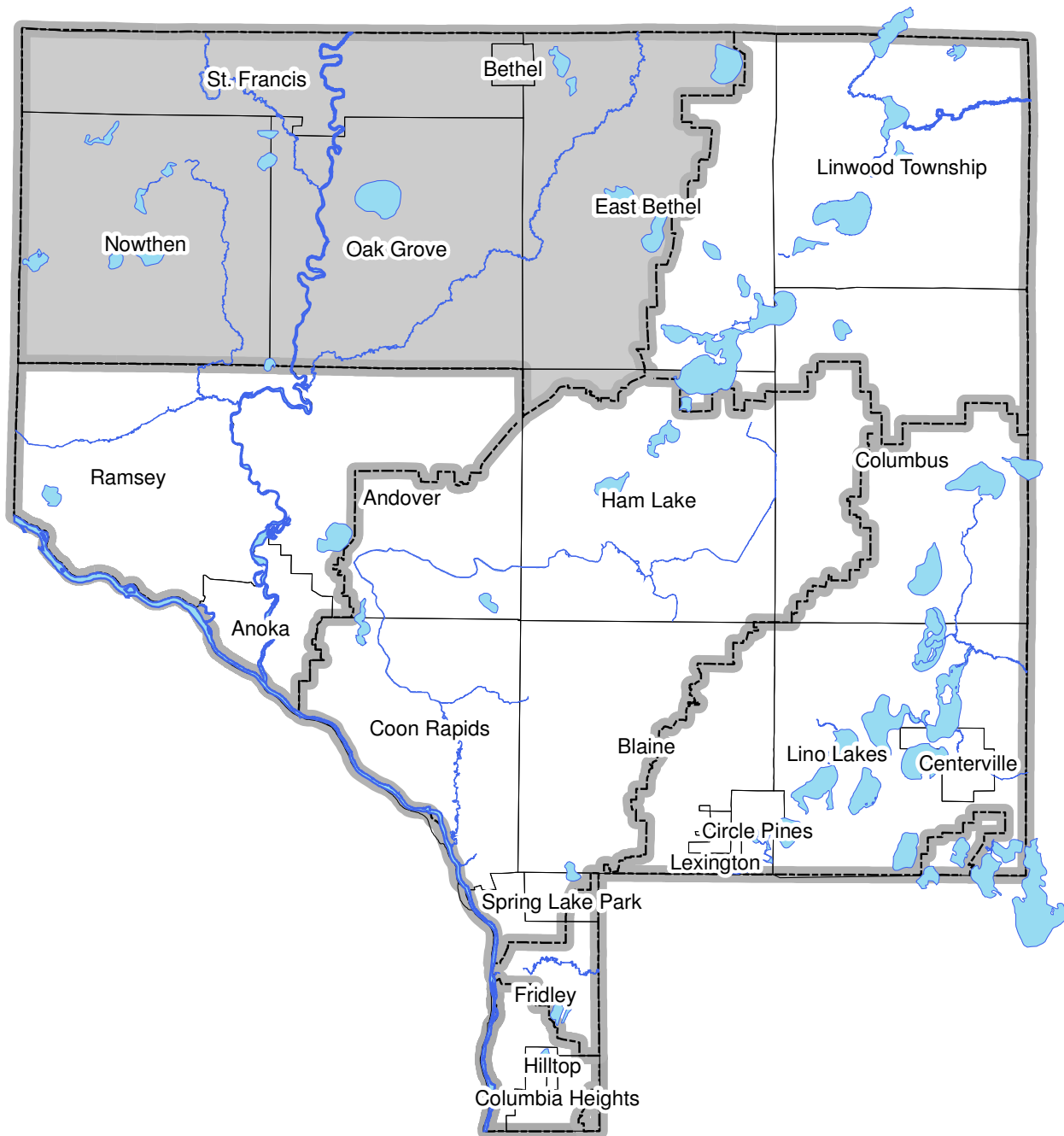


# Excerpt from the 2018 Anoka Water Almanac

## *Chapter 3: Upper Rum River Watershed*



Prepared by the Anoka Conservation District

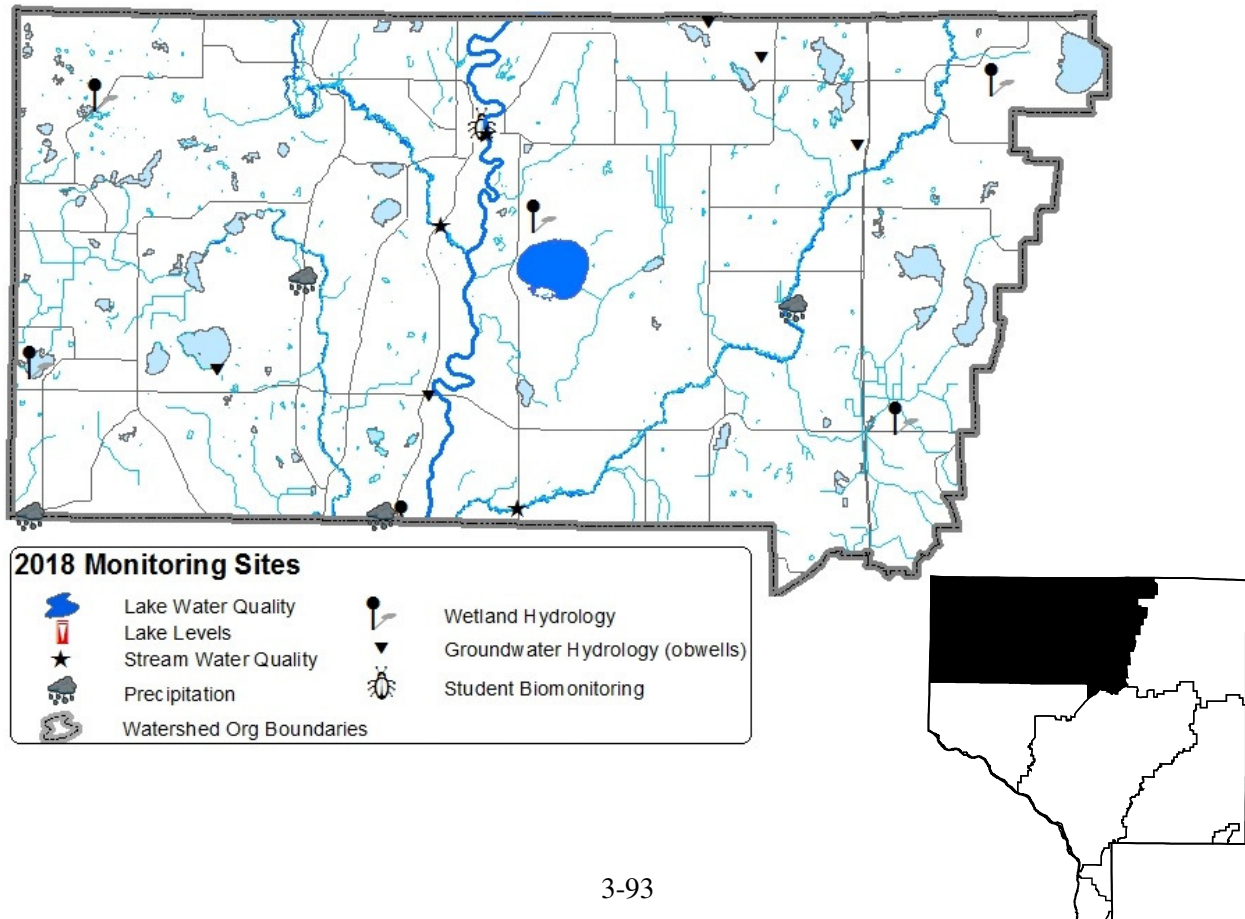




# Upper Rum River Watershed

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## Lake Levels

**Partners:** URRWMO, ACD, MN DNR, volunteers

**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 (<https://www.dnr.state.mn.us/lakefind/index.html>).

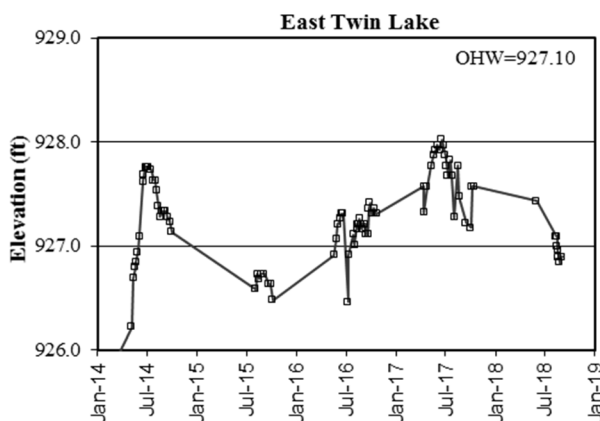
**Purpose:** To understand lake hydrology, including the impact of climate or other water budget changes. These data are useful for regulatory, building/development, and lake management decisions.

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

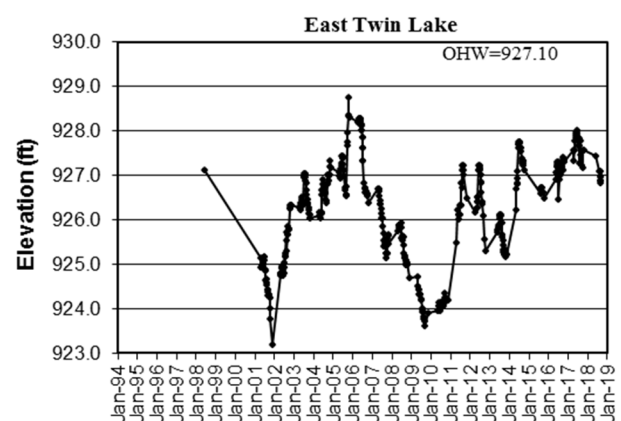
**Results:** Lake levels were measured by volunteers throughout the 2018 open water season. Lake gauges were installed and surveyed by the Anoka Conservation District and MN DNR. Lakes generally followed the expected trend of increasing water levels in spring and early summer and declining levels by mid-summer. Lakes generally experienced rebounding water levels starting in mid-September. Overall lake levels were near average though some were higher and some were lower.

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. All lakes monitored were lower than the OHW for much of the monitoring season.

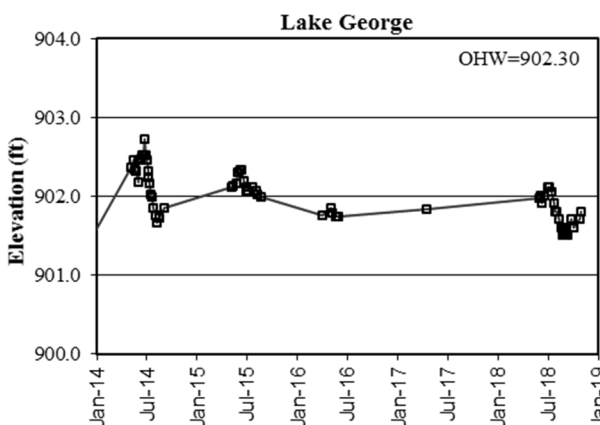
**East Twin Lake Levels – last 5 years**



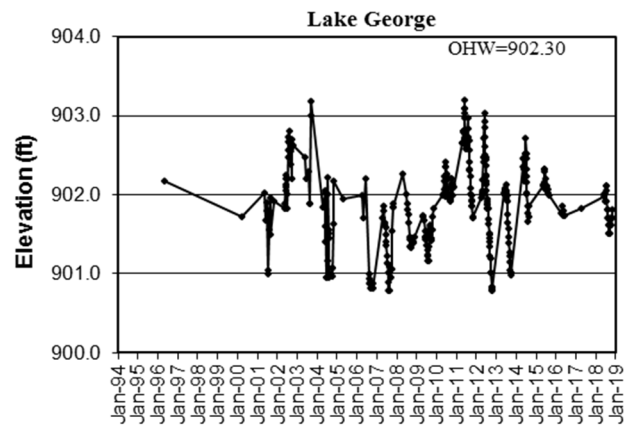
**East Twin Lake Levels – last 25 years**



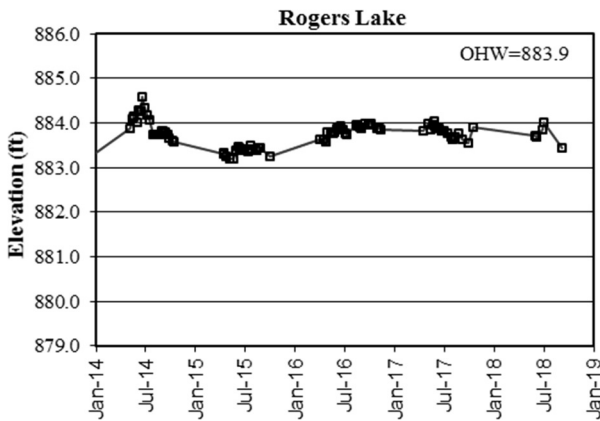
**Lake George Levels– last 5 years**



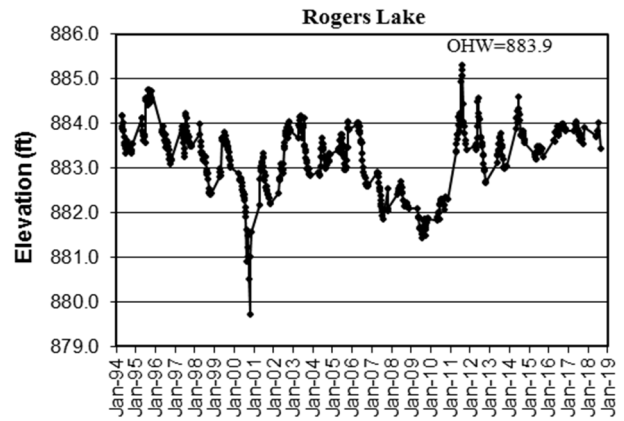
**Lake George Levels – last 25 years**



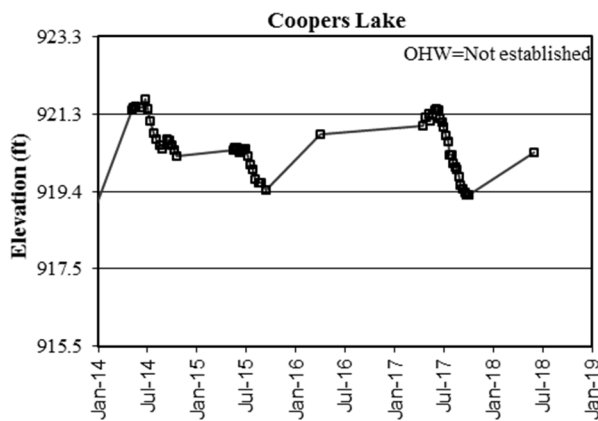
**Rogers Lake Levels – last 5 years**



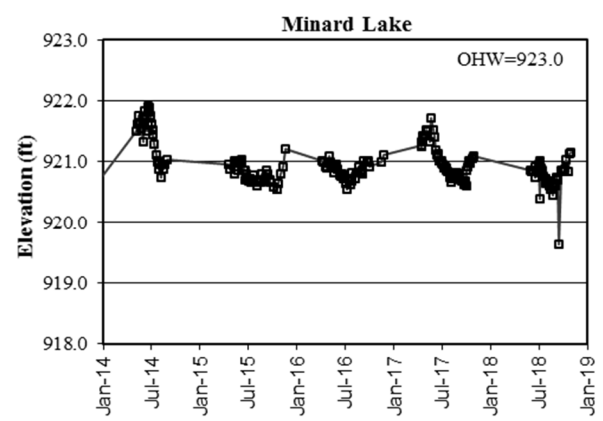
**Rogers Lake Levels – last 25 years**



**\*Coopers Lake Levels – last 5 years**



**Minard Lake Levels – last 5 years**



\*Only one reading was obtained for Coopers Lake in 2018. A new volunteer will be pursued for 2019.

## Lake Water Quality

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**Partners:** ACD, Lake George LID

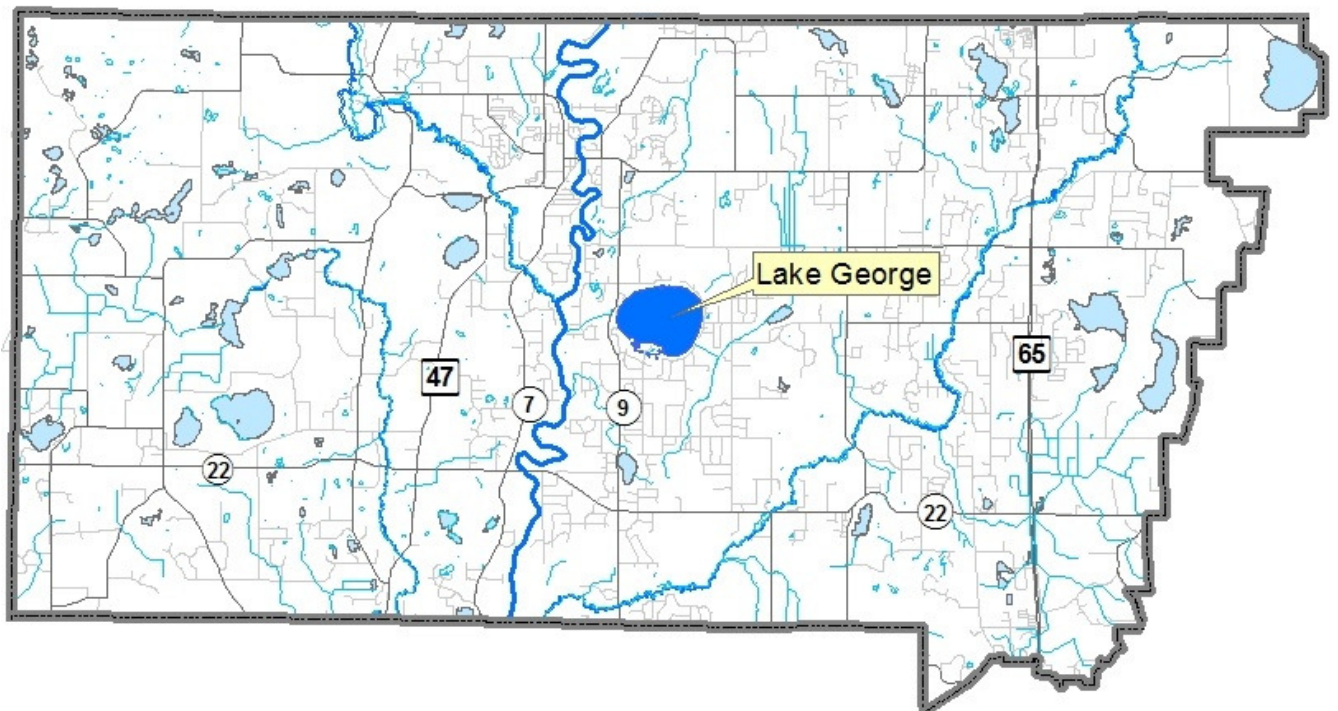
**Description:** May through September twice-monthly monitoring of the following parameters: total phosphorus, chlorophyll-a, Secchi transparency, dissolved oxygen, turbidity, temperature, Specific Conductivity, pH, and salinity.

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

**Locations:** Lake George

**Results:** Detailed data for Lake George is 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



# 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 surrounded 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 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 one or both with herbicide.

## 2018 Results

In 2018 Lake George had good water quality for this region of the state (NCHF Ecoregion), receiving an overall A letter grade and mesotrophic rating. Dating back to 2009, Lake George has maintained an overall B grade each year with the exception of 2015 and this year when a slight decline in average total phosphorus (TP) bumped the scores to an A. Total phosphorus in 2018 averaged 22.5 µg/L, tied with 2015 as the lowest since 2008. Secchi transparency was as high as 17.2 feet in May, but dropped to as low as 6.3 feet in early August. Average Secchi transparency was 9.4 feet, an improvement over recent years and more in line with averages seen a decade or more ago. Chlorophyll-a (Cl-a) averaged 6.8 µg/L, which was similar to the last 5 years, with the exception of a moderate increase in 2016 to 7.8 µg/L. Chlorophyll-a and transparency were poorest in early September, however, TP was poorest in May. All three parameters were better than State water quality standards for deep lakes in this region (<40 µg/L TP, <14 µg/L Cl-a, and >1.4 m Secchi transparency).

## Trend Analysis

Twenty-nine 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- 2018). During this period there is a statistically significant trend of declining Secchi transparency (one-way ANOVA  $F_{1,19}=14.37$ ,  $p<0.05$ ). 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,  $F_{2,18}=1.62$ ,  $p=0.22$ ). Last year, when only the last 10 sampling years' worth of data since 2000 were analyzed a statistically significant increase in TP was apparent (one-way ANOVA  $F_{1,19}=2.23$ ,  $p<0.05$ ) as well as a trend (though not significant) towards increased Cl-a. However, when the last 10 years of sampling were analyzed again this year there were no statistically significant trends. Much of the decline in transparency has occurred since the year 2000 or slightly before. In short, from 2000 to 2017 a trend of poorer (lower) transparency was occurring and a less dramatic trend of poorer (higher) total phosphorus was occurring. Chlorophyll-a (algae) levels show no statistically significant trend of change. This year these trends have disappeared due to the best Secchi and total phosphorus readings in ten years but they could easily reappear in future years and we should not be complacent in monitoring of or managing for water quality in Lake George.

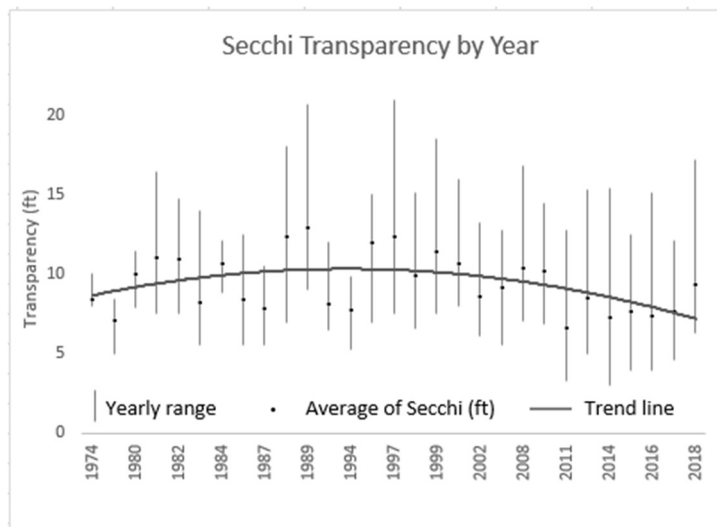
## Lake George

CITY OF OAK GROVE, LAKE ID #02-0091

### Discussion

Lake George remains one of the clearest of the Anoka County lakes, but its trend of declining Secchi transparency is 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).

**Lake George Secchi transparency trend:** Includes years with partial datasets not covering all open water months. Those years are excluded from ACD's statistical analysis and graphs later in the document.



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 2018 a special study of this lake titled "Lake George Water Quality Improvement Assessment" was completed. Work from 2016-2018 included intensive monitoring of tributaries, modeling, and evaluation of projects to correct transparency declines. The work focused on the watershed, and a "phase 2" study of in-lake processes may occur in the future.

The aforementioned study provides some insight into the causes of transparency decline and 2018 results. While a number of factors may play a role in transparency declines, more frequent wet years are the most significant driver identified. Years that are wetter than the 90<sup>th</sup> percentile result in increased volumes of runoff and nutrients into the lake from tributaries, and the lake has poorer clarity in those years. These "wet" years have been more frequent during the period that lake transparency has declined. Four of the eight years from 2010 to 2017 were "wet" with water year precipitation above the 90<sup>th</sup> percentile. 2018 was not a "wet" year, and Secchi transparency improved. There is concern that climate change and development in the watershed will drive poorer water quality in Lake George into the future. The study was funded by the Lake George Improvement District, Lake George Conservation Club, Anoka Conservation District, and a State Clean Water Fund grant.



The study recommends projects and actions to improve water quality. Among these are replacement of the deteriorating Ditch 19 weir just east of Lake George which is an important hydrological control for the lake. The weir is scheduled for replacement in 2019. This work offers modest benefits of reduced nutrient

delivery to the lake in wet years, and the broader benefits of restoring lake hydrology and enhancing game fish spawning opportunities. Other actions include agricultural best practices, an iron-enhanced sand filter, public education, lakeshore restorations, enhanced stormwater standards for new developments in the lakeshed and others. While certain tributary subwatersheds do generate more nutrients than others, and therefore deserve special consideration for projects, it is also noted that some of these subwatersheds drain through large wetlands with some apparent pollutant removal ability which must be considered when siting projects. Projects nearest the lake are favored because they treat a larger upstream area and don't duplicate treatment that might already be provided by certain wetlands.

Two exotic invasive plants are present in Lake George, curly-leaf pondweed and Eurasian water milfoil. The Lake George Improvement District works 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.

### Historical Summertime Mean Values

Agency	MC	MC	MC	MC	MC	MC	ACD	MC	ACD	ACD	ACD
Year	1980	1981	1982	1984	1989	1994	1997	1998	1999	2000	2002
TP	22.5	22.0	22.3	24.4	24.3	25.4	17.4	27.5	21.1	16.3	19.9
Cl-a	7.3	7.1	7.0	9.5	4.5	6.9	13.2	7.8	5.6	5.8	5.2
Secchi (m)	3.1	3.4	3.4	3.3	3.9	2.4	3.6	2.7	3.5	2.8	2.6
Secchi (ft)	10.2	11.2	11.0	10.8	12.9	7.8	11.7	9.0	11.4	10.7	8.6

#### Carlson's Trophic State Indices

TSIP	49	49	49	50	50	51	45	52	48	44	47
TSIC	50	50	50	53	45	50	56	51	48	48	47
TSIS	44	42	43	43	40	48	42	45	42	45	46
TSI	48	47	47	49	45	49	48	49	46	46	47

#### Lake George Water Quality Report Card

Year	1980	1981	1982	1984	1989	1994	1997	1998	1999	2000	2002
TP	A	A	A	B	B	B	A	B	A	A	A
Cl-a	A	A	A	A	A	A	B	A	A	A	A
Secchi	A	A	A	A	A	B	A	B	A	B	B
<b>Overall</b>	<b>A</b>	<b>A</b>	<b>A</b>	<b>A</b>	<b>A</b>	<b>B</b>	<b>A</b>	<b>B</b>	<b>A</b>	<b>A</b>	<b>A</b>

Agency	ACD	ACD	MC	MC	ACD	ACD	ACD	ACD	ACD	ACD
Year	2005	2008	2009	2011	2013	2014	2015	2016	2017	2018
TP	26.0	23.0	26.2	29.0	30.3	25.5	22.5	28.4	23.3	22.5
Cl-a	5.4	6.4	7.0	12.4	6.1	6.4	2.7	7.8	5.7	6.8
Secchi (m)	2.8	3.2	2.9	1.8	2.6	2.2	2.9	2.3	2.4	2.9
Secchi (ft)	9.1	10.4	9.5	6.7	8.6	7.4	9.4	7.4	7.7	9.4

#### Carlson's Trophic State Indices

TSIP	51	49	51	53	53	51	49	52	50	49
TSIC	47	49	50	55	48	49	40	51	48	49
TSIS	45	43	45	52	46	49	45	48	48	45
TSI	48	47	49	53	49	49	45	50	48	48

#### Lake George Water Quality Report Card

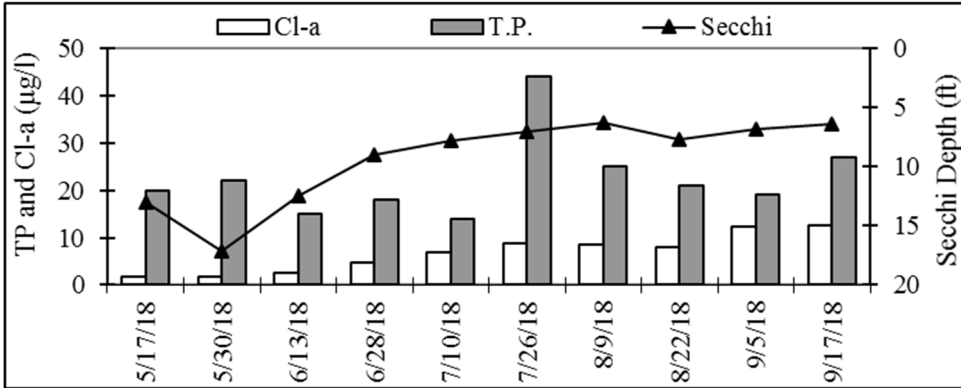
Year	2005	2008	2009	2011	2013	2014	2015	2016	2017	2018
TP	B	B+	B	B	B	B	A	B	B	A
Cl-a	A	A	A	B	A	A	A	A	A	A
Secchi	B	A	B	C	B	B	B	B	B	B
<b>Overall</b>	<b>B</b>	<b>A</b>	<b>B</b>	<b>B</b>	<b>B</b>	<b>B</b>	<b>A</b>	<b>B</b>	<b>B</b>	<b>A</b>



# Lake George

CITY OF OAK GROVE, LAKE ID # 02-0091

## 2018 Daily Results



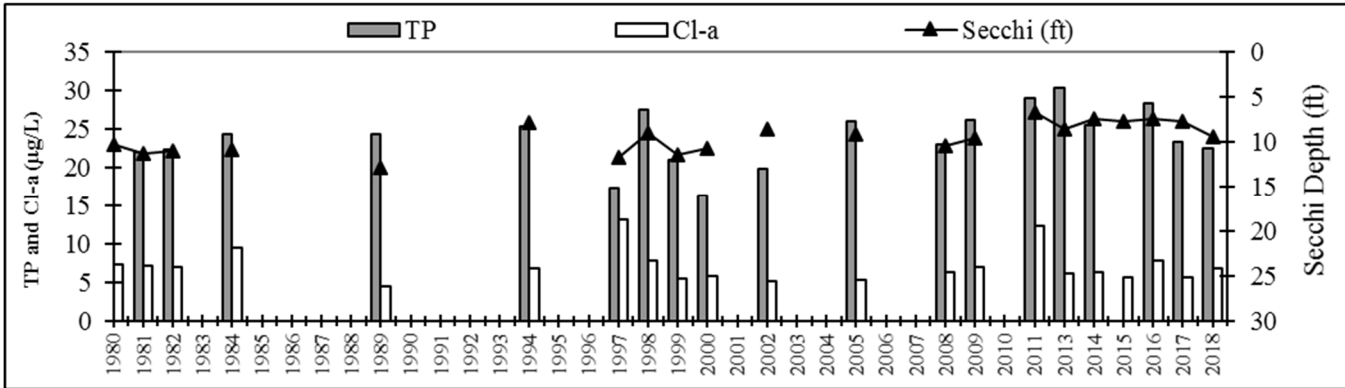
## 2018 Median Values

pH		8.39
Specific Conductivity	mS/cm	0.224
Turbidity	NTU	1.80
D.O.	mg/l	8.55
D.O.	%	106.15
Temp.	°F	75.3
Salinity	%	0.1
Cl-a	µg/L	7.5
T.P.	µg/l	20.5
Secchi	ft	7.8

## 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
2018	A	A	B	A
State Standards	40 µg/L	14 µg/L	>4.6 ft	

## Historic Annual Averages



## 2018 Water Quality Data

		Date:	5/17/2018	5/30/2018	6/13/2018	6/28/2018	7/10/2018	7/26/2018	8/9/2018	8/22/2018	9/5/2018	9/17/2018			
		Time:	15:05	12:30	11:00	13:17	13:50	13:24	15:22	10:35	12:05	12:47			
	Units	R.L.*	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Average	Min	Max
pH		0.1	8.75	7.46	8.38	8.84	8.57	8.40	8.82	8.05	8.05	8.35	8.4	7.46	8.84
Specific Conductivity	mS/cm	0.01	0.246	0.249	0.219	0.209	0.233	0.242	0.210	0.212	0.211	0.228	0.2	0.21	0.25
Turbidity	NTU	1	2.00	0.00	0.00	0.00	1.60	3.900	2.30	2.50	62.00	1.00	1.5	0.00	3.90
D.O.	mg/l	0.01	9.89	7.90	8.43	8.93	8.66	9.85	9.81	6.47	7.47	8.33	8.6	6.47	9.89
D.O.	%	1	109.7	101.6	98.8	110.4	109.0	119.9	125.4	77.3	88.5	103.3	104.4	77.3	125.4
Temp.	°C	0.1	19.29	24.10	21.66	24.74	26.87	24.04	26.18	23.99	22.62	24.07	23.8	19.29	26.87
Temp.	°F	0.1	66.7	75.4	71.0	76.5	80.4	75.3	79.1	75.2	72.7	75.3	74.8	66.72	80.37
Salinity	%	0.01	0.12	0.12	0.11	0.10	0.11	0.12	0.10	0.10	0.10	0.11	0.1	0.10	0.12
Cl-a	µg/L	1	1.78	1.78	2.67	4.8	6.9	8.7	8.5	8.0	12.3	12.5	6.8	1.78	12.50
T.P.	mg/l	0.005	0.020	0.022	0.015	0.018	0.014	0.044	0.025	0.021	0.019	0.027	0.0	0.01	0.04
T.P.	µg/l	5	20	22	15	18	14	44	25	21	19	27	22.5	14.00	44.00
Secchi	ft		13.0	17.2	12.4	9.0	7.8	7.1	6.3	7.7	6.8	6.4	9.4	6.33	17.17
Secchi	m		4.0	5.2	3.8	2.7	2.4	2.2	1.9	2.3	2.1	2.0	2.9	1.93	5.23
Physical			1.0	1.0	2.0	1.0	2.0	2.0	1.0	1.0	1.0	1.0	1.3	1	2
Recreational			1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.00	1.00

\*reporting limit

## 2018 Aquatic Invasive Vegetation Mapping

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### Lake George

CITY OF OAK GROVE, LAKE ID # 02-0091

**Partners:** Lake George LID

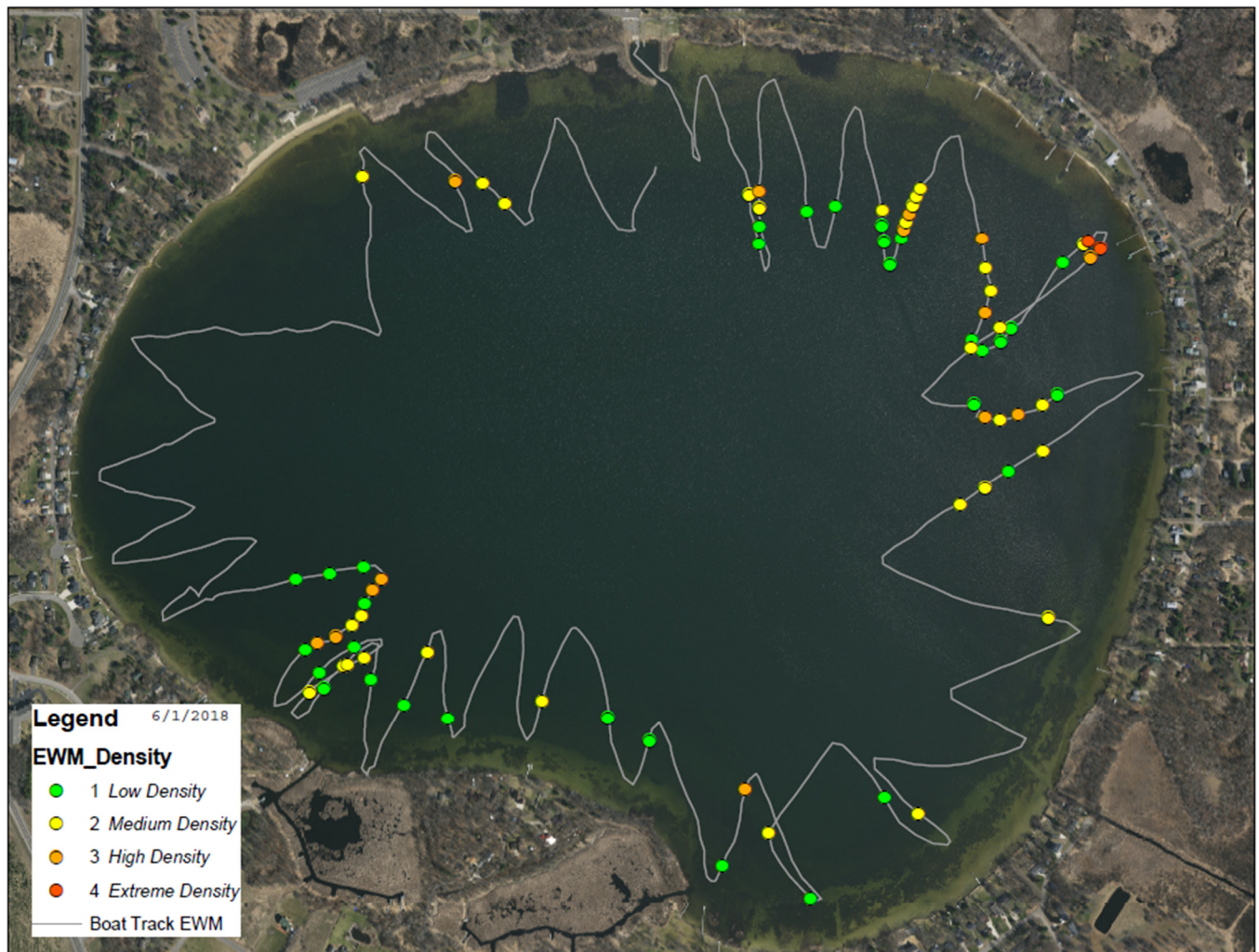
**Description:** The Anoka Conservation District (ACD) was contracted by the Lake George Lake Improvement District (LID) to conduct an aquatic invasive vegetation delineation.

**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

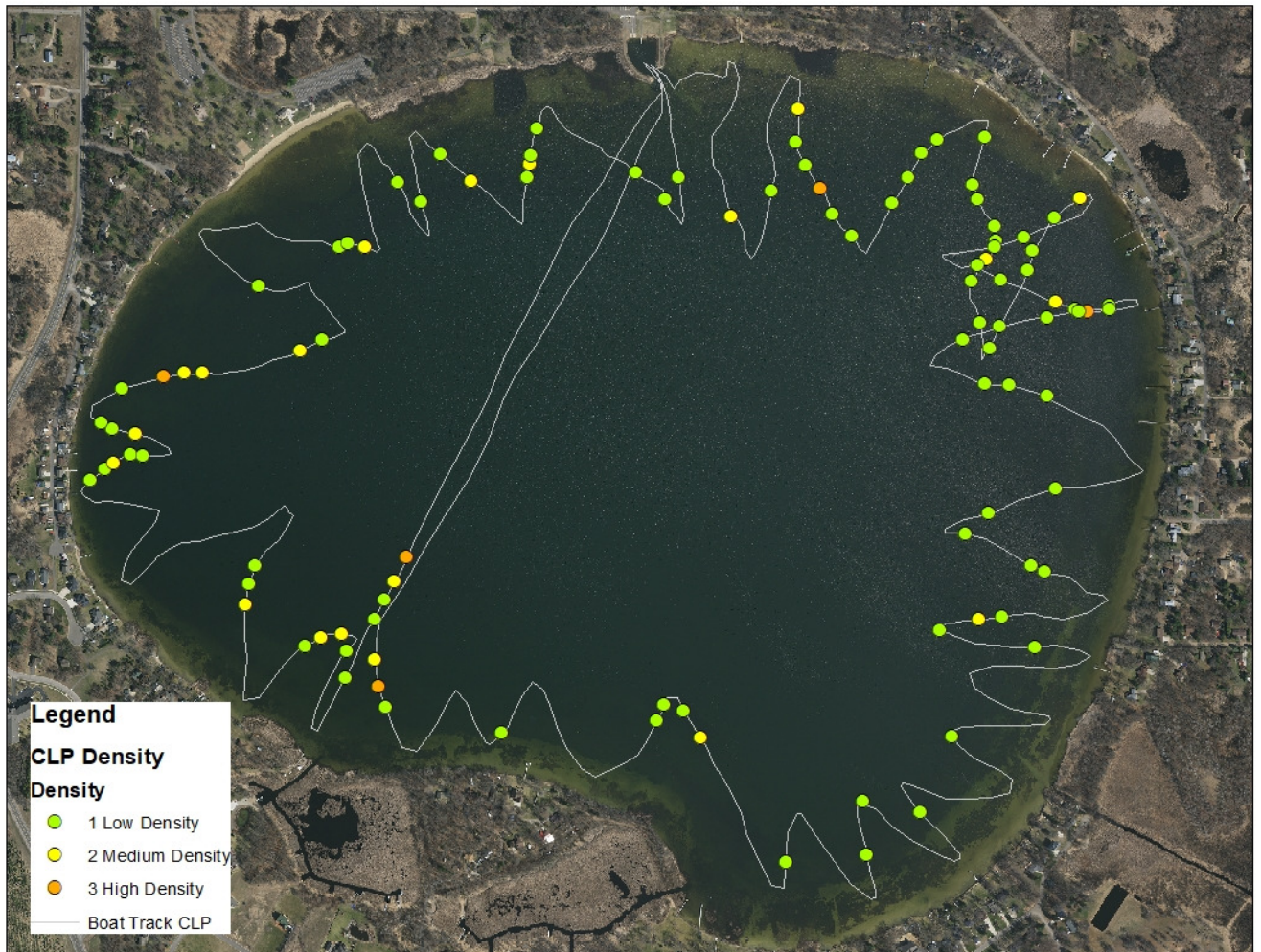
**Results:** Maps presented below were delivered to the MN DNR and Lake George Improvement District within 48 hours of the field surveys. These survey points were reviewed by the MNDNR and herbicide treatment was approved for Eurasian water milfoil on 56.7 acres of Lake George. No treatment of curly-leaf pondweed occurred in 2018 due to suppressed densities and concern about native pondweeds suffering from past treatments.

### June 1, 2018 Lake George Eurasian Water Milfoil (EWM) Survey





**May 18, 2018 Lake George Curly Leaf Pondweed (CLP) survey**



## Stream Water Quality - Chemical Monitoring

**Partners:** MPCA, ACD

**Description:** The Rum River and several tributary streams were monitored in 2018. The locations of river monitoring include the approximate top and bottom of the Upper Rum River Watershed Management Organization (WMO) and at the top of the Lower Rum River WMO. Tributaries were monitored simultaneously with Rum River monitoring for greatest comparability near their outfalls into the river. Monitoring at the bottom of the Lower Rum River WMO was completed by the Metropolitan Council (Met Council). 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 by Anoka Conservation District occurred in May through October for each of the following parameters: total suspended solids, total phosphorus, Secchi tube transparency, dissolved oxygen, turbidity, temperature, specific conductivity, pH, and salinity. Metropolitan Council monitoring occurred weekly March to October and semi-monthly November to February. The Met Council monitors all the parameters listed above, plus several more. Met Council monitoring data can be found on their Environmental Information Management Systems (EIMS) website (<https://eims.metc.state.mn.us/>). Data from both sources are summarized in this report.

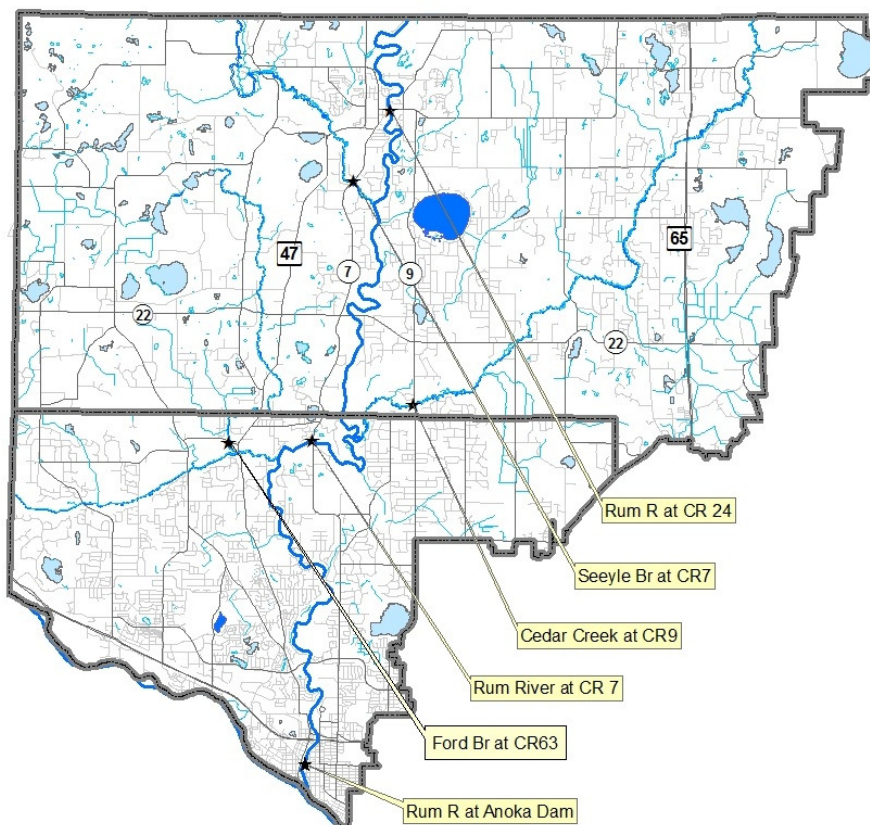
**Purpose:** To detect water quality trends, diagnose and identify the source of any problems, and guide management.

**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



## ***Stream Water Quality Monitoring***

---

### **RUM RIVER**

Rum River at Co. Rd. 24 (Bridge St), St. Francis	STORET Site ID = S000-066
Rum River at Co. Rd. 7 (Roanoke St), Ramsey	STORET Site ID = S004-026
Rum River at Anoka Dam, Anoka <sup>1</sup>	STORET Site ID = S003-183

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<sup>1</sup>Located in the LRRWMO and monitored by the Metropolitan Council

#### **Years Monitored**

At Co. Rd. 24 – 2004, 2009-2011, 2014-2018

At Co. Rd. 7 – 2004, 2009- 2011, 2014-2018

At Anoka Dam – 1996-2011(MC WOMP), 2015-2018

#### **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, 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 2014-2018 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 2018 the river was monitored during both storm and baseflow conditions by grab samples. At County Road 24 (farthest upstream) only four samples were taken due to lower funding levels. At County Road 7, eight water quality samples were taken; half during baseflow and half following storms. These two sites were monitored by the Anoka Conservation District. At the Anoka Dam the river was monitored by the Metropolitan Council using a different schedule.

Monitoring was conducted during both base flow and storm conditions. 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 drought years, smaller storms were sampled because of a lack of larger storms. All storms sampled were significant runoff events.

Key water quality parameters were monitored at all sites. Parameters tested with portable meters included pH, Specific 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, as well as chloride at Rum River at County Road 7. Additional parameters were monitored at the Anoka Dam by the Metropolitan Council.

Water levels or flow was observed during each water quality sampling. The Metropolitan Council 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 at all sites in 2018. 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 (<https://www.pca.state.mn.us/data/environmental-quality-information-system-equis>).

## Results Summary

This report includes data from 2018 and an overview of previous year's data. The following is a summary of results.

- Dissolved constituents were measured by specific conductivity and chlorides. Specific conductivity in the Rum River is lower than other Anoka County streams. Specific conductivity increases mildly downstream, though it is slightly lower at the furthest downstream site compared to the mid-county site. Average specific conductivity for sites tested in 2018 from upstream to downstream was 0.266, 0.282, and 0.269 mS/cm, respectively. Chloride was tested at Rum River at C.R. 7 where it averaged 14 mg/L, which is low. As development continues in all parts of the Rum River watershed, efforts to prevent future problems should include minimizing road deicing salt use and utilizing new water softening technology. Other streams near the Rum River do have significant high chlorides problems.
- Phosphorus in the Rum River in recent years has been near the State water quality standard of 100 µg/L at all sampled sites. Sites exceeded the standard on three single sampling occasions in 2018, once during baseflow, and twice after a storm event. 2018 total phosphorus in the Rum River in 2018 averaged 78.8, 83.3, and 86.0 µg/L at sampled sites from upstream to downstream. This year total phosphorus increased slightly compared to the low values of 2017. The minimal increase from upstream to downstream is overall a good thing as it points to relatively small phosphorus contributions occurring in Anoka County. However, 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 peaked at the mid-county site Rum River at C.R. 7 where average turbidity was 19.3 NTU. From upstream to downstream in 2018 turbidity averages were 7.2, 19.43, and 3.85 NTU, respectively. TSS levels were low in the Rum River compared to other Anoka County streams averaging 10.94, 10.1, and 5.54 mg/L from upstream to downstream. The low turbidity and TSS levels at the downstream site are likely due to settling in the pool created by the dam at Anoka. 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, especially as other pollutants may be associated with suspended solids.
- pH returned to more typical levels in 2018 in the Rum River after being elevated on some occasions in 2017. 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. However, this year there were no examples of pH exceeding 9, in fact the highest pH recorded was 8.46, within the range required to meet state standards. This decrease in pH both on average and overall is good, but concern remains because there have been a number of spikes in pH over 8.5 in recent years. pH levels over 9 are quite alkaline for natural waterways. There are a variety of potential factors leading to temporary spikes in pH, including discharge of high nutrient and algae waters to the river from lakes or wetlands. pH should continue to be monitored in the Rum River in the future.
- Dissolved oxygen remained above the state standard of 5 mg/L in 2018 and previous monitored years, however the lowest recorded level occurred this year. The lowest concentration recorded at any of the three sites in 2018 was 5.64 mg/L at Rum River at C.R. 7 compared to 6.89 mg/L at Rum River at Anoka Dam in 2017.

Below the data are presented and discussed for each parameter in greater detail. 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.

### ***Specific Conductivity***

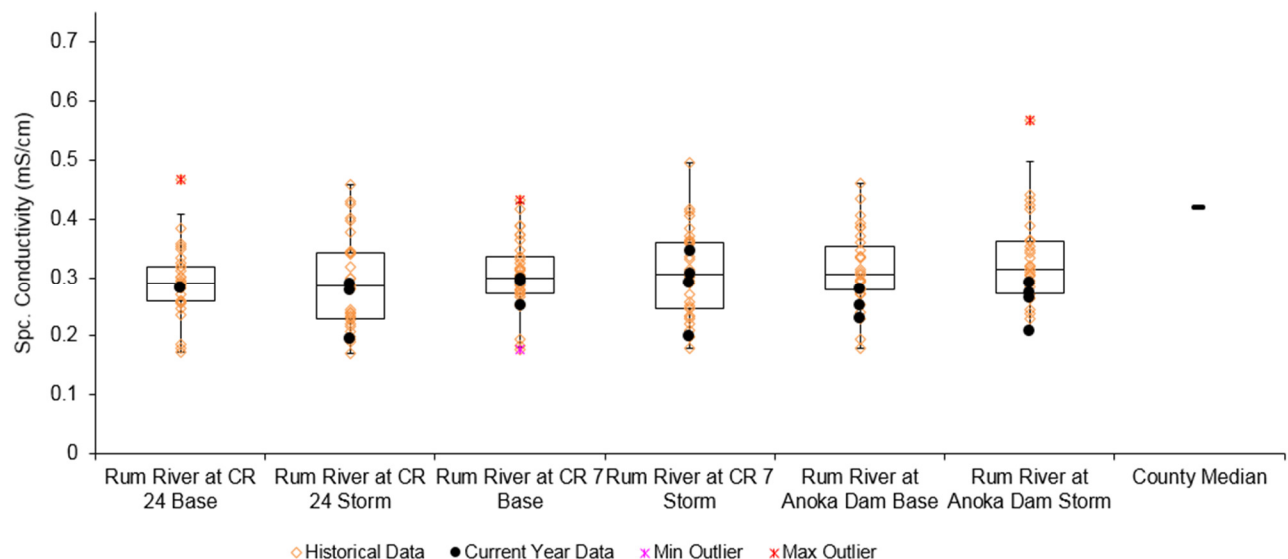
Specific conductivity and chlorides are measures of dissolved pollutants. Dissolved pollutant sources include road runoff and industrial chemicals, among many others. Metals, hydrocarbons, and road salts, as well as other pollutants are often of concern in a suburban environment. Specific Conductivity is the broadest measure of dissolved pollutants we use. It measures electrical Specific Conductivity of the water; pure water with no dissolved constituents has zero Specific Conductivity.

Specific conductivity is acceptably low in the Rum River, in the past it has shown a consistent pattern of increasing downstream (see figure below) and is usually higher during baseflow conditions. Average specific conductivity from upstream to downstream in 2018 (all conditions) did not meet these expectations with readings of 0.266 mS/cm, 0.282 and 0.269 mS/cm, respectively. All three sites are lower than the historical median for 34 Anoka County streams of 0.420 mS/cm and. The 2018 maximum observed specific conductivity in the Rum River was 0.347 mS/cm at County Road 7 during storm conditions. During storm flows there is a statistically significant trend of increasing specific conductivity from upstream to downstream when averaged over the last 5 years.

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

In years past, specific conductivity has increased from upstream to downstream and that is the expected trend. During baseflow, this increase from upstream to downstream likely reflects greater road densities and deicing salt application. That this pattern is not seen this year could be due to precipitation or runoff differences, or the timing of sampling. Additionally, the below the dam specific conductivity readings were atypical in 2018 in that specific conductivity was higher during storm than baseflow events, averaging 0.279 mS/cm during storms and 0.254 mS/cm during baseflow.

**Specific Conductivity during Baseflow and Storm Conditions.** Orange diamonds are historical data from previous years and black circles are 2018 readings. Box plots show the median (middle line), 25<sup>th</sup> and 75<sup>th</sup> percentile (ends of box), and 10<sup>th</sup> and 90<sup>th</sup> percentiles (floating outer lines).



## Chlorides

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. Specific conductivity data, reported above, is partially a reflection of chlorides with higher specific conductivity corresponding to higher chlorides, generally.

In 2018 water samples for chloride analysis were taken from the Rum River at CR7. At this location average chloride was 14.7 mg/L for all events and 14.2 and 15.0 mg/L for storms and base flow conditions, respectively. This reflects the typical trend seen in specific conductivity of greater dissolved pollutants during baseflow conditions and likely reflects infiltration of road salts into the shallow aquifer. This information could be of greater value if chloride sampling occurred at all sites sampled in the Rum River watershed and, additionally, if samples were taken after snowfall events and corresponding specifically to snowmelt.

## Total Phosphorus

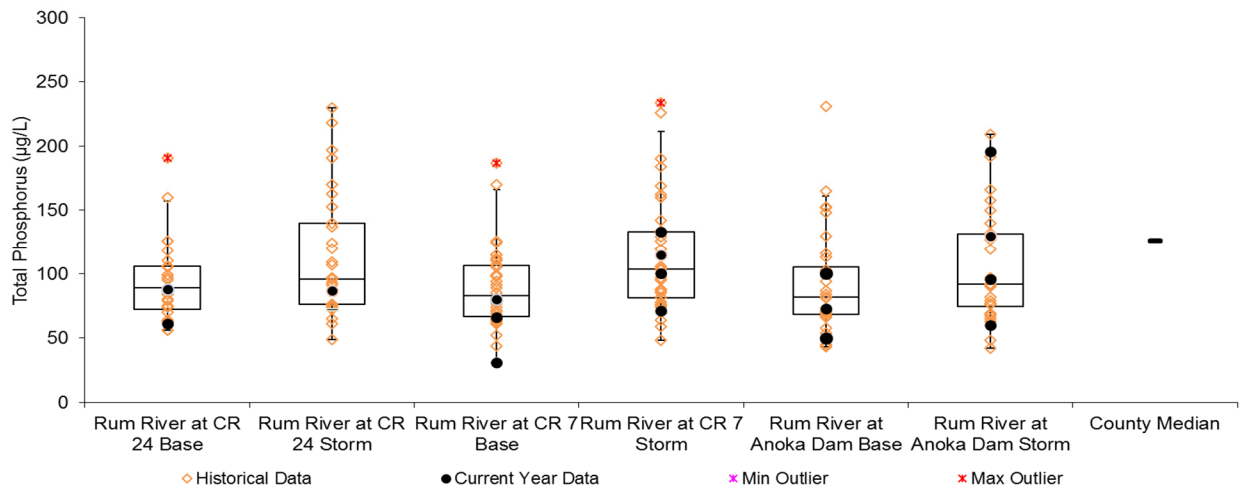
Phosphorus is one of the most common pollutants in this region, and can be associated with urban runoff, agricultural runoff, wastewater, and many other sources. It causes excessive algal growth and a number of other associated problems for aquatic life and recreation. Rum River total phosphorus is near State impairment thresholds.

The average phosphorus concentration in 2018 increased from upstream to downstream and approached State standards for impairment. At the three monitored sites phosphorus from upstream to downstream was 78.8, 83.3 and 86.0  $\mu\text{g/L}$ , respectively. The watershed becomes increasingly suburbanized in the lower reaches.

In 2018, as in many years pre-2016, total phosphorus was close to exceeding State water quality standards. Four samples in 2018 yielded total phosphorus concentrations over the State standard of 100  $\mu\text{g/L}$ . Of those, two occurred on July 2<sup>nd</sup> at the mid-county and downstream sites after a significant rainfall event.

Understanding that the Rum River is close to exceeding State water quality standards for phosphorus, monitoring should be continued in the future 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 should include robust stormwater treatment to not just keep nutrient loading to the river the same, but reduce it. Reductions will be necessary to offset likely increases from land use changes, more intense precipitation events, upstream ditch cleaning and others forces.

**Total Phosphorus during Baseflow and Storm Conditions.** Orange diamonds are historical data from previous years and black circles are 2018 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentile (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 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, such as phosphorus, are attached to particles. Many stormwater treatment practices such as street sweeping, sumps, and stormwater settling ponds target sediment and attached pollutants. In 2018, median turbidity and total suspended solids in the Rum River were lower than the historical median for Anoka County streams.

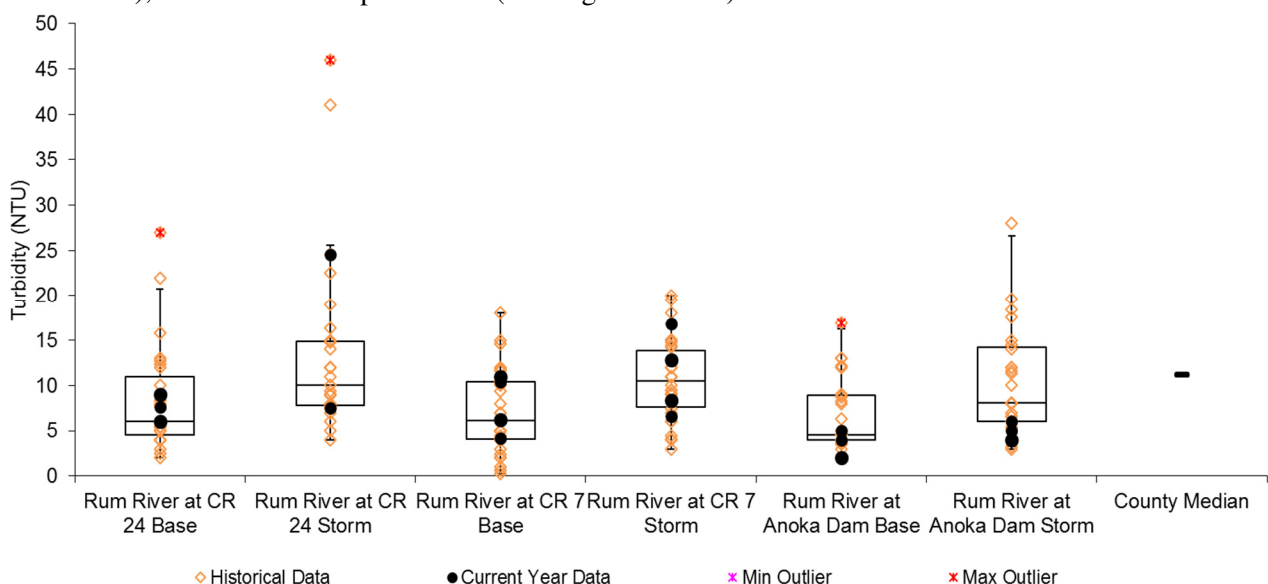
In the Rum River, turbidity is generally low but increases during storms. There is substantial variability (see figure below). There is no clear change in turbidity or suspended solids upstream to downstream. The average turbidity, in 2018 (storms and baseflow) for each site moving upstream to downstream was 7.2, 19.4, and 3.85 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. Over the last 5 years there is a statistically significant increase in turbidity from upstream to downstream during baseflow conditions and also for all samples. This likely reflects the effect of increased erosion and contribution of sediments in the more developed southern portion of the county.

Average TSS results (all conditions) in 2018 for sites moving upstream to downstream were 10.94, 10.1, and 5.54 mg/L. These are all lower than the Anoka County stream median for TSS of 13.66 mg/L. It is also lower than State water quality standards. 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 2018 was 24 mg/L. ACD has not collected a sample over 30 mg/L TSS since May of 2010.

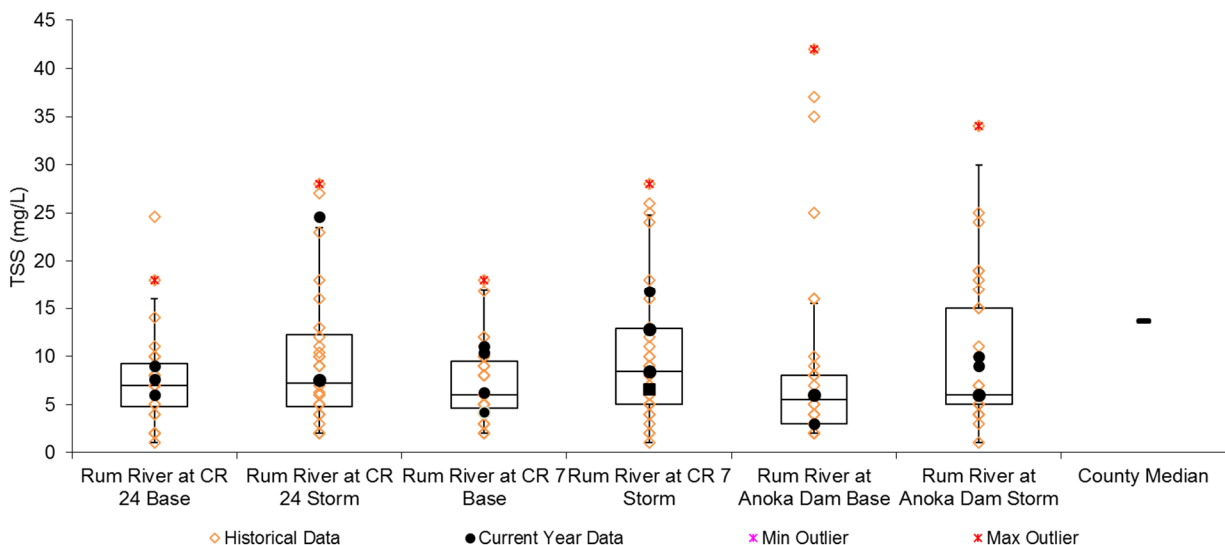
Suspended solids can come from within and outside of the river channel. Sources on land include soil erosion, road sanding, and others. Riverbank erosion and movement of the river bottom also contributes to suspended solids. A moderate amount of this “bed load” is natural and expected.

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, especially given that stormwater carries many pollutants in addition to suspended sediments. 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 2018 readings. Box plots show the median (middle line), 25<sup>th</sup> and 75<sup>th</sup> percentile (ends of box), and 10<sup>th</sup> and 90<sup>th</sup> percentiles (floating outer lines).



**Total Suspended Solids during Baseflow and Storm Conditions.** Orange diamonds are historical data from previous years and black circles are 2018 readings. Box plots show the median (middle line), 25<sup>th</sup> and 75<sup>th</sup> percentile (ends of box), and 10<sup>th</sup> and 90<sup>th</sup> percentiles (floating outer lines).



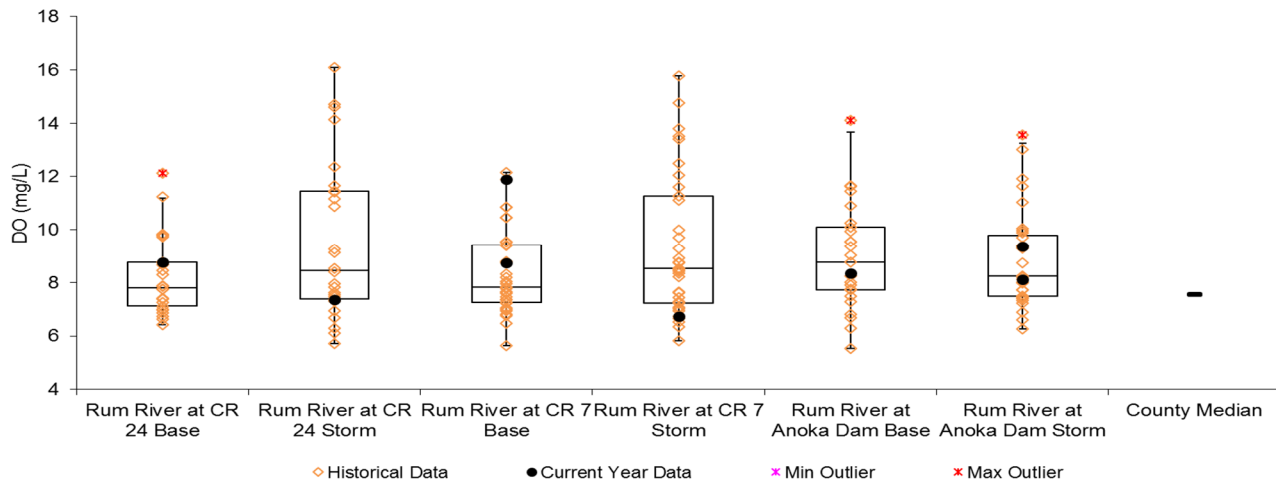
### ***Dissolved Oxygen***

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 2018, dissolved oxygen in the Rum River was always above 5 mg/L at all monitoring sites.

The lowest dissolved oxygen observed in the Rum River in 2018 was 5.64 mg/L. This is only the fifth time that a dissolved oxygen reading below 6 has occurred in the Rum River throughout the monitoring record, with the 3 most recent previous readings occurring during a single storm in 2011 when dissolved oxygen dipped below six at all three sites.

Decreases in dissolved oxygen may result from an increase in the level of nutrients in the stream. Making sure that phosphorus and nitrogen inputs to the stream are maintained or lowered is important for healthy dissolved oxygen levels. The principle sources of these nutrients are fertilizer and wastewater.

**Dissolved Oxygen during Baseflow and Storm Conditions.** Orange diamonds are historical data from previous years and black circles are 2018 readings. Box plots show the median (middle line), 25<sup>th</sup> and 75<sup>th</sup> percentile (ends of box), and 10<sup>th</sup> and 90<sup>th</sup> percentiles (floating outer lines).



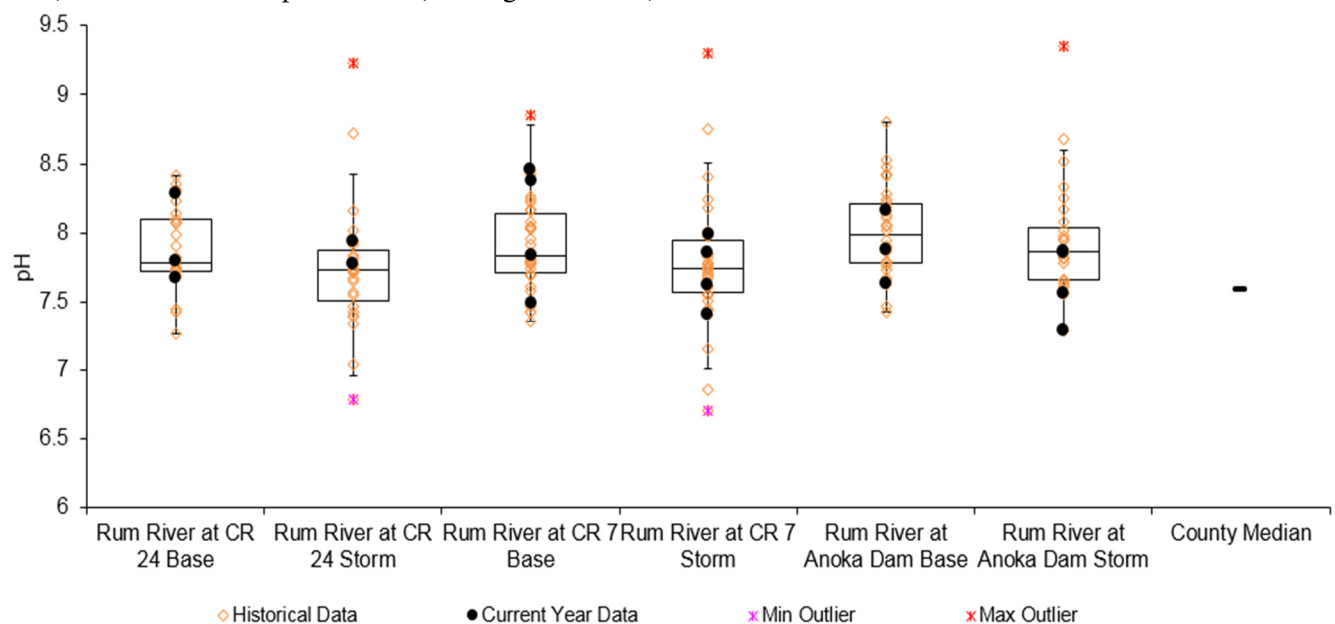


## pH

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. This year saw a positive change with no events exceeding 8.5.

There are a variety of potential factors leading to temporary spikes in pH. It is, however, disconcerting that spikes over 8.5 seem to be happening more frequently in recent years, although it is a positive development that they did not occur this year. 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 2018 readings. Box plots show the median (middle line), 25<sup>th</sup> and 75<sup>th</sup> percentile (ends of box), and 10<sup>th</sup> and 90<sup>th</sup> percentiles (floating outer lines).



## Summary and Recommendations

In general, the Rum River's water quality is good. However, there is typically a slight increase in specific conductivity moving downstream, phosphorus levels are near state water quality standards, and pH spikes over 8.5 have been more frequent in recent years, although they did not occur this year. The river is in need of protection now to avoid restoration becoming a necessity later.

In addition to comparing water quality in the Rum River upstream to downstream, water quality was also compared between Rum River tributaries and the Rum River main stem. For specific conductivity, total suspended solids, and total phosphorus the Rum river had better water quality

**Relative changes in 3 water quality parameters** in tributaries and the Rum River moving upstream to downstream. Arrows indicate difference relative to Rum River at CR 24 (top of the county).

	Specific Conductivity	Total Suspended Solids	Total Phosphorus
	Difference Relative to Rum R. at CR 24		
Rum River @ CR 24	0.266 mS/cm	10.94 mg/L	78.8 µg/L
Seelye Brook @ CR 7	+	-	+
Cedar Creek @ CR 9	+	+	+
Rum River @ CR 7	+	-	+
Ford Brook @ CR 63	+	+	+
Rum River @ Anoka Dam	=	-	+

than the tributaries, except when TSS results at Rum River at CR 24 and Seelye Brook at CR 9 were compared. For the tributaries sampled it is clear that they would be contributing to worsening water quality in the Rum River. Many of the tributaries experience frequent exceedances of state standards, especially for total phosphorus. This is important since the Rum River is already nearing exceedance of total phosphorus standards and this shows that the tributaries are likely contributing to this problem. Moving forward it is important to continue to monitor both the Rum River and its tributaries in order to prioritize management and to understand how tributary water quality effects the Rum River.

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. This continued development has the potential to degrade water quality unless carefully planned and managed with the river in mind. Specifically, new development should follow stormwater standards designed to at least maintain, and preferably reduce, phosphorus discharge to the river. Road deicing locally, which has become more sophisticated in recent years, should focus on minimizing salt application while keeping roads safe.

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 do exist, and enforcement is key. Additionally, preservation of riparian parcels with high natural resources quality should be considered with easement or fee title acquisition.

Watershed-wide (Mille Lacs Lake to the Anoka Dam) coordination of Rum River management is especially active currently. A Watershed Restoration and Protection Strategies (WRAPS) was completed in 2017. It is a scientific study that identifies recommended management strategies. A "One Watershed, One Plan" (1W1P) in 2019-2020 offers multi-county planning. This plan will prioritize and coordinate action. After completion of the 1W1P a new state funding source will become available – Watershed Based Funding – to implement water quality improvement projects.

# ***Stream Water Quality Monitoring***

## **CEDAR CREEK**

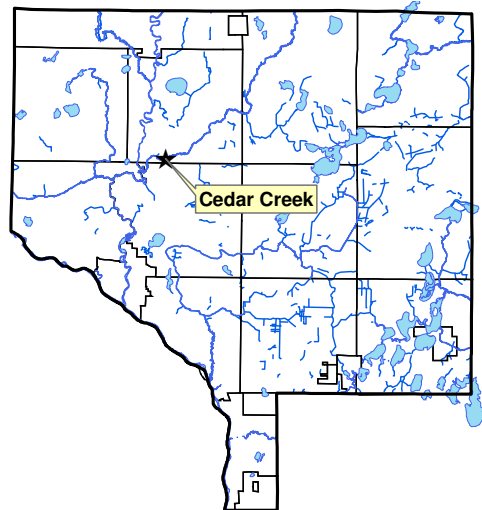
at Hwy 9, Oak Grove

STORET Site ID = S003-203

### **Background**

Cedar Creek originates in south-central Isanti County and flows southwest into 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 2018 and an overview of previous year's data. The following is a summary of results.

- Dissolved constituents, as measured by specific conductivity, in Cedar Creek are higher in recent years at baseflow conditions. Specific conductivity averaged 0.467 mS/cm in 2018 with the long term baseflow median now up to 0.426 mS/cm. This increase in baseflow specific conductivity is a concerning trend. Chlorides were last sampled in 2013, but sampling of chlorides should be considered again given the increase in specific conductivity levels. Road deicing salt is believed to be a large contributor to elevated chlorides.
- Phosphorus averaged poorer than 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 area due to the lasting effects of nutrient loading downstream including in the Rum River. Phosphorus results in Cedar Creek averaged 227 µg/L in 2018 up from 151 µg/L in 2017. Phosphorus is typically 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 varied widely. Total suspended solids averaged 34.7 mg/L, and turbidity averaged 17.45 NTU. This year TSS exceeded the state standard of 30 mg/L. While a breakdown of sources is not available, some natural sources including wetlands may contribute.
- pH was within the acceptable range of 6.5-8.5. On one occasion in 2017 pH reached 8.94, the highest pH ever recorded in Cedar Creek, but in 2018 pH stayed below 8.5.
- Dissolved oxygen was within the range considered healthy for streams in this area. DO averaged 7.88 mg/L.

### **Methods**

In 1998, 2005-2006, 2011, 2013-2018 monitoring was conducted to determine how Rum River tributary water quality compares to and affects Rum River water quality.

Monitoring was conducted during both baseflow and storm conditions. 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 drought years, smaller storms were sampled because of a lack of larger storms. All storms sampled were significant runoff events.

Key water quality parameters were monitored at all sites. Parameters tested with portable meters included pH, specific 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. Water level was also recorded during each sampling event.

2018 water quality data is presented below. 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 on their website (<https://www.pca.state.mn.us/data/environmental-quality-information-system-equis>).

### Cedar Creek 2018 Water Quality Data

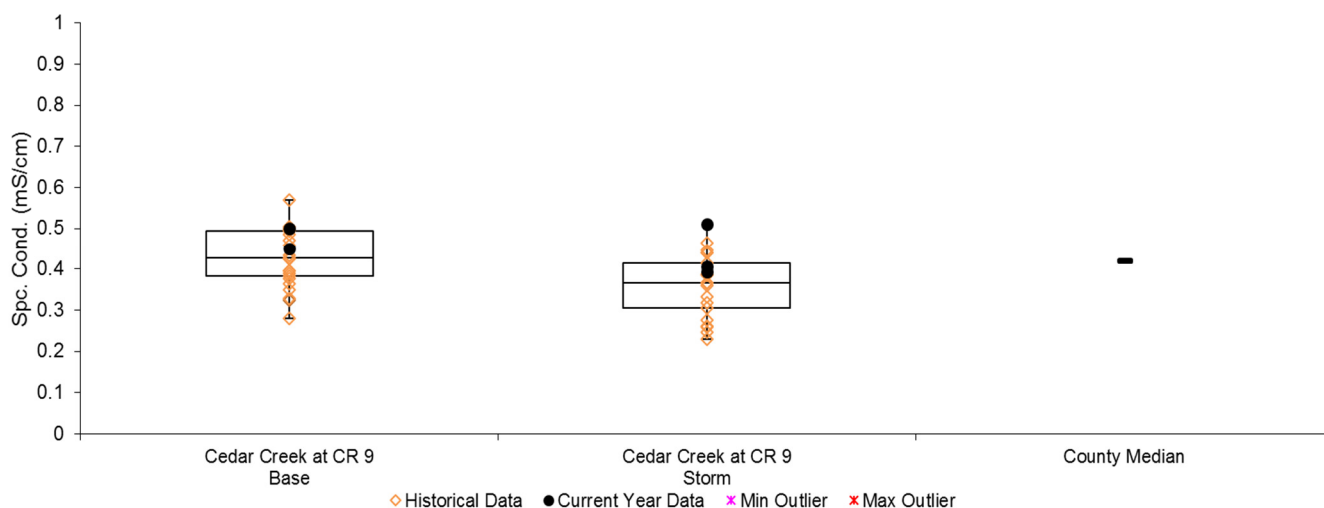
Cedar Creek 2018			5/22/2018	6/7/2018	7/2/2018	7/12/2018	8/28/2018				
	Units	R.L.*	Results	Results	Results	Results	Results	Median	Average	Min	Max
pH		0.1	8.22	7.98	7.26	7.94	7.78	7.94	7.84	7.26	8.22
Spc. Conductivity	mS/cm	0.01	0.449	0.511	0.406	0.500	0.393	0.45	0.45	0.39	0.51
Turbidity	NTU	1	9.3	23.9	19.9	16.7	0	16.70	13.96	0.00	23.90
D.O.	mg/L	0.01	7.79	7.88	5.88	7.45	7.41	7.45	7.28	5.88	7.88
D.O.	%	1	80.3	89.1	65.9	76.8	80.9	80.30	78.60	65.90	89.10
Temp.	°C	0.1	16.77	19.87	19.30	23.53	17.92	19.30	19.48	16.77	23.53
Salinity	‰	0.01	0.21	0.25	0.19	0.24	0.19	0.21	0.22	0.19	0.25
T.P.	ug/L	10	134	298	284	193	121	193.00	206.00	121.00	298.00
TSS	mg/L	2	23	61	36	19	8.9	22.60	29.50	8.90	61.00
Secchi-tube	cm	100	>100	45	48	53	>100	48.00	48.67	45.00	>100
Appearance			2	0	0	0	0				

### Specific Conductivity

Specific 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. Specific conductivity is the broadest measure of dissolved pollutants we use. It measures electrical specific conductivity of the water; pure water with no dissolved constituents has zero specific 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.

Specific conductivity is right on par in Cedar Creek at CR 9 compared to other Anoka County streams. Median specific conductivity (all years) is 0.426 mS/cm during baseflow and 0.363 mS/cm during storm events, respectively. The long-term countywide median specific conductivity for all conditions is 0.420 mS/cm. However, this includes many heavily urbanized streams, which Cedar Creek is not.

**Specific Conductivity during Baseflow and Storm Conditions.** Orange diamonds are historical data from previous years and black circles are 2018 readings. Box plots show the median (middle line), 25<sup>th</sup> and 75<sup>th</sup> percentile (ends of box), and 10<sup>th</sup> and 90<sup>th</sup> percentiles (floating outer lines).



Baseflow specific conductivity appears to be higher over the last few sampling years (since 2014). The median baseflow specific conductivity since 2014 is 0.485 mS/cm, above the long-term median suggesting increasing levels. However, the median storm flow specific conductivity since 2014, 0.319 mS/cm, is lower than the long-term average.

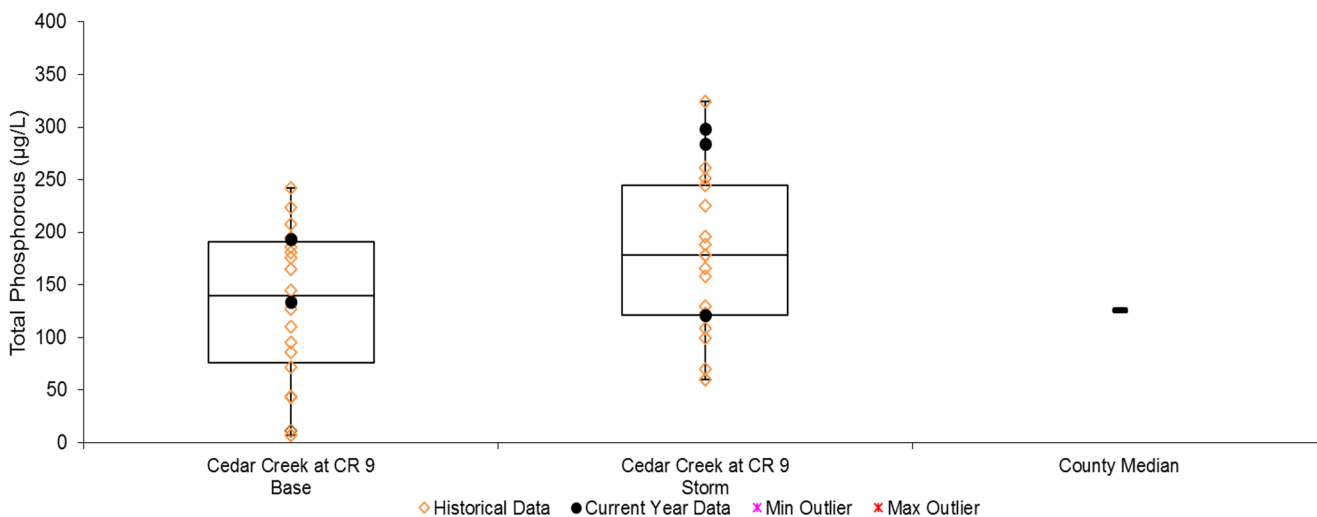
This increase in baseflow specific conductivity levels reveals some information about sources of loading into the stream. Higher levels at baseflow conditions indicate that the surficial groundwater of the watershed is being loaded with salts and other chemicals that increase specific conductivity. Some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

### ***Total Phosphorus***

Total phosphorus in Cedar Creek remained high in 2018 averaging 227 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. 19 of the 23 measurements taken since 2014 were >100 µg/L, the State water quality standard. In 2018, the highest observed total phosphorus concentrations were recorded during June and July at 298 µg/L and 284 µg/L. Individual results over 200 µg/L have become an annual occurrence since 2015. These recent high observances tend to inflate the long term average, so the median can be a better indicator of long term conditions. Nonetheless, phosphorus concentrations in Cedar Creek are at concerning levels and higher in recent years. 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 2018 readings. Box plots show the median (middle line), 25<sup>th</sup> and 75<sup>th</sup> percentile (ends of box), and 10<sup>th</sup> and 90<sup>th</sup> 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

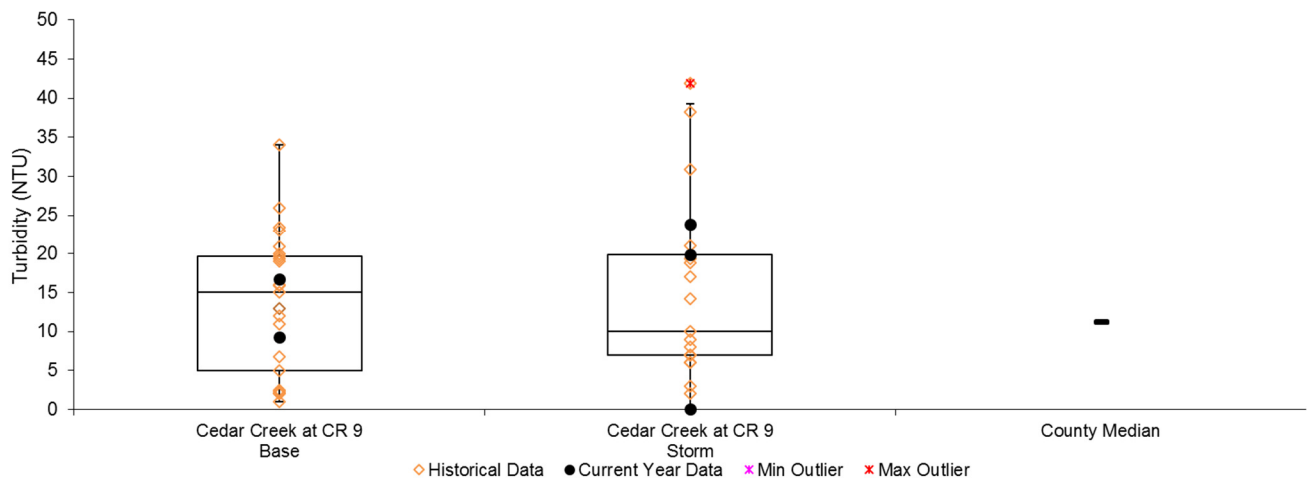
aquatic life, and because many other pollutants are attached to particles. Many stormwater treatment practices such as street sweeping, sumps, and stormwater settling ponds target sediment and attached pollutants.

Cedar Creek turbidity in 2018 was variable amongst the four samples taken. A low storm flow result of 0 NTU in August was opposed by a high storm flow result of 23.9 in June. The average turbidity in Cedar Creek in 2018 was 17.45 NTU and median was 18.30 NTU.

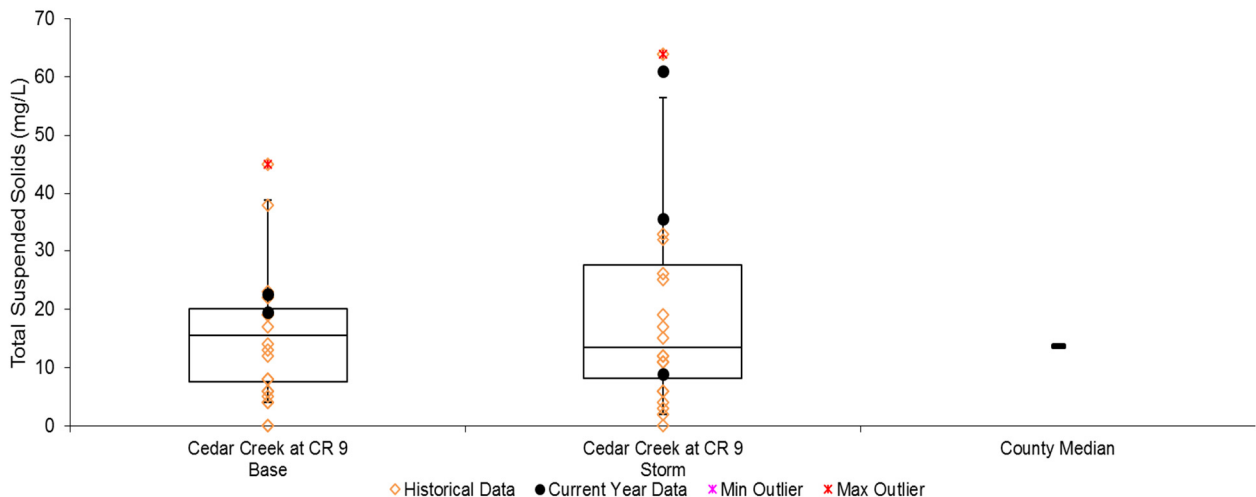
The median turbidity (all years) fell to 9.8 NTU during baseflow and to 9.0 NTU during storm events after 2018 results were added. Both are higher than the median for Anoka County streams of 8.5 NTU. The maximum turbidity measured in 2018 was 23.9 NTU.

TSS was similar to turbidity with low spring and summer results bracketing high early summer results. The median TSS concentration for Cedar Creek is 8 mg/L in 2018, lower than the median for all Anoka County streams of 14 mg/L. 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 2018 readings. Box plots show the median (middle line), 25<sup>th</sup> and 75<sup>th</sup> percentile (ends of box), and 10<sup>th</sup> and 90<sup>th</sup> percentiles (floating outer lines).



**Total Suspended Solids during Baseflow and Storm Conditions.** Orange diamonds are historical data from previous years and black circles are 2018 readings. Box plots show the median (middle line), 25<sup>th</sup> and 75<sup>th</sup> percentile (ends of box), and 10<sup>th</sup> and 90<sup>th</sup> percentiles (floating outer lines).

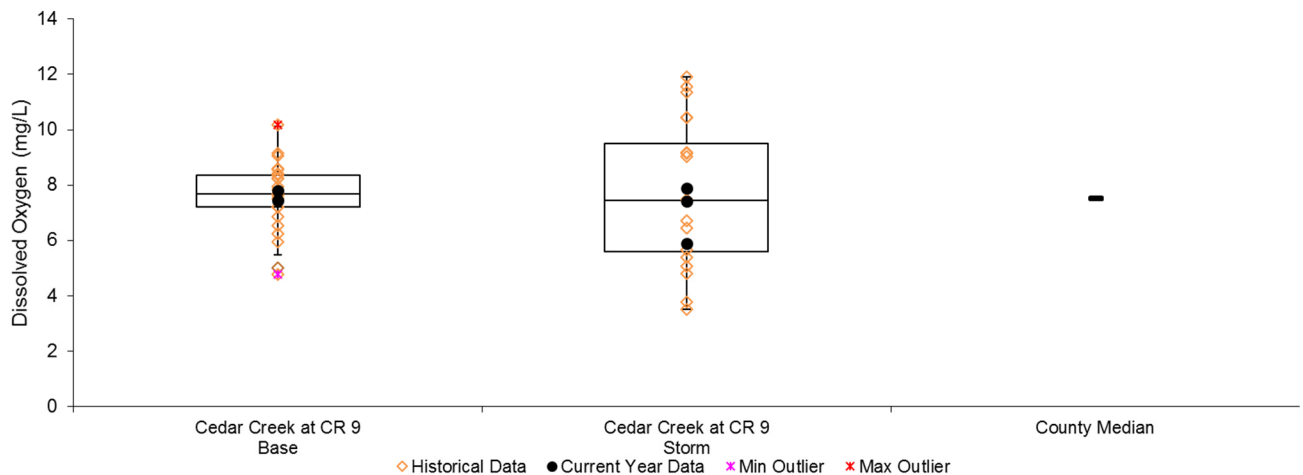


## Dissolved Oxygen

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 2018, dissolved oxygen in Cedar Creek was always above 5 mg/L. Median dissolved oxygen for all years of data is 7.48mg/L during baseflow and 7.59 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.

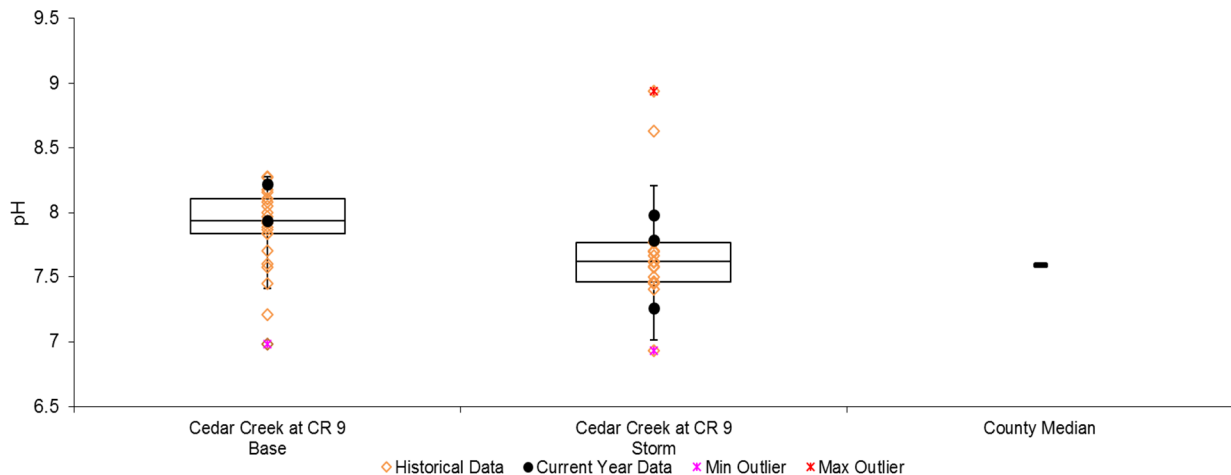
**Dissolved Oxygen during Baseflow and Storm Conditions.** Orange diamonds are historical data from previous years and black circles are 2018 readings. Box plots show the median (middle line), 25<sup>th</sup> and 75<sup>th</sup> percentile (ends of box), and 10<sup>th</sup> and 90<sup>th</sup> percentiles (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. Although pH has exceeded 8.5 twice in the past there were no exceedances this year. The readings were all on the high end of the acceptable range between 7.26 and 8.22. 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 2018 readings. Box plots show the median (middle line), 25<sup>th</sup> and 75<sup>th</sup> percentile (ends of box), and 10<sup>th</sup> and 90<sup>th</sup> percentiles (floating outer lines).





# Stream Water Quality Monitoring

## FORD BROOK

at County Road 63, Nowthen

STORET Site ID = 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 2018 and an overview of previous year's data. The following is a summary of results.

- Dissolved constituents, as measured by specific conductivity, in Ford Brook were greater in 2018 during baseflow conditions than recent years and above average when compared to similar Anoka County streams. Specific conductivity averaged 0.479 mS/cm in 2018. Levels are not highly problematic today, but could become so over time. Like many streams in the area, Ford Brook experiences its highest specific conductivity during baseflow. Specific conductivity is commonly linked to road deicing salts, and other sources like water softeners and dissolved pollutants can contribute. Periodic chloride sampling is recommended to verify if observed specific conductivity increases are due to salts. Road deicing practices and technologies continue to develop and be adopted locally, but more appear needed.
- Total phosphorus 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. In 2018 phosphorus results in Ford Brook averaged 148 µg/L with a maximum of 184 µg/L and a minimum of 94 µg/L. This is higher than the average for all years of 92 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 14.18 mg/L. Turbidity averaged 10.22 NTU. There is no current management concern.
- pH was well within the acceptable range for all readings in 2018. With a minimum value of 7.62 and a maximum of 8.21.
- Dissolved oxygen was within the health range for streams. DO averaged 7.39 mg/L (maximum of 8.32 mg/L and a minimum of 6.13 mg/L).



### Ford Brook 2018 Water Quality Data

Ford Brook			5/22/2018	6/7/2018	7/2/2018	7/12/2018	8/28/2018				
	Units	R.L.*	Results	Results	Results	Results	Results	Median	Average	Min	Max
pH		0.1	8.21	8.12	7.62	7.74	7.94	7.94	7.93	7.62	8.21
Sp. Conductivity	mS/cm	0.01	0.505	0.537	0.460	0.484	0.409	0.484	0.479	0.409	0.537
Turbidity	NTU	1	1.8	10.1	24.5	9.8	4.9	9.8	10.2	1.8	24.5
D.O.	mg/L	0.01	7.20	8.11	7.17	6.13	8.32	7.20	7.39	6.13	8.32
D.O.	%	1	75.5	92.3	82.0	76.3	92.2	82.0	83.7	75.5	92.3
Temp.	°C	0.1	17.58	20.35	20.59	24.72	18.71	20.35	20.39	17.58	24.72
Salinity	‰	0.01	0.24	0.26	0.22	0.23	0.19	0.23	0.23	0.19	0.26
T.P.	µg/L	10	145	94	184	162	155	155	148	94	184
TSS	mg/L	2	13	10	32	10	6.2	10	14.2	6.2	32.4
Secchi-tube	cm	100	90	50	48	>100	>100	>90	>78	48	>100

\*reporting limit



## Methods

In 1998, 2001, 2003-2006, 2011, 2014-2018 monitoring was conducted to determine how Rum River tributary water quality compares to and affects Rum River water quality.

Monitoring was conducted during both baseflow and storm conditions. 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 drought years, smaller storms were sampled because of a lack of larger storms. All storms sampled were significant runoff events.

Key water quality parameters were monitored at all sites. Parameters tested with portable meters included pH, specific 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. Water level was also recorded during each sampling event.

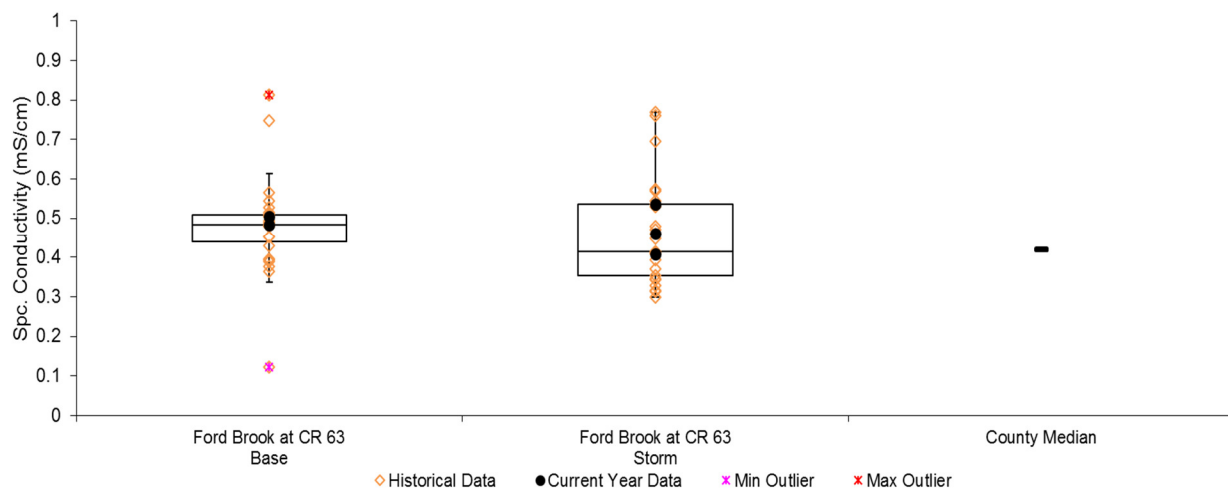
2018 water quality data is presented above. All other raw data can be obtained from the Anoka Conservation District, and is also available through the Minnesota Pollution Control Agency's EQuIS database, which is available through their website (<https://www.pca.state.mn.us/data/environmental-quality-information-system-equis>).

## Specific Conductivity

Median specific conductivity results in Ford Brook are mildly higher than the median for other Anoka County streams. Median specific conductivity in Ford Brook is 0.484 mS/cm (all years) during baseflow conditions and 0.415 mS/cm during storms, compared to the countywide median of 0.420 mS/cm during all conditions. Baseflow specific conductivity in 2018 was higher than recent years sampled dating back to 2011 (no monitoring occurred 2004-2010). Baseflow specific conductivity levels appear to be rising throughout the county, and Ford Brook is no exception.

The baseflow vs storm flow comparison of specific conductivity 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.

**Specific Conductivity at Ford Brook.** Orange diamonds are historical data from previous years and black circles are 2018 readings. Box plots show the median (middle line), 25<sup>th</sup> and 75<sup>th</sup> percentile (ends of box), and 10<sup>th</sup> and 90<sup>th</sup> percentiles (floating outer lines).



A likely cause of the increase in specific 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. Periodic chloride sampling to assess the contribution of salts to the dissolved pollutant load is recommended.

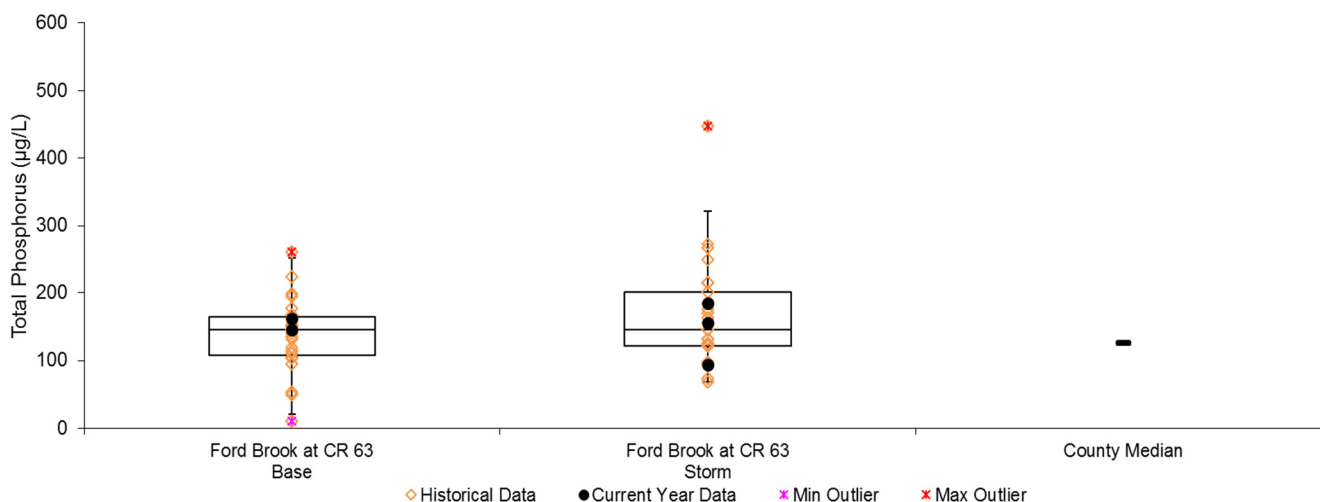
From a management standpoint, it is important to remember that the sources of both stormwater and baseflow dissolved pollutants are generally the same; it is only the timing of delivery to the stream that is different. Preventing their release into the environment and treating them before infiltration 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.

### ***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 figure below). TP levels in 2018 were similar, and regularly exceeded the State standard of 100 µg/L, with a minimum of 94 and a maximum of 184 µg/L. TP levels during storms in 2018, 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 robust 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 currently planned as large lot residential.

**Total Phosphorus at Ford Brook.** Orange diamonds are historical data from previous years and black circles are 2018 readings. Box plots show the median (middle line), 25<sup>th</sup> and 75<sup>th</sup> percentile (ends of box), and 10<sup>th</sup> and 90<sup>th</sup> percentiles (floating outer lines).



### ***Total Suspended Solids (TSS) and Turbidity***

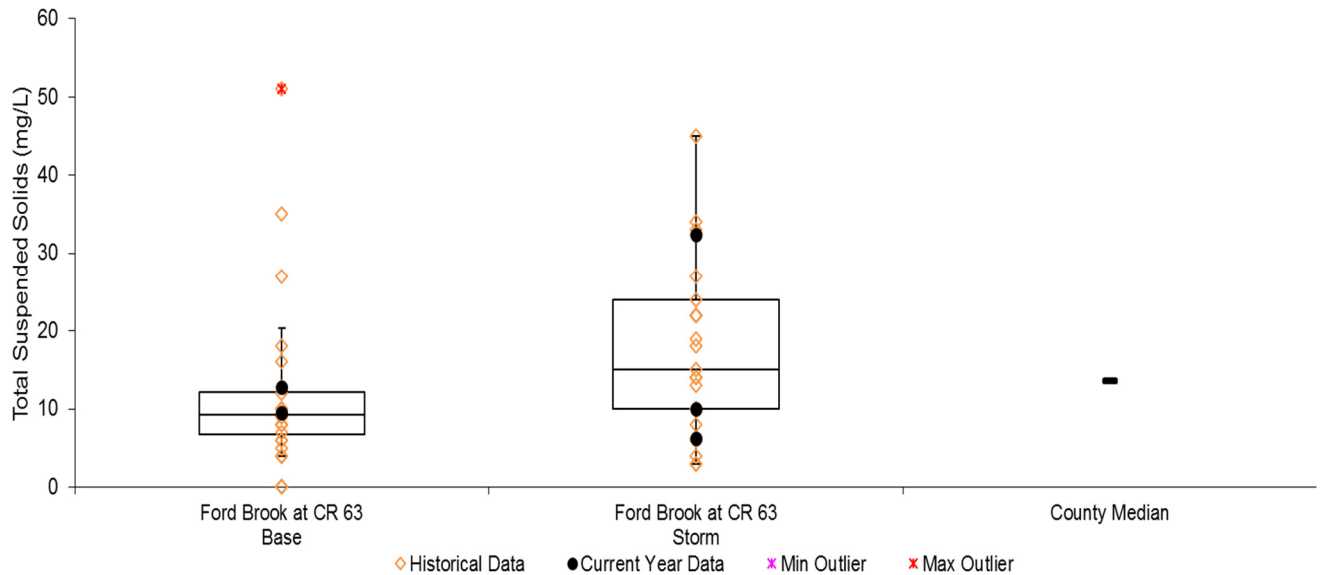
Turbidity and total suspended solids (TSS) are two different measurements of solid material suspended in the water. Turbidity is measured by refraction of a light beam passed through a water sample. It is most sensitive to large particles. Total suspended solids are measured by filtering solids from 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.

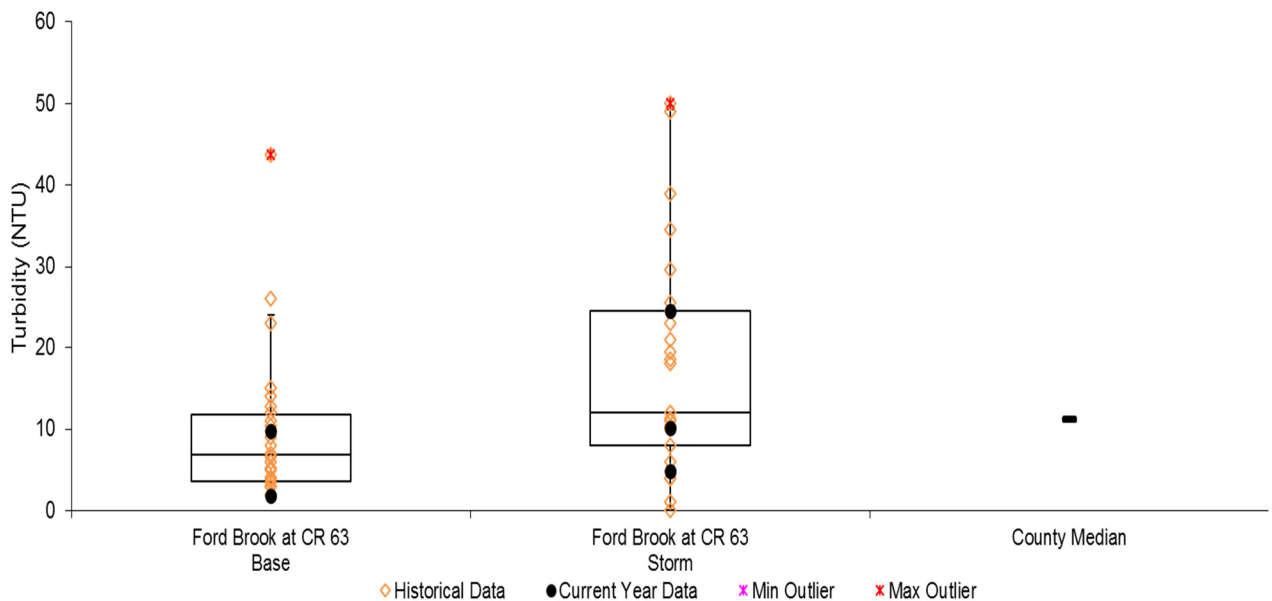
Median turbidity for Ford Brook during baseflow (all years) is 6.8 NTU. Turbidity during storm events has a median (all years) of 12 NTU. The countywide median for all streams is 11.3 NTU for all conditions. In 2018, none of the readings exceeded the MPCA's water quality threshold of 25 NTU, after two of five eclipsed it in 2016 and one did in 2017.

Average TSS in 2018 was 14.18 mg/L, and the long term median for all conditions is 13.66 mg/L. The highest TSS measurement in 2018 was 32.4 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 2018 readings. Box plots show the median (middle line), 25<sup>th</sup> and 75<sup>th</sup> percentile (ends of box), and 10<sup>th</sup> and 90<sup>th</sup> percentiles (floating outer lines).



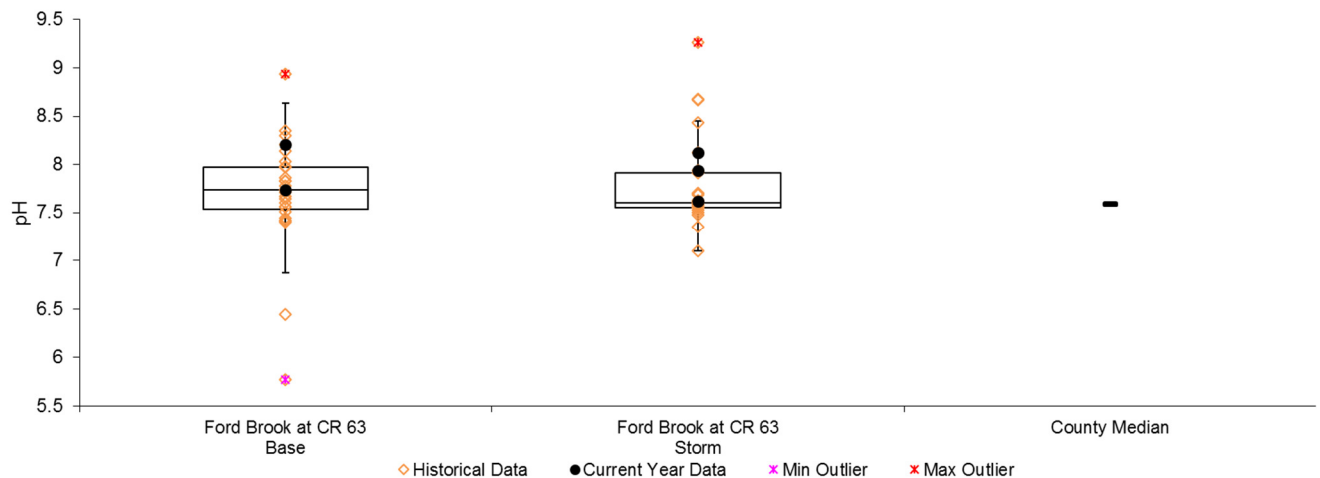
**Turbidity at Ford Brook.** Orange diamonds are historical data from previous years and black circles are 2018 readings. Box plots show the median (middle line), 25<sup>th</sup> and 75<sup>th</sup> percentile (ends of box), and 10<sup>th</sup> and 90<sup>th</sup> percentiles (floating outer lines).



## pH

pH refers to the acid or base nature of the water. The Minnesota Pollution Control Agency's water quality standard is that pH should fall between 6.5 and 8.5. pH in 2018 was always within these limits. In 2017 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 2018 readings. Box plots show the median (middle line), 25<sup>th</sup> and 75<sup>th</sup> percentile (ends of box), and 10<sup>th</sup> and 90<sup>th</sup> percentiles (floating outer lines).

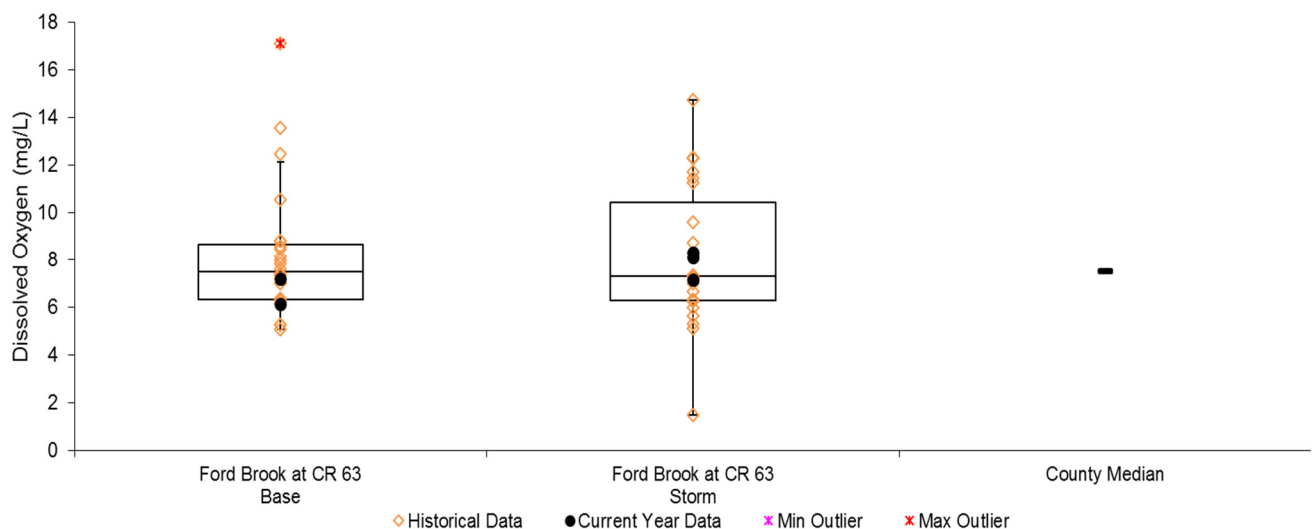


## Dissolved Oxygen

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 2018 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 2018 readings. Box plots show the median (middle line), 25<sup>th</sup> and 75<sup>th</sup> percentile (ends of box), and 10<sup>th</sup> and 90<sup>th</sup> percentiles (floating outer lines).



# Stream Water Quality Monitoring

## SEELYE BROOK

at Co. Rd. 7, St. Francis

STORET Site ID = 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

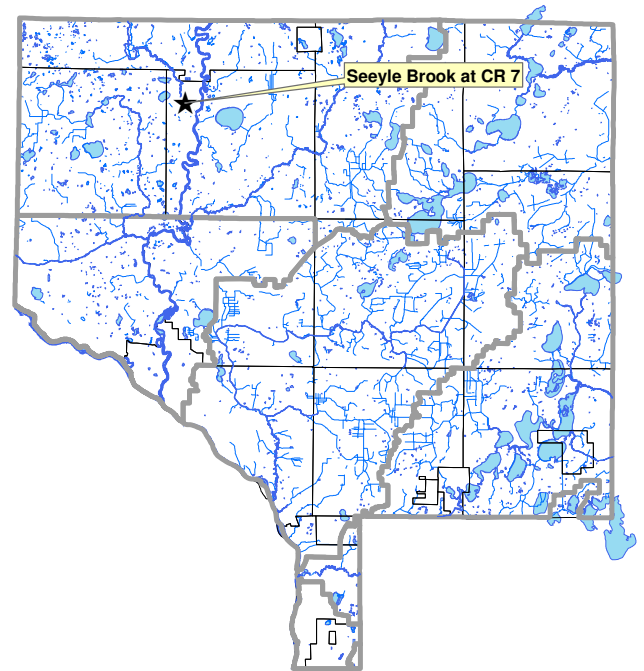
This report includes data from 2018 and an overview of previous year's data. The following is a summary of results.

- Dissolved constituents, as measured by specific conductivity, have been rising in recent years, particularly during baseflow conditions. The baseflow median specific conductivity since 2014 is 0.446 mS/cm, pre-2014 baseflow median specific 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.
- Phosphorus averaged above the MPCA water quality standard of 100 µg/L, as in previous years. Seelye Brook often exceeds the limit, even during baseflow periods. Phosphorus in Seelye Brook averaged 147.20 µg/L (maximum of 177 µg/L and a minimum of 108 µg/L) in 2018.
- Suspended solids and turbidity remain quite low in Seelye Brook compared to other streams. Turbidity had an elevated reading and a very low reading. Turbidity averaged 24.24 NTU while TSS averaged 12.45 mg/L. With the high turbidity reading excluded the average turbidity was 11.0 NTU.
- Dissolved oxygen was within the healthy range for a stream. DO averaged 7.34 mg/L (maximum of 7.74 mg/L and a minimum of 6.75 mg/L).
- pH on average was within the range considered normal and healthy for streams in this area, averaging 7.84.

### Seelye Brook 2018 Water Quality Data

Seelye Brook			5/22/2018	6/7/2018	7/2/2018	7/12/2018	8/28/2018				
	Units	R.L.*	Results	Results	Results	Results	Results	Median	Average	Min	Max
pH		0.1	8.12	8.16	7.67	7.46	7.80	7.80	7.84	7.46	8.16
Spc. Conductivity	mS/cm	0.01	0.464	0.535	0.433	0.519	0.431	0.464	0.476	0.431	0.535
Turbidity	NTU	1	77.3	13.6	9.6	9.1	11.6	11.6	24.2	9.1	77.3
D.O.	mg/L	0.01	7.65	7.74	6.91	6.75	7.65	7.65	7.34	6.75	7.74
D.O.	%	1	no result	84.4	79.5	80.8	83.6	82.2	82.08	79.5	84.4
Temp.	°C	0.1	15.93	18.24	20.65	23.01	17.88	18.24	19.14	15.9	23.0
Salinity	%	0.01	0.22	0.26	0.21	0.25	0.2	0.22	0.23	0.20	0.26
T.P.	ug/L	10	108	177	174	151	126	151	147	108	177
TSS	mg/L	2	9.0	15.6	10.0	18.0	6.2	10.0	11.8	6.2	18.0
Secchi-tube	cm		>100	78	90	>100	>100	>100	>94	78	>100
Appearance			2	0	0	0	0				

\*reporting limit



## Methods

In 1998, 2005, 2011, 2013-2018 monitoring was conducted to determine how Rum River tributary water quality compares to and affects Rum River water quality.

Monitoring was conducted during both base flow and storm conditions. 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 drought years, smaller storms were sampled because of a lack of larger storms. All storms sampled were significant runoff events.

Key water quality parameters were monitored at all sites. Parameters tested with portable meters included pH, specific 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. Water level was also recorded during each sampling event.

2018 water quality data is presented above. 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 (<https://www.pca.state.mn.us/data/environmental-quality-information-system-equis>).

## *Specific Conductivity*

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

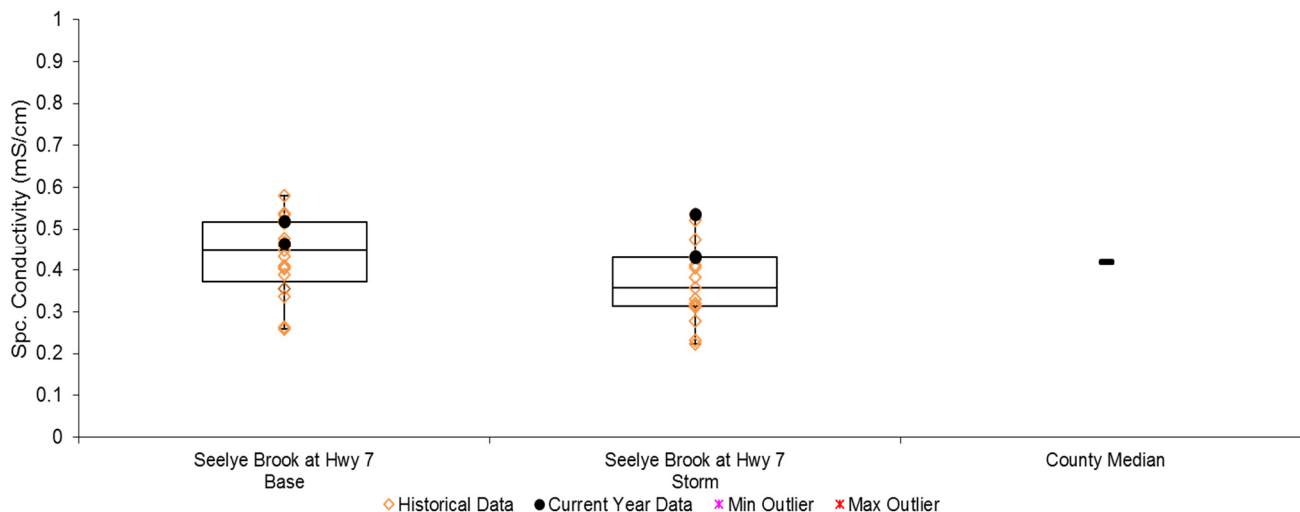
Specific conductivity has historically been low in Seelye Brook at Hwy 7, but has increased during baseflow conditions in recent years. Specific conductivity is typically higher at baseflow conditions than at stormflow conditions. Median specific conductivity (all years) is 0.446 mS/cm during baseflow and 0.357 mS/cm during storm events. The overall median for all conditions is 0.408 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 specific conductivity is 0.515 mS/cm. Of the 2018 samples, two were at the upper quartile of historic samples exceeding 0.5 mS/cm once at baseflow and once at stormflow.

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 specific 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, especially in the winter or early spring after snow events or during snowmelt 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.

**Specific Conductivity during Baseflow and Storm Conditions.** Orange diamonds are historical data from previous years and black circles are 2018 readings. Box plots show the median (middle line), 25<sup>th</sup> and 75<sup>th</sup> percentile (ends of box), and 10<sup>th</sup> and 90<sup>th</sup> percentiles (floating outer lines).



### **Total Phosphorus**

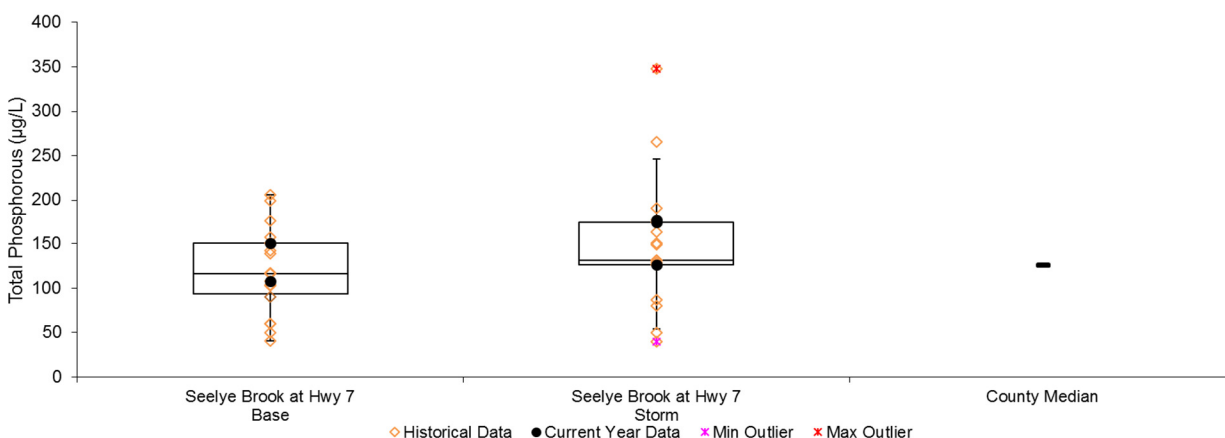
Total phosphorus (TP) is a common nutrient pollutant. It is limiting for most algal growth. Phosphorus is above desirable levels in Seelye Brook, but it is not atypical compared to other streams in the area.

Total phosphorus concentrations in Seelye Brook in 2018 were similar to many past years, but higher than 2017. It averaged over the State water quality standard of 100 µg/L (147.20 µg/L). 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 double 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 Seelye 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 2018 readings. Box plots show the median (middle line), 25<sup>th</sup> and 75<sup>th</sup> percentile (ends of box), and 10<sup>th</sup> and 90<sup>th</sup> 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.

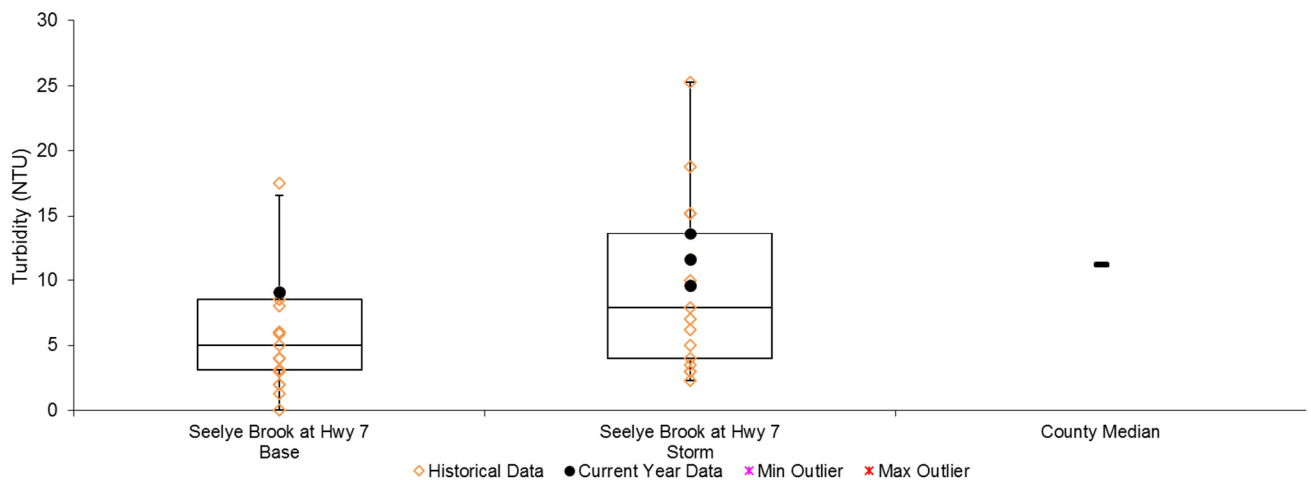
Overall, turbidity in Seelye Brook remains low compared to other streams. This is despite one high reading of 77.3 NTU in 2018. The median turbidity (all years) is 5.0 NTU during baseflow and 7.9 NTU during storm events, both lower than the median for Anoka County streams of 8.5 NTU. The State water quality standard is 25 NTU.

TSS concentrations in 2018 were low, similar to previous years. The median TSS concentration in Seelye Brook during baseflow conditions was 5.5 mg/L and the storm flow median was just 9.0 mg/L. These medians, along with the historical average of 9.1 mg/L are well below the state water quality standard of 30 mg/L.

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.

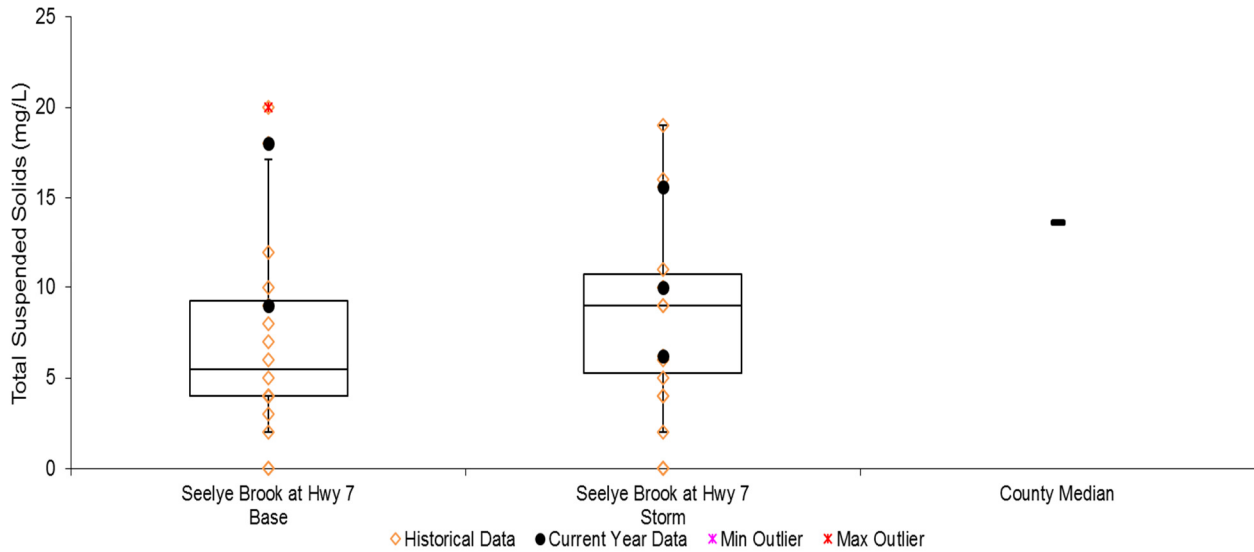
Both turbidity and TSS, while low, should continue to be monitored in this watershed. This monitoring can be especially important as development of the area continues and can be an indicator of poor erosion management practices.

**Turbidity during Baseflow and Storm Conditions.** Orange diamonds are historical data from previous years and black circles are 2018 readings. Box plots show the median (middle line), 25<sup>th</sup> and 75<sup>th</sup> percentile (ends of box), and 10<sup>th</sup> and 90<sup>th</sup> percentiles (floating outer lines).





**Total Suspended Solids during Baseflow and Storm Conditions.** Orange diamonds are historical data from previous years and black circles are 2018 readings. Box plots show the median (middle line), 25<sup>th</sup> and 75<sup>th</sup> percentile (ends of box), and 10<sup>th</sup> and 90<sup>th</sup> percentiles (floating outer lines).

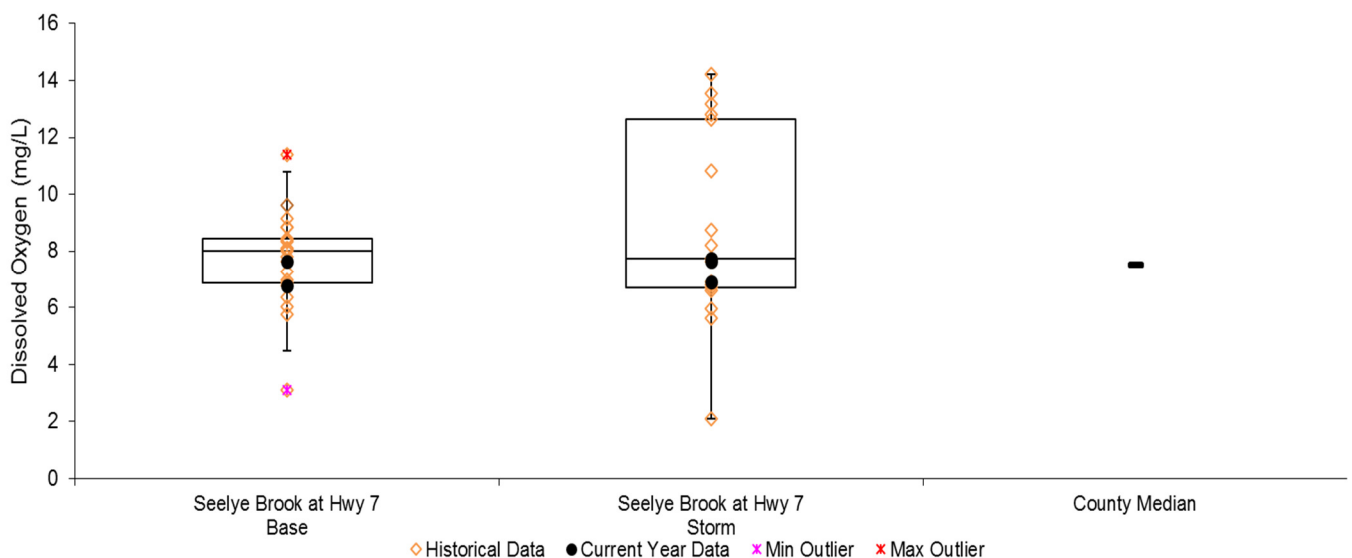


### ***Dissolved Oxygen***

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 2018 was no exception. Median dissolved oxygen (all years) is 8.00 mg/L during baseflow and 7.74 mg/L during storm events. The average dissolved oxygen concentration in 2018 was 7.34 mg/L with a minimum reading of 6.75 mg/L.

**Dissolved Oxygen during Baseflow and Storm Conditions.** Orange diamonds are historical data from previous years and black circles are 2018 readings. Box plots show the median (middle line), 25<sup>th</sup> and 75<sup>th</sup> percentile (ends of box), and 10<sup>th</sup> and 90<sup>th</sup> percentiles (floating outer lines).

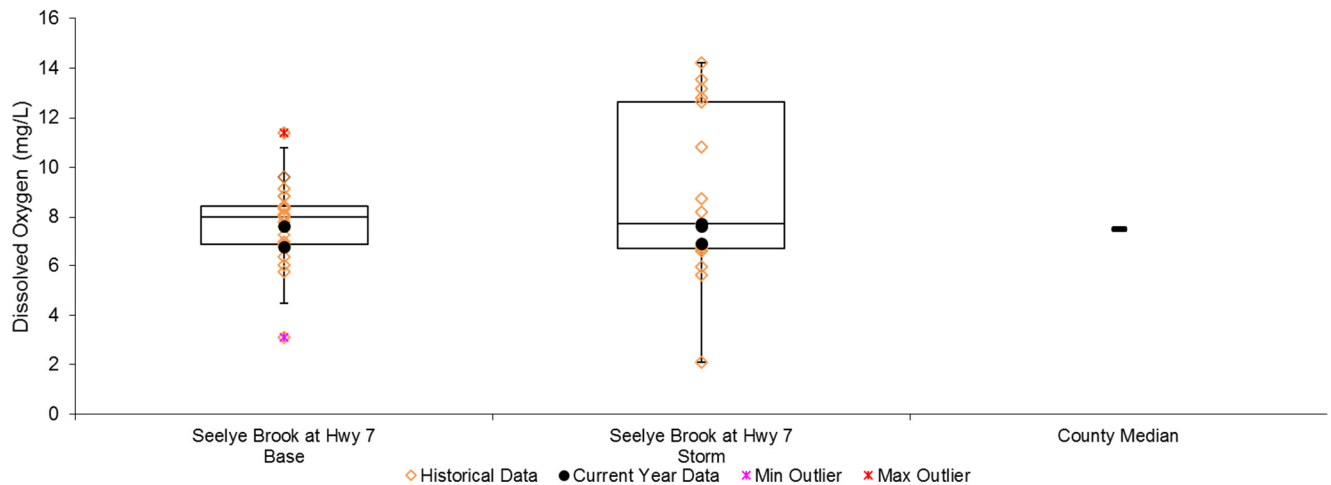


## pH

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 except once in 2017. It is not a concern unless additional similar readings are found in the future. Fortunately, in 2018 pH was all well within the normal range (minimum 7.46, maximum 8.16).

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.

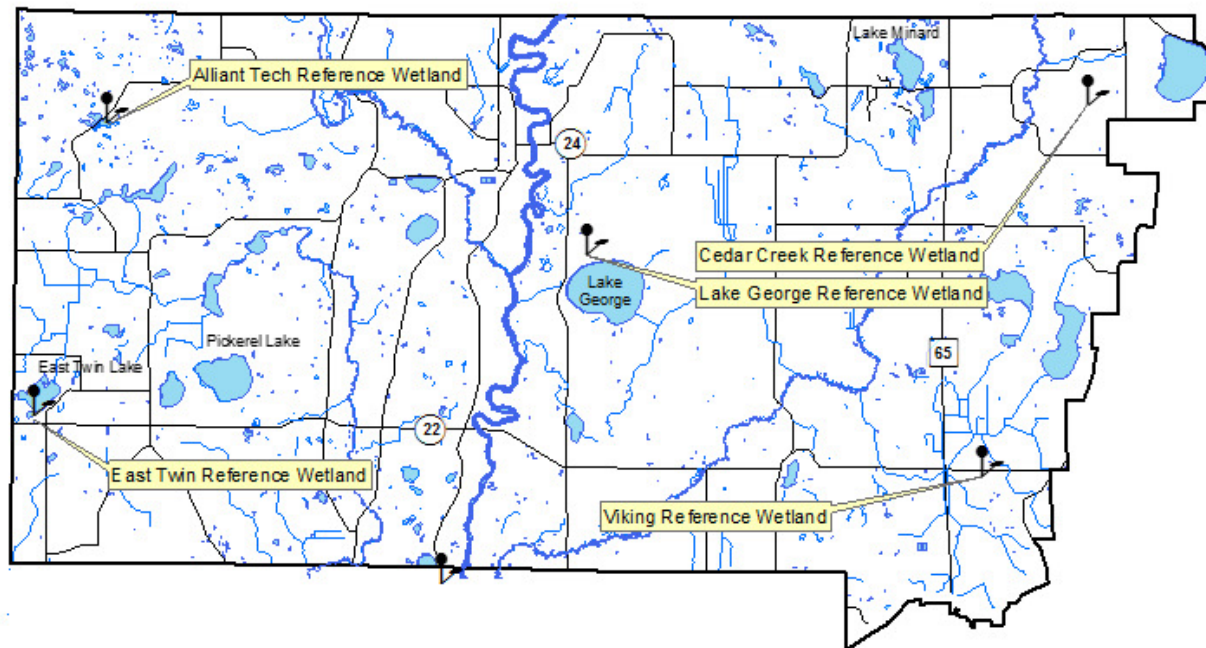
**pH during Baseflow and Storm Conditions.** Orange diamonds are historical data from previous years and black circles are 2018 readings. Box plots show the median (middle line), 25<sup>th</sup> and 75<sup>th</sup> percentile (ends of box), and 10<sup>th</sup> and 90<sup>th</sup> percentiles (floating outer lines).



## Wetland Hydrology

- Partners:** URRWMO, ACD
- 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](http://www.AnokaNaturalResources.com) using the Data Access Tool.

### Upper Rum River Watershed Wetland Hydrology Monitoring Sites



# Wetland Hydrology Monitoring

## 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	-

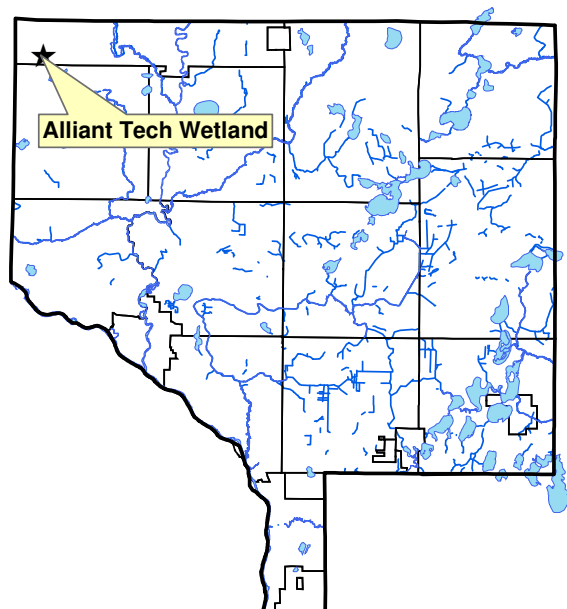
**Surrounding Soils:** Emmert

### Vegetation at Well Location:

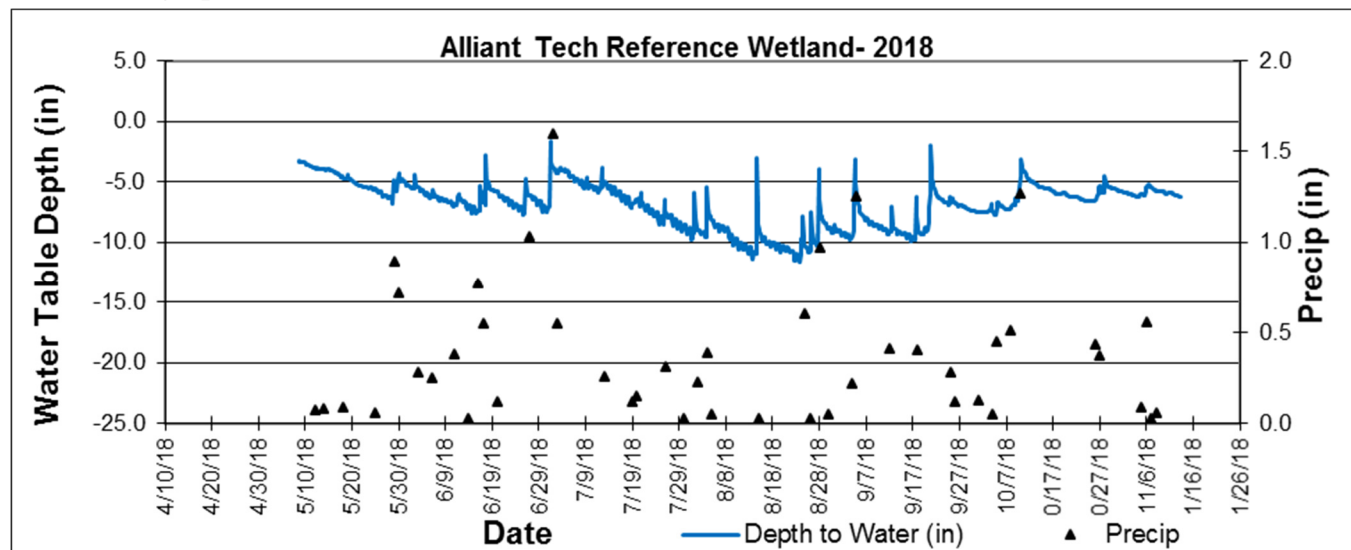
Scientific	Common	% Coverage
Carex Spp	Sedge undiff.	90
Lycopus americanus	American Bungleweed	20
Phalaris arundinacea	Reed Canary Grass	5

### 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.



### 2018 Hydrograph



## Wetland Hydrology Monitoring

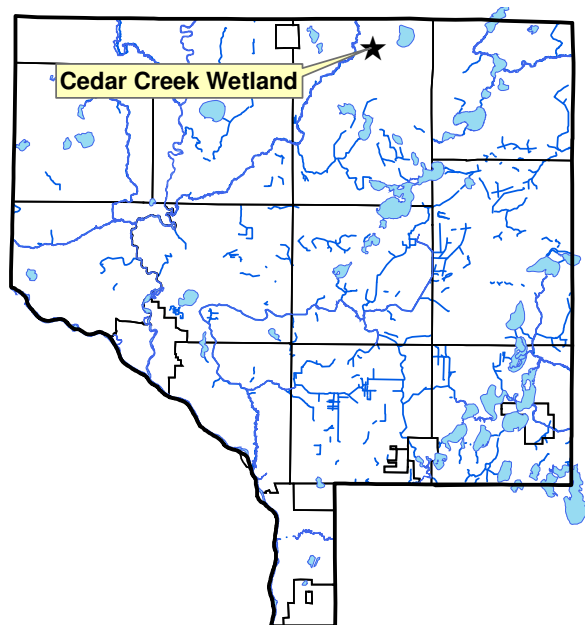
### CEDAR CREEK REFERENCE WETLAND

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

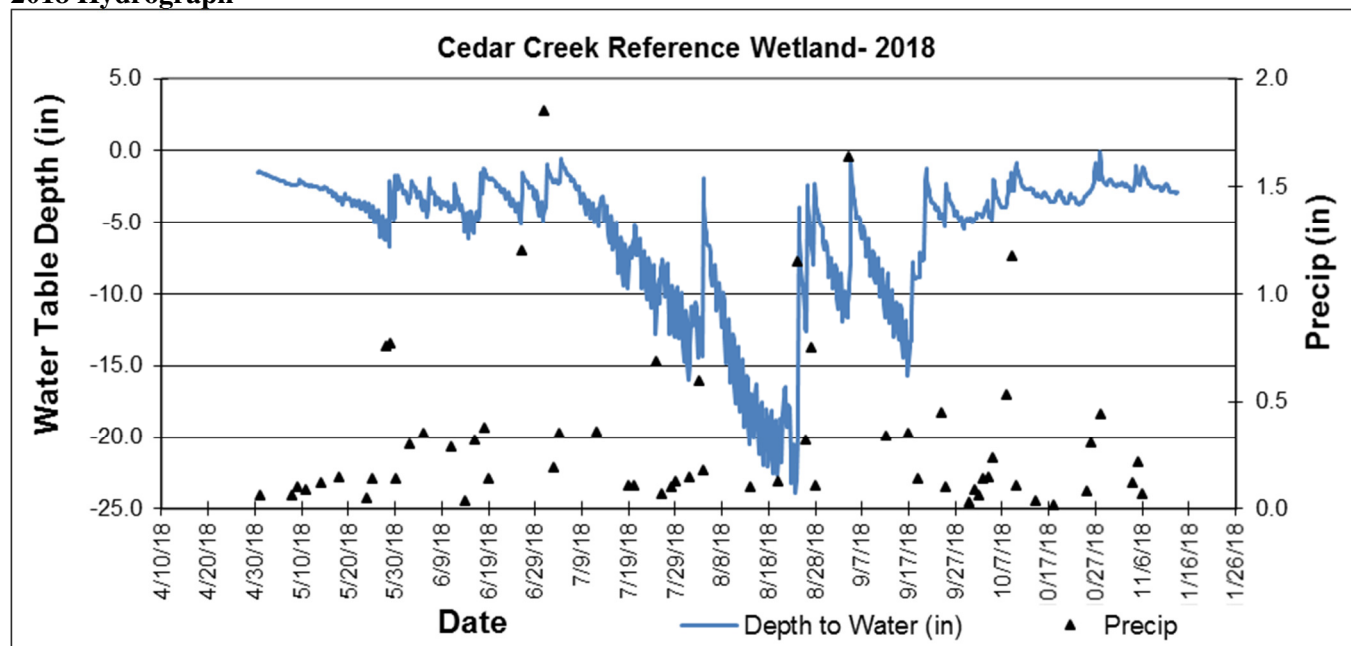
#### Site Information

**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.



#### 2018 Hydrograph



# Wetland Hydrology Monitoring

## 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

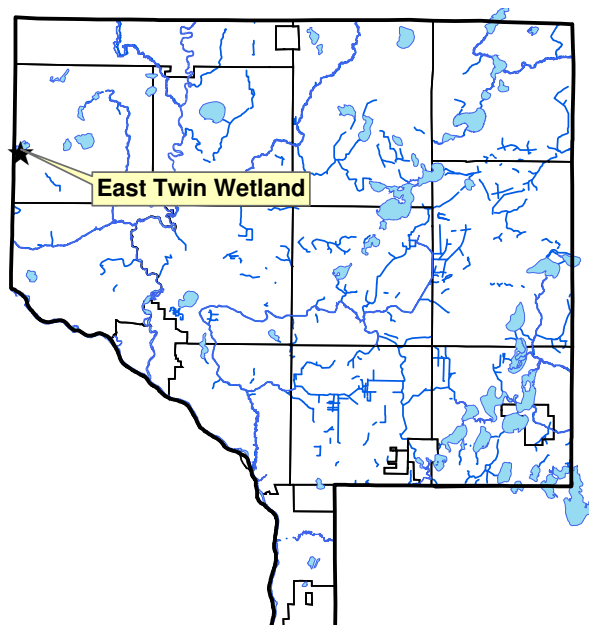
### Soils at Well Location:

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:

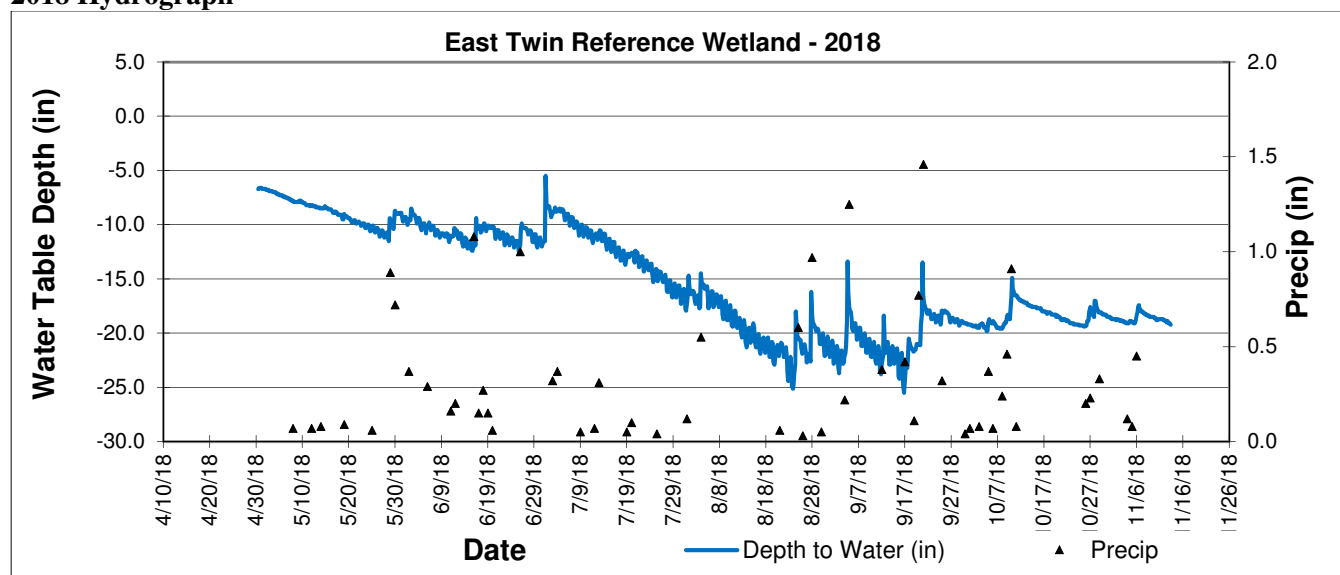
Scientific	Common	% Coverage
Phalaris arundinacea	Reed Canary Grass	100
Cornus amomum	Silky Dogwood	30
Fraxinus pennsylvanica	Green Ash	30



### 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.

### 2018 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:

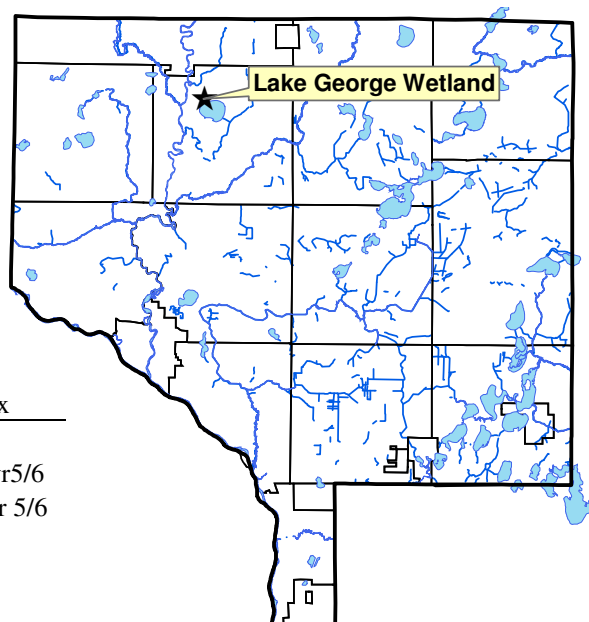
Horizon	Depth	Color	Texture	Redox
A	0-8	10yr2/1	Sandy Loam	-
Bg	8-24	2.5y5/2	Sandy Loam	20% 10yr5/6
2Bg	24-35	10gy 6/1	Silty Clay Loam	10% 10yr 5/6

**Surrounding Soils:** Lino loamy fine sand and Zimmerman fine sand

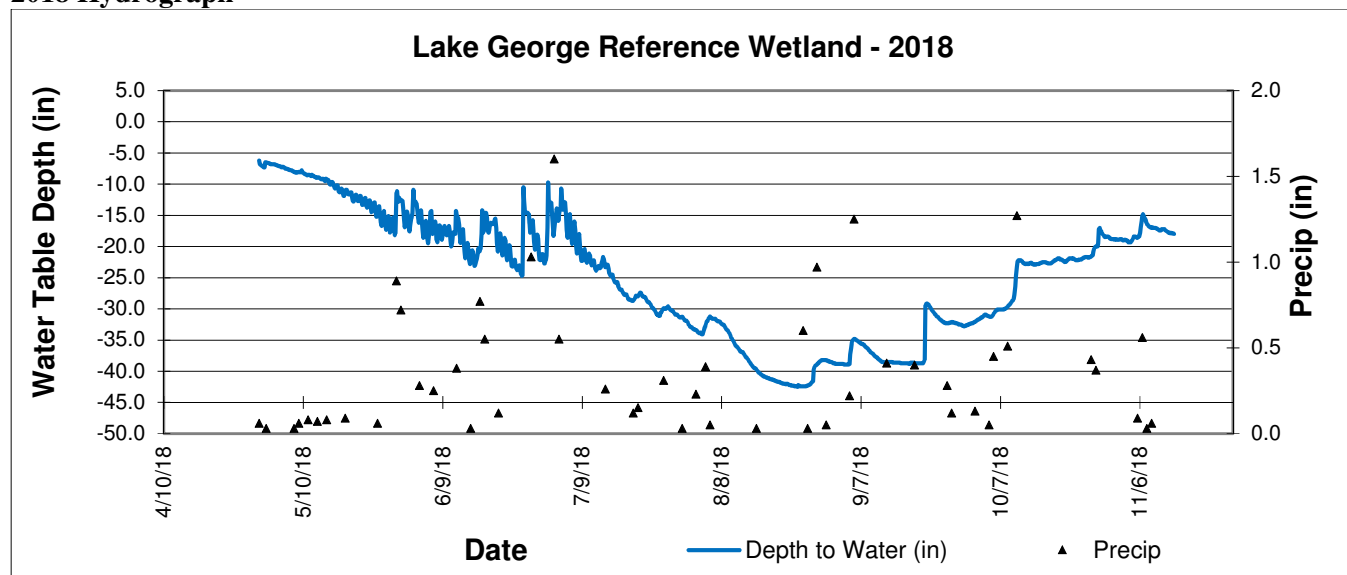
### Vegetation at Well Location:

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.



### 2018 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:

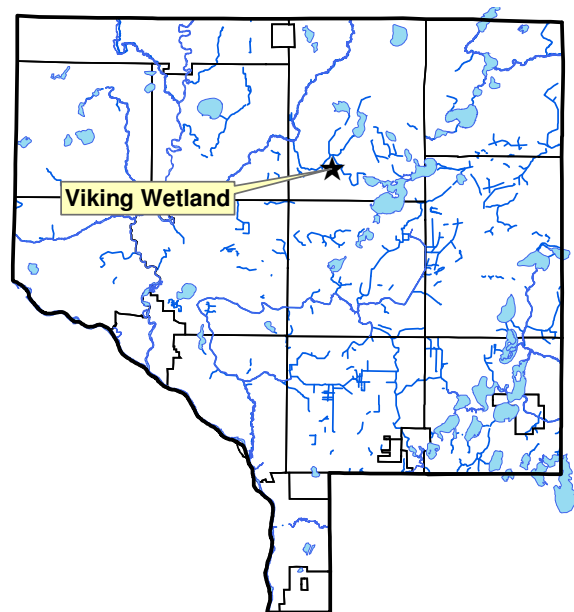
Horizon	Depth	Color	Texture	Redox
A	0-12	10yr2/1	Sandy Loam	-
Ab	12-16	N2/0	Sandy Loam	-
Bg1	16-25	10yr4/1	Sandy Loam	-
Bg2	25-40	10yr4/2	Sandy Loam	5% 10yr5/6

**Surrounding Soils:** Zimmerman fine sand

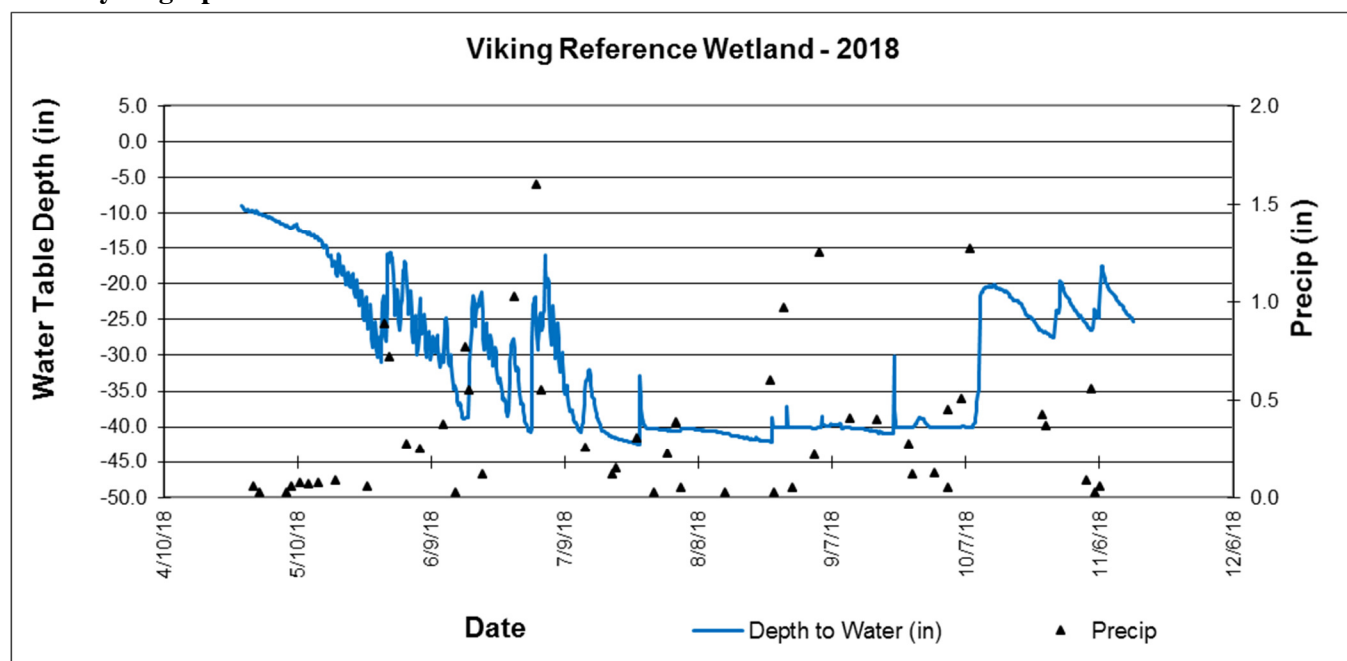
### Vegetation at Well Location:

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).



### 2018 Hydrograph



# Lake George Water Quality Improvement Assessment

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**Partners:** Lake George LID

**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 for stopping the decline in Lake George water quality and assist in securing grant funds for project installations.

**Results:** **Executive Summary**

This two-part study of the Lake George lakeshed is aimed at determining the causes of, and potential solutions to, declining water clarity in Lake George. This report includes the results of monitoring and modeling of the lakeshed that lend insight into causes of declining water clarity, and actions to address that problem. Actions are ranked by their cost effectiveness at reducing nutrient loading to the lake. It is anticipated that phase 2 of this study analyzing in-lake and near-lake factors will follow in the coming years. Watershed managers and cities should use this report to guide lake water quality improvement efforts.

The first part of this study included two years of water quality and hydrology monitoring of direct drainages to Lake George. Those data informed the development of two computer models of the lakeshed, a P8 urban catchment model for water quality analysis and a Storm Water Management Model (SWMM) for hydrology analysis. These models were used to determine the lake's nutrient and water budgets, and the effects of changes within the lakeshed. These efforts helped determine drivers of lake water quality decline. Findings of monitoring and modeling included:

- Lake water quality has shown a decline since 1998 (20-year trend). Lake transparency has declined and phosphorus concentrations have increased. Both are slow incremental changes that are statistically significant.
- The lake's five subwatersheds deliver varying amounts of phosphorus to the lake. In order of most to least they are: Ditch 19, northeast, north, near lake, and northwest subwatersheds. Substantial amounts of pollutants generated in the Ditch 19 subwatershed are removed by Grass Lake, which serves as a filter or settling basin. While near lake pollutant loading is amongst the lowest in total, it is the highest on a per-acre basis and deserves attention because pollutants generated there go directly into the lake, not into wetlands that may offer some filtering.
- A cause of water quality decline is more frequent wet years driving increased runoff to the lake. Among the sources of phosphorus are large wetland complexes, which drain to the lake more during months or years of high precipitation.
- Anticipated future land use changes could significantly increase nutrient loading to the lake.
- A shifting aquatic plant community in the lake may be destabilizing shallow lake sediments and increasing phosphorus concentrations in the lake by replacing once abundant native pondweeds with invasive species.

The second part of this study included identifying and ranking projects for the treatment of stormwater draining from the lakeshed to Lake George, and actions to be implemented on a broader scale to protect lake water quality. Potential projects identified during this analysis were modeled to estimate reductions in total phosphorus (TP), total suspended solids (TSS), and if possible, volume. Cost estimates were developed for each project, including up to 30

years of operations and maintenance. Projects were ranked by cost effectiveness with respect to their reduction of TP. A variety of projects were identified, including:

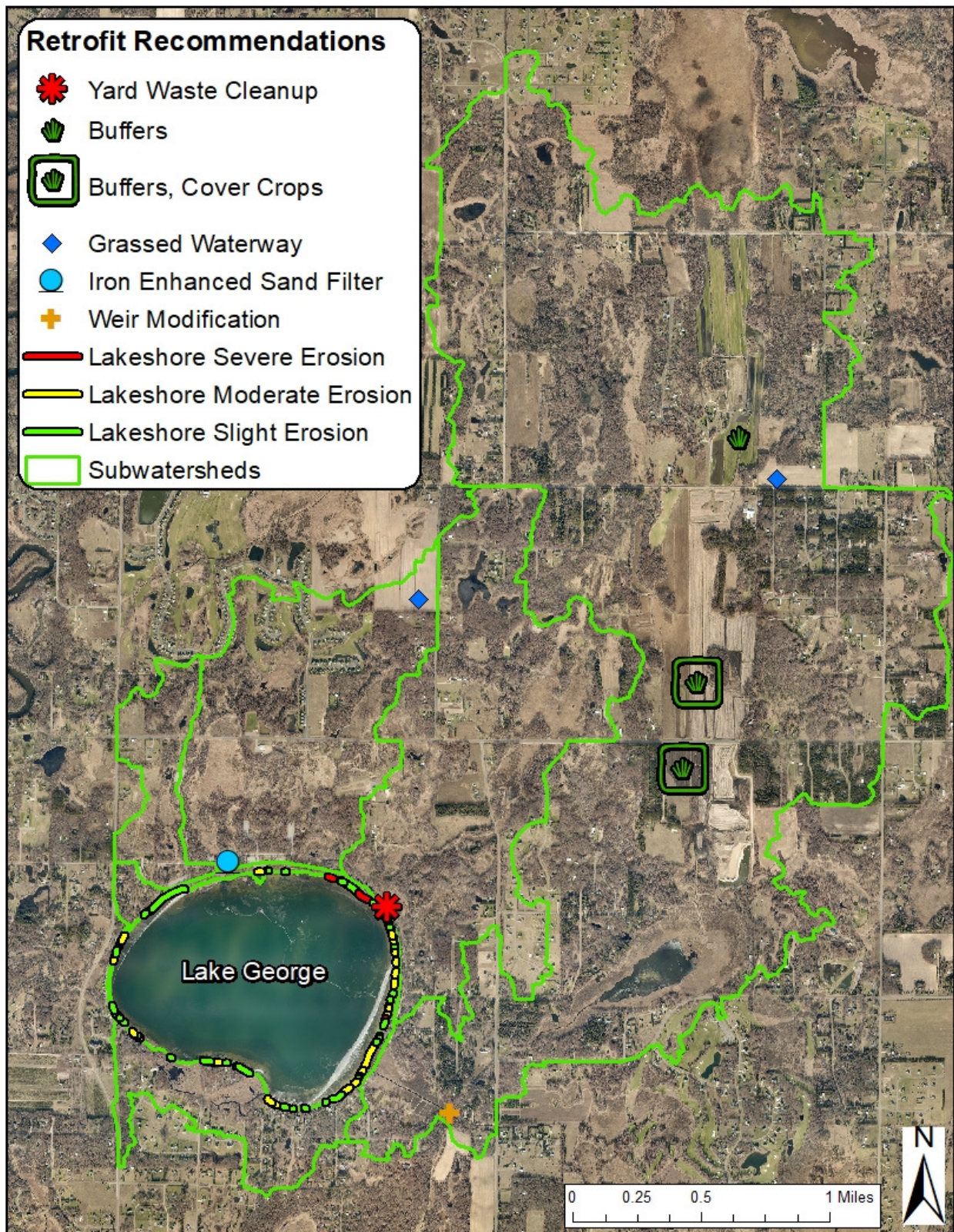
- Lakeshore stabilizations and/or buffer installations,
- Installation of riparian buffers, cover crops, and grassed waterways in agricultural areas,
- Reconstruction of the Ditch 19 weir,
- One iron enhanced sand filter, and
- Good housekeeping recommendations.

At Lake George, preventing future water quality declines is as important as correcting past water quality declines. For this reason, the table of prioritized actions on the following pages includes both projects to improve current water quality and actions to ensure land use change does not result in degradation. This study found that increased frequency of wet years is also a significant contributing factor to Lake George water quality declines, and given that annual precipitation is difficult to control, other offsetting actions are imperative.

This report provides conceptual sketches or photos of recommended water quality improvement projects. The intent is to provide an understanding of the approach. If a project is selected, site-specific designs must be prepared. Many of the proposed projects will require engineered plan sets if selected. This typically occurs after committed partnerships are formed to install the project. Committed partnerships must include willing landowners when installed on private property.

The map and table on the next pages summarize potential projects and actions, and groups them based on direct impact to Lake George. These projects are organized in order of cost effectiveness at reducing phosphorus delivery to the lake.





**Summary of preferred stormwater retrofit opportunities ranked by cost-effectiveness with respect to total phosphorus (TP) reduction.** TSS and volume reductions are also shown. For more information on each project refer to the catchment profile pages in this report. Projects indirectly impacting the lake are those upstream of wetlands or Grass Lake which may already provide some treatment. This should be considered when comparing cost effectiveness of projects, as proximity to the lake is not considered in pollutant reduction estimates.

### Projects Directly Impacting Lake George

Project Rank	Retrofit Type (refer to catchment profile pages for additional detail)	Subwatershed	Projects Identified	TP Reduction (lb/yr)	TSS Reduction (lb/yr)	Volume Reduction (ac-ft/yr)	Probable Project Cost (2018 Dollars)	Estimated Annual Operations & Maintenance (2018 Dollars)	Estimated cost/ lb-TP/year (30-year)
1	Lakeshore Stabilization- Severe Erosion	Lake Adjacent	100 Linear-ft	3.64	4,512	n/a	\$16,555	\$150	\$193
2	Iron Enhanced Sand Filter (IESF)	North Inlet	1 (3 sizes)	20-40	488-976	n/a	\$394,072-\$487,844	\$1,676-\$3,352	\$741-\$490
3	Lakeshore Stabilization- Moderate Erosion	Lake Adjacent	100 Linear-ft	0.52	612	n/a	\$11,555	\$150	\$1,035
4	Ditch 19 Weir Modification	Ditch 19	1 (2 scenarios)	-1.6-4.5	4-344	3.8-5.8	\$300,000	\$0	-\$6,061-\$2,242
5	Shoreline Buffers	Near Lake	85	0.03	8	0.03	\$3,652	\$66	\$6,568
6	Lakeshore Stabilization- Slight Erosion	Lake Adjacent	100 Linear-ft	0.08	62	n/a	\$11,555	\$150	\$6,982

### Projects Indirectly Impacting Lake George

7	Grassed Waterway	North Inlet	1 (2 sizes)	1.3-1.6	314-337	0.51-0.74	\$6,372-\$7,196	\$50-\$100	\$197-\$213
8	Cropland Riparian Buffers- 50'	Ditch 19	3 variations	17.62-53.03	140.26-422.12	n/a	\$16,408-\$35,883	\$3,524-\$10,606	\$223-\$231
9	Cropland Riparian Buffers- 16.5'	Ditch 19	4 variations	2.08-9.10	25.52-111.65	n/a	\$8,916-\$16,341	\$800-\$3,500	\$444-\$528
10	Grassed Waterway	Ditch 19	1 (2 sizes)	0.3-0.4	78-84	0.13-0.19	\$5,750-\$5,951	\$13-25	\$561-\$612
11	Cropland Cover Crops	Ditch 19	3 variations	19.0-56.9	203-610 (tons)	n/a	\$72,547-\$203,042	\$68,751-\$199,246	\$3,618-\$3,750



## Summary of recommended non-structural actions to protect Lake George water quality

Stormwater Action	Importance Ranking	Description of the Action
Yard waste disposal cleanup	High	Clean up yard waste disposal identified in the Northeast watershed in this report. Take educational or other actions needed to ensure further disposal does not occur in the future.
MIDS Stormwater Standards	High	Minimal Impact Design Standards (MIDS) for stormwater focus on containing and infiltrating as much stormwater as possible. These standards are especially important as precipitation levels increase, and open areas develop. Keeping stormwater, and the pollutants it contains, on the land and allowing it to infiltrate into the ground is a key strategy. The City of Oak Grove is the land use authority, and would be responsible for any such stormwater standards with the guidance of the Upper Rum River Watershed Management Organization. A special effort with these groups to consider customized stormwater standards for the Lake George watershed is recommended.
Phase 2: In-Lake Study	High	A study to determine the effects of in-lake factors on Lake George, and recommend future management action is advised. In-lake factors that can affect water quality include game fish, rough fish, in-lake sediment stability, wave action, lake usage, aquatic vegetation, and others. While Phase 1 of this study found many water quality correlations and contributing factors from the lakeshed, there may be other in-lake factors affecting water quality as well.
Maintain or Enhance Near-Lake Wetlands	High	Wetlands through with the North and Northeast inlets to the lake drain should be protected or enhanced. These wetlands reduce pollutants coming from the upper watershed before they reach the lake. Efforts to channelize the current dispersed flow through these wetlands is not advised.
Public Education	Moderate	Ongoing outreach and education to homeowners regarding actions they can take (or shouldn't take) in order to keep the lake health is recommended. Specifically, dumping of leaves, sediment, and other yard waste near the lake can have a large impact on lake water quality. Additionally, mowing to the waters' edge and eliminated native vegetation increases shoreline erosion rates and allows stormwater to run overland unimpeded to the lake. Over fertilization and the use of phosphorus fertilizers near a lake contribute to algal proliferation and decreased water clarity. All of these issues can be addressed by educated homeowners. The message has to be spread in an effective, informative and actionable way.
Continue AIS Management with Native Vegetation in Mind	Moderate	Herbicide treatments to control aquatic invasive species (AIS) should continue to be done in a way mindful of lake health. Certain native species of aquatic vegetation can be negatively affected by herbicide treatments targeting invasive species. These native species are important to the lake for a host of reasons, including the water quality benefit they provide. Continue selecting herbicide treatment areas, chemicals and timing in a way that minimizes impacts on native plants.
Shoreland Septic Inventory and Replacement	Low	Locate and replace non-compliant septic systems in the shoreland zone. Due to a community septic system serving much of the Lake George area, septic system concerns are lessened. However, maintenance or correction of septic systems should be a priority for all others.

## Rum River Bank Stabilization

- Partners:** LRRWMO, URRWMO, ACD, MN DNR Conservation Partners Legacy Grant, Lessard-Sams Outdoor Heritage Council grant, landowners
- Description:** 12 riverbank stabilization projects were installed on the Rum River in Anoka and Isanti Counties in 2018. At these sites, cedar tree revetments and willow stakes were used to stabilize eroding banks. The projects were installed with labor from Conservation Corps Minnesota (CCM) work crews. Funding for the 4 revetments installed in Anoka County came from the Conservation Partners Legacy Grant Program from the Outdoor Heritage Fund, a Clean Water Fund CCM crew labor grant, the URRWMO and LRRWMO, and landowner contributions. Funding for 4 additional 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, as well as to reduce the likelihood of a much larger and more expensive corrective project in the future.
- Location:** Rum River Central Regional Park, 8 residential properties in Anoka County, City of Isanti, and 2 residential properties in Isanti County.
- Results:** Stabilized 2,223 linear feet of riverbank on the Rum River in Anoka and Isanti Counties.



### Bank Stabilization Projects in Anoka County in 2018



# Rum River Bank Erosion Inventory

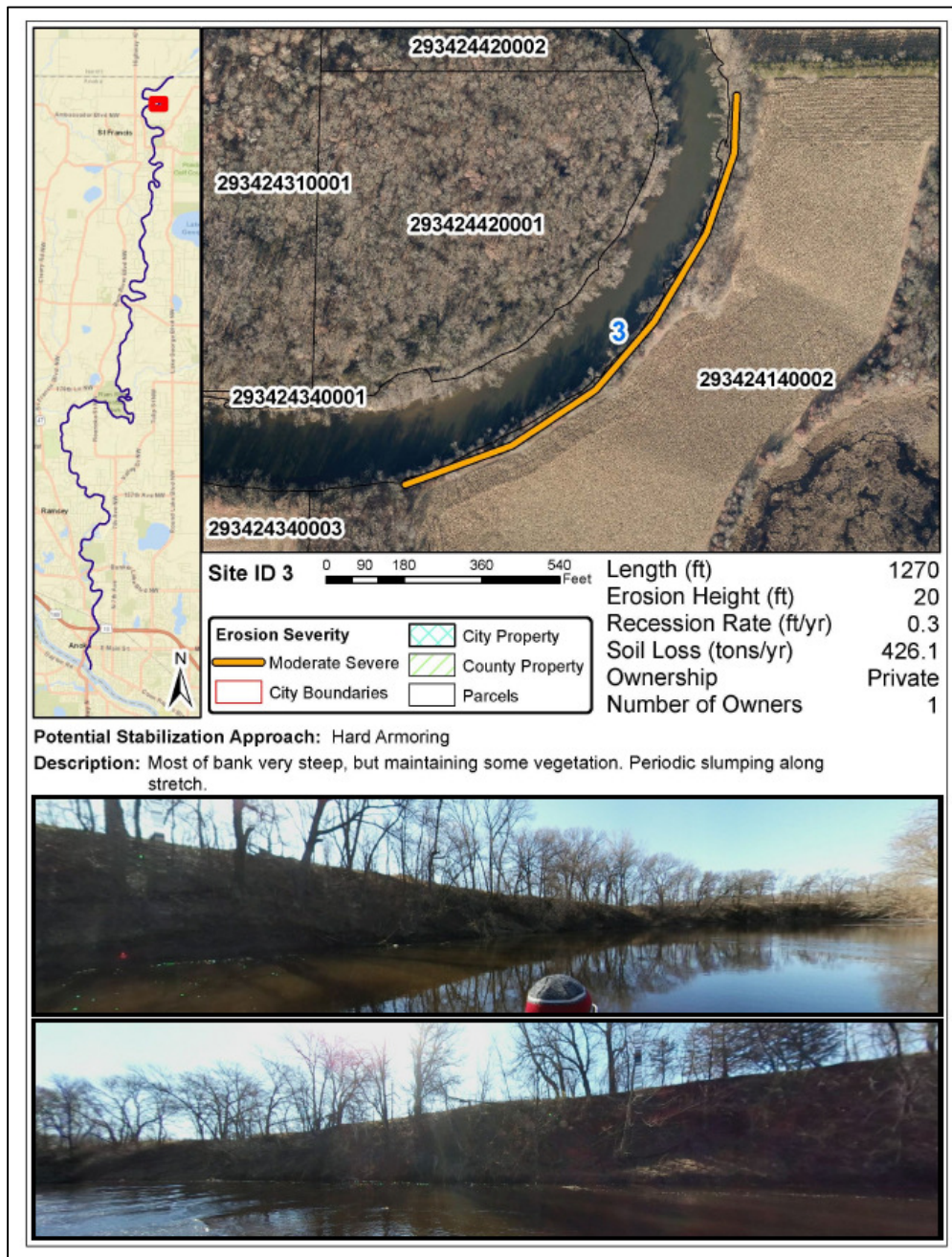
**Partners:** ACD

**Description:** The Anoka Conservation District (ACD) prepared an inventory of Rum River bank erosion using 360° photos of the riverbanks of the Rum throughout Anoka County. The photos are available through Google Maps using the Street View feature. An inventory report identifying 80 stretches of riverbank with moderate to very severe erosion is available on ACD's website. Estimated project cost and annual sediment load reduction to the river were calculated.

**Purpose:** To identify and prioritize riverbank stabilization sites and be used by ACD and other entities to pursue grant funds to restore or stabilize eroding stretches of Rum Riverbank.

**Location:** Rum River conveyance throughout Anoka County

**Results:** Inventory of 80 stretches of moderate to very severe erosion on banks of the Rum River.





## URRWMO Website

**Partners:** URRWMO, ACD

**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](http://www.URRWMO.org)

**Results:** In 2018 a new URRWMO website was developed. The previous website was >10 years old and there were problems with website security. The Anoka Conservation District developed a template website and finalized it with URRWMO Board input. The new website includes:

- Directory of board members,
- Meeting minutes and agendas,
- Watershed management plan and annual reports,
- Descriptions of work that the organization is directing,
- Highlighted projects,
- Informational videos,
- Maps of the URRWMO.

The website is regularly updated throughout the year.

### URRWMO Website Homepage



The screenshot shows the homepage of the Upper Rum River Watershed Management Organization (URRWMO) website. At the top, there is a navigation bar with a hamburger menu icon on the left, the URRWMO logo in the center, and a search bar and a home icon on the right. Below the navigation bar is a large banner image of a lake at dusk with the text "Helping to Protect Our Resources" overlaid. Under the banner, the heading "Upper Rum River Watershed Management Organization" is followed by a notice about a November 20, 2018 meeting. The main text describes the URRWMO as a joint powers organization of several cities and its mission to maintain water resources. To the right of the text is a map of Anoka County, Minnesota, showing the URRWMO watershed boundary in red. The map includes labels for various towns and cities, as well as a scale bar and a north arrow.

**Upper Rum River Watershed Management Organization**

\*\*\*\*\*November 20, 2018 Technical Advisory Committee Meeting - 10am at Oak Grove City Hall\*\*\*\*\*

The URRWMO is a joint powers organization including the Cities of St. Francis, Oak Grove, Nowthen, Bethel, and portions of East Bethel. A small corner of Ham Lake also falls within the URRWMO. The WMO Board is made up of representatives from each of these cities.

This organization seeks to maintain the quality of area lakes, rivers, streams, groundwater, and other water resources across municipal boundaries. Resources of particular importance to the URRWMO include the Rum River, Seelye Brook, Ford Brook, Cedar Creek, and numerous ditches that drain to the Rum River. This stretch of the Rum River is designated as a state Scenic and Recreational Waterway. Lake George and East Twin Lakes, the primary recreation lakes in the watershed, are also of high priority, in addition to many smaller lakes and wetlands.

## URRWMO Annual Newsletter

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**Partners:** URRWMO, ACD

**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."

### 2018 URRWMO Newsletter Article

## Upper Rum River Watershed Management Organization

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### MEDIA RELEASE

**Contact person:** Jamie Schurbon 763-434-2030 ext. 12

**Date:** September 10, 2018

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#### New Local Water Plan 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, 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. It will continue to be monitored. Lake George has good water quality for this region of the state, receiving an overall B 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 most updated plan draft and information about the URRWMO is available at [www.URRWMO.org](http://www.URRWMO.org) or contact Chuck Schwartz at 612-548-3141.

# URRWMO 2017 Annual Reports to the State

**Partners:** URRWMO, ACD

**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 30<sup>th</sup>).

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.

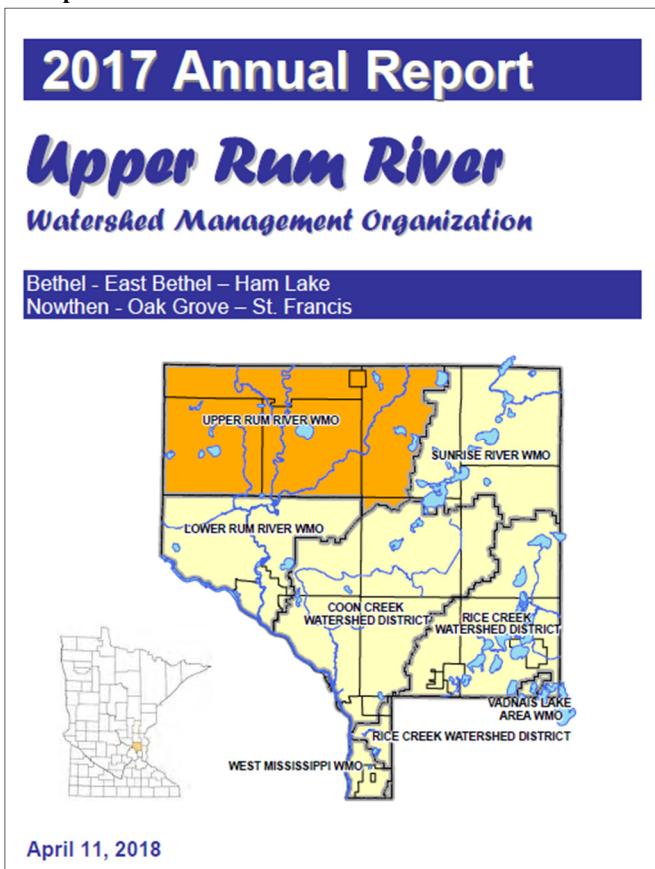
**Locations:** Watershed-wide

**Results:** The Anoka Conservation District assisted the URRWMO with preparation of a 2017 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,
- State Auditor's reporting forms through the State's SAFES website.

All were completed by the end of April 2018. The report to BWSR and financial report are available on the URRWMO website.

## Report to BWSR Cover



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



## Financial Summary

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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

Table will be added in early 2019 to summarize 2018 finances

## Recommendations

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- **Ensure stormwater treatment standards for new development result in no increase, and preferably a decrease, in phosphorus.** The Rum River is just below State standards for impairment and several tributaries exceed State nutrient standards. State MS4 stormwater treatment standards are aimed at maintaining water quality only, and it may be favorable to consider Minimum Impact Development Standards (MIDS) that are aimed at pollutant reductions.
- **Participate in the Rum River One Watershed One Plan** process, resulting in prioritized management across the entire Rum River watershed.
- **Install projects identified in the 2018 Lake George Water Quality Improvement Assessment, St. Francis stormwater assessment and Rum River WRAPS.** In the Upper Rum River WMO priorities to consider include reversing the declining transparency trend in Lake George and ensuring Rum River phosphorus does not increase because it is close to State impairment thresholds.
- **Periodically monitor chlorides in streams.** Monitoring every 3 years minimum is recommended.
- **Promote practices that limit road deicing salt applications** while keeping roads safe. Streams throughout the URRWMO have increasing specific conductivity. Requiring municipal plow drivers to become certified through MN Pollution Control Agency deicing courses is recommended.
- **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.
- **Identify subwatersheds in URRWMO for future subwatershed assessment studies.** These studies identify water quality improvement projects and rank them by cost effectiveness.

