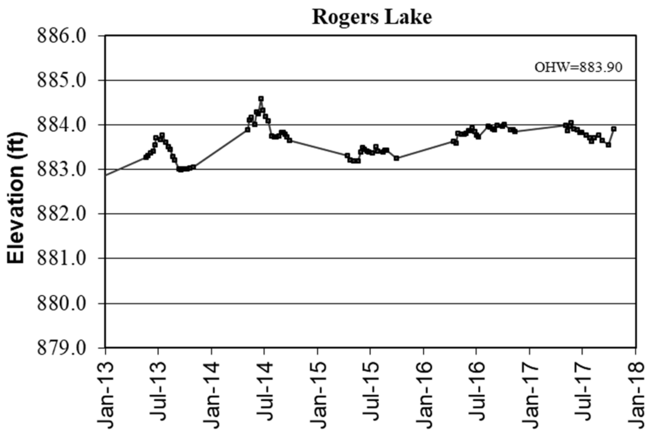
***Lake George Levels – last 5 years**



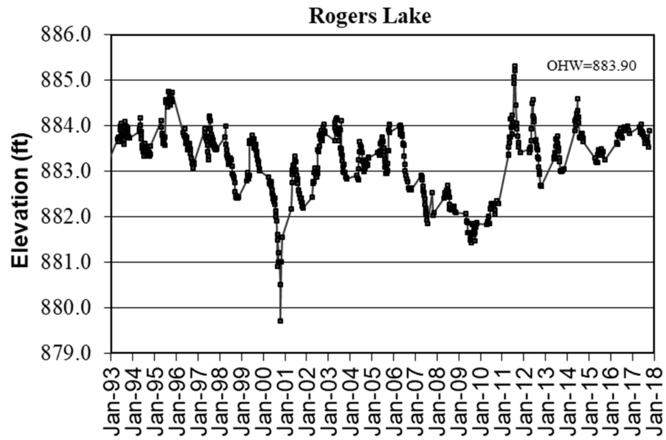
Lake George Levels – last 25 years



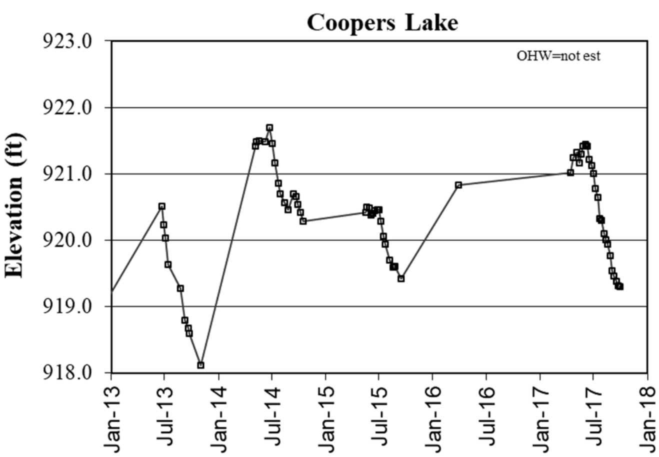
Rogers Lake Levels – last 5 years



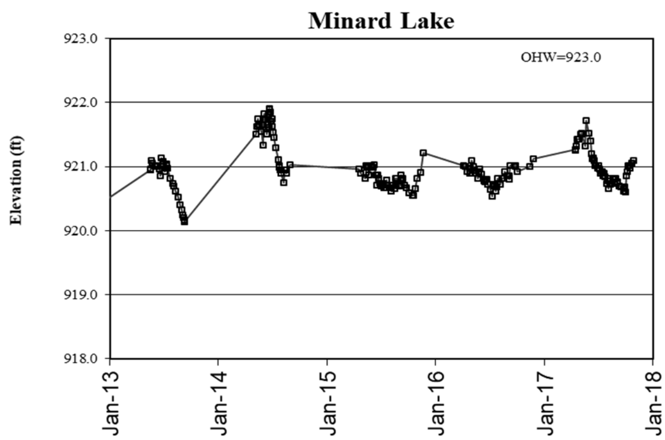
Rogers Lake Levels – last 25 years



Coopers Lake Levels – last 5 years



Minard Lake Levels – last 5 years



*Only one reading was received from the Lake George volunteer in 2017. A new volunteer will be pursued for 2018.

Lake Water Quality

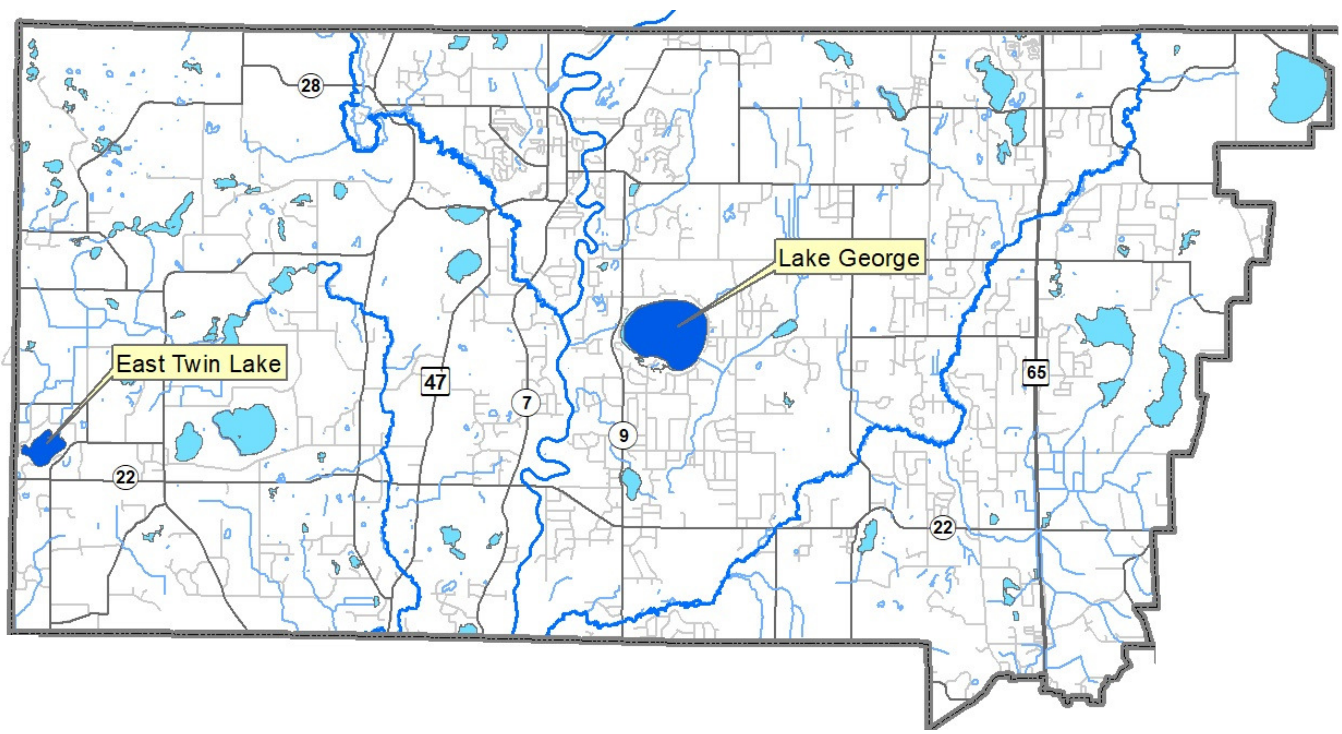
Description: May through September twice-monthly monitoring of the following parameters: total phosphorus, chlorophyll-a, Secchi transparency, dissolved oxygen, turbidity, temperature, conductivity, pH, and salinity.

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

Locations: Lake George

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 at the MPCA's electronic data access website. Refer to Chapter 1 for additional information on interpreting the data and on lake dynamics.

Upper Rum River Watershed Lake Water Quality Monitoring Sites



East Twin Lake
City of Nowthen, Lake ID # 02-0133

Background

East Twin Lake is located near Anoka County's western boarder in the City of Nowthen. The lake has a surface area of 116 acres with a maximum depth of 77 feet (20.1 m), making it Anoka County's deepest lake. Public access is from East Twin Lake City Park, where there is both a swimming beach and boat launch. The lakeshore is only moderately developed, with residences being mostly of low density and encompassing about half of the shoreline. The watershed is >75% undeveloped, with low-density residential areas. This lake is one of the clearest in the county. One exotic invasive plant, curly leaf pondweed, has been discovered in this lake.

2017 Results

In 2017, East Twin Lake had excellent water quality for this region of the state (NCHF Ecoregion), receiving an overall A grade; a mark it has achieved 14 of the 15 years monitored since 1980 (1983 is the exception with an overall B grade). The lake is mesotrophic, meaning low nutrients drive a moderate to low amount of production. The lake has excellent Secchi transparency, averaging over 10 feet in 2017. Some historically high Secchi readings in this lake include; 19.1 ft. Secchi transparency on June 12, 2013, 18.7 ft. in May of 2011, 22 ft. on May 28, 2008 and 20 ft. in spring 2002; these are the deepest at any Anoka County lake since at least 1996. East Twin is locally unique maintaining >10 feet of transparency late into summer. The lake's poorest water quality parameter on the grading scale is total phosphorus (TP), receiving more B letter grades than A grades going back to 1980. 2017 was a return to an A grade for TP, however, after B grades in 2011 and 2013. TP concentrations averaged 27.1 µg/L without a lot of fluctuation throughout the sampling season. Chlorophyll-a (Cl-a) concentrations averaged just 3.9 µg/L. Additionally, subjective observation by ACD staff ranked physical and recreational conditions optimal.

Trend Analysis

Fifteen years of water quality data have been collected by the Metropolitan Council (1980, '81,'83, '95, and '98), the Minnesota Pollution Control Agency (1989), and the Anoka Conservation District (1997, '99, 2000, 2002, 2005, 2008, 2011, 2013, and 2017). A statistically significant improvement in overall water quality since 1980 has been shown (repeated measures MANOVA with response variables TP, Cl-a, and Secchi depth, $F_{2,12}= 4.06$, p=<0.05). Analyzing each data type individually offers some clues as to the drivers of that water quality improvement. One-way ANOVAs revealed that chlorophyll-a has declined in a significant manner ($F_{1,13} = 11.38$, $p= 0.005$) and continues to be the most important factor in the multi-parameter trend. Total phosphorus also shows a downward trend, though not statistically significant, and Secchi transparency shows a very weak trend towards improvement.

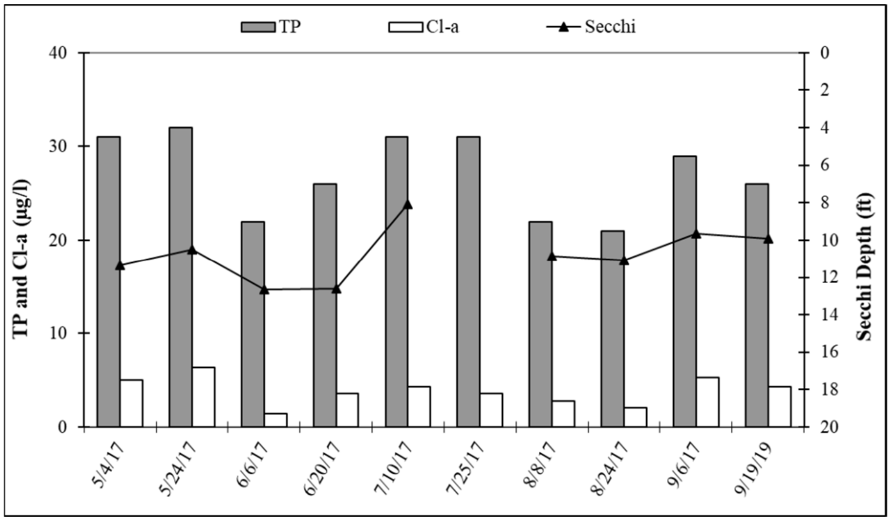
Discussion

East Twin Lake has had good water quality as long as it has been monitored back to 1980, never receiving lower than a B letter grade for any parameter. Statistical analysis shows that the water quality is improving. The ecology of this lake is different from that of other Anoka County lakes because it is so deep. Sediment and dead algae can sink to the bottom and are essentially lost from the system because resuspension by wind, rough fish, and other forces is minimal. In shallower lakes, these nutrients circulate within the lake much more readily and the lake sediments can be a source of nutrients and turbidity that affect water quality. Additionally, East Twin Lake's watershed is small, so there is a small area from which polluted runoff might enter the lake. Aquatic vegetation is also healthy, but not so prolific as to be a nuisance, further contributing to high water quality. One exotic invasive plant is present in the lake, Curly-leaf pondweed (CLP), though its growth is moderate and restricted in extent due to lake depth. CLP, unlike most aquatic vegetation, does not contribute to increasing water quality.

East Twin Lake

City of Nowthen, Lake ID # 02-0133

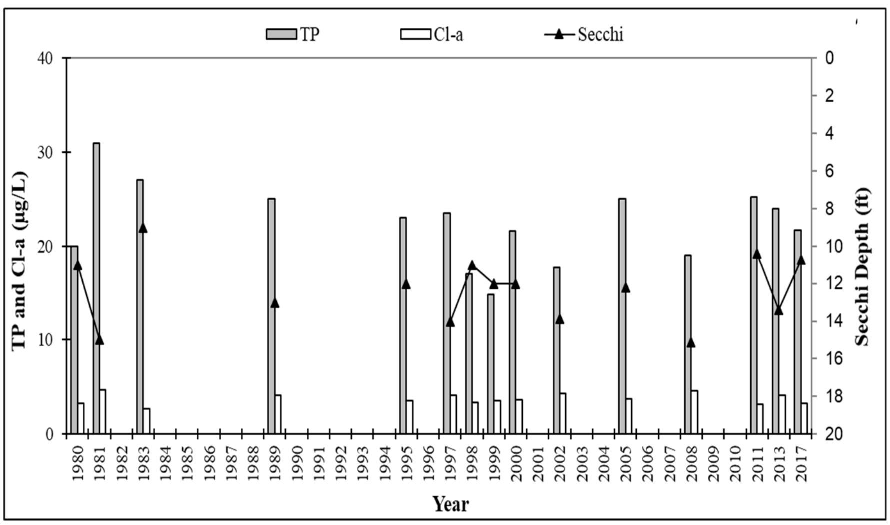
2017 Daily Results



Historical Report Card

Year	TP	Cl-a	Secchi	Overall
1980	A	B	A	**A**
1981	B	A	A	**A**
1983	B	B	B	**B**
1989	B	A	A	**A**
1995	B	A	A	**A**
1997	B	A	A	**A**
1998	B	A	A	**A**
1999	A	A	A	**A**
2000	A	A	A	**A**
2002	A	A	A	**A**
2005	B	A	A	**A**
2008	A	A	A	**A**
2011	B	A	A	**A**
2013	B	A	A	**A**
2017	A	A	A	**A**
2017 average	21.7 µg/L	3.9 µg/L	3.3 meters	
State standards	40 µg/L	14 µg/L	1.4 meters	

Historical Annual Averages



2017 Medians

pH		7.76
Conductivity	mS/cm	0.23
Turbidity	NTU	2.55
Dissolved Oxygen	mg/l	7.94
Dissolved Oxygen	%	0.97
Temp	°C	22.18
Temp	°F	71.92
Salinity	%	0.11
Chlorophyll-a	µg/L	3.95
Total Phosphorus	mg/l	0.02
Total Phosphorus	µg/l	21.50
Secchi	ft	10.83
Secchi	m	3.30

2017 Raw Data

East Twin Lake		Date:	5/4/2017	5/24/2017	6/6/2017	6/20/2017	7/10/2017	7/25/2017	8/8/2017	8/24/2017	9/6/2017	9/19/2019			
2017 Water Quality Data		Time:	12:00	11:55	13:10	11:35	12:00	11:40	12:00	12:25	11:45	11:30			
	Units	R.L.*	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Average	Min	Max
pH		0.1	7.97	8.08	8.25	7.94	7.66	7.31	7.39	7.69	7.70	7.81	7.78	7.31	8.25
Conductivity	mS/cm	0.01	0.191	0.220	0.240	0.222	0.215	0.247	0.261	0.232	0.227	0.234	0.229	0.191	0.261
Turbidity	NTU	1	2.80		3.10	2.80	1.40	10.60	2.30	0.00		0.00	2.88	0.00	10.60
D.O.	mg/l	0.01	11.19	10.29	9.83	8.52	7.98	7.62	6.88	7.16	6.75	7.89	8.41	6.75	11.19
D.O.	%	1	103.6%	104.7%	115.0%	102.0%	99.8%	95.1%	82.1%	84.4%	75.4%	88.6%	95%	75%	115%
Temp.	°C	0.1	11.08	14.49	22.38	22.62	24.81	24.87	23.14	21.98	19.40	19.42	20.4	11.1	24.9
Temp.	°F	0.1	51.9	58.1	72.3	72.7	76.7	76.8	73.7	71.6	66.9	67.0	68.8	51.9	76.8
Salinity	%	0.01	0.09	0.10	0.12	0.11	0.10	0.12	0.12	0.11	0.11	0.11	0.11	0.09	0.12
Cl-a	µg/L	1	5.00	6.40	1.40	3.60	4.30	3.60	2.80	2.10	5.30	4.30	3.9	1.4	6.4
T.P.	mg/l	0.005	0.021	0.023	0.022	0.021	0.027	0.025	0.017	0.013	0.029	0.019	0.022	0.013	0.029
T.P.	µg/l	5	21	23	22	21	27	25	17	13	29	19	21.7	13	29
Secchi	ft		11.3	10.5	12.7	12.6	8.1		10.8	11.1	9.7	9.9	10.7	8.1	12.7
Secchi	m		3.5	3.2	3.9	3.8	2.5		3.3	3.4	2.9	3.0	3.3	2.5	3.9
Field Observations			Clear	Clear	Clear	Clear	Dark/Clear	Clear	Clear	Clear	Clear	Clear			
Physical			1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Recreational			1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Lake George

CITY OF OAK GROVE, LAKE ID # 02-0091

Background

Lake George is located in north-central Anoka County. The lake has a surface area of 535 acres with a maximum depth of 32 feet (9.75 m). Public access is from Lake George County Park on the lake's north side, where there is both a swimming beach and boat launch. About 70% of the lake is circumscribed by homes; the remainder is county park land. The watershed is mostly undeveloped or vacant, with some residential areas, particularly on the lakeshore and in the southern half of the watershed. Two invasive exotic aquatic plants are established in this lake, Curly-leaf pondweed and Eurasian Water Milfoil. ACD does annual mapping of densities for each type of plant, and the Lake George Improvement District treats both with herbicide.

2017 Results

In 2017 Lake George had good water quality for this region of the state (NCHF Ecoregion), receiving an overall B letter grade and mesotrophic rating. Dating back to 2009, Lake George has maintained this overall B grade each year with the exception of 2015 when a slight decline in average total phosphorus (TP) bumped that score to an A. Total phosphorus in 2017 averaged 23.3 µg/L, the second lowest on record since 2008. Secchi transparency was as high as 12.2 feet in June, but dropped to as low as 4.5 feet in early September. Average Secchi transparency was 7.7 feet, a slight improvement from 2016, but still 2-3 ft. poorer than a decade ago. Chlorophyll-a (Cl-a) averaged 5.7 µg/L, which was similar to the last 5 years, with the exception of a moderate increase in 2016 to 7.8 µg/L. Total phosphorous, chlorophyll-a, and transparency were all poorest in early September. All three parameters were better than water quality standards for deep lakes in this region (<40 µg/L TP, <14 µg/L Cl-a, and >1.4m Secchi transparency). While conforming with state standards is great, it does not help the lake earn the frequent A letter grades it enjoyed during the beginning of the millennium (1997-2002 the lake received an overall A letter grade each year except 1998).

Trend Analysis

Twenty years of water quality data have been collected by the Metropolitan Council (between 1980 and 2009) and the Anoka Conservation District (1997, 1999, 2000, 2002, 2005, 2008, 2011, 2013-2017). During this period there is a statistically significant trend of declining Secchi transparency (one-way ANOVA $F_{1,18}$= 16.56, p=<0.001). The Rum River Watershed Restoration and Protection Strategy (WRAPS) report also found "strong evidence" of declining water clarity using a Kendall-Mann statistical analysis. However, an Anoka Conservation District broader analysis of overall water quality that simultaneously considers TP, Cl-a and Secchi transparency did not find a statistically significant trend looking at all years of data (repeated measures MANOVA with response variables TP, Cl-a, and Secchi depth, $F_{2,17}$= 2.0, p=0.17). Looking at only the last 10 sampling years' worth of data since 2000, however, shows a statistically significant increase in TP (one-way ANOVA $F_{1,9}$ =5.63, *p*=<0.05) as well as a trend (though not significant) towards increased Cl-a. Much of the decline in transparency has occurred since the year 2000 or slightly before. In short, since 2000 a solid trend of poorer (lower) transparency is occurring and a less dramatic trend of poorer (higher) total phosphorus is occurring. Chlorophyll-a (algae) levels show no statistically significant trend of change.

Lake George

CITY OF OAK GROVE, LAKE ID # 02-0091

Discussion

Lake George remains one of the clearest of the Anoka County lakes, but its trend toward declining Secchi transparency is seriously concerning (see graph below). Lake George is a highly valued lake due to its recreational opportunities and ecological quality. The lake has a large park, many lakeshore homes, and a notably diverse plant community (most metro area lakes have 10-12 different aquatic plant species; Lake George is home to 24).

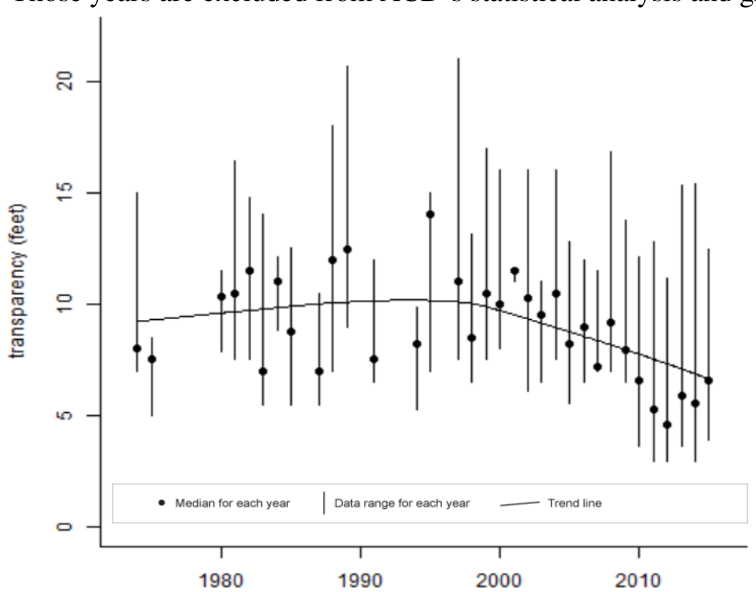
An additional concern for Lake George is noted in the 2017 Rum River Watershed Fish-Based Lake IBI Stressor Identification Report by the MN DNR. That report found Lake George's fish community was not impaired, but was of special concern and vulnerable. Lack of aquatic habitat and near-shore development disturbances were causes of concern.

In 2016 the ACD began monitoring and data collection for phase 1 of an in depth study into lake water quality declines, with the objective of identifying measures that would reverse the trends. Phase 1 is focused on the lake's watershed, but not in-lake processes. Two years of water quality data have been collected at two outfalls into Lake George and contributing streams into the wetlands that feed those outfalls, as well as numerous monitoring sites in the County Ditch 19 system. The study includes watershed modeling, project identification, and ranking of those project by cost effectiveness. A final report is expected in 2018. This study is funded by the Lake George Improvement District, Lake George Conservation Club, Anoka Conservation District, a State Clean Water Fund grant and others. If necessary, a phase 2 of the study in the future may occur which would focus on in-lake factors affecting water quality.

In the meantime, continued efforts should include monitoring, education, and lakeshore best management practices. Residential lakeshore restorations are one high priority and immediately actionable item. Several lakeshore properties have recently undertaken projects to correct erosion and restore native plant communities, but many property owners on Lake George aggressively manicure their lakeshore in ways that are detrimental to lake health.

Two exotic invasive plants are present in Lake George, Curly-leaf pondweed and Eurasian Water Milfoil. The Lake George Improvement District was formed to control these plants, and multiple years of localized treatments have occurred. In coordination with the MN DNR, the Lake Improvement District continually works to achieve control of these invasive plants without harming native plants or water quality. Water quality has been monitored immediately before and after herbicide treatments in some recent years, and no obvious causal relationship between weed treatment and water quality was found.

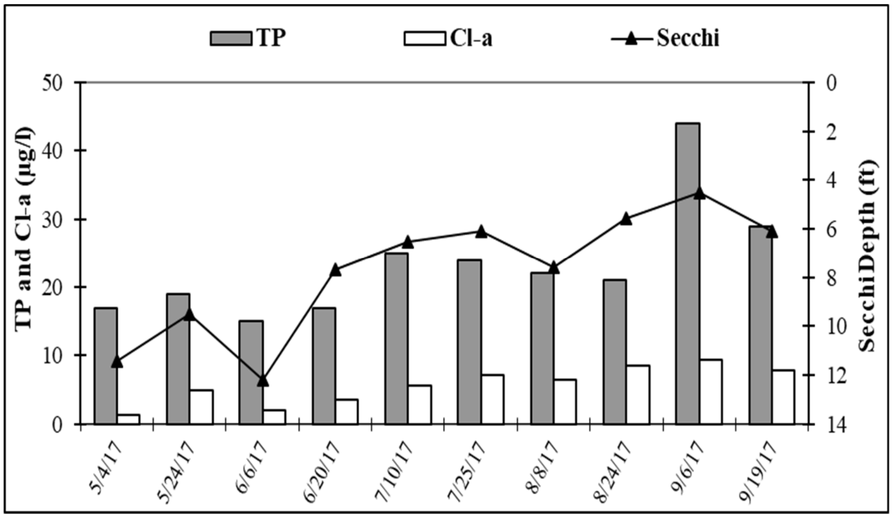
Lake George Secchi transparency trend- MN DNR. Note: Includes years with partial datasets not covering all open water months. Those years are excluded from ACD's statistical analysis and graphs on the following page.



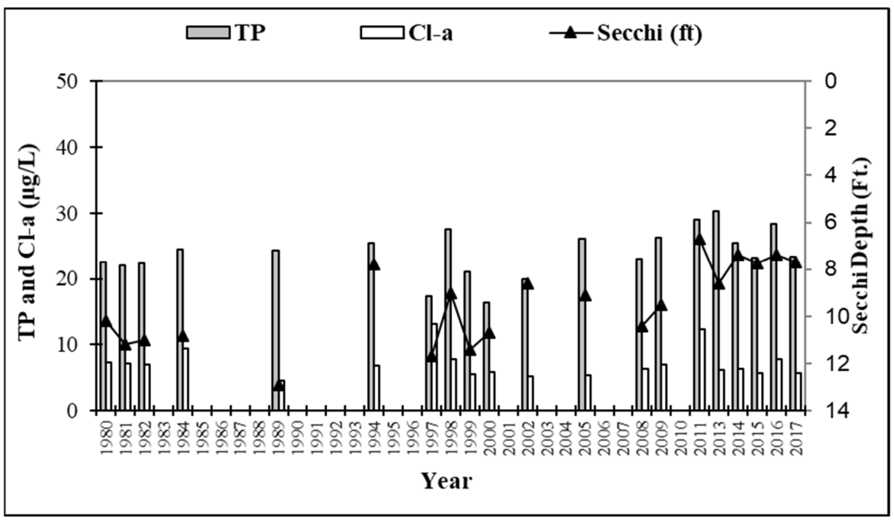
Lake George

City of Oak Grove, Lake ID # 02-0091

2017 Daily Results



Historical Annual Averages



Historical Report Card

Year	TP	Cl-a	Secchi	Overall
1980	A	A	A	**A**
1981	A	A	A	**A**
1982	A	A	A	**A**
1984	B	A	A	**A**
1989	B	A	A	**A**
1994	B	A	B	**B**
1997	A	B	A	**A**
1998	B	A	B	**B**
1999	A	A	A	**A**
2000	A	A	B	**A**
2002	A	A	B	**A**
2005	B	A	B	**B**
2008	B	A	A	**A**
2009	B	A	B	**B**
2011	B	B	C	**B**
2013	B	A	B	**B**
2014	B	A	B	**B**
2015	A	A	B	**A**
2016	B	A	B	**B**
2017	B	A	B	**B**
2017 average	23.3 µg/L	5.7 µg/L	2.35 meters	
State standard	40 µg/L	14 µg/L	1.4 meters	

2017 Medians

pH		8.45
Conductivity	mS/cm	0.23
Turbidity	NTU	3.50
Dissolved Oxygen	mg/l	8.99
Dissolved Oxygen	%	1.05
Temp	°C	22.30
Temp	°F	72.14
Salinity	%	0.11
Chlorophyll-a	µg/L	6.05
Total Phosphorus	mg/l	0.02
Total Phosphorus	µg/l	21.50
Secchi	ft	7.06
Secchi	m	2.15

2017 Raw Data

		Date:	5/4/2017	5/24/2017	6/6/2017	6/20/2017	7/10/2017	7/25/2017	8/8/2017	8/24/2017	9/6/2017	9/19/2017			
		Time:	12:45	12:45	14:00	12:20	11:15	11:00	11:15	11:45	11:00	10:50			
	Units	R.L.*	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Average	Min	Max
pH		0.1	7.96	8.23	8.74	8.46	8.72	8.42	8.50	8.43	8.11	8.51	8.41	7.96	8.74
Conductivity	mS/cm	0.01	0.195	0.219	0.230	0.210	0.203	0.236	0.247	0.225	0.228	0.233	0.223	0.195	0.247
Turbidity	NTU	1	3.30		3.70	4.50	1.50	15.800	7.00	1.60		2.20	4.95	2	16
D.O.	mg/l	0.01	10.76	9.87	9.91	8.54	8.71	9.59	8.89	9.09	8.75	8.46	9.26	8.46	10.76
D.O.	%	1	100.9%	100.7%	117.1%	102.5%	110.2%	118.2%	107.2%	108.9%	98.0%	95.5%	106%	96%	118%
Temp.	°C	0.1	11.22	14.50	22.43	22.48	25.37	25.03	23.68	22.17	19.63	19.58	20.6	11.2	25.4
Temp.	°F	0.1	52.2	58.1	72.4	72.5	77.7	77.1	74.6	71.9	67.3	67.2	69.1	52.2	77.7
Salinity	%	0.01	0.09	0.10	0.11	0.10	0.10	0.11	0.12	0.11	0.11	0.11	0.11	0.09	0.12
Cl-a	µg/L	1	1.4	5.0	2.1	3.6	5.7	7.1	6.4	8.5	9.4	7.8	5.7	1.4	9.4
T.P.	mg/l	0.005	0.017	0.019	0.015	0.017	0.025	0.024	0.022	0.021	0.044	0.029	0.023	0.015	0.044
T.P.	µg/l	5	17	19	15	17	25	24	22	21	44	29	23.3	15	44
Secchi	ft		11.4	9.5	12.2	7.7	6.5	6.1	7.6	5.6	4.5	6.1	7.7	4.5	12.2
Secchi	m		3.5	2.9	3.7	2.3	2.0	1.9	2.3	1.7	1.4	1.9	2.35	1.4	3.7
Field Observations			Clear, Green Tint	Clear	Clear	Green	Dark Green	Clear	lear, Green ti	Clear	Murky	Cloudy			
Physical			1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.0	1.1	1.0	2.0
Recreational			1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Lake George
City of Oak Grove, Lake ID # 02-0091

2017 Aquatic Invasive Vegetation Mapping

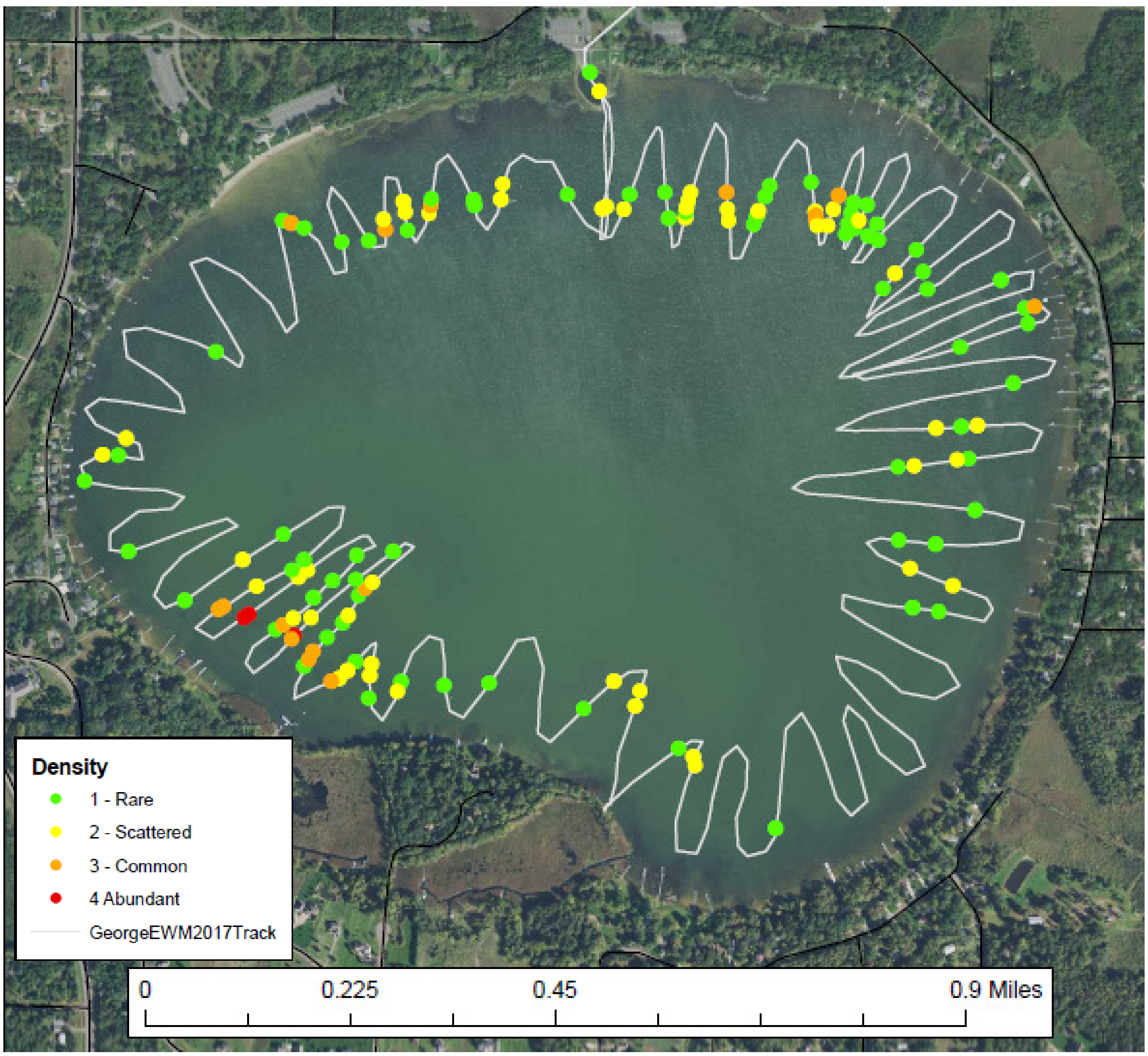
Description: The Anoka Conservation District (ACD) was contracted by the Lake George Lake Improvement District (LID) to conduct an aquatic invasive vegetation delineation.

Purpose: To map out the presence of Curly Leaf Pondweed (CLP) and Eurasian Water Milfoil (EWM) as required for MN DNR herbicide treatment permits. A goal was to map these invasive species as early as possible in the growing season to allow for herbicide treatment as early as possible for reduced impacts on native plants and lessened possible impacts on water quality.

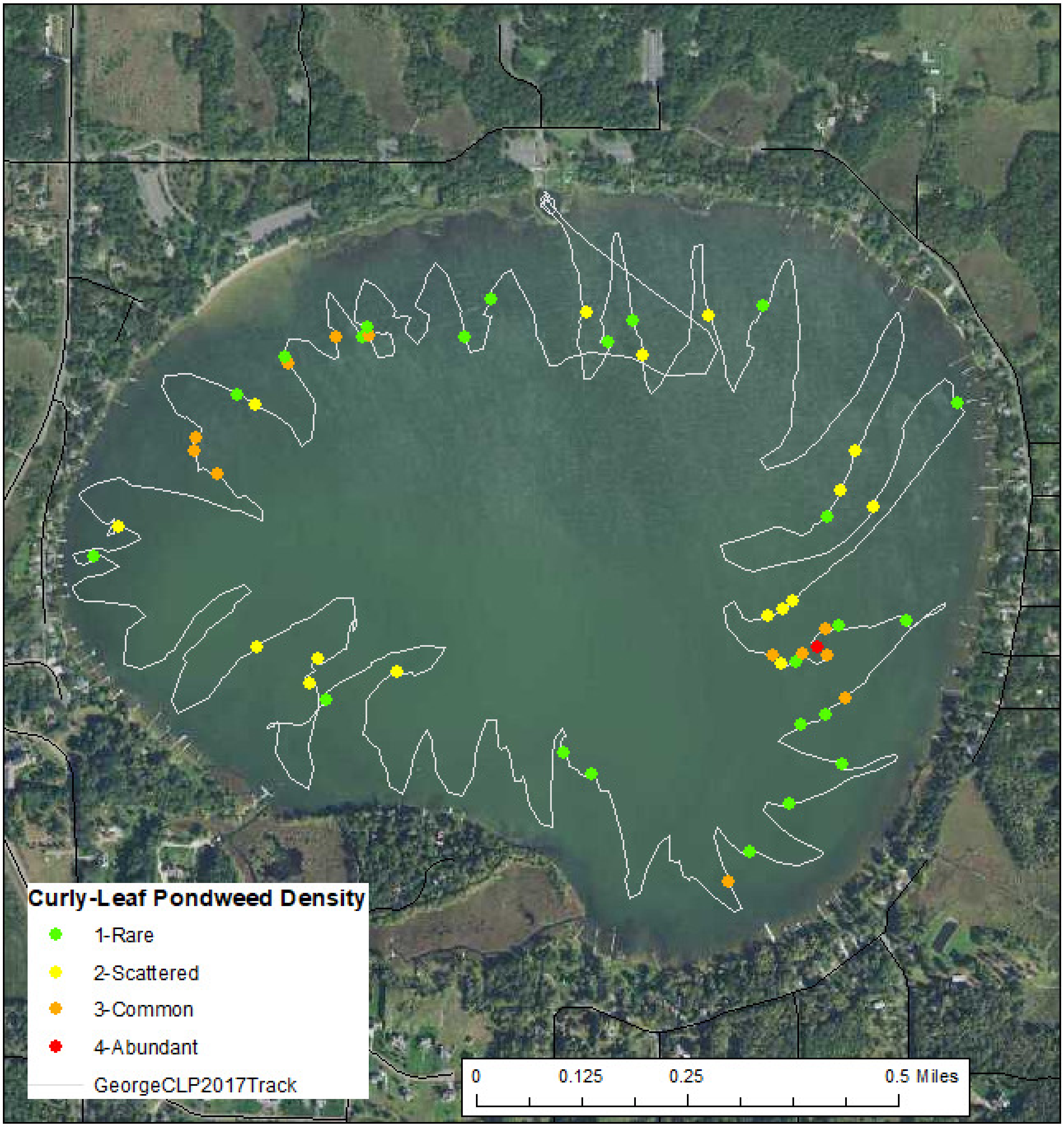
Locations: Lake George

Results: A map is presented below and was delivered to the MN DNR and Lake George Improvement District within 48 hours of the field surveys. These survey points were reviewed by the MNDNR and herbicide treatments occurred in areas with the greatest density of invasive plants.

May 12, 2017 Lake George Eurasian Water Milfoil (EWM) Survey



April 21, 2017 Lake George Curly Leaf Pondweed (CLP) survey



Stream Water Quality - Chemical Monitoring

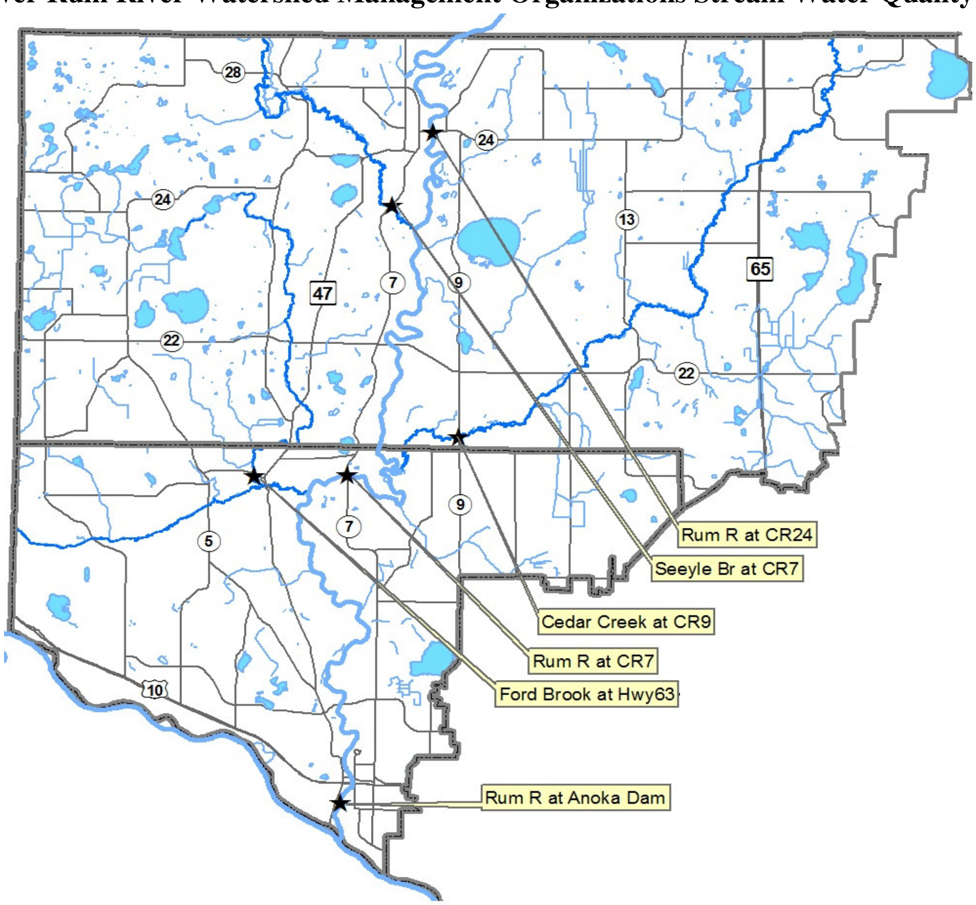
Description: The Rum River and several tributary streams were monitored in 2017. The locations of river monitoring include the approximate top and bottom of the Upper and Lower Rum River Watershed Management Organizations. Tributaries were monitored simultaneously with Rum River monitoring for greatest comparability near their outfalls into the river. Collectively, these data allow for an upstream to downstream water quality comparison within Anoka County, as well as within each watershed organization. It also allows us to examine whether the tributaries degrade Rum River water quality. Monitoring occurred in May through September for each of the following parameters: total suspended solids, total phosphorus, Secchi tube transparency, dissolved oxygen, turbidity, temperature, conductivity, pH, and salinity.

Purpose: To detect water quality trends, diagnose and identify the source of any problems, and guide management.

Locations: Rum River at Co Rd 24
Rum River at Co Rd 7
Rum River at the Anoka Dam
Seelye Brook at Co Rd 7
Cedar Creek at Co Rd 9
Ford Brook at Co Rd 63

Results: Results are presented on the following pages.

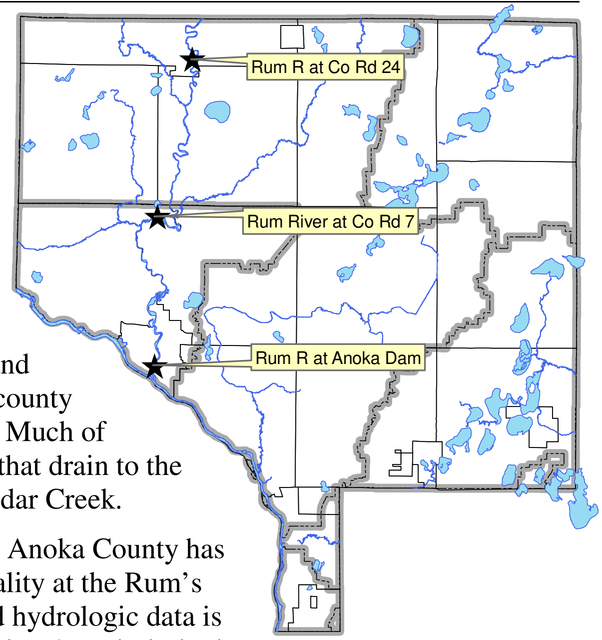
Upper and Lower Rum River Watershed Management Organizations Stream Water Quality Sites



RUM RIVER

Rum River at Co. Rd. 24 (Bridge St), St. Francis*	STORET SiteID =	S000-066
Rum River at Co. Rd. 7 (Roanoke St), Ramsey	STORET SiteID =	S004-026
Rum River at Anoka Dam, Anoka	STORET SiteID =	S003-183

*Located in and paid by the URRWMO, but reported with other Rum River data for a more complete analysis.



Years Monitored

At Co. Rd. 24 –	2004, 2009-2011, 2014-2017
At Co. Rd. 7 –	2004, 2009- 2011, 2014-2017
At Anoka Dam –	1996-2011(MC WOMP), 2015-2017

Background

The Rum River is one of Anoka County's highest quality and most valuable water resources. It is designated as a state scenic and recreational river throughout Anoka County, except south of the county fairgrounds in Anoka. It is used for boating, tubing, and fishing. Much of western Anoka County drains to the Rum River. Subwatersheds that drain to the Rum include Seelye Brook, Trott Brook, and Ford Brook, and Cedar Creek.

The extent to which water quality improves or is degraded within Anoka County has been unclear. The Metropolitan Council has monitored water quality at the Rum's outlet to the Mississippi River since 1996. This water quality and hydrologic data is well suited for evaluating the river's water quality just before it joins the Mississippi River. Monitoring elsewhere has occurred only in more recent years. Water quality changes might be expected from upstream to downstream because land use changes dramatically from rural residential in the upstream areas of Anoka County to suburban in the downstream areas.

Methods

In 2004, 2009- 2011 and 2014-2017 monitoring was conducted to determine if Rum River water quality changes in Anoka County, and if so, generally where changes occur. The data is reported for all sites together for a more comprehensive analysis of the river from upstream to downstream.

In 2017 the river was monitored during both storm and baseflow conditions by grab samples. At the two further downstream locations, eight water quality samples were taken; half during baseflow and half following storms. At the upstream site, only four samples were taken due to lower funding levels. Storms were generally defined as one-inch or more of rainfall in 24 hours, or a significant snowmelt event combined with rainfall. In some years, particularly the drought year of 2009, smaller storms were sampled because of a lack of larger storms. All storms sampled were significant runoff events. Parameters tested with portable meters included pH, conductivity, turbidity, temperature, salinity, and dissolved oxygen. Parameters tested by water samples sent to a state-certified lab included total phosphorus and total suspended solids. During every sampling event the water level (stage) was recorded. The monitoring station at the Anoka Dam includes automated equipment that continuously tracks water levels and calculates flows. Water level and flow data for other sites were obtained from the US Geological Survey, who maintains a hydrological monitoring site at Viking Boulevard.

The purpose of this report is to make an upstream to downstream comparison of Rum River water quality. It includes only parameters tested in 2017. It does not include additional parameters tested at the Anoka Dam or additional monitoring events at that site. For that information, see Metropolitan Council reports at https://eims.metc.state.mn.us/. All other raw data can be obtained from the Anoka Conservation District, and is also available through the Minnesota Pollution Control Agency's EQuIS database, which is available through their website.

Results Summary

This report includes data from 2017 and an overview of previous year's data. The following is a summary of results.

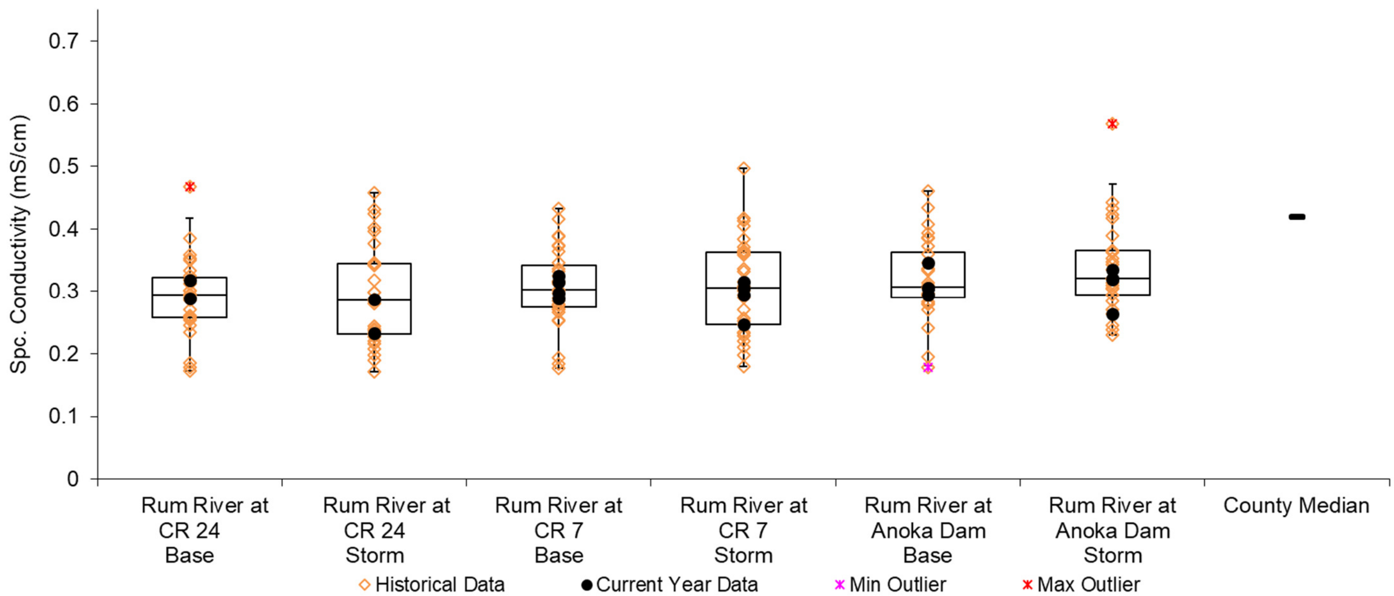
- Dissolved constituents, were measured by conductivity and chlorides. Conductivity in the Rum River is lower than other Anoka County streams. There is cause for concern however, as conductivity consistently increases moving downstream. Average conductivity for sites tested in 2017 from upstream to downstream was 0.282, 0.299 and 0.311 mS/cm respectively. This increase is likely caused by higher road and development density contributing higher loads of road salts and water softener salt. As development continues in all parts of the Rum River watershed, particular attention should be paid to minimizing road salt use, new water softening technology.
- Phosphorous in the Rum River in recent years has been near the State water quality standard of 100 µg/L at all sampled sites, but in 2017 somewhat better conditions were found. Sites exceeded this mark on two single sampling occasions in 2017, once during baseflow, and once after a storm event. 2017 total phosphorus in the Rum River in 2017 averaged 66, 74 and 69 µg/L at sampled sites moving upstream to downstream. Compared to other Anoka County streams, and even the Rum in recent years, these averages are low. Because small increases in phosphorus could cause the Rum River to exceed State standards and be declared "impaired," preventing phosphorus increases should be a focus of watershed management.
- Suspended solids and turbidity generally remained at acceptable levels in the Rum River and are lower than most other Anoka County streams. Average turbidity actually decreased from upstream to downstream in 2017 with averages of 8.0, 7.4, and 7.0 NTU respectively. TSS levels were low in the Rum River compared to other Anoka County streams with 2017 sampling site averages of 7.25, 8.0 and 5.4 mg/L upstream to downstream. Though suspended solids remain well under state impairment thresholds in the Rum, turbidity does show a moderate increase during storm events, and stormwater runoff mitigation should be a focus of management efforts.
- pH was relatively high in 2017 in the Rum River. pH should remain between 6.5 and 8.5 to support aquatic life and meet State water quality standards. On one occasion in May 2017, all three sampled sites exceeded pH 9. pH levels over 9 are quite alkaline for natural waterways. There is a variety of potential factors leading to temporary spikes in pH. What is disconcerting is the fact that the spikes over 8.5 seem to be happening more frequently in recent years. pH should continue to be monitored in the Rum River in the future to see if the spikes get worse or become even more common.
- Dissolved oxygen remained well above the state standard of 5 mg/L in 2017 and previous monitored years. The lowest concentration recorded at any of the three sites in 2017 was 6.89 mg/L.

On the following pages data are presented and discussed for each parameter. Management recommendations will be included at the conclusion of this report. The Rum River is an exceptionally important waterbody, and its protection and improvement should be a high priority.

Conductivity

Conductivity and chlorides are measures of dissolved pollutants. Dissolved pollutant sources include road runoff and industrial chemicals, among many others. Metals, hydrocarbons, road salts, and others are often of concern in a suburban environment. Conductivity is the broadest measure of dissolved pollutants we use. It measures electrical conductivity of the water; pure water with no dissolved constituents has zero conductivity. Chlorides are the measure of chloride salts, the most common of which are road de-icing chemicals and those used in water softening. Chlorides can also be present in other pollutant types, such as wastewater. These pollutants are of greatest concern because of the effect they can have on the stream's biological community. They can also be of concern because the Rum River is upstream from the Twin Cities drinking water intakes on the Mississippi River.

Conductivity during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2017 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



Conductivity is acceptably low in the Rum River, but shows a consistent pattern of increasing downstream (see figure above) and is usually higher during baseflow conditions. Average conductivity from upstream to downstream of the sites monitored in 2017 (all conditions) was 0.282 mS/cm, 0.299 and 0.311 mS/cm, respectively. All three sites are lower than the historical median for 34 Anoka County streams of 0.420 mS/cm, but each site averaged slightly higher conductivity than in 2016. The 2017 maximum observed conductivity in the Rum River was 0.346 mS/cm at the Anoka Dam during baseflow conditions. This spike was still lower than the median for all other Anoka County streams.

Conductivity is lower on average during storm events (especially in the upstream sites), suggesting that stormwater runoff contains fewer dissolved pollutants than the surficial water table that feeds the river during baseflow. High baseflow conductivity has been observed in most other nearby streams as well. This occurrence has been studied extensively, and the largest cause has been found to often be road salts that have infiltrated into the shallow aquifer. Water softening salts and geologic materials also contribute, but to a lesser degree.

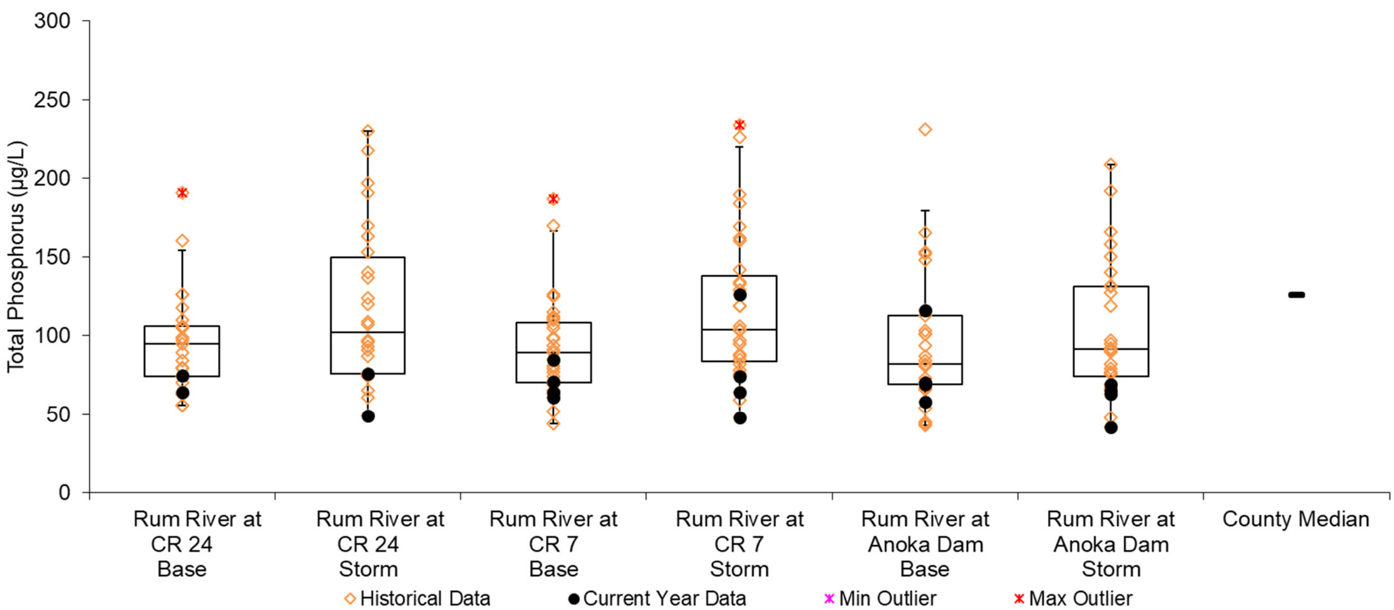
Conductivity increased from upstream to downstream. During baseflow, this increase from upstream to downstream likely reflects greater road densities and deicing salt application. During storms, the higher conductivity downstream is reflective of greater stormwater runoff and pollutants associated with the more densely developed lower portions of the watershed.

Total Phosphorus

Total phosphorus in the Rum River was low in 2017, but in previous years is close to exceeding State water quality standards. Phosphorus is one of the most common pollutants in this region, and can be associated with urban runoff, agricultural runoff, wastewater, and many other sources. The average phosphorus concentration in 2017 at the three monitored sites (all conditions) moving upstream to downstream was 66, 74 and 69 µg/L. Two samples events in 2017 yielded total phosphorus concentrations over 100 µg/L. In previous years, phosphorus concentrations were near the 100 µg/L State water quality standard.

Understanding that the Rum River is close to exceeding State water quality standards for phosphorus, future monitoring should be continued and every effort should be made to prevent phosphorus increases which would likely result in the Rum River being designated a State "impaired" water. Future upgrades to wastewater treatment plants throughout the Rum River watershed may offer phosphorus reductions. At the same time, development in the lower watershed, including increased stormwater discharges, may result in phosphorus increases. Development controls that result in no net increase in phosphorus should be considered.

Total phosphorus during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2017 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



Turbidity and Total Suspended Solids (TSS)

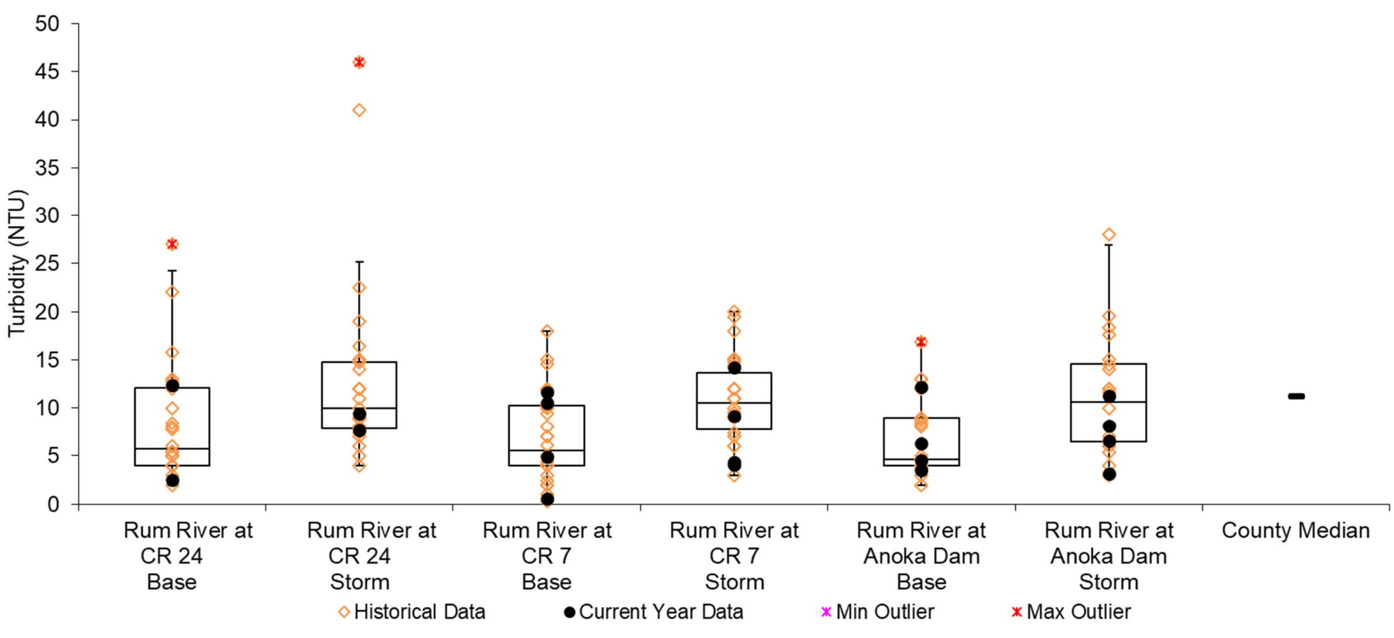
Turbidity and total suspended solids (TSS) are two different measurements of solid material suspended in the water. Turbidity is measured by the refraction of a light beam passed through a water sample and is most sensitive to large particles. Total suspended solids is measured by filtering solids from a water sample and weighing the filtered material. The amount of suspended material is important because it affects transparency and aquatic life, and because many other pollutants are attached to particles. Many stormwater treatment practices such as street sweeping, sumps, and stormwater settling ponds target sediment and attached pollutants. In 2017, turbidity and total suspended solids in the Rum River were lower than the historical median for Anoka County streams.

In the Rum River, turbidity is generally low but increases during storms. There is substantial variability (see figure below). There is no clear change in turbidity or suspended solids upstream to downstream. The average turbidity, in 2017 (storms and baseflow) for each site moving upstream to downstream was 8.0, 7.4, and 7.0 NTU. The historical median for Anoka County streams is 11.2 NTU. Turbidity was elevated on a few occasions, especially during and after storm events, though the maximum turbidity measured at County Road 7 after a storm event of 14.2 NTU is quite low for a highest annual recording.

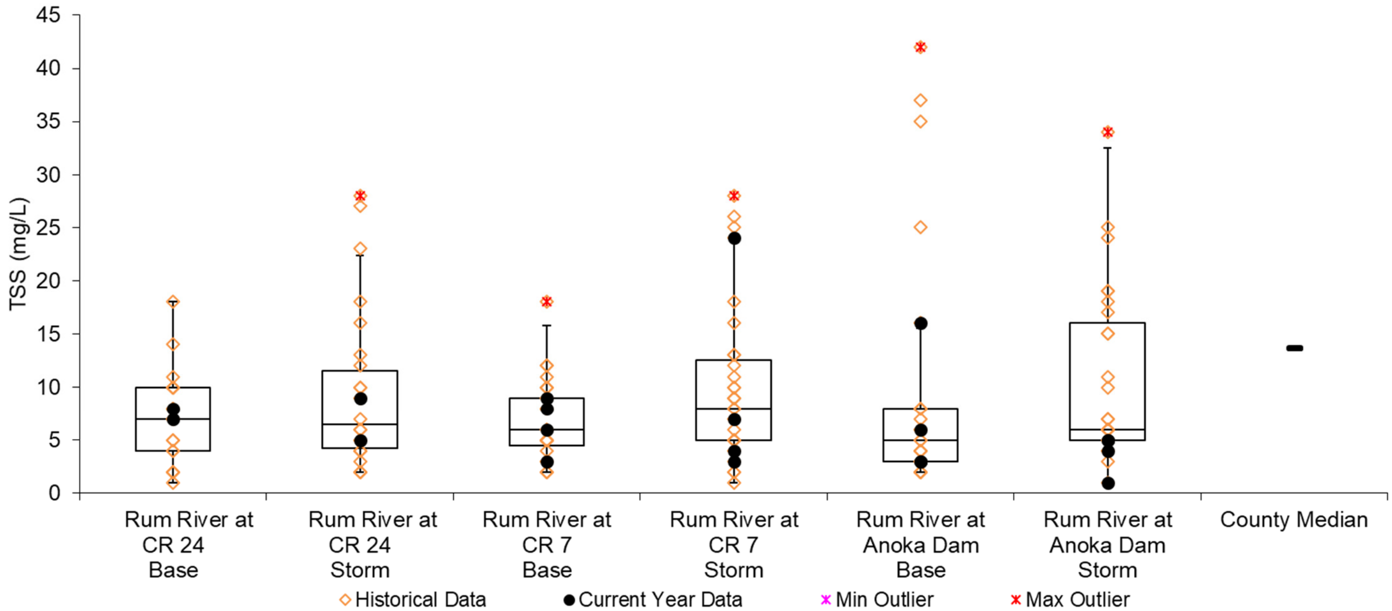
Average TSS results (all conditions) in 2017 for sites moving upstream to downstream was 7.25, 8.0 and 5.4 mg/L. These are all lower than the Anoka County stream median for TSS of 13.66 mg/L. It is important to note the suspended solids can come from sources within and outside of the river channel. Sources on land include soil erosion, road sanding, and others. Riverbank erosion and movement of the river bottom also contributes to suspended solids. A moderate amount of this "bed load" is natural and expected. The state threshold for TSS impairment in the Rum River is 10% of samples April 1-September 30 exceeding 30 mg/L TSS. The highest concentration recorded in 2017 was 24 mg/L. ACD has not collected a sample over 30 mg/L TSS since May of 2010.

Though the Rum River remains well under the impairment threshold for TSS, rigorous stormwater treatment should occur as the Rum River watershed continues to be developed, or the collective pollution caused by many small developments could seriously impact the river. Bringing stormwater treatment up to date in older developments is also important.

Turbidity during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2017 readings Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



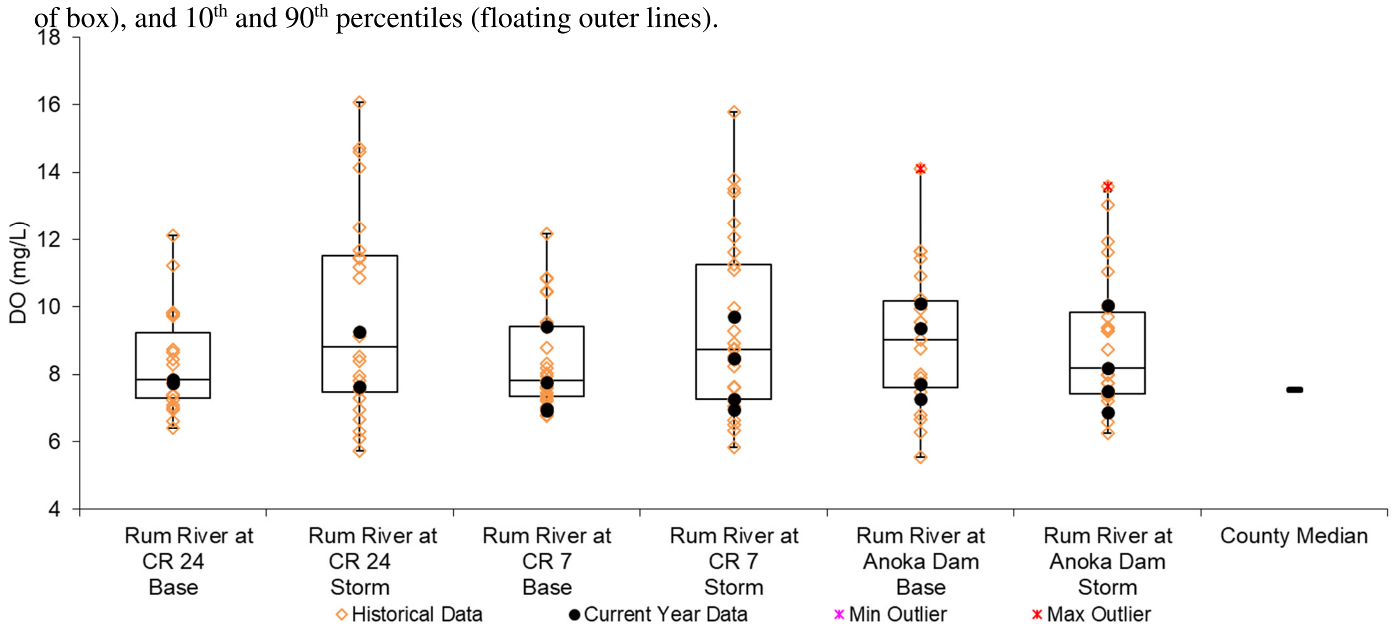
Total suspended solids during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2017 readings Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



Dissolved Oxygen

Dissolved oxygen is necessary for aquatic life, including fish. Organic pollution causes oxygen to be consumed during decomposition. If oxygen levels fall below the state water quality standard of 5 mg/L, aquatic life begins to suffer. A stream is considered impaired if 10% of observations are below this level in the last 10 years. Dissolved oxygen levels are typically lowest in the early morning because of decomposition consuming oxygen at night without offsetting oxygen production by photosynthesis. In 2017, dissolved oxygen in the Rum River was always above 5 mg/L at all monitoring sites, with 6.89 mg/L being the lowest concentration recorded. ACD has never recorded a dissolved oxygen concentration below 6 mg/L in the Rum with sampling dating back to 2004.

Dissolved oxygen during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2017 readings Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).

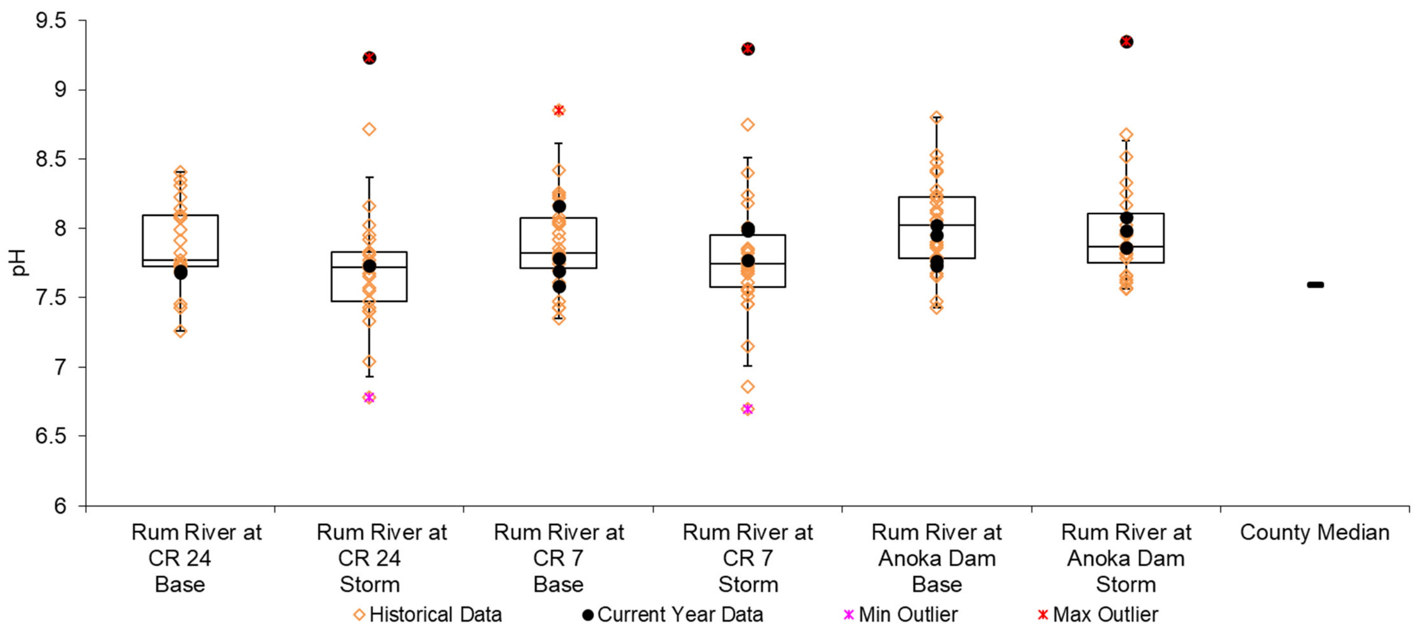


pH

pH refers to the acidity of the water. The Minnesota Pollution Control Agency's water quality standard is for pH to remain between 6.5 and 8.5. The Rum River is generally within this range, but has exceeded 8.5 on rare occasions in the past. In recent years (2015, 2017) however, exceedances of 8.5 have been commonplace at all sites. In 2017, pH levels over 9 were recorded at all three sites after a storm event on 5/18/2017. Exceedances were recorded in 2015 after a spring storm in March at the lower two sampling sites as well as at the Anoka Dam during baseflow conditions in July.

There is a variety of potential factors leading to temporary spikes in pH. What is disconcerting is the fact that the spikes over 8.5 seem to be happening more frequently in recent years. pH should continue to be monitored in the Rum River in the future to see if the spikes get worse or become even more common.

pH during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2017 readings Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



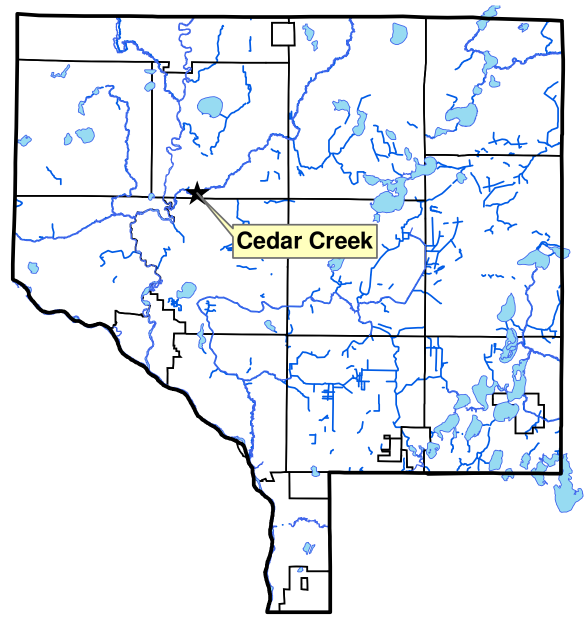
Summary and Recommendations

The Rum River's water quality in general is good. However, there is a slight increase in conductivity moving downstream, phosphorus levels are near state water quality standards, and pH spikes over 8.5 seem to be happening more frequently. Protection of the Rum River should continue to be a high priority for local officials. Large population increases are expected to continue in the Rum River's watershed within Anoka County, and this continued development has the potential to degrade water quality unless carefully planned and managed with the river in mind. Development pressure is likely to be especially high near the river because of its scenic and natural qualities. Local ordinances to preserve the scenic nature of the river, treat stormwater thoroughly before discharge, and minimizing road salting should be considered. A proposed "One Watershed, One Plan" across the entire Rum River watershed may offer a chance for multi-county planning. The recently completed Rum River Watershed Restoration and Protection Strategies (WRAPS) offers management strategies for throughout the watershed.

CEDAR CREEK

at Hwy 9, Oak Grove STORET SiteID = S003-203

Background



Cedar Creek originates in south-central Isanti County and flows south. Cedar Creek is a tributary to the Rum River. In north-central Anoka County it flows through some areas of high quality natural communities, including the Cedar Creek Ecosystem Science Reserve. Habitat surrounding the stream in other areas is of moderate quality overall. However, the stream is on the State's list of impaired waters for high *E. coli* bacteria.

Cedar Creek is one of the larger streams in Anoka County. Stream widths of 25 feet and depths greater than 2 feet are common at baseflow. The stream bottom is primarily silt. The watershed is moderately developed with scattered single-family homes, and continues to develop rapidly.

Results Summary

This report includes data from 2017 and an overview of previous year's data. The following is a summary of results.

- Dissolved constituents, as measured by conductivity in Cedar Creek are higher in recent years at baseflow conditions. Conductivity averaged 0.398 mS/cm with a long term baseflow median now up to 0.426 mS/cm. This increase in baseflow conductivity is a concerning trend. Chlorides were last sampled in 2013, but sampling of chlorides should be considered again given the increase in conductivity levels. Road deicing salt is believed to be a large contributor to elevated chlorides.
- Phosphorous averaged over the State water quality standard of 100 µg/L. Cedar Creek often exceeds the state standard, even during baseflow periods and should be a high priority management focus due to the lasting effects of nutrient loading downstream. Phosphorous results in Cedar Creek averaged 151 µg/L in 2017. Phosphorus is highest after storms. Much of the watershed is in an undeveloped state, and a portion of the phosphorus is likely from natural sources such as wetlands.
- Suspended solids and turbidity ranged widely. Total suspended solids averaged 22.3 mg/L, and turbidity averaged 15.8 NTU. These findings are within the range observed in other years, and are better than State standards.
- pH was generally within the acceptable range of 6.5-8.5. On one occasion in 2017 reached 8.94, the highest pH ever recorded in Cedar Creek. There has been one other such case historically, and interestingly, both occasions happened during storm flows when pH is generally lower.
- Dissolved oxygen was within the range considered healthy for streams in this area. DO averaged 7.75 mg/L.

Cedar Creek 2017 Water Quality Data

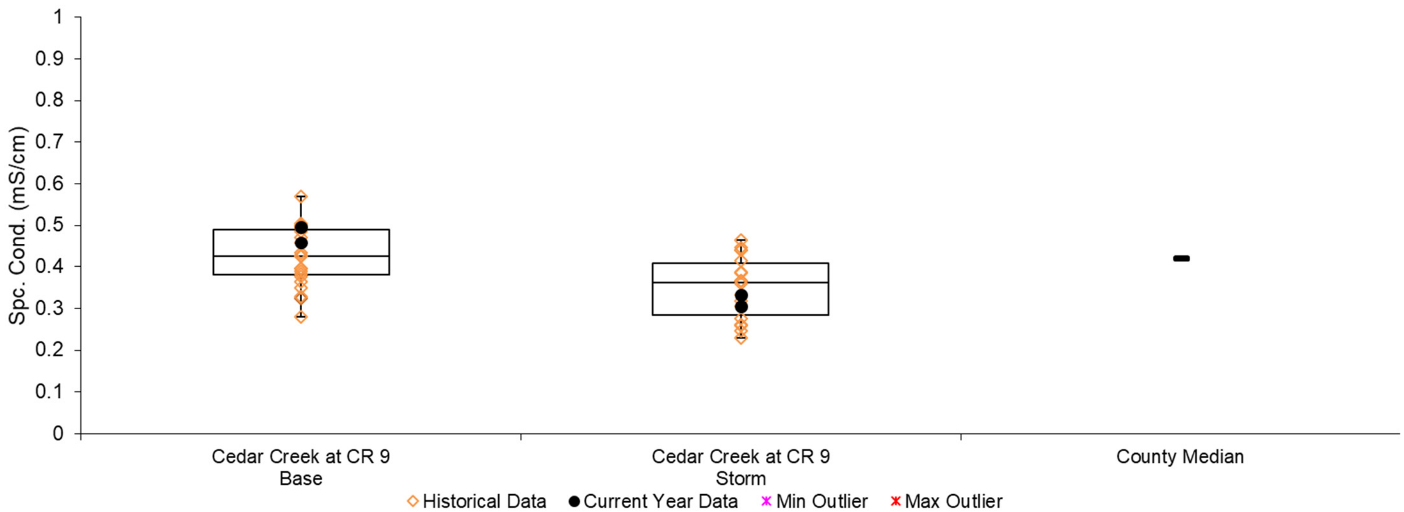
			4/20/2017	5/18/2017	6/7/2017	7/17/2017				
	Units	R.L.*	Results	Results	Results	Results	Median	Average	Min	Max
pH		0.1	7.46	8.94	7.70	7.89	7.80	8.00	7.46	8.94
Conductivity	mS/cm	0.01	0.305	0.333	0.458	0.496	0.40	0.398	0.305	0.496
Turbidity	NTU	1	9.0	30.9	20.9	2.4	14.95	15.80	2.40	30.90
D.O.	mg/L	0.01	9.14	5.66	8.37	7.82	8.10	7.75	5.66	9.14
D.O.	%	1	80.1	54.9	91.7	91.2	85.65	79.5	54.9	91.7
Temp.	°C	0.1	8.05	13.57	19.33	21.66	16.45	15.7	8.1	21.7
Salinity	%	0.01	0.14	0.15	0.22	0.24	0.19	0.19	0.14	0.24
T.P.	ug/L	10	70	196	242	95	145.50	151	70	242
TSS	mg/L	2	11	32	38	8	21.50	22.3	8.0	38.0
Secchi-tube	cm			43.00	63	>100	53.00	>90	43	>100
Appearance			Brown	Murky, Debris	Clear, light brown	Clear				

*reporting limit

Conductivity

Conductivity and chlorides are measures of dissolved pollutants. Dissolved pollutant sources include road runoff and industrial chemicals, among many others. Metals, hydrocarbons, road salts, and others are often of concern in a suburban environment. Conductivity is the broadest measure of dissolved pollutants we use. It measures electrical conductivity of the water; pure water with no dissolved constituents has zero conductivity. Chlorides are the measure of chloride salts, the most common of which are road de-icing chemicals. Chlorides can also be present in other pollutant types, such as wastewater. These pollutants are of greatest concern because of the effect they can have on the stream's biological community. Historical chloride data can be obtained from the Anoka Conservation District and is also available through the Minnesota Pollution Control Agency's EQuIS database, which is available through their website.

Conductivity during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2017 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



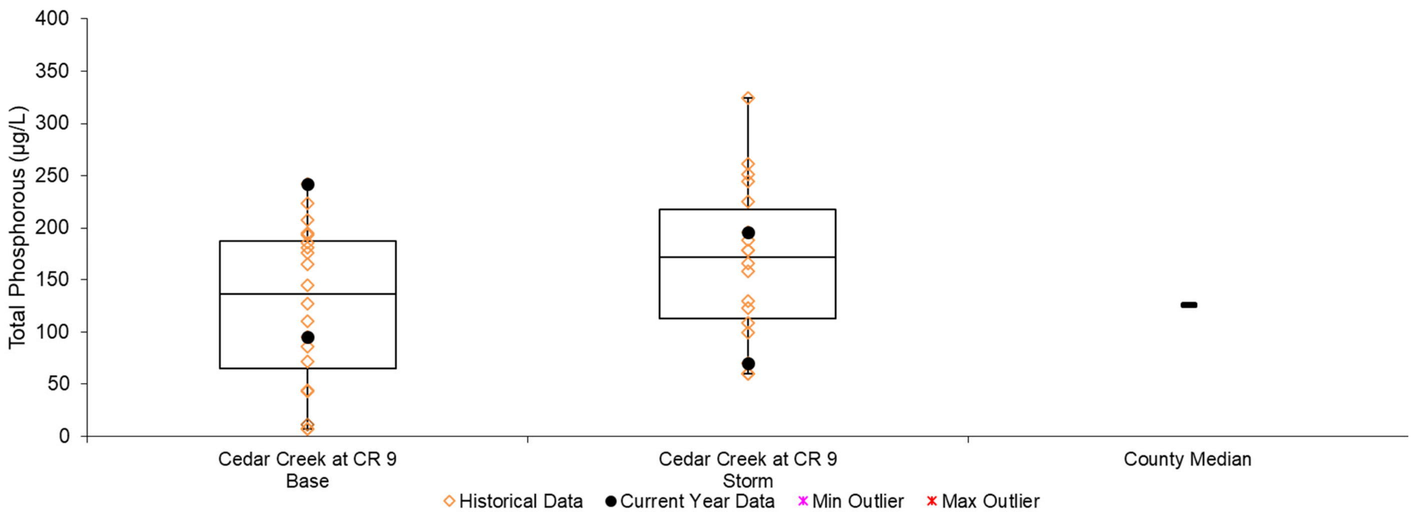
Conductivity is right on par in Cedar Creek at CR 9 compared to other Anoka County streams. Median conductivity (all years) is 0.426 mS/cm during baseflow and 0.363 mS/cm during storm events, respectively. The long-term countywide median conductivity for all conditions is 0.420 mS/cm. This however includes many heavily urbanized streams as well. Baseflow conductivity appears to be higher over the last few sampling years (since 2014). The median baseflow conductivity since 2014 is 0.485 mS/cm, above the long-term median suggesting increasing levels. However, the median storm flow conductivity since 2014, 0.319 mS/cm, is lower than the long-term average.

This increase in baseflow conductivity levels reveals some information about sources of loading into the stream. Higher levels at baseflow conditions indicate that the surficial groundwater of the watershed is being loaded with salts and other chemicals that increase conductivity. Some common sources of this type of pollution are road salts, septic leaks, and agricultural chemicals. These chemicals appear to be entering the stream in higher concentrations from the local surficial groundwater. Storm runoff then dilutes conductivity levels during rain events.

Total Phosphorus

Total phosphorus in Cedar Creek remained high in 2017 averaging 151 µg/L during all conditions. This nutrient is one of the most common pollutants in our region, and can be associated with urban runoff, agricultural runoff, wastewater, and many other sources. The median phosphorus concentration at Cedar Creek at CR 9 (all years) is 136 µg/L during baseflow, similar to the County stream median, and 172 µg/L during storm events. 14 of the 18 measurements taken since 2014 were >100 µg/L, the State water quality standard. In 2017, the highest observed total phosphorus concentrations were recorded during May and June at 196 µg/L and 242 µg/L. Individual results over 200 µg/L have become an annual occurrence since 2015. In all, phosphorus concentrations in Cedar Creek are at concerning levels and should be an area of pollution control efforts. Sources may include a mix of natural sources, such as wetlands, in combination with agricultural and suburban runoff.

Total phosphorus during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2017 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



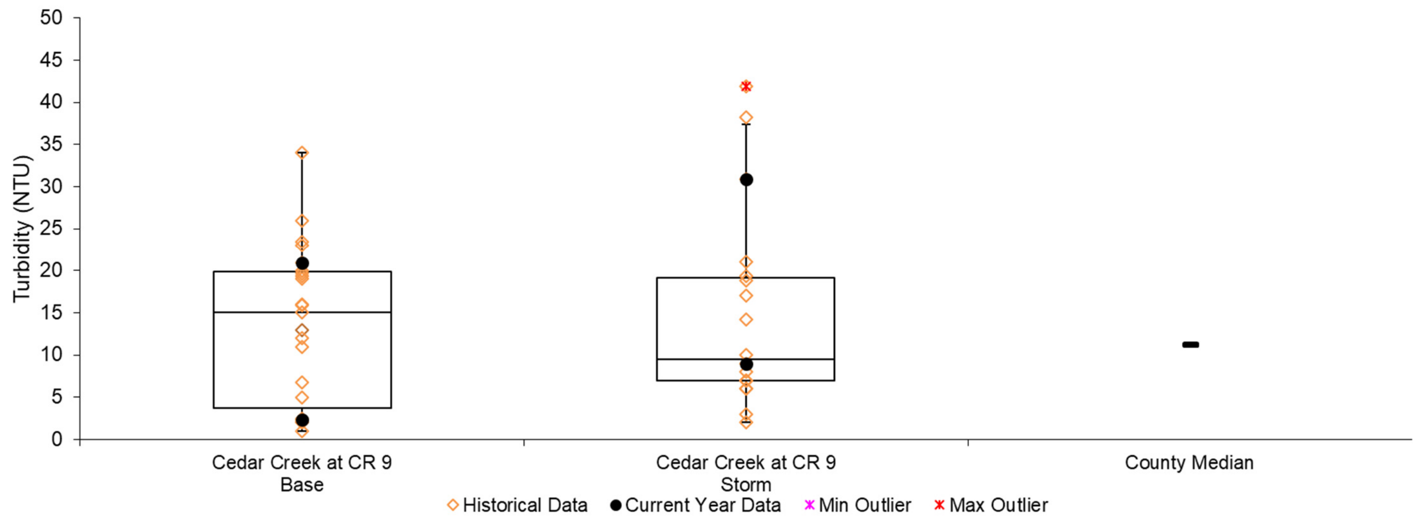
Turbidity and Total Suspended Solids (TSS)

Turbidity and total suspended solids (TSS) are two different measurements of solid material suspended in the water. Turbidity is measured by refraction of a light beam passed through a water sample. It is most sensitive to large particles. Total suspended solids are measured by filtering solids from a water sample and weighing the filtered material. The amount of suspended material is important because it affects transparency and aquatic life, and because many other pollutants are attached to particles. Many stormwater treatment practices such as street sweeping, sumps, and stormwater settling ponds target sediment and attached pollutants.

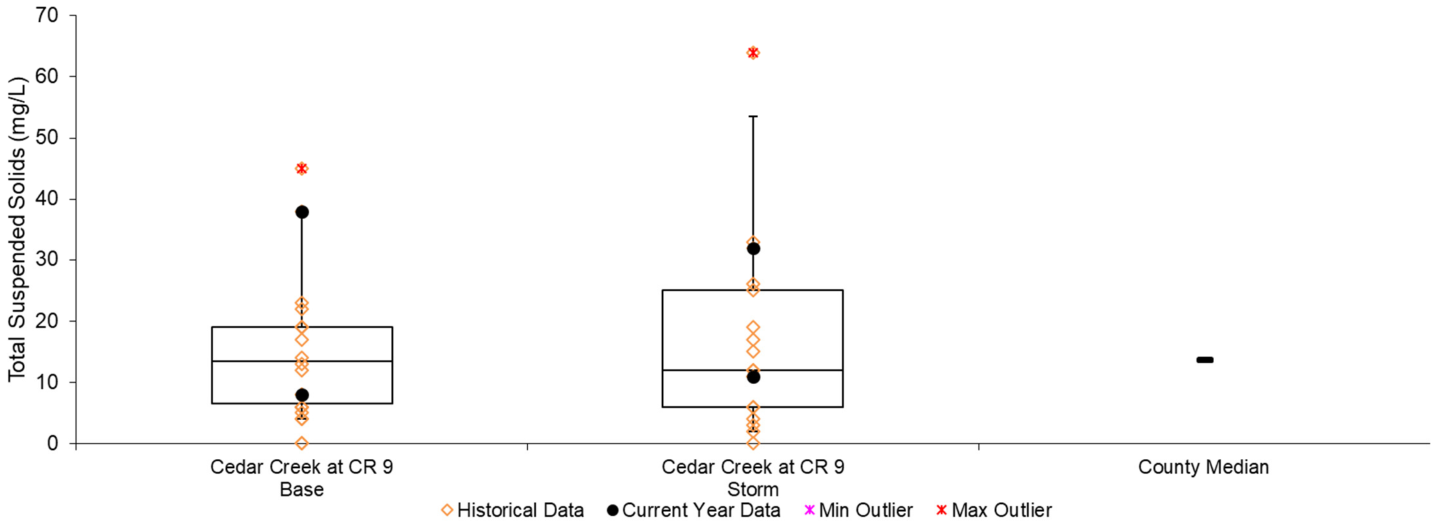
Cedar Creek turbidity in 2017 was variable amongst the four samples taken. A low storm flow result of 9 NTU in early spring and a low baseflow result of 2.4 NTU in July were bracketed by higher results (20.9 and 30.9 NTU) in May and June. The median turbidity (all years) remains 15 NTU during baseflow and rose slightly to 9.5 NTU during storm events after 2017 results were added. Both are higher than the median for Anoka County streams of 8.5 NTU. The maximum turbidity measured in 2017 was 30.9 NTU.

TSS was similar to turbidity with low spring and summer results bracketing high early summer results. The median TSS concentration for Cedar Creek is 12 mg/L, matching the median for all Anoka County streams. TSS is lower than the State water quality standard of no more than 10% of observations greater than 30 mg/L.

Turbidity during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2017 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



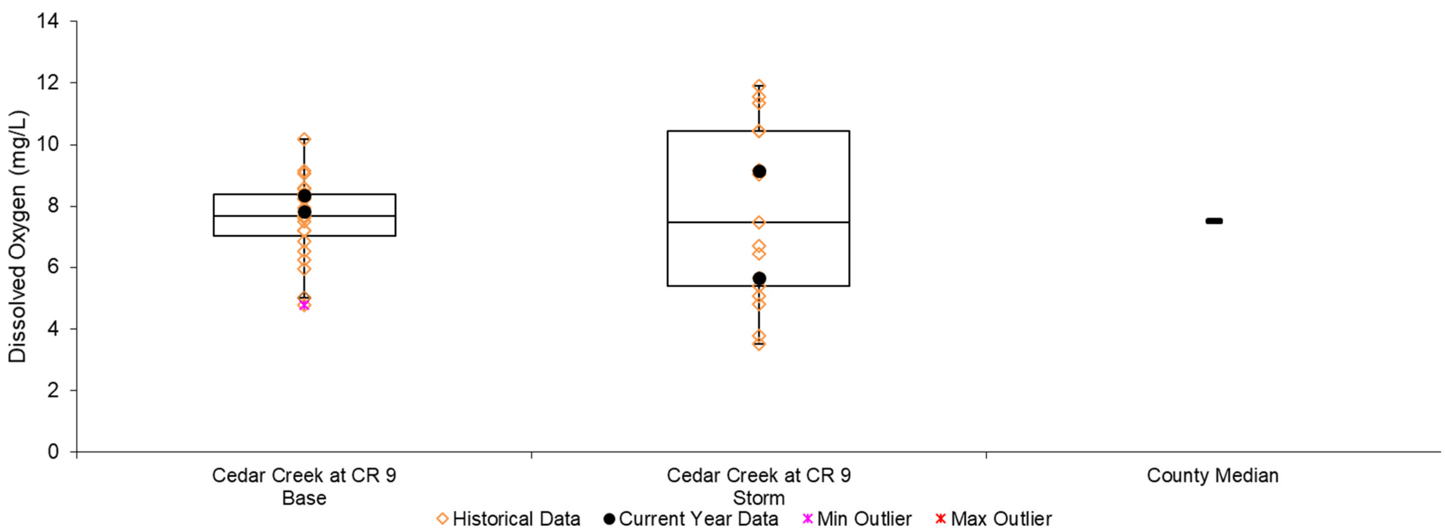
Total Suspended Solids during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2017 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



Dissolved Oxygen

Dissolved oxygen is necessary for aquatic life, including fish. Organic pollution consumes oxygen when it decomposes. If oxygen levels fall below the state standard of 5 mg/L aquatic life begins to suffer. In 2017, dissolved oxygen in Cedar Creek was always above 5 mg/L. Median dissolved oxygen of all years of data is 7.68mg/L during baseflow and 7.46 mg/L during storm events. Few readings of <5 mg/L have been observed at Cedar Creek, and there is no management concern at this time.

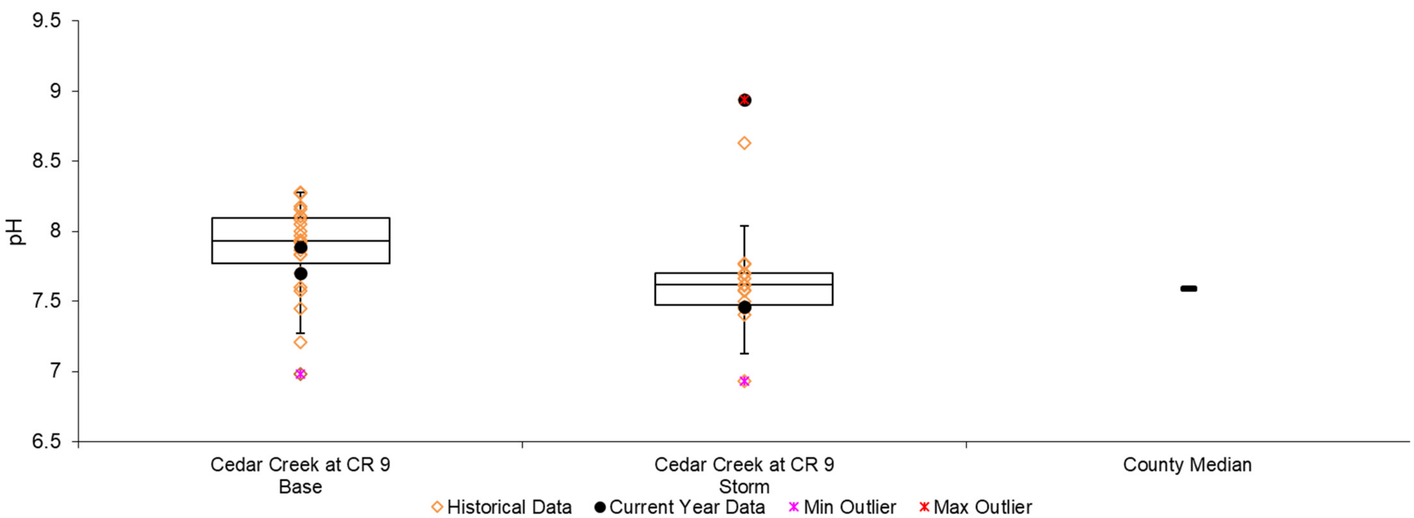
Dissolved oxygen during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2017 readings Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



pH

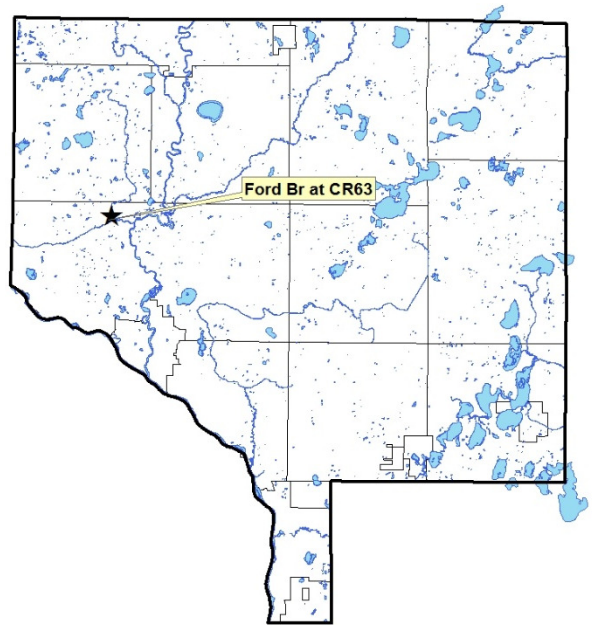
pH refers to the acid or base nature of the water. The Minnesota Pollution Control Agency's water quality standard is for pH to be between 6.5 and 8.5. Including 2017, Cedar Creek has only had two measurements outside of this range, one of which was in 2017. A pH of 8.94 measured on 5/18/2017 is the highest pH ever recorded in Cedar Creek. pH is generally lower during storms than during baseflow, but interestingly, the two highest pH readings historically have been high outliers during storm flows. The pH of rain is typically lower (more acidic). The rare occasion when pH exceeds the State standard should not be concerning.

pH during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2017 readings Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



FORD BROOK

at County Road 63, Nowthen STORET SiteID = S003-200



Background

Ford Brook originates at Goose Lake in northwestern Anoka County and flows south. Ford Brook is a tributary to the Rum River. It joins Trott Brook just prior to the Rum River. The watershed is moderately developed with scattered single-family homes, but continues to be developed as large-lot residential.

Results Summary

This report includes data from 2017 and an overview of previous year's data. The following is a summary of results.

- Dissolved constituents, as measured by conductivity, in Ford Brook were greater in 2017 during baseflow conditions than recent years and above average when compared to similar Anoka County streams. Conductivity averaged 0.481 mS/cm in 2017. Levels are not highly problematic today, but could become so over time. Like many streams in the area, Ford Brook seems to be experiencing a baseflow conductivity increase. Conductivity is commonly linked to road deicing salts, although other sources like water softeners and dissolved pollutants can contribute. Periodic chloride sampling is recommended to verify if observed conductivity increases are due to salts. Road deicing practices and technologies continue to develop and be adopted locally, but more appears needed.
- Total Phosphorous remained, on average, in excess of the MPCA water quality standard of 100 µg/L. Ford Brook often exceeds the limit, even during baseflow conditions. This is common for streams in the area. Phosphorous results in Ford Brook averaged 116 µg/L with a maximum of 145µg/L and a minimum of 73 µg/L. Modest phosphorus reduction efforts could realistically keep Ford Brook off the State list of impaired waters. New development that could increase phosphorus should utilize appropriate phosphorus reduction practices.
- Suspended solids and turbidity both averaged below (better than) State standards. Total suspended solids averaged 17.25 mg/L. Turbidity averaged 15.6 NTU. There is no current management concern.
- pH was well within the acceptable range for three of four reading in 2017. The fourth reading, during a storm, had the highest pH on record of 9.26. The average pH for 2017 was 8.12. The rare high reading is not a management concern.
- Dissolved oxygen was within the health range for streams. DO averaged 8.16 mg/L (maximum of 9.62 mg/L and a minimum of 7.29 mg/L).

Ford Brook 2017 Water Quality Data

			4/20/2017	5/18/2017	6/7/2017	7/17/2017				
	Units	R.L.*	Results	Results	Results	Results	Median	Average	Min	Max
pH		0.1	7.63	9.26	7.74	7.86	7.80	8.12	7.63	9.26
Conductivity	mS/cm	0.01	0.411	0.470	0.514	0.527	0.49	0.481	0.411	0.527
Turbidity	NTU	1	18.6	29.6	10.4	3.8	14.50	15.60	3.80	29.60
D.O.	mg/L	0.01	9.62	7.29	8.13	7.61	7.87	8.16	7.29	9.62
D.O.	%	1	83.4	70.1	89.7	91.5	86.55	83.7	70.1	91.5
Temp.	°C	0.1	7.53	13.44	21.43	23.01	17.44	16.4	7.5	23.0
Salinity	%	0.01	0.19	0.22	0.25	0.25	0.24	0.23	0.19	0.25
T.P.	ug/L	10	73	145	114	132	123	116	73	145
TSS	mg/L	2	15	33	12	9	13.50	17.3	9.0	33.0
Secchi-tube	cm			57	98	>100	98	>90	57	>100
Appearance			Brown, White Foam	Brown	Clear	Clear				

*reporting limit

Conductivity

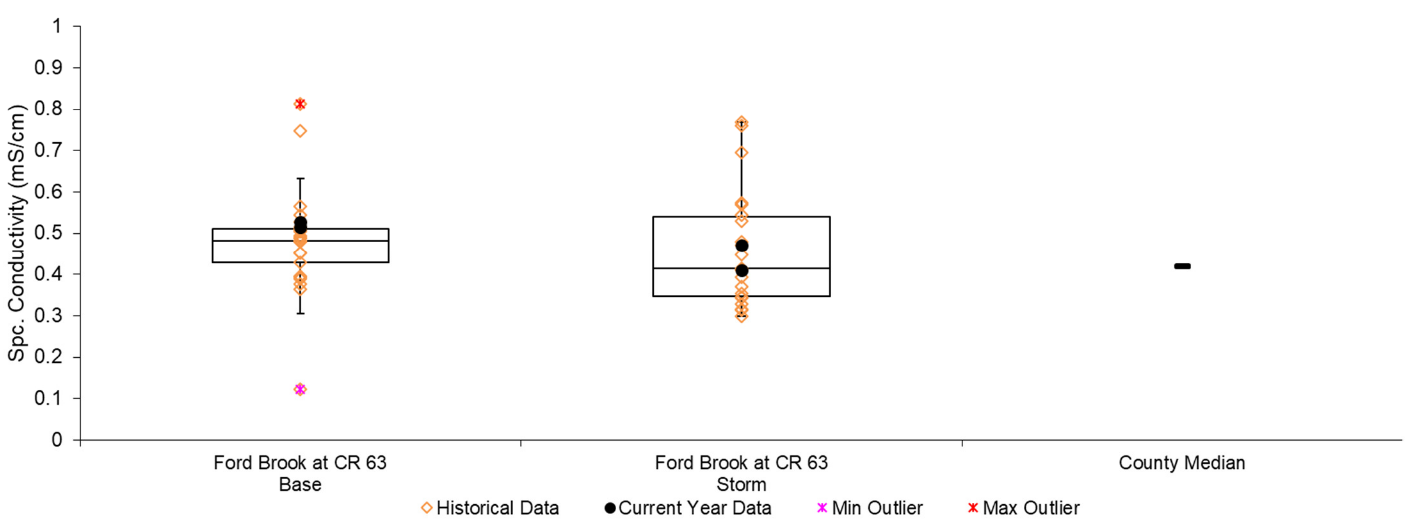
Median conductivity results in Ford Brook are higher than the median for other Anoka County streams. Median conductivity in Ford Brook is 0.481 mS/cm (all years) during baseflow conditions and 0.414 mS/cm during storms, compared to the countywide median of 0.420 mS/cm during all conditions. Baseflow conductivity in 2017 was higher than recent years sampled dating back to 2011 when monitoring resumed in this stream (no monitoring occurred 2004-2010). Baseflow conductivity levels appear to be rising throughout the county, and Ford Brook is no exception.

The baseflow vs storm flow comparison lends some insight into the pollutant sources. If dissolved pollutants were only elevated during storms, stormwater runoff would be suspected as the primary contributor. If dissolved pollutants were highest during baseflow, pollution of the shallow groundwater which feeds the stream during baseflow would be suspected to be a primary contributor. In Ford Brook we find similar, but slightly lower dissolved pollutants during storms. In other words, both stormwater runoff and groundwater are sources of dissolved pollutants, with shallow groundwater contributing slightly more. While storms dilute some of the baseflow pollutants, they also carry additional pollutants, which can offset the dilution.

A likely cause of the increase in conductivity in streams at baseflow is chlorides from road salting. Water softener discharge or dissolved pollutants can also contribute. These salts both runoff into the water and infiltrate into the shallow groundwater that feeds the stream during baseflow. WMOs should consider periodic chloride sampling to assess the contribution of salts to the dissolved pollutant load.

From a management standpoint, it is important to remember that the sources of both stormwater and baseflow dissolved pollutants are generally the same; it is only the timing of delivery to the stream that is different. Preventing their release into the environment and treating them before infiltration should be a high priority. Training and equipment that minimize road salting while keeping roads safe is being increasingly emphasized by watershed managers throughout the region.

Conductivity at Ford Brook. Orange diamonds are historical data from previous years and black circles are 2017 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).

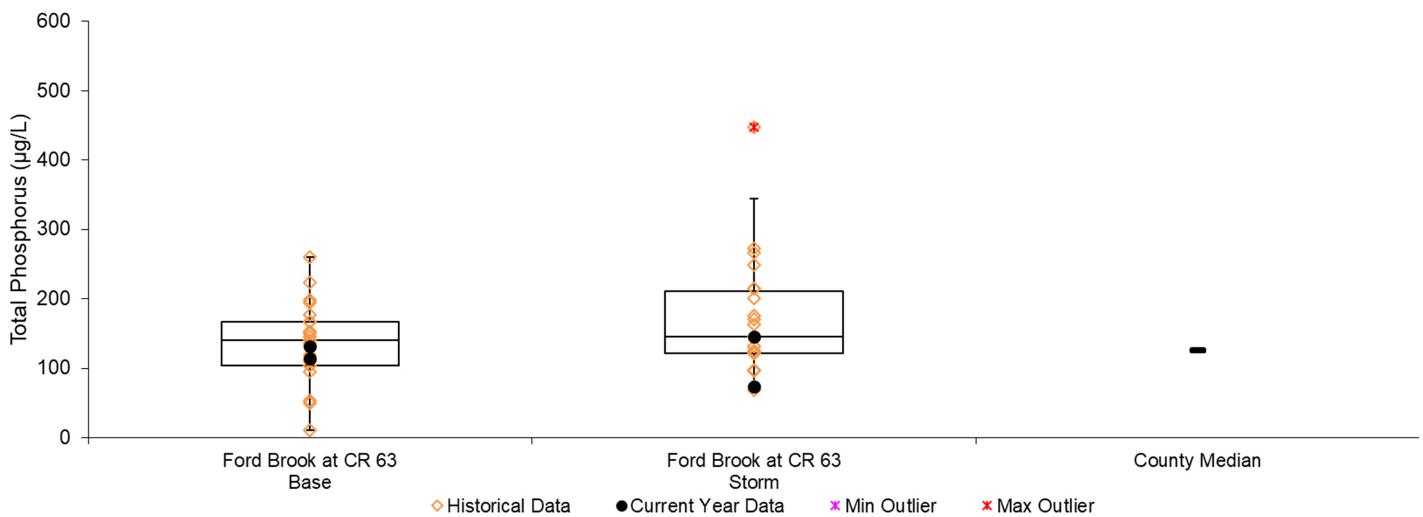


Total Phosphorus

Total phosphorus (TP) is a common nutrient pollutant. It is limiting for most algal growth. In the past, total phosphorus in Ford Brook has been moderate during baseflow conditions and increased during storms (see figures below). TP levels in 2017 were still similar, and regularly exceeded the State standard of 100 µg/L. TP levels during storms in 2017, while still averaging higher than the State standard, were on the low end of the range historically observed in this stream.

The phosphorus levels observed are common for Anoka County streams, but do exceed the State's water quality standard. Efforts to reduce phosphorus should be considered but even higher priority should be put on ensuring adequate water treatment for stormwater discharges from new development. The Ford Brook watershed is likely to experience significant development in the years to come. Most of it is current planned as large lot residential.

Total Phosphorus at Ford Brook. Orange diamonds are historical data from previous years and black circles are 2017 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



Total Suspended Solids (TSS) and Turbidity

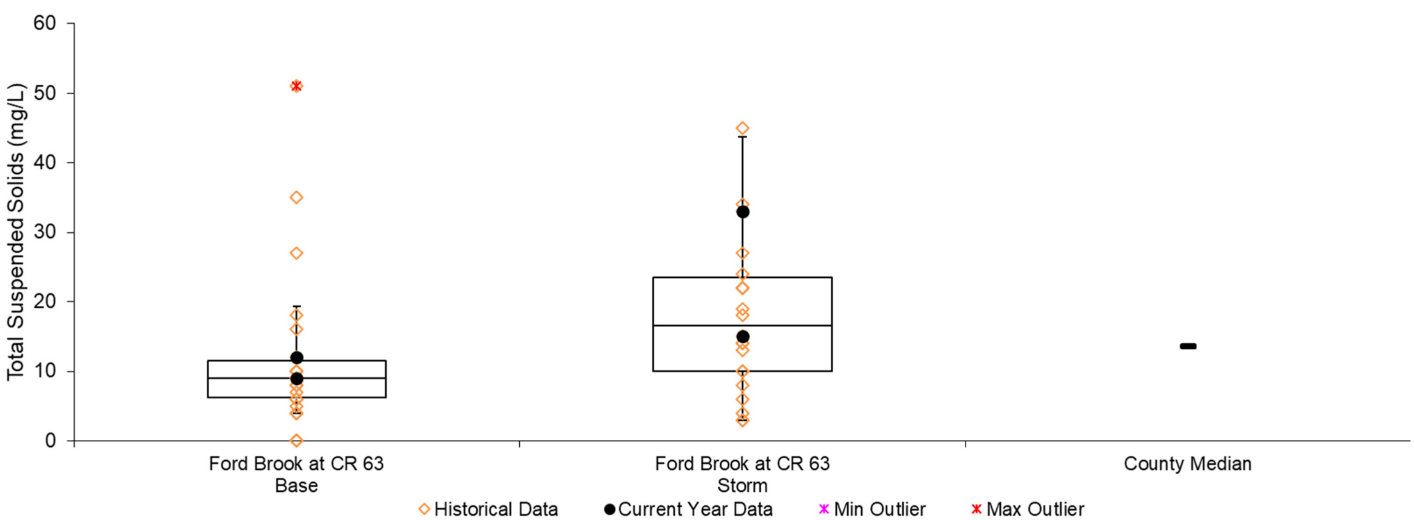
Turbidity and total suspended solids (TSS) are two different measurements of solid material suspended in the water. Turbidity is measured by refraction of a light beam passed through a water sample. It is most sensitive to large particles. Total suspended solids are measured by filtering solids from a water sample and weighing the filtered material. The amount of suspended material is important because it affects transparency and aquatic life, and because many other pollutants are attached to particles. Many stormwater treatment practices such as street sweeping, sumps, and stormwater settling ponds target sediment and attached pollutants.

In Ford Brook, both TSS and turbidity are generally low, though considerably higher during storm events than baseflow. Overall, the levels observed are similar to other streams in the region, below (better than) State water quality standards, and not a significant management concern.

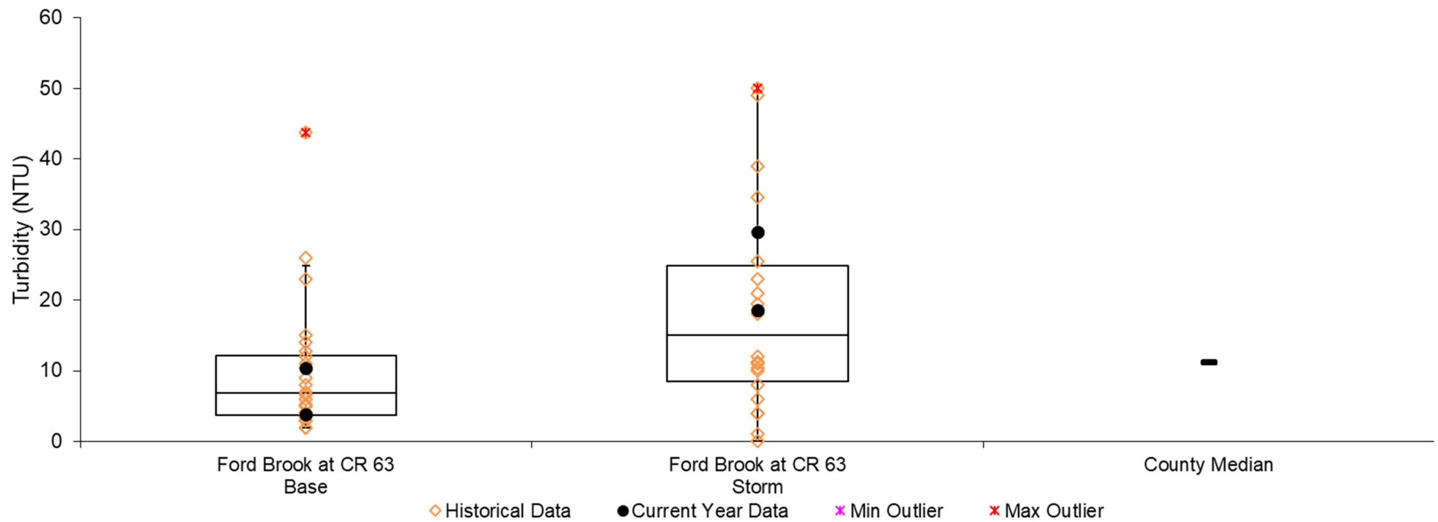
Median turbidity for Ford Brook during baseflow (all years) is 6.8 NTU. Turbidity during storm events is has a median (all years) of 15 NTU. The countywide median for all streams is 8.5 NTU for all conditions. In 2017, one of four readings exceeded the MPCA's water quality threshold of 25 NTU, after two of five eclipsed in in 2016.

Average TSS in 2017 was 17.25 mg/L, and the long term median for all conditions is 10 mg/L. The highest TSS measurement in 2017 was 33 mg/L. The State TSS water quality standard is that no more than 10% of samples should exceed 30 mg/L. Ford Brook's TSS and turbidity appear to be better than State standards.

Total Suspended Solids at Ford Brook. Orange diamonds are historical data from previous years and black circles are 2017 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



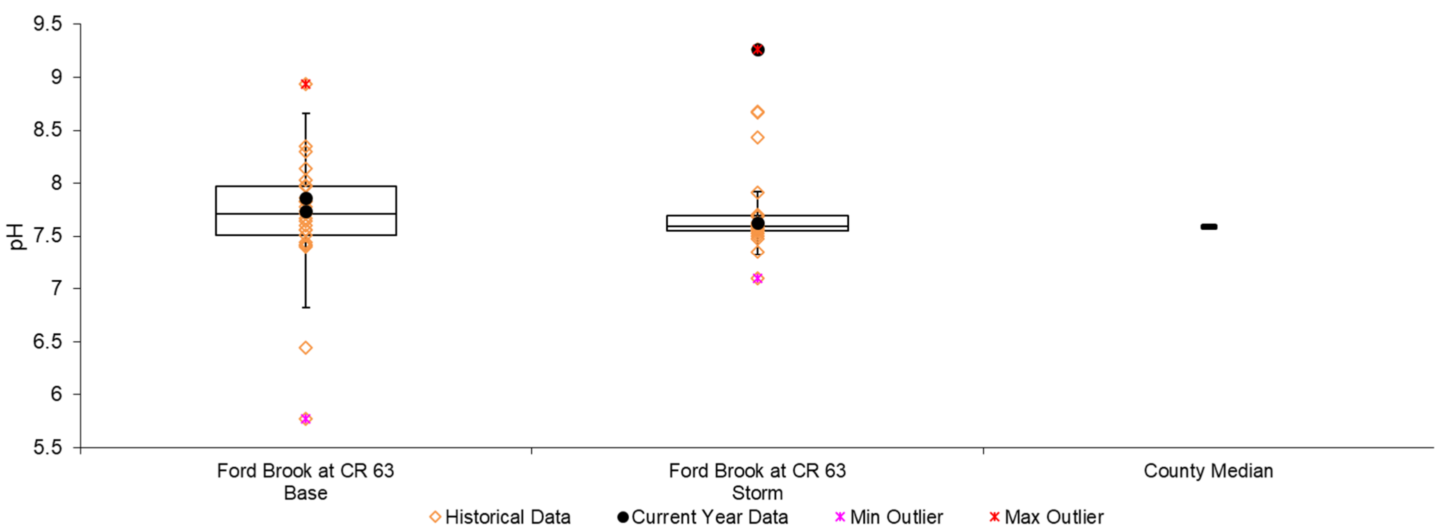
Turbidity at Ford Brook. Orange diamonds are historical data from previous years and black circles are 2017 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



pH

pH refers to the acid or base nature of the water. The Minnesota Pollution Control Agency's water quality standard is for pH to be between 6.5 and 8.5. Three of the four pH readings taken in 2017 were within the State standard range of 6.5-8.5. One storm flow sample had a pH of 9.26, the highest pH ever recorded in Ford Brook. While occasional readings outside of this range have occurred in previous years, they were not large departures that generated concern.

pH at Ford Brook. Orange diamonds are historical data from previous years and black circles are 2017 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).

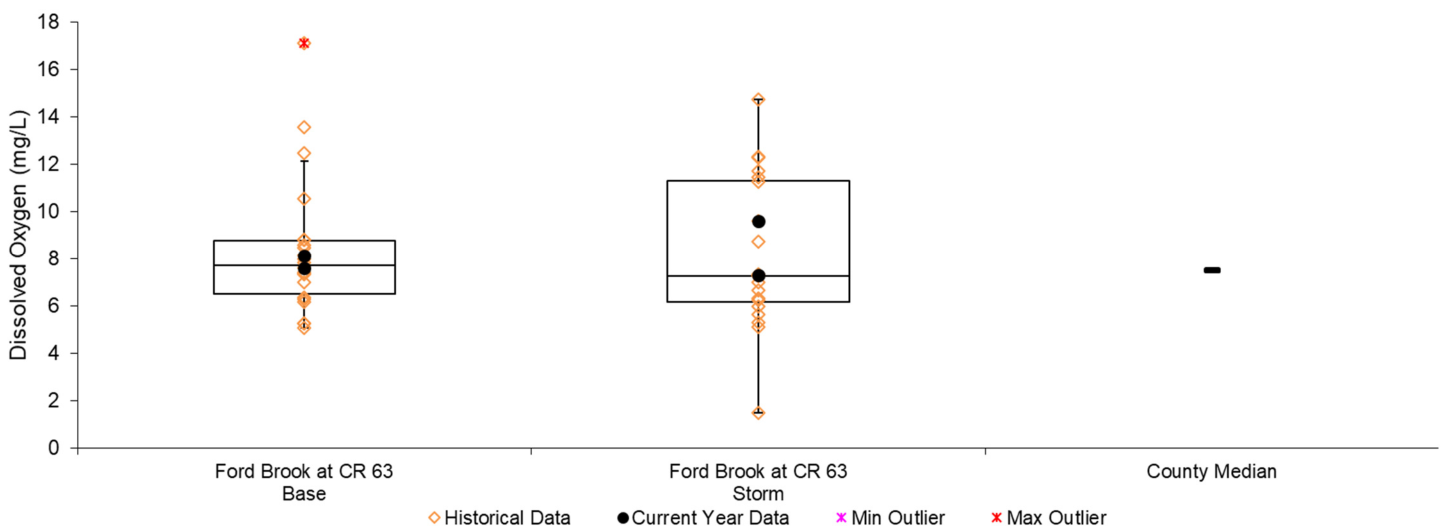


Dissolved Oxygen

Dissolved oxygen is necessary for aquatic life, including fish. Organic pollution causes oxygen to be consumed when it decomposes. If oxygen levels fall below the state standard of 5 mg/L, aquatic life begins to suffer.

Dissolved oxygen in Ford Brook was within acceptable levels. None of the samples collected in 2017 were below the 5 mg/L State standard, when aquatic life suffers.

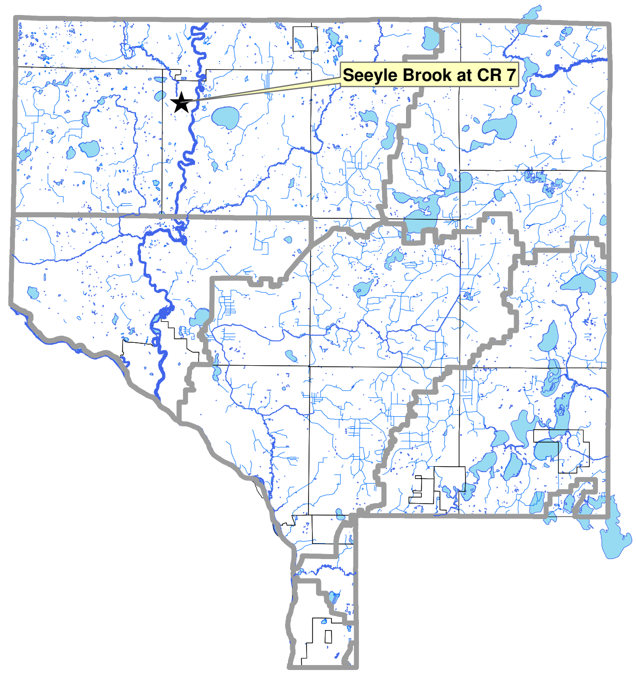
Dissolved Oxygen at Ford Brook. Orange diamonds are historical data from previous years and black circles are 2017 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



Stream Water Quality Monitoring

SEELYE BROOK

at Co. Rd. 7, St. Francis STORET SiteID = S003-204



Background

Seelye Brook originates in southwestern Isanti County and flows south through northwest Anoka County, draining into the Rum River just east of the sampling site. This stream is low gradient, like most other streams in the area. It has a silty or sandy bottom and lacks riffle-pool sequences. It is a moderate to large stream for Anoka County, with a typical baseflow width of 20-25 feet.

The sampling site is in the road right of way of the Highway 7 crossing. Aside from the bridge footings and concrete-grouted stone around the bridge, the stream at this location has a sandy bottom. This site experiences scour during high water because flow is constricted under the bridge. Banks are steep and undercut.

Results Summary

This report includes data from 2017 and an overview of previous year's data. The following is a summary of results.

- Dissolved constituents, as measured by conductivity have been rising in recent years, particularly during baseflow conditions. The baseflow median conductivity since 2014 is 0.515 mS/cm, pre-2014 baseflow median conductivity was 0.397 mS/cm. These levels are becoming concerning, and it is likely that chlorides are a cause and following suit; thus they should be monitored as well.
- Phosphorous remain at concerning levels and again averaged above the MPCA water quality standard of 100 µg/L. Seelye Brook often exceeds the limit, even during baseflow periods. Phosphorous in Seelye Brook averaged 108.25 µg/L (maximum of 151 µg/L and a minimum of 50 µg/L) in 2017.
- Suspended solids and turbidity remain quite low in Seelye Brook compared to other streams. Both parameters had an elevated reading and a very low reading. Turbidity averaged 7.65 NTU while TSS averaged 8.5 mg/L.
- Dissolved oxygen was within the healthy range for a stream. DO averaged 7.79 mg/L (maximum of 8.75 mg/L and a minimum of 6.70 mg/L).
- pH on average was within the range considered normal and healthy for streams in this area, averaging 8.07. A record high reading of 9.14 was recorded in 2017, but this is not a recurring problem in Seelye Brook.

			4/20/2017	5/18/2017	6/7/2017	7/17/2017				
	Units	R.L.*	Results	Results	Results	Results	Median	Average	Min	Max
pH		0.1	7.53	9.14	7.80	7.81	7.81	8.07	7.53	9.14
Conductivity	mS/cm	0.01	0.313	0.382	0.539	0.522	0.45	0.439	0.313	0.539
Turbidity	NTU	1	6.2	15.2	8.0	1.3	7.10	7.68	1.30	15.20
D.O.	mg/L	0.01	8.75	6.70	8.43	7.26	7.85	7.79	6.70	8.75
D.O.	%	1	75.7	63.9	88.2	83.6	79.65	77.9	63.9	88.2
Temp.	°C	0.1	7.58	13.29	18.33	20.78	15.81	15.0	7.6	20.8
Salinity	%	0.01	0.15	0.18	0.17	0.25	0.18	0.19	0.15	0.25
T.P.	ug/L	10	50	129	151	103	116.00	108	50	151
TSS	mg/L	2	<2	16	12	4	12.00	8.5	<2	16.0
Secchi-tube	cm			89.00	91	>100	90.00	>90	89	>100
Appearance			Clear, Tanin Tinted	Murky	Clear	Clear				

*reporting limit

Conductivity

Conductivity is a broad measure of dissolved constituents in water. It measures electrical conductivity of the water; pure water with no dissolved constituents has zero conductivity. Dissolved pollutant sources include urban road runoff, industrial chemicals, deicing salts and others. Overall, baseflow conductivity in Seelye Brook is moderately high and rising.

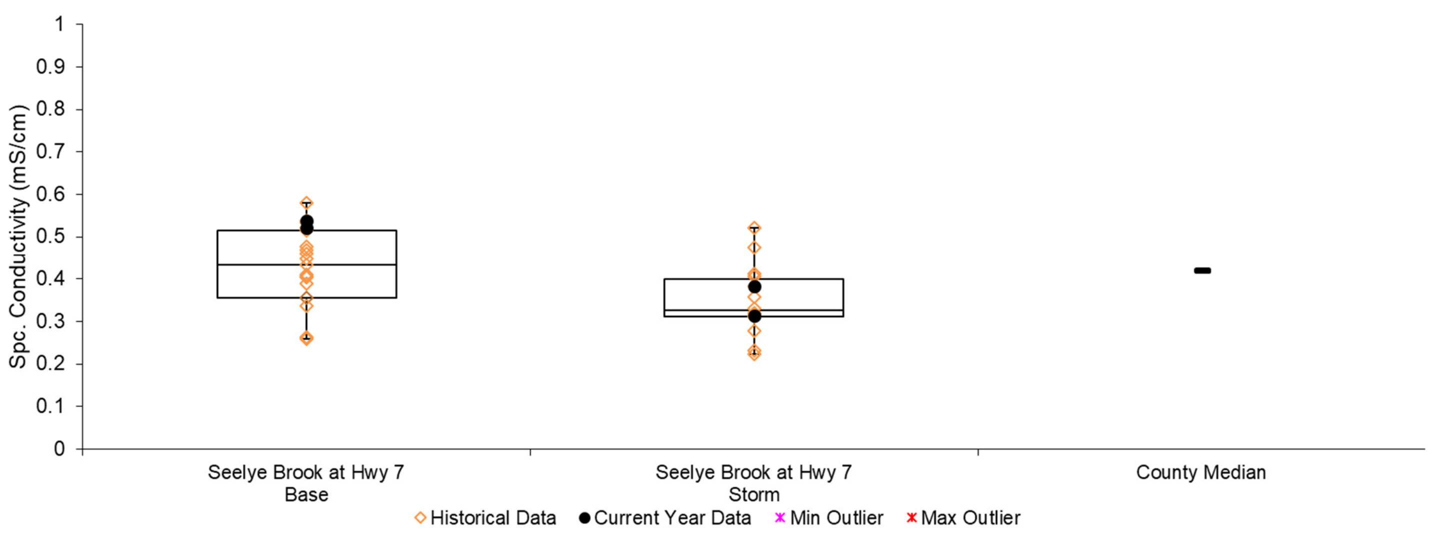
Conductivity has historically been low in Seelye Brook at Hwy 7, but has increased during baseflow conditions in recent years. Median conductivity (all years) is 0.433 mS/cm during baseflow and 0.325 mS/cm during storm events. The overall median for all conditions is 0.403 mS/cm, just below the median for Anoka County streams of 0.420 mS/cm, which includes many streams in very highly urbanized areas. Since August of 2014, however, the median baseflow conductivity is 0.515 mS/cm. Both of the 2017 baseflow samples were at the upper quartile of historical samples, both exceeding 0.5 mS/cm.

The baseflow vs storm flow comparison lends some insight into the pollutant sources. If dissolved pollutants were only elevated during storms, stormwater runoff would be suspected as the primary contributor. If dissolved pollutants were highest during baseflow, pollution of the shallow groundwater which feeds the stream during baseflow would be suspected to be a primary contributor. In Seelye Brook we find lower dissolved pollutants during storms. In other words, both stormwater runoff and groundwater are sources of dissolved pollutants, with shallow groundwater contributing more. While storms dilute some of the baseflow pollutants, they also carry additional pollutants, which can offset the dilution.

A likely cause of the increase in conductivity in streams is chlorides from road salting. Water softener discharge or dissolved pollutants can also contribute. These salts both runoff into the water and infiltrate into the shallow groundwater that feeds the stream during baseflow. WMOs should consider periodic chloride sampling to assess the contribution of salts to the dissolved pollutant load.

From a management standpoint, it is important to remember that the sources of both stormwater and baseflow dissolved pollutants are generally the same; it is only the timing of delivery to the stream that is different. Preventing their release into the environment and treating them before infiltration should be a high priority. Training and equipment that minimize road salting while keeping roads safe is being increasingly emphasized by watershed managers throughout the region.

Conductivity during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2017 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



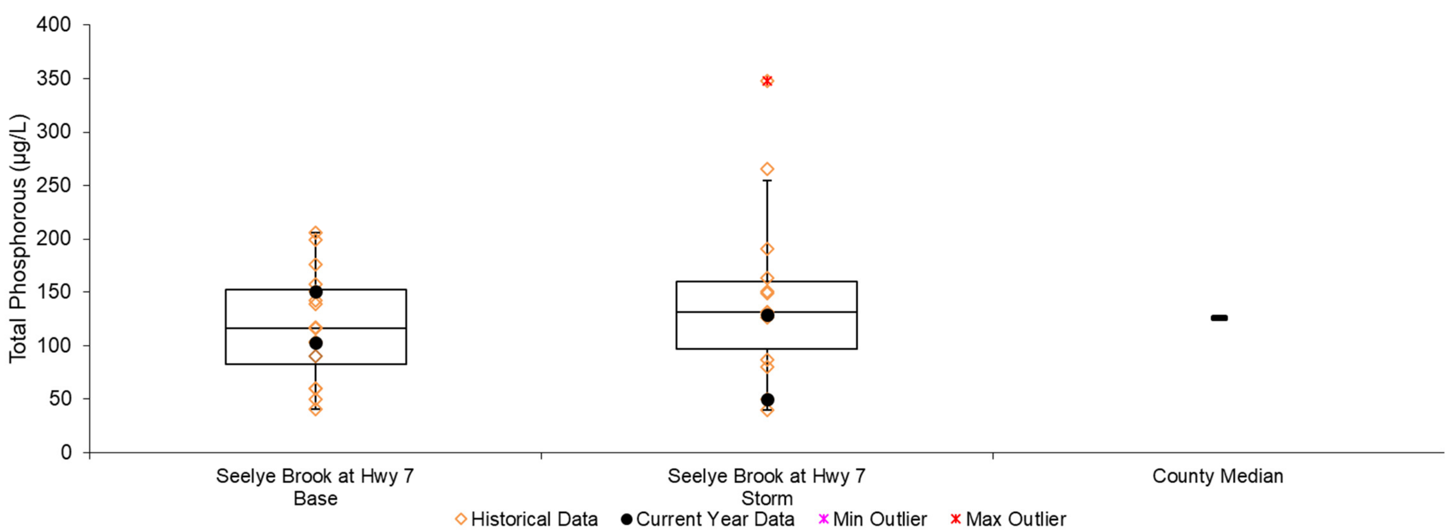
Total Phosphorus

Total phosphorus concentrations in Seelye Brook in 2017 were lower than in recent years, though still averaged over the State water quality standard of 100 µg/L (108.25 µg/L). This nutrient is one of the most common pollutants in our region and can be associated with runoff from various sources. The median phosphorus concentration at Seelye Brook at Hwy 7 (all years) is 116.5 µg/L during baseflow and 131 µg/L during storm events. Only one of sixteen samples taken since June of 2014 has resulted in TP concentrations below the state water quality standard of 100 µg/L, with some samples doubling the standard.

The benefits of a recent upgrade to the City of St. Francis wastewater plant are unclear in this data. The new plant went online in April 2017 with new nutrient reduction technologies. The new plant discharges entirely to Seeyle Brook; previously there were discharges to both Seelye Brook and the Rum River.

Phosphorus in Seelye Brook is at concerning levels and should continue to be an area of pollution control effort as the area urbanizes. Cooperative efforts with Isanti County and Isanti Soil and Water Conservation District would likely be helpful, given that Seelye Brook originates in Isanti County.

Total phosphorus during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2017 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



Turbidity and Total Suspended Solids (TSS)

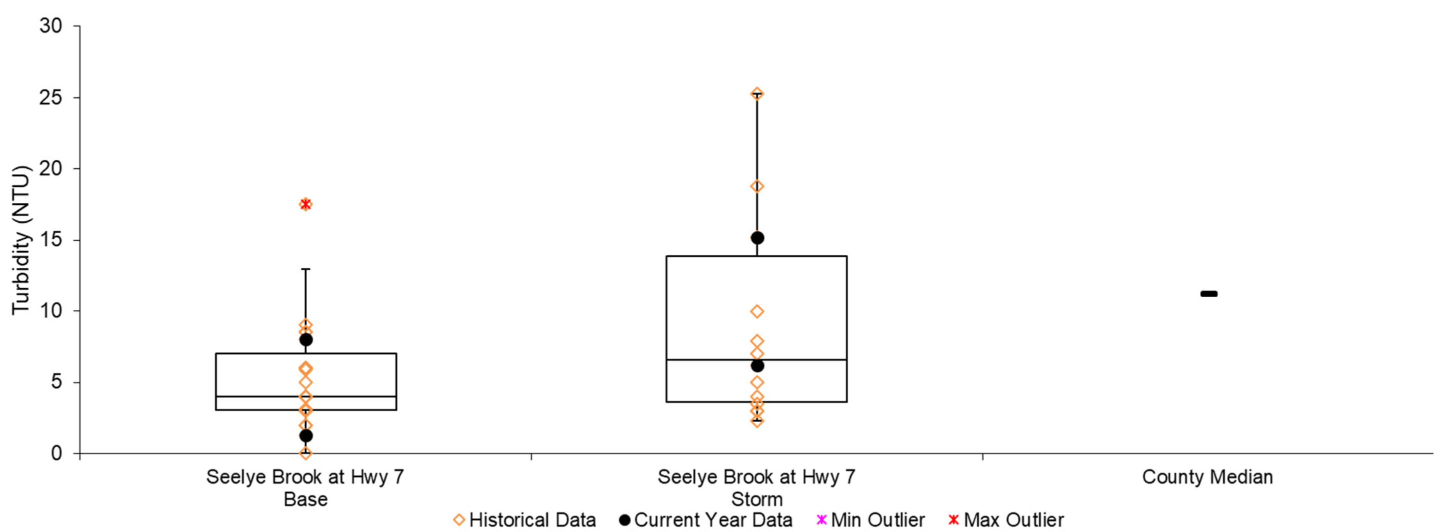
Turbidity and total suspended solids (TSS) are two different measurements of solid material suspended in the water. Turbidity is measured by refraction of a light beam passed through a water sample. It is most sensitive to large particles. Total suspended solids are measured by filtering solids from a water sample and weighing the filtered material. The amount of suspended material is important because it affects transparency and aquatic life, and because many other pollutants are attached to particles. Many stormwater treatment practices such as street sweeping, sumps, and stormwater settling ponds target sediment and attached pollutants. Turbidity and TSS are low in Seelye Brook, and there are no management concerns at this time.

Overall, turbidity in Seelye Brook remains low compared to other streams with its highest reading ever recorded last year in 2016 of just 25.3 NTU. The median turbidity (all years) is 4.0 NTU during baseflow and 6.6 NTU during storm events, both lower than the median for Anoka County streams of 8.5 NTU. The State water quality standard is 25 NTU.

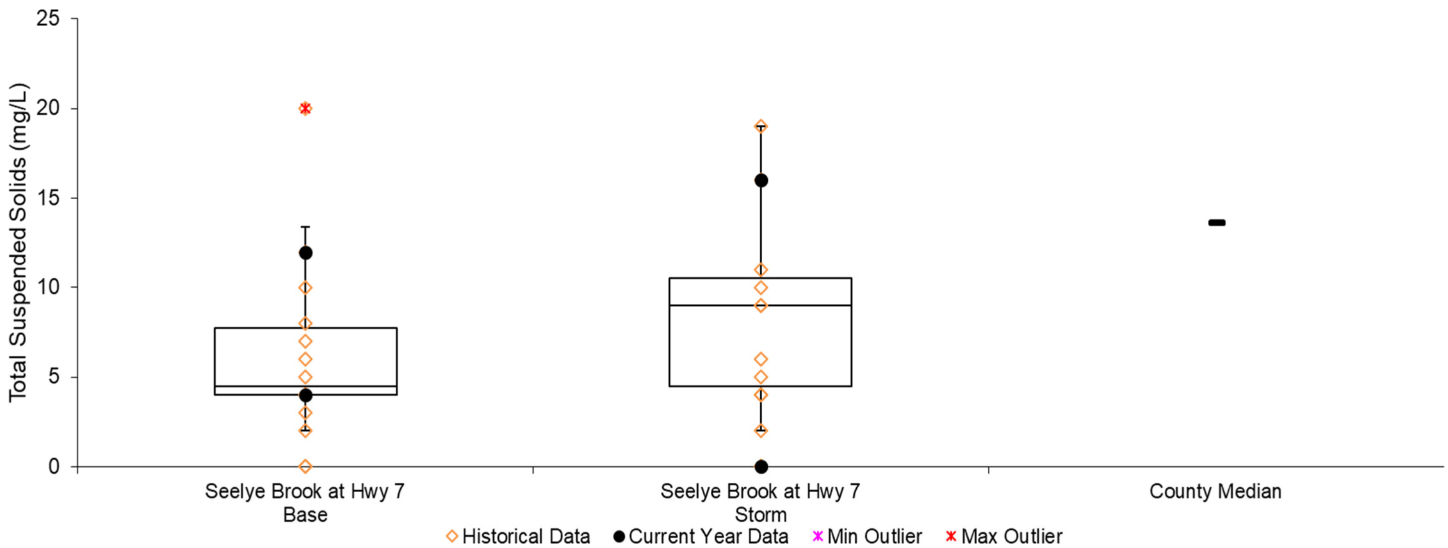
TSS concentrations in 2017 were similarly low. The median TSS concentration in Seelye Brook during baseflow conditions was 4.0 mg/L and the storm flow median was just 5.5 mg/L. These medians, along with the historical average of 6.6 mg/L are well below the state water quality standard of 30 mg/L.

It is important to note the suspended solids can come from sources within and outside of the river channel. Sources on land include soil erosion, road sanding, and others. Riverbank erosion and movement of the river bottom also contributes to suspended solids. A moderate amount of this "bed load" is natural and expected. Both turbidity and TSS, while low, should continue to be monitored in this watershed. This monitoring can be especially important as development of the area continues and can be an indicator of poor erosion management practices.

Turbidity during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2017 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



Total Suspended Solids during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2017 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).

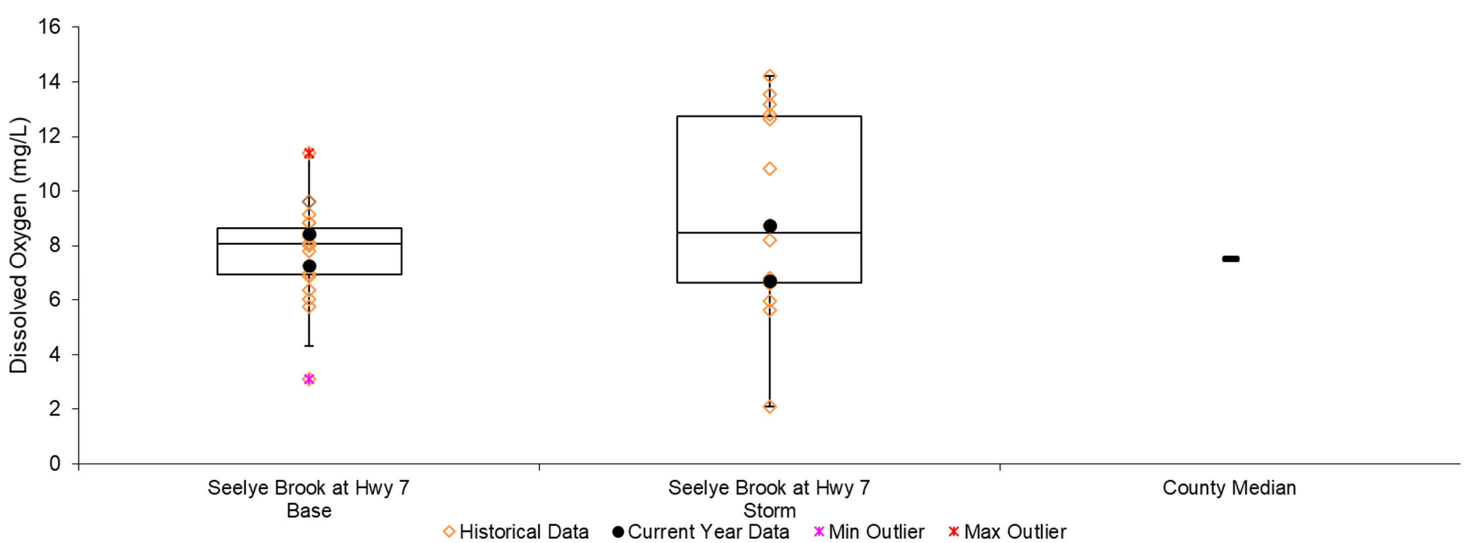


Dissolved Oxygen

Dissolved oxygen is necessary for aquatic life, including fish. Organic pollution causes oxygen to be consumed when it decomposes. If oxygen levels fall below the state standard of 5 mg/L, aquatic life begins to suffer.

Seelye Brook's dissolved oxygen levels are typically well above 5 mg/L, and 2017 was no exception. Median dissolved oxygen (all years) is 8.08 mg/L during baseflow and 8.48 mg/L during storm events. The average dissolved oxygen concentration in 2017 was 7.79 mg/L with a minimum reading of 6.70 mg/L.

Dissolved oxygen during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2017 readings Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).

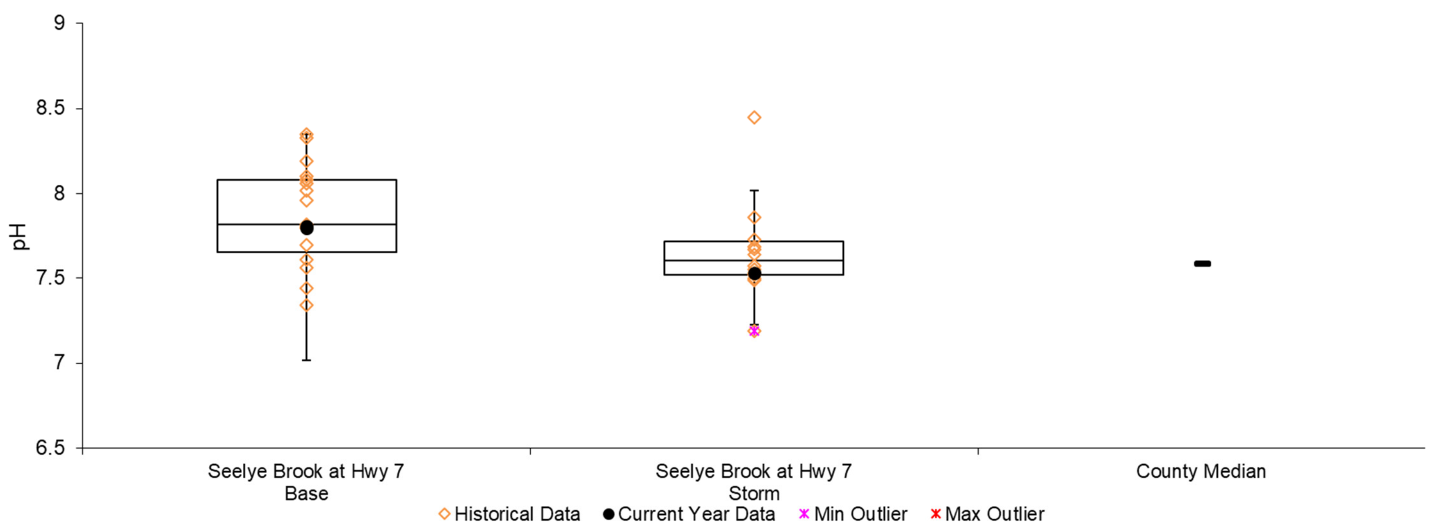


pH

pH refers to the acidity of the water. The Minnesota Pollution Control Agency's water quality standard is for pH to be between 6.5 and 8.5. Seelye Brook had not exceeded this range during any of the years the ACD has sampled it until 2017. A high pH reading of 9.14 was recorded during a storm flow in 2017. This high reading is an exception and an outlier, especially during a storm flow event, for Seelye Brook. It is not a concern unless additional similar readings are found in the future.

It is interesting to note that pH is generally slightly lower during storms than during baseflow conditions. This is because the pH of rain is typically lower (more acidic). While acid rain is a longstanding problem, its effect on this aquatic system is small.

pH during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2017 readings Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



Wetland Hydrology

Description: Continuous groundwater level monitoring at a wetland boundary, to a depth of 40 inches. Countywide, the ACD maintains a network of 23 wetland hydrology monitoring stations.

Purpose: To provide understanding of wetland hydrology, including the impacts 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: Alliant Tech Reference Wetland, Alliant Tech Systems property, St. Francis

Cedar Creek, Cedar Creek Natural History Area, East Bethel

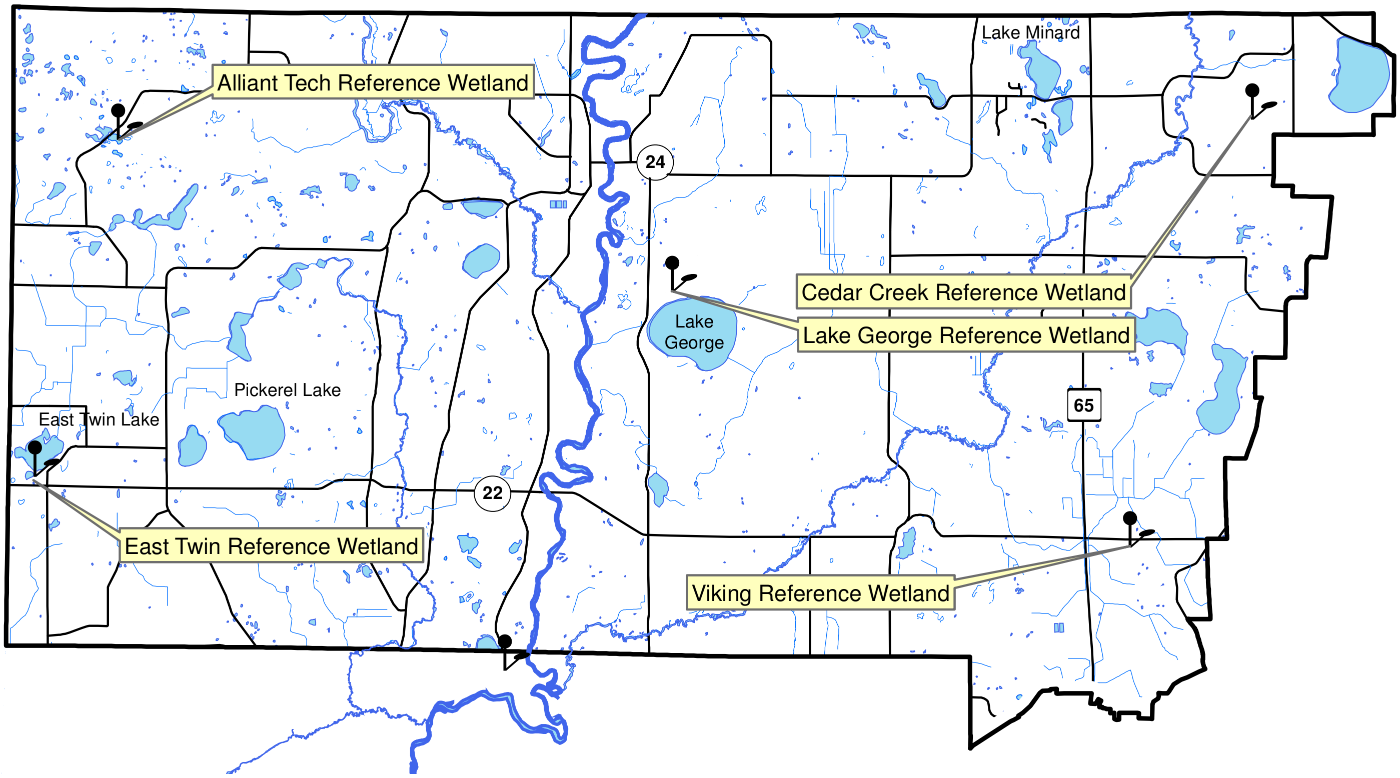
East Twin Reference Wetland, East Twin Township Park, Nowthen

Lake George Reference Wetland, Lake George County Park, Oak Grove

Viking Meadows Reference Wetland, Viking Meadows Golf Course, East Bethel

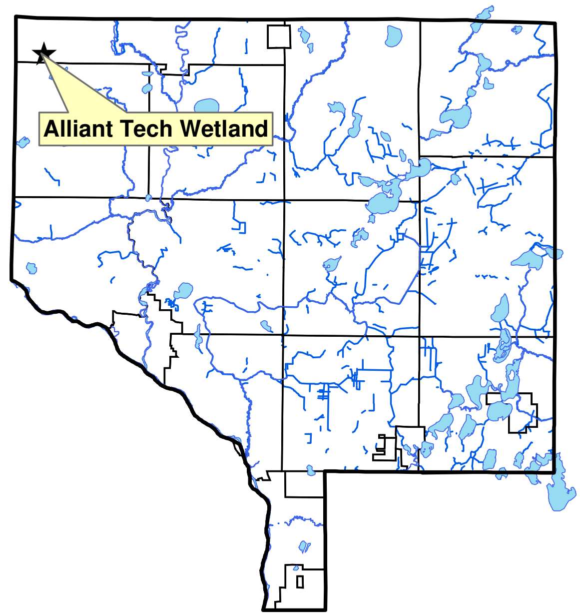
Results: See the following pages. Raw data and updated graphs can be downloaded from www.AnokaNaturalResources.com using the Data Access Tool.

Upper Rum River Watershed Wetland Hydrology Monitoring Sites



ALLIANT TECH REFERENCE WETLAND

Alliant Techsystems Property, St. Francis



Site Information

Monitored Since: 2001

Wetland Type: 5

Wetland Size: ~12 acres

Isolated Basin? Yes

Connected to a Ditch? No

Soils at Well Location:

Horizon	Depth	Color	Texture	Redox
A	0-8	N2/0	Mucky loam	-
Bg	8-35	5y5/1	Sandy loam	-

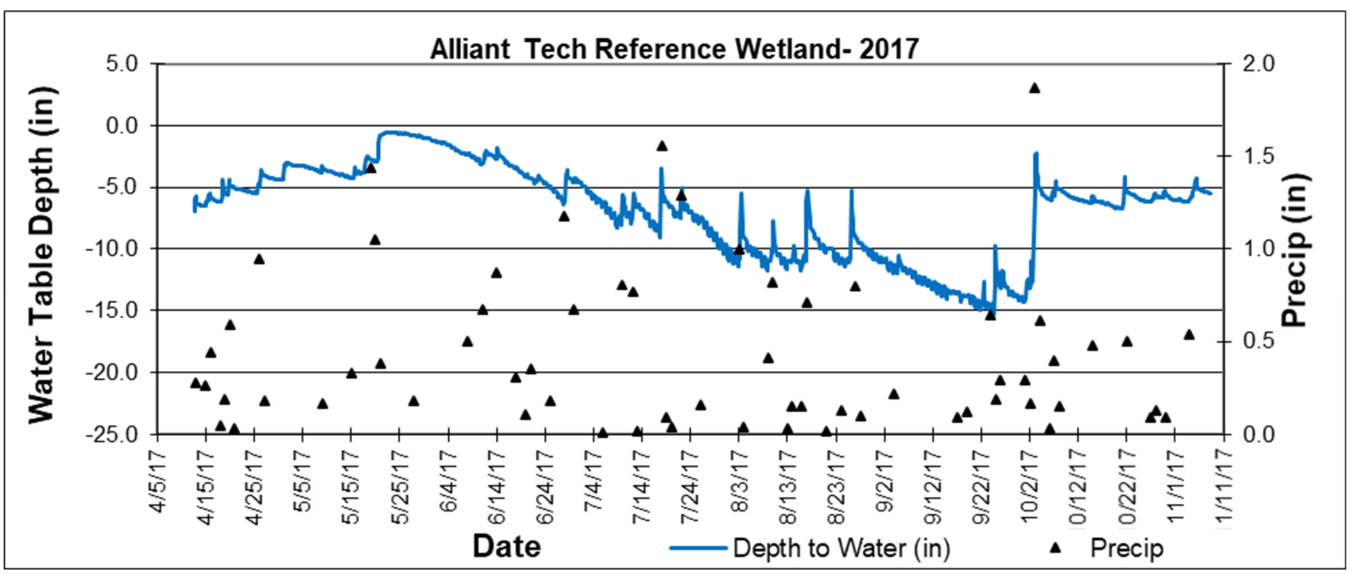
Surrounding Soils: Emmert

Vegetation at Well Location:

Scientific	Common	% Coverage
Carex Spp	Sedge undiff.	90
Lycopus americanus	American Bungleweed	20
Phalaris arundinacea	Reed Canary Grass	5

Other Notes: This wetland lies next to the highway, in a low area surrounded by hilly terrain. It holds water throughout the year, and has a beaver den.

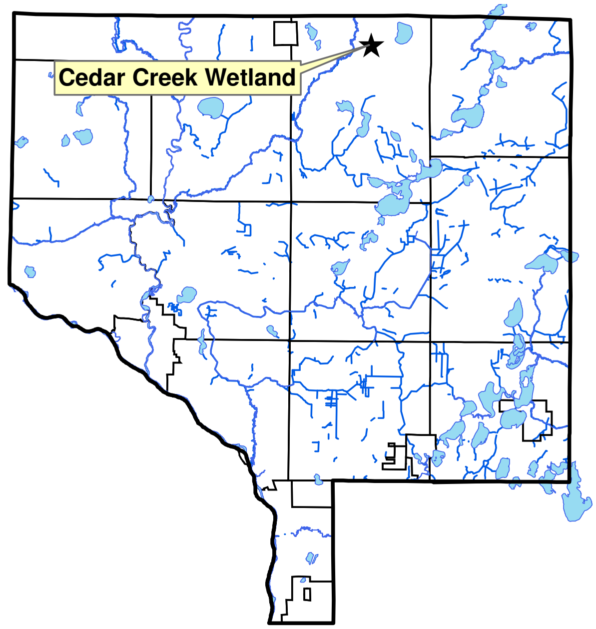
2017 Hydrograph



CEDAR CREEK REFERENCE WETLAND

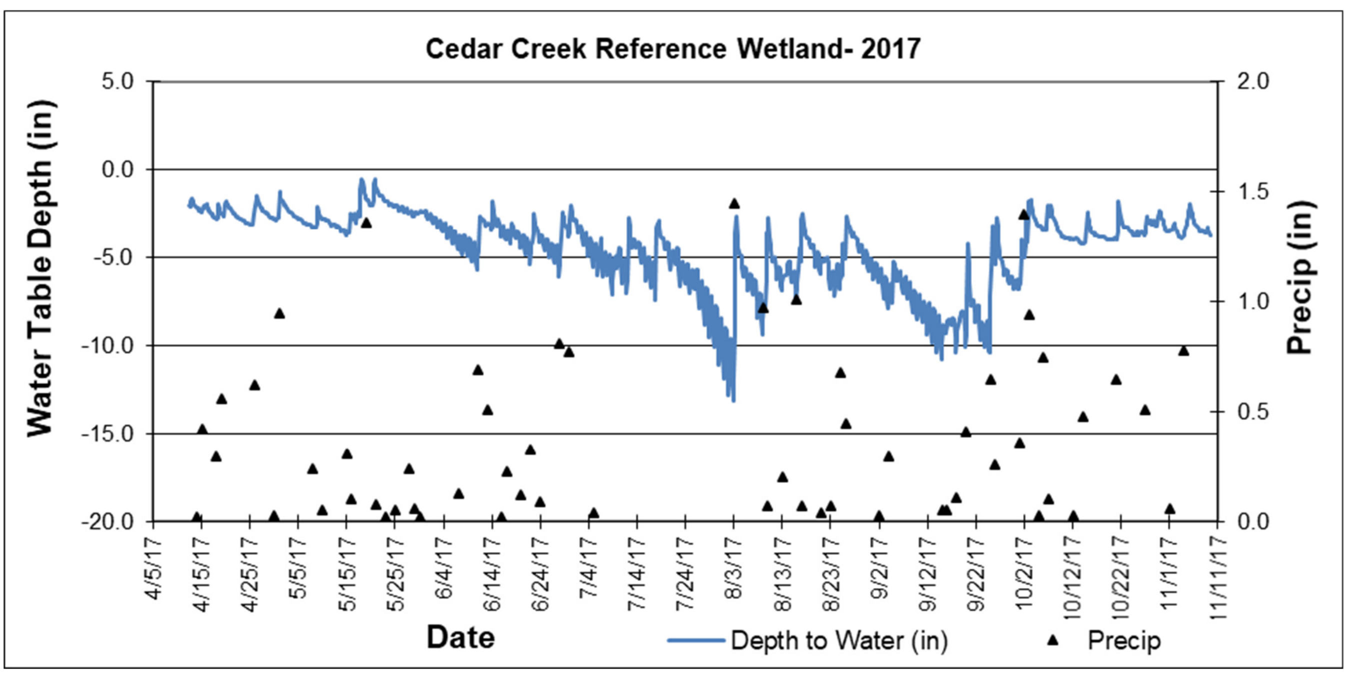
Univ. of Minnesota Cedar Creek Natural History Area, East Bethel

Site Information



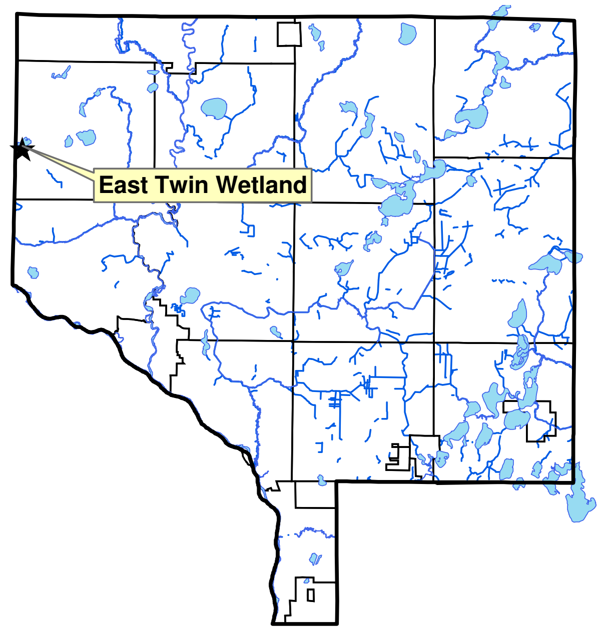
Monitored Since:	1996
Wetland Type:	6
Wetland Size:	unknown, likely >150 acres
Isolated Basin?	No
Connected to a Ditch?	No
Soils at Well Location:	not yet available
Surrounding Soils:	Zimmerman
Vegetation at Well Location:	not yet available
Other Notes:	The Cedar Creek Ecosystem Science Reserve, where this wetland is located, is a University of Minnesota research area. Much of this area, including the area surrounding the monitoring site, is in a natural state. This wetland probably has some hydrologic connection to the floodplain of Cedar Creek, which is 0.7 miles from the monitoring site.

2017 Hydrograph



East Twin Reference Wetland

East Twin Lake Township Park, Nowthen



Site Information

Monitored Since: 2001

Wetland Type: 5

Wetland Size: ~5.9 acres

Isolated Basin? Yes

Connected to a Ditch? No

Soils at Well Location:

Horizon	Depth	Color	Texture	Redox
A	0-8	10yr 2/1	Mucky Loam	-
Oa	Aug-40	N2/0	Organic	-

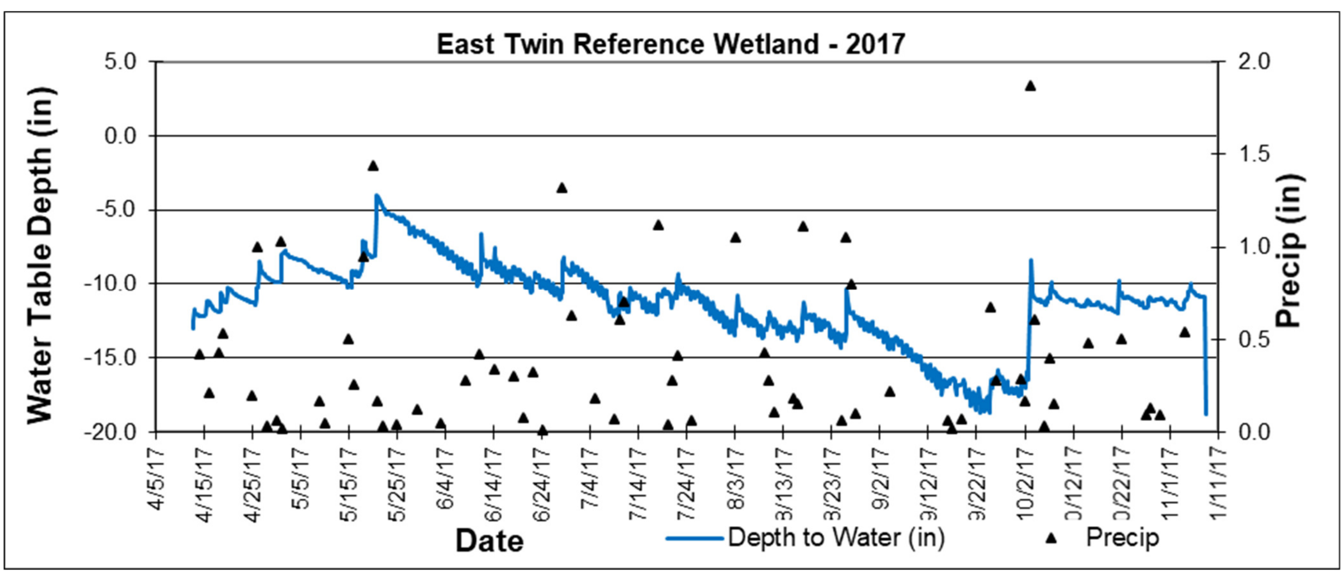
Surrounding Soils: Lake Beach, Growton and Heyder fine sandy loams

Vegetation at Well Location:

Scientific	Common	% Coverage
Phalaris arundinacea	Reed Canary Grass	100
Cornus amomum	Silky Dogwood	30
Fraxinus pennsylvanica	Green Ash	30

Other Notes: This wetland is located within East Twin Lake County Park, and is only 180 feet from the lake itself. Water levels in the wetland are influenced by lake levels.

2017 Hydrograph

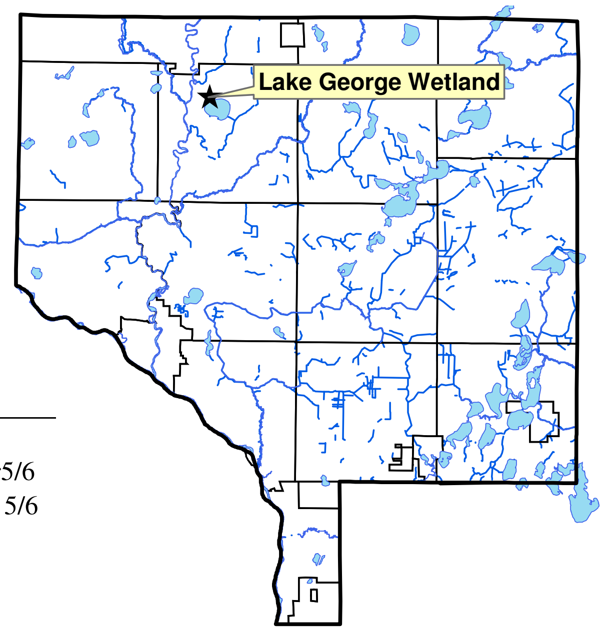


Wetland Hydrology Monitoring

LAKE GEORGE REFERENCE WETLAND

Lake George County Park, Oak Grove

Site Information



Monitored Since: 1997

Wetland Type: 3/4

Wetland Size: ~9 acres

Isolated Basin? Yes, but only separated from wetland complexes by roadway.

Connected to a Ditch? No

Soils at Well Location:

Horizon	Depth	Color	Texture	Redox
A	0-8	10yr2/1	Sandy Loam	-
Bg	8-24	2.5y5/2	Sandy Loam	20% 10yr5/6
2Bg	24-35	10gy 6/1	Silty Clay Loam	10% 10yr 5/6

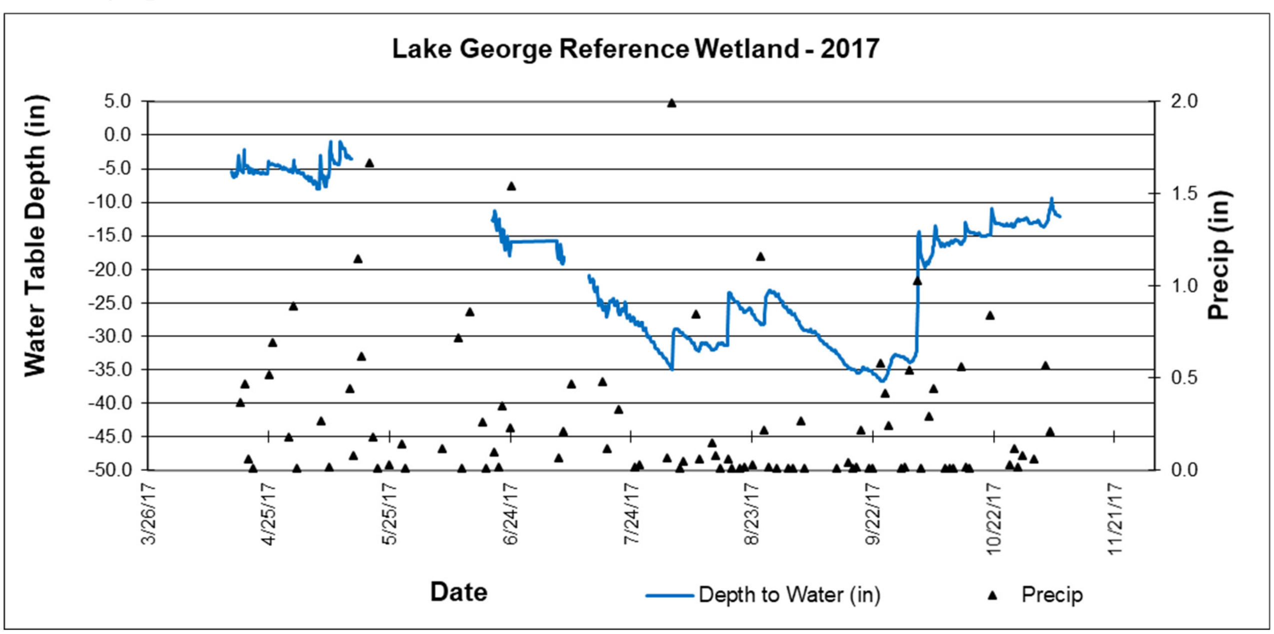
Surrounding Soils: Lino loamy fine sand and Zimmerman fine sand

Vegetation at Well Location:

Scientific	Common	% Coverage
Cornus stolonifera	Red-osier Dogwood	90
Populus tremuloides	Quaking Aspen	40
Quercus rubra	Red Oak	30
Onoclea sensibilis	Sensitive Fern	20
Phalaris arundinacea	Reed Canary Grass	10

Other Notes: This wetland is located within Lake George County Park, and is only about 600 feet from the lake itself. Much of the vegetation within the wetland is cattails.

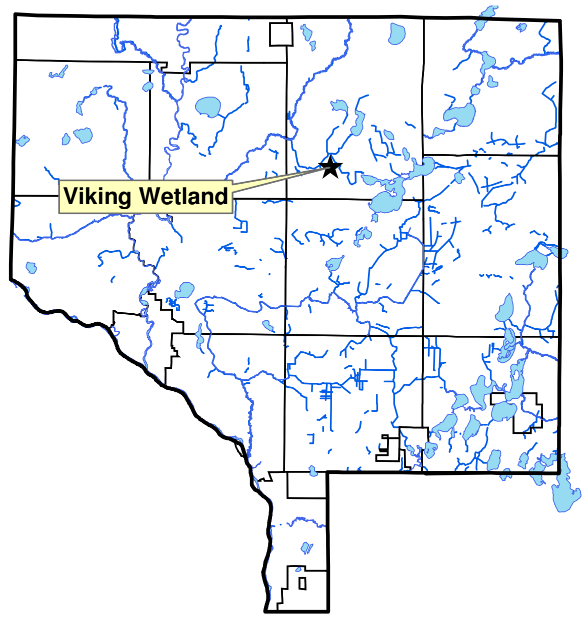
2017 Hydrograph



Wetland Hydrology Monitoring

VIKING MEADOWS REFERENCE WETLAND

Viking Meadows Golf Course, East Bethel



Site Information

Monitored Since: 1999

Wetland Type: 2

Wetland Size: ~0.7 acres

Isolated Basin? No

Connected to a Ditch? Yes, highway ditch is tangent to wetland

Soils at Well Location:

Horizon	Depth	Color	Texture	Redox
A	0-12	10yr2/1	Sandy Loam	-
Ab	12-16	N2/0	Sandy Loam	-
Bg1	16-25	10yr4/1	Sandy Loam	-
Bg2	25-40	10yr4/2	Sandy Loam	5% 10yr5/6

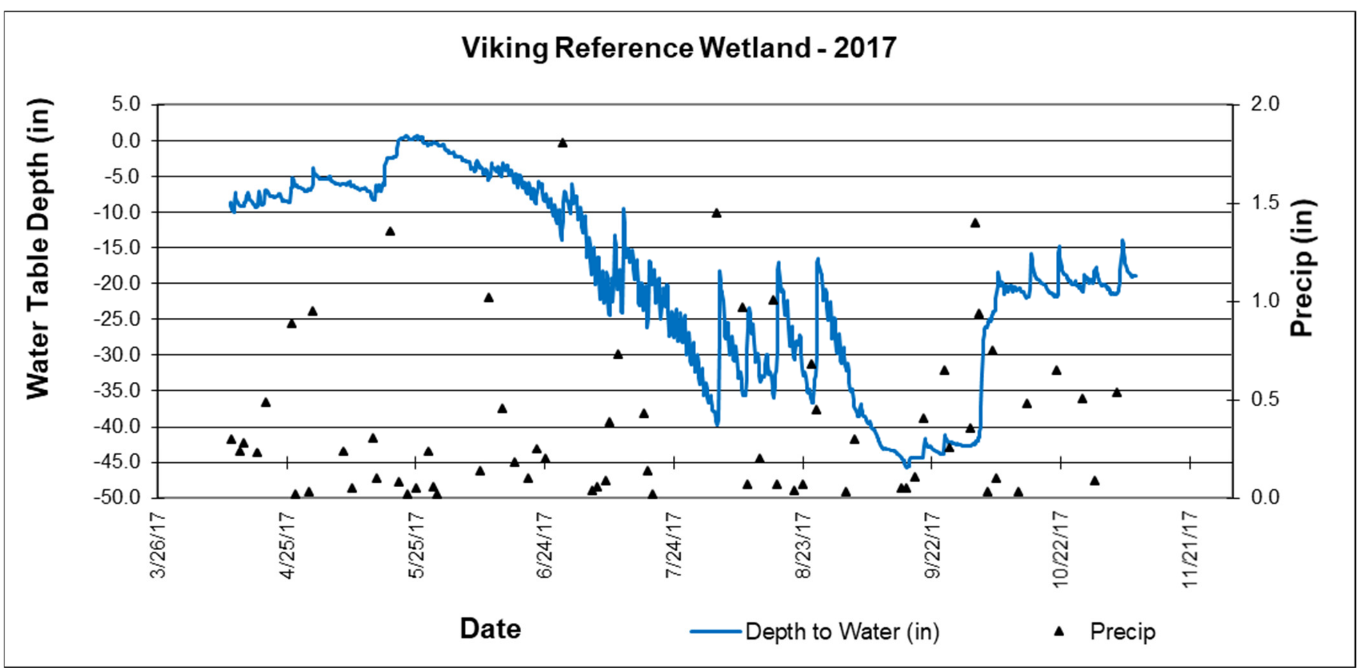
Surrounding Soils: Zimmerman fine sand

Vegetation at Well Location:

Scientific	Common	% Coverage
Phalaris arundinacea	Reed Canary Grass	100
Acer rubrum (T)	Red Maple	75
Acer negundo (T)	Boxelder	20

Other Notes: This wetland is located at the entrance to Viking Meadows Golf Course, and is adjacent to Viking Boulevard (Hwy 22).

2017 Hydrograph



Lake George Stormwater Retrofit Analysis – Interim Study Report

Description: Lake George is a premier recreation lake in Anoka County. Water quality, especially Secchi transparency, has been declining in Lake George in the past decade. The Lake George Improvement District, Lake George Conservation Club and Anoka Conservation District have partnered on a State Clean Water Fund grant to determine the sources of pollution to Lake George and identify specific projects to correct the lake water quality decline. Study components include monitoring, modeling, project identification and project cost effectiveness ranking. Final work products include a prioritized list of projects and concept designs.

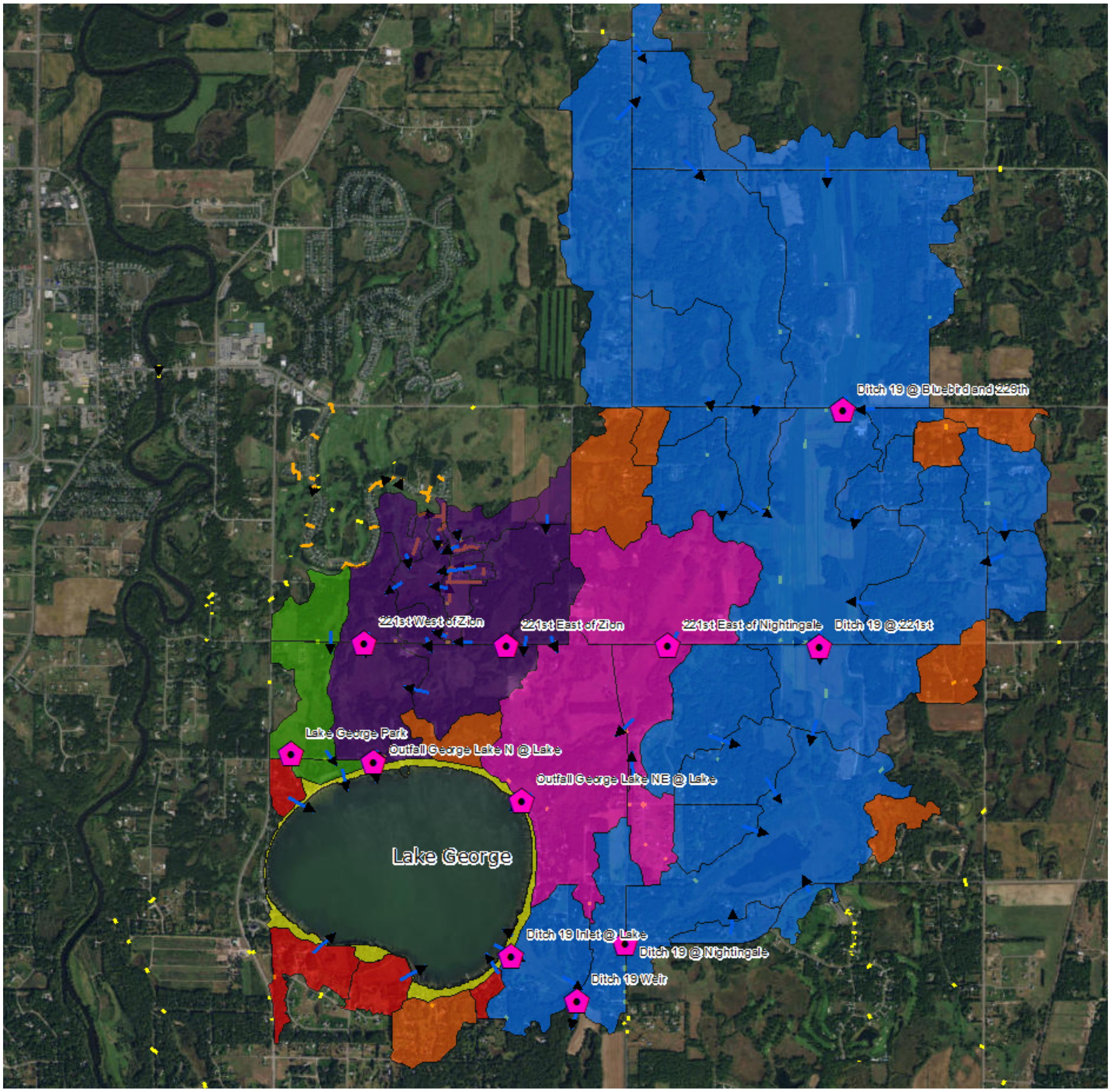
Purpose: To guide managers to the most cost effective approaches of stopping the decline in Lake George water quality and assist in securing grant funds for project installations.

Results: In 2016 and 2017 all inlets and outlets of the lake were subject to hydrologic and water quality monitoring. Nine sites total were monitored. In late 2017 this data was used to build and calibrate a computer hydrologic model of the watershed. GIS and field reviews have identified 11 possible water quality projects which will be modeled in 2018.

Discussion: As of February 2018, general observations include:

- During wetter years, the direct tributary wetlands are likely discharging more, and their discharge into the lake tends to be tannin stained. This can contribute to a decline in lake water clarity.
- The decline in transparency appeared to start around 2010 (or slightly before) which coincides with the increase in lake levels.
- During drier years, when tributary wetlands may be discharging less, lake clarity is generally better.
- Water quality in County Ditch 19 is generally better than the other tributaries. Whether water from County Ditch 19 flows into the lake, or the lake outflows to the ditch, is controlled by a State-owned weir. That weir is deteriorated – the weir is lower than originally constructed due to rust. The lower weir level would contribute to less frequent inflow of Ditch 19 water into Lake George. In this scenario, a disproportionately large part of the lake's water budget is from the other tributaries that have poorer water quality.
- Possible approaches to correct the situation include rehabilitation of the County Ditch 19 weir (planned by the State in 2018-19), hydraulic restorations of the direct tributary wetlands and/or smaller projects throughout the watershed that reduce nutrients reaching the lake. 11 possible water quality projects sites are being explored.

These observations are preliminary only. Final reporting is expected by December 31, 2018.



Lake George watershed and subcatchments as modeled for the Lake George Targeted BMP Analysis. Water monitoring sites are shown as hexagons.

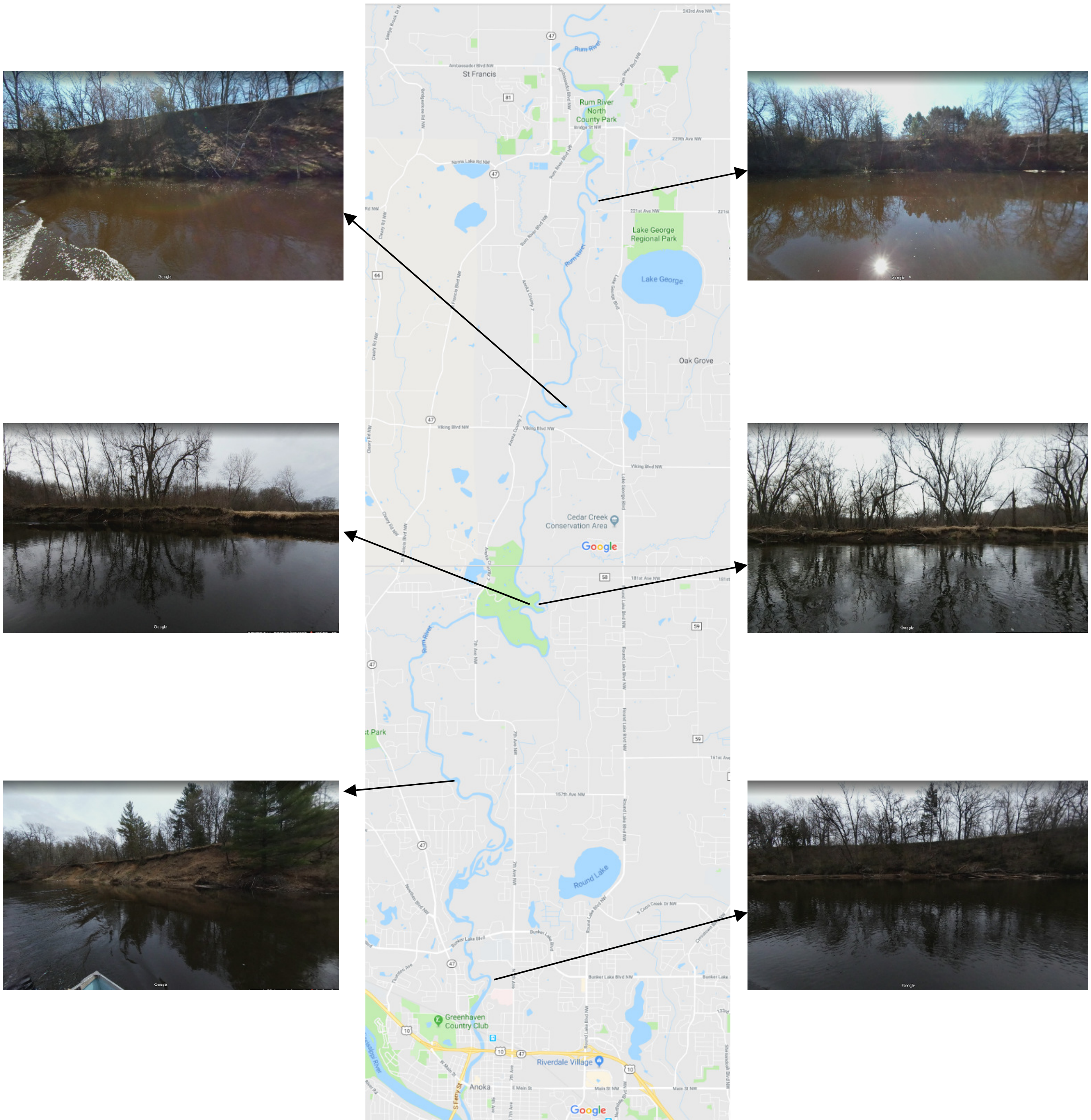
Rum River 360^{O} Photo Inventory

Description: The Anoka Conservation District performed a full 360^{O} photo inventory of bank conditions on the Rum River throughout Anoka County in the spring of 2017. This photo inventory was uploaded to Google Maps and is available to the public.

Purpose: To create a photo inventory of bank conditions to be used to guide future restoration projects and track bank condition changes in the future.

Location: Rum River through Anoka County

Results: 360^{O} images are available on Google Maps Street View. The user is able to zoom down to water level and pan around the full 360^{O} to view the River and bank conditions.



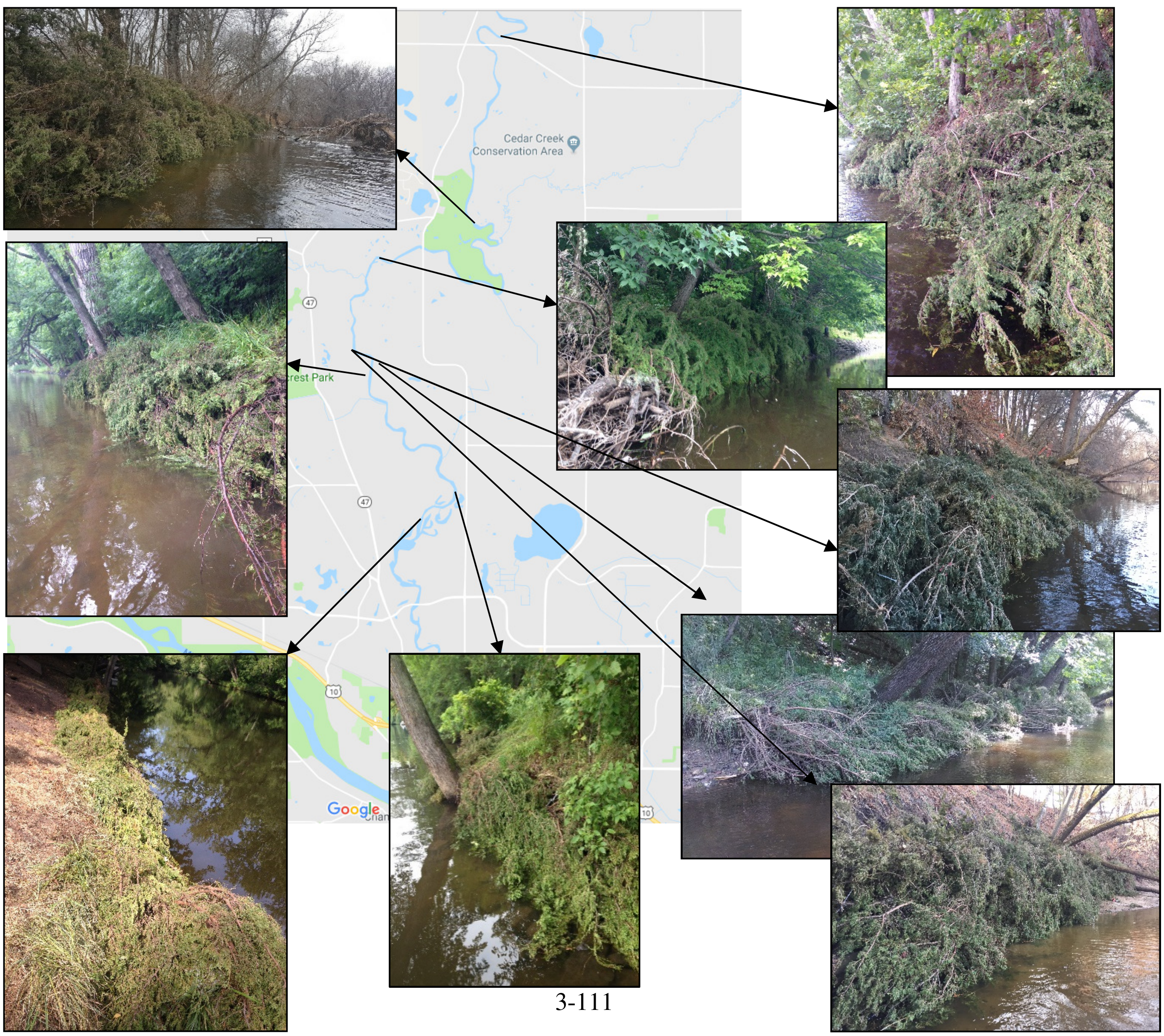
Rum River Bank Stabilizations

Description: 12 riverbank stabilization projects were installed on the Rum River in Anoka and Isanti Counties in 2017. At these sites, cedar tree revetments and willow stakes were used to stabilize eroding banks. The projects were installed in partnership with the Conservation Corps Minnesota (CCM). Funding for the 9 Anoka County projects came from the Conservation Partners Legacy Grant Program from the MN DNR. Another grant supported by the MN Clean Water Fund provided construction crew labor from the Conservation Corps of Minnesota. Other funding came from the Upper and Lower Rum River Watershed Management Organizations and landowners. Funding for 3 revetments in Isanti County came from the Lessard-Sams Outdoor Heritage Council, a Clean Water Fund CCM crew labor grant and landowner contribution.

Purpose: To stabilize areas of riverbank with mild to moderate erosion, in order to reduce sediment loading in the Rum River, reduce the likelihood of a much larger and more expensive corrective project in the future, and to improve aquatic habitat.

Location: Rum River Central Regional Park, 8 residential properties in Anoka County, City of Isanti park, and 2 residential properties in Isanti County.

Results: Stabilized 2,223 linear feet of riverbank on the Rum River in Anoka and Isanti Counties.



Water Quality Grant Fund

Description: Through 2017 the Upper River Watershed Management Organization (URRWMO) partnered with the Anoka Conservation District's (ACD) Water Quality Cost Share Program. The URRWMO contributed funds to be used as cost share grants for projects that improve water quality in lakes, streams, or rivers within the URRWMO area. The ACD provides administration of the grants. Grant awards follow ACD policies and generally cover 50% or 70% of materials cost (see ACD website for full policies).

In early 2017 the URRWMO decided to discontinue this program. It directed that the balance of program funds be allocated to Rum Riverbank stabilization projects planned in 2017 through the Anoka Conservation District's Cedar Tree Revetment project. That program installed two projects in the URRWMO in 2017.

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

Locations: Throughout the watershed.

Results: Projects are reported in the year they are installed.

URRWMO Cost Share Fund Summary

2006 URRWMO Contribution	+	$ 990.00
2006 Expenditures		$ 0.00
2007 URRWMO Contribution	+	$ 1,000.00
2007 Expenditures		$ 0.00
2008 Expenditures		$ 0.00
2009 Expenditures		$ 0.00
2010 URRWMO Contribution	+	$ 500.00
2011 URRWMO Contribution	+	$ 567.00
2010-11 Expenditure Petro streambank stabilization	-	$1,027.52
2011 Expenditure Erickson lakeshore restoration	-	$ 233.63
2012 Expenditure Erickson lakeshore restoration	-	$ 137.97
2012 URRWMO Contribution	+	$1,000.00
2013 URRWMO Contribution	+	$ 0
2014 Expenditure – Stitt lakeshore restoration	-	$1,059.69
2013 Correction	+	$ 0.48
2014 URRWMO Contribution		$ 0.00
2015 URRWMO Contribution		$ 0.00
2016 URRWMO Contribution		$ 0.00
*2017 Expenditure – Rum River revetments	-	$ 1598.67
Fund Balance		**$ 0.00**

* URRWMO directed ACD to transfer remaining funds into ACD's fund for Rum Riverbank stabilizations using cedar tree revetments. No URRWMO funds remain in this program.

URRWMO Website

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

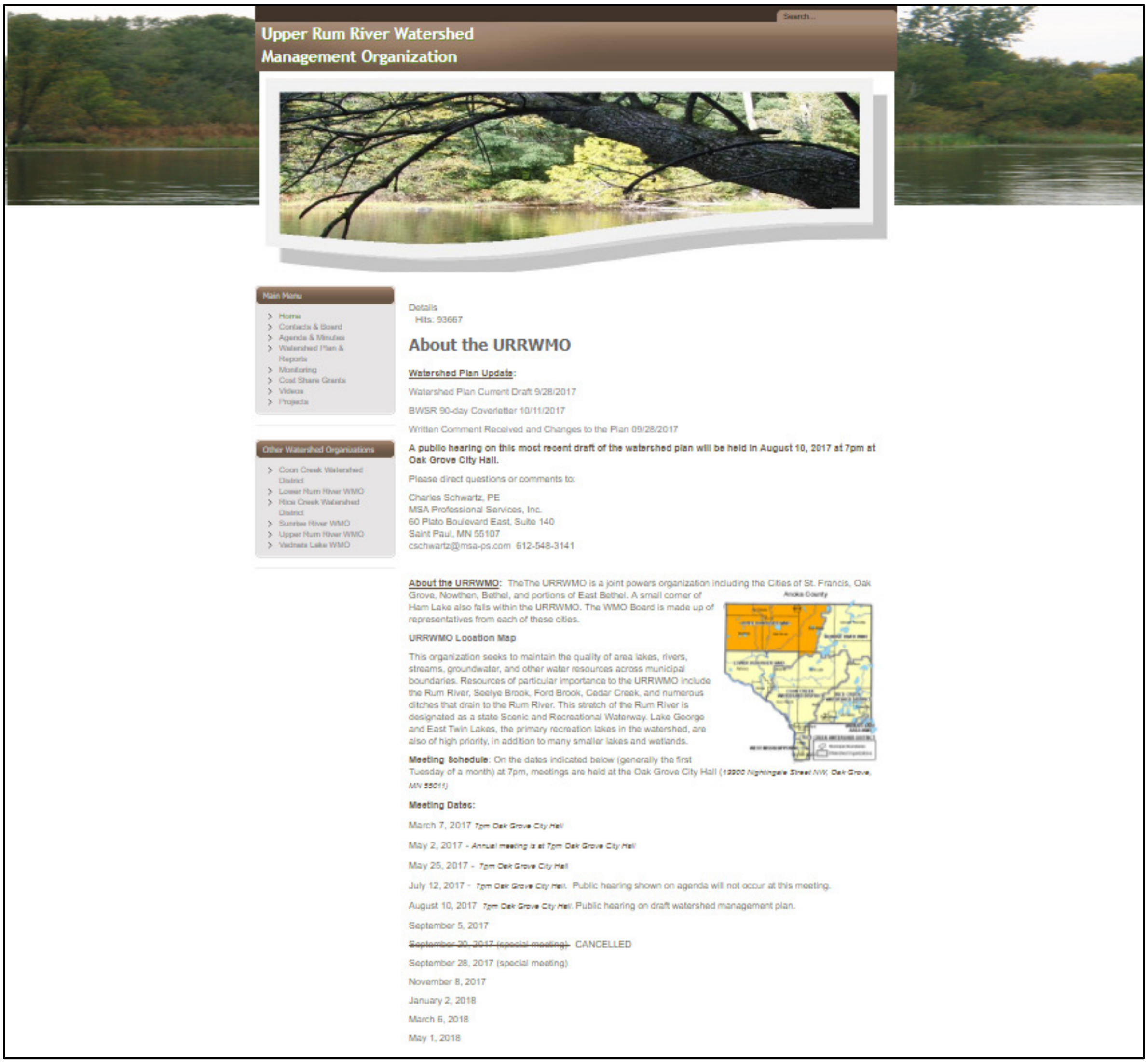
Purpose: To increase awareness of the URRWMO and its programs. The website also provides tools and information that helps users better understand water resources issues in the area.

Location: www.URRWMO.org

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

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

URRWMO Website Homepage



URRWMO Annual Newsletter

Description: The URRWMO Watershed Management Plan and state rules call for an annual URRWMO newsletter in addition to the WMO website. The URRWMO produces a newsletter article including information about the URRWMO, its programs, related educational information, and the URRWMO website address. This article is provided to each member city, and they are asked to include it in their city newsletters.

Purpose: To increase public awareness of the URRWMO and its programs as well as receive input.

Locations: Watershed-wide.

Results: The Anoka Conservation District (ACD) assisted the URRWMO by drafting the annual newsletter article about the new management plan for area streams and lakes. The URRWMO Board reviewed and edited the draft article. The finalized article was posted to the URRWMO website, sent to each member community for publication in their newsletters and provided to the Independent School District 15 publication, "The Courier."

2017 URRWMO Newsletter Article

Upper Rum River
Watershed Management Organization

MEDIA RELEASE

Contact person: Jamie Schurbon, 763-434-2030 ext. 12
Date: November 27, 2017

Local Plan for Lakes, Waterways
Near Completion

A new local plan for the Rum River, Lake George and other local waterways is in its final stages. The plan focuses on water quality, but also addresses stormwater management, flood prevention and other topics. Once approved by the State, this management plan outlines projects that will be led by the Upper Rum River Watershed Management Organization (URRWMO) over the next 10 years.

The URRWMO is comprised of representatives from the cities of Bethel, East Bethel, Oak Grove, Nowthen, St. Francis and Ham Lake. Its purpose is to address water management issues which often cross city boundaries. The organization, and its new plan, put emphasis on implementing already-existing rules and finding the highest priority problems upon which to focus limited funding. The plan positions the organization to compete for State water quality grants to fund larger projects. Work outlined in the plan includes water quality improvement projects, fixing shoreline erosion, culvert and stormwater inspections, and regular water quality monitoring.

The Rum River and Lake George are two high priorities in the new plan. The Rum River is in relatively good condition, and a highly valued State Scenic and Recreational River. Phosphorus levels are near, but slightly better than state water quality standards and lower than the median of 34 other Anoka County streams. It will continue to be monitored. Lake George has good water quality for this region of the state, receiving an overall A letter grade, however declining secchi transparency is a concern. East Twin Lake, Pickerel Lake, Seelye Brook, Cedar Creek, Ford Brook and Crooked Brook are some other waterbodies also discussed in the plan.

The plan is being considered by the State for final approvals. The most updated plan draft and information about the URRWMO is available at www.URRWMO.org or contact Chuck Schwartz at 612-548-3141.

URRWMO 2016 Annual Reports to the State

Description: The Upper Rum River Watershed Management Organization (URRWMO) is required by law to submit an annual report to the Minnesota Board of Water and Soil Resources (BWSR). This report consists of an up-to-date listing of URRWMO Board members, activities related to implementing the URRWMO Watershed Management Plan, the status of municipal water plans, financial summaries, and other work results. The report is due annually 120 days after the end of the URRWMO's fiscal year (April 30th).

Additionally, the URRWMO is required to perform annual financial reporting to the State Auditor. This includes submitting a financial report and filling out a multi-worksheet form.

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

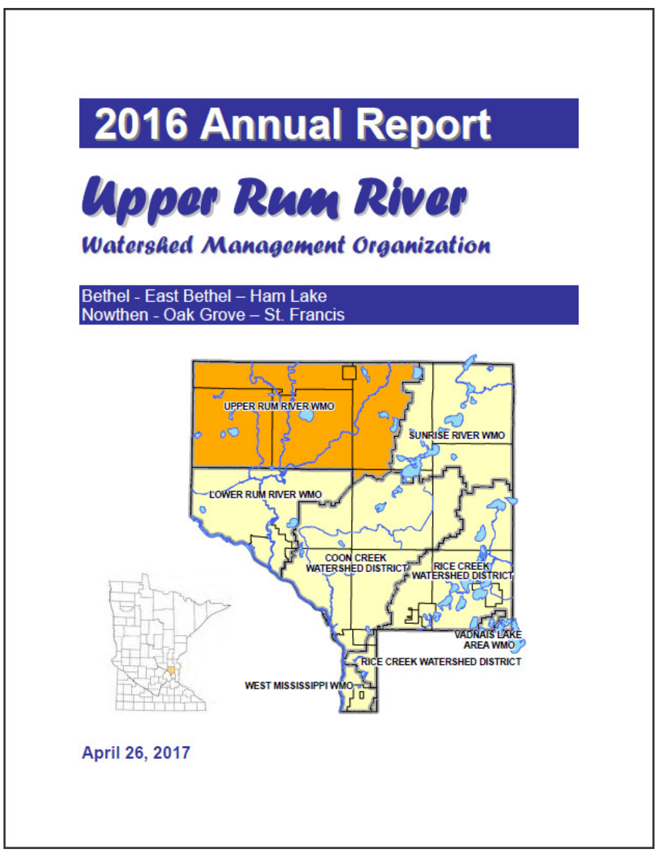
Locations: Watershed-wide

Results: The Anoka Conservation District assisted the URRWMO with preparation of a 2016 Upper Rum River WMO Annual Report to BWSR and reporting to the State Auditor. This included:

- preparation of an unaudited financial report,
- a report to BWSR meeting MN statutes
- and the State Auditor's reporting forms through the State's SAFES website.

All were completed by the end of April 2017. The report to BWSR and financial report are available on the URRWMO website.

Report to BWSR Cover



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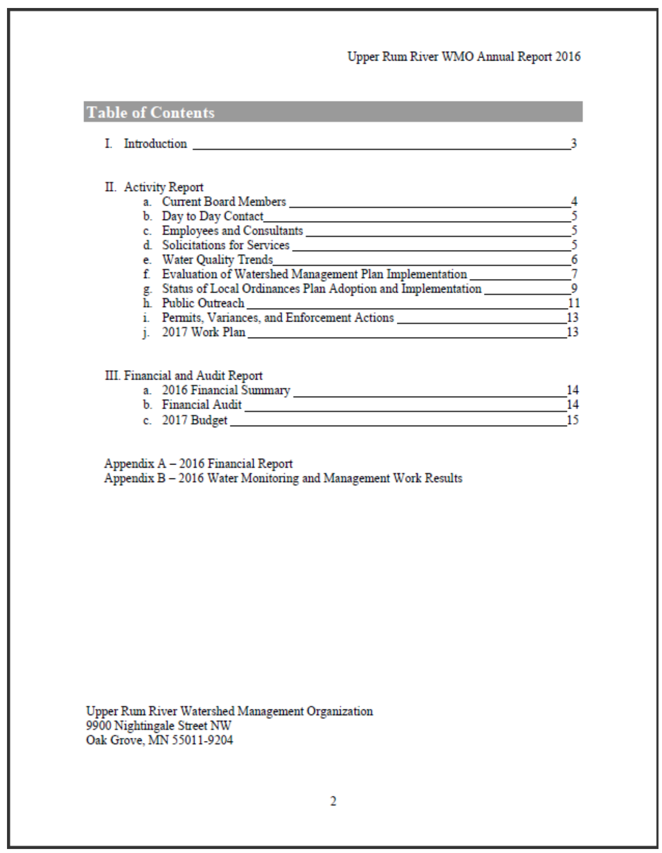

Upper Rum River WMO Annual Report 2016

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Upper Rum River Watershed Management Organization
9900 Nightingale Street NW
Oak Grove, MN 55011-9204

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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.

Upper Rum River Watershed Financial Summary

Upper Rum River Watershed	URRWMO Admin/Reporting/Grant Search	County, City, SWCD Asst (no charge)	WMO Asst (no charge)	Rum River 1W1P	URRWMO Promo/Website	Volunteer Precip	Reference Wetlands	DNR Groundwater Wells	Lake Levels	Lake Water Quality	Stream Water Quality	WOMP	Rum River Revets	Targeted BMP Promotion & Design	Rum River WRAPP	Lake George Phase 1 SRA	AIS Lake George Mapping	Inventory - Rum River Erosion	Total
Revenues																			
URRWMO	1000				1305		1950		1200	3500	4200		1599						14754
State - Other								490								28706			29196
MPCA															6691				6691
DNR OHF													9148						9148
DNR CPL																			0
BWSR Cons Delivery		877	416					517										51	1860
BWSR Capacity Staff				2763										567				1910	5240
BWSR Capacity Direct																			0
BWSR Cost Share																			0
BWSR Cost Share TA																			0
BWSR Local Water Planning	112		175		47	219				165					161		962		1841
Metro ETA & NPEAP																			0
Metro AWQCP																			0
Regional/Local												880	19189			3000	1088		24157
Anoka Co. General Services		706	416	366									5400						6888
County Ag Preserves/Projects																12335			12335
Service Fees													6261			3000			9261
Investment Dividend																			0
Rents																			0
Product Sales																			0
TOTAL	1112	1582	1006	3129	1352	219	1950	1007	1200	3665	4200	880	41597	567	6852	47041	2050	1961	121370
Expenses-																			
Capital Outlay/Equip	42	39	59	73	27	10	50	69	39	140	53	20	629	19	91	787	49	11	2208
Personnel Salaries/Benefits	991	1428	874	2817	942	180	1421	803	928	2309	1058	682	26638	592	1815	27860	1817	2143	75297
Overhead	41	56	41	74	36	12	107	71	55	157	74	36	1481	27	83	1479	84	87	4001
Employee Training	2	6	3	20	5	1	12	5	5	18	6	3	226	1	2	181	1	1	498
Vehicle/Mileage	10	18	5	24	11	3	43	17	17	48	25	15	463	10	19	493	34	50	1305
Rent	25	36	24	82	24	6	75	42	33	115	47	26	816	17	44	899	52	63	2425
Project Installation													5479						5479
Project Supplies				39	306	7	17		10	878	677		1382		4799	15343	12		23471
McKay Expenses																			0
TOTAL	1112	1582	1006	3129	1352	219	1726	1007	1087	3665	1940	783	37113	666	6852	47041	2050	2355	114685
NET	0	0	0	0	0	0	224	0	113	0	2260	97	4484	-100	0	0	0	-394	6685

Recommendations

- **Integrate the Rum River WRAPP (Watershed Restoration and Protection Plan) into the URRWMO's activity plans.** This WRAPP is an assessment of the entire Rum River watershed, including recommended management strategies, that was produced by the MPCA and local water managers.
- **Update the URRWMO's water monitoring plan**, which expired in 2017. The current draft plan lacks a monitoring schedule, which should be developed. Projects identified in an approved plan are eligible for Watershed Based Funding from the State.
- **Install projects identified in the St. Francis stormwater assessment** that is aimed at improving Rum River water quality. The study identified numerous stormwater treatment opportunities and ranking them by cost effectiveness. It lays the groundwork for project installations.
- **Collaborate in county-wide efforts to allocate Watershed Based Funding to deserving projects.** This funding is a new, non-competitve way of distributing Clean Water Funds as of 2018. $826,000 is available throughout Anoka County. Projects must be in the WMO plan.
- **Collaborate on efforts to diagnose declining water quality in Lake George and fix it.** The Lake George Improvement District and the Anoka Conservation District have begun study. Results are anticipated in 2018.
- **Periodically monitor chlorides in streams** to verify if observed baseflow conductivity increases are due to salts. Every 3 years minimum is recommended.
- **Promote practices that limit road deicing salt applications** while keeping roads safe. Streams throughout the URRWMO have increasing conductivity.
- **Protect streams from phosphorus increases.** Streams throughout the URRWMO have phosphorus that is near or exceeding State water quality thresholds. Yet none are on the State impaired waters list for this problem. Projects that reduce nutrient loads and prevent additional nutrient loading as the area develops are advised.
- **Monitor Lake George water quality at least every other year.** The lake has a declining trend. The Lake Improvement District has taken up monitoring every other year when the URRWMO has not funded that work, but would prefer to put their dollars into projects.
- **Promote groundwater conservation.** Metropolitan Council models predict 3+ft drawdown of surface waters in parts of the URRWMO by 2030, and 5+ft by 2050.