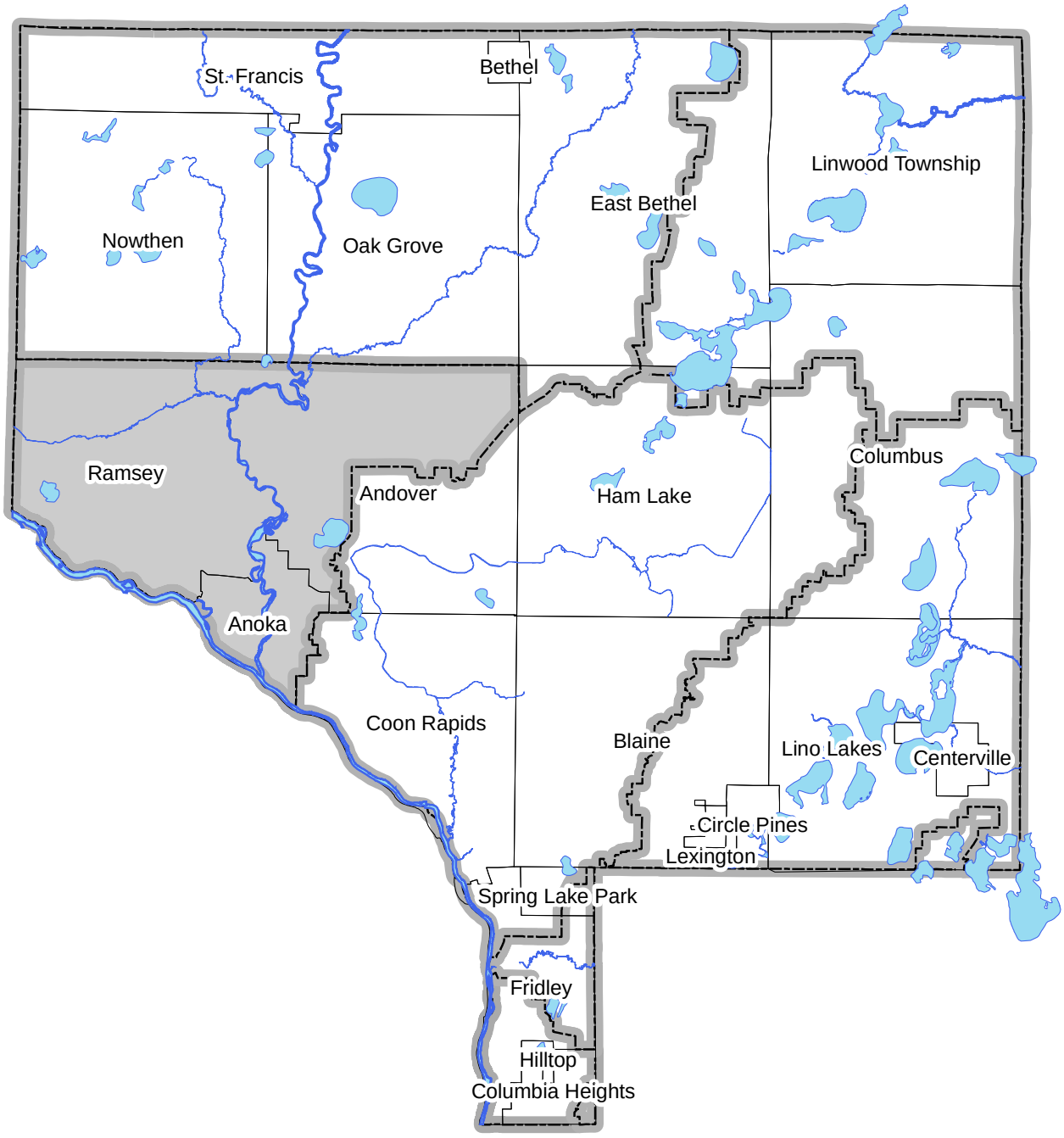
Excerpt from the
2015 Anoka Water Almanac

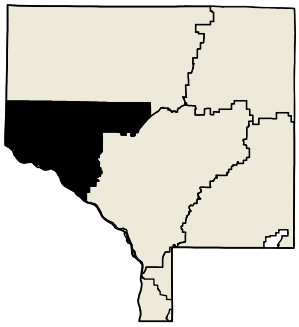
Chapter 4: Lower Rum River Watershed

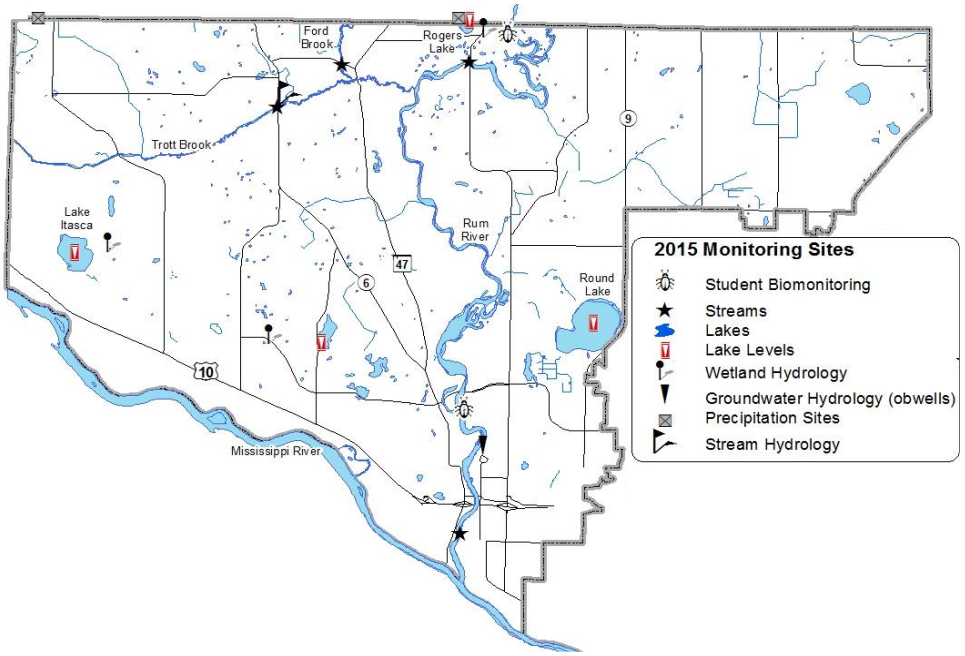


Prepared by the Anoka Conservation District

CHAPTER 4:
LOWER RUM RIVER WATERSHED

ACAP = Anoka County Ag Preserves, ACD = Anoka Conservation District, LRRWMO = Lower Rum River Watershed Mgmt Org, MC = Metropolitan Council, MNDNR = MN Dept. of Natural Resources, LSOHC = Lessard-Sams Outdoor Heritage Councial





Lake Level Monitoring

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

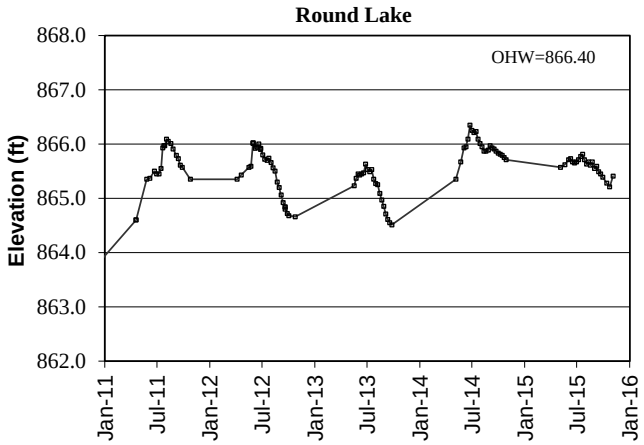
Purpose: To understand lake hydrology, including the impact of climate or other water budget changes. These data are useful for regulatory, building/development, and lake management decisions.

Locations: Itasca, Round, Rogers, and Sunfish/Grass Lakes

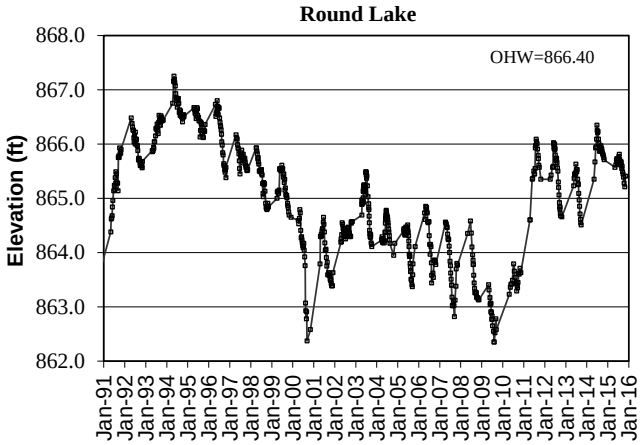
Results: Lake levels were measured by volunteers throughout the 2015 open water season. Lake gauges were installed and surveyed by the Anoka Conservation District and MN DNR. Lakes had increasing water levels in spring and early summer and then fell later in the year due to less rainfall. Increased rainfall late into fall caused a spike in lake levels at the end of the year. Overall lake levels were lower than in 2014 when heavy rainfall totals occurred.

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.

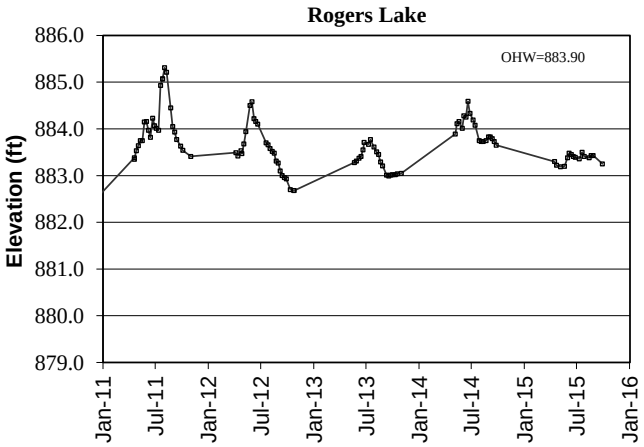
Round Lake Levels – last 5 years



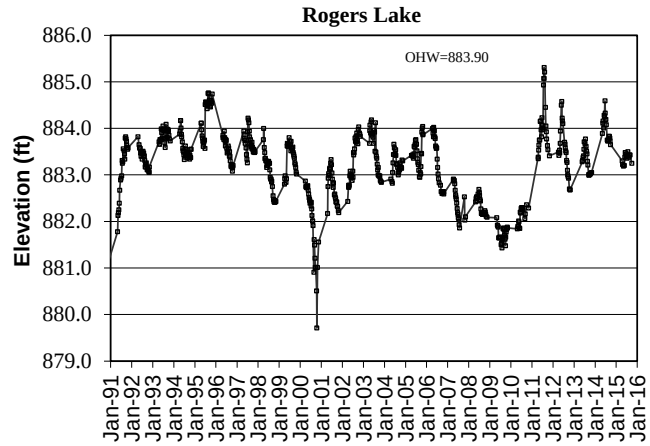
Round Lake Levels – last 25 years



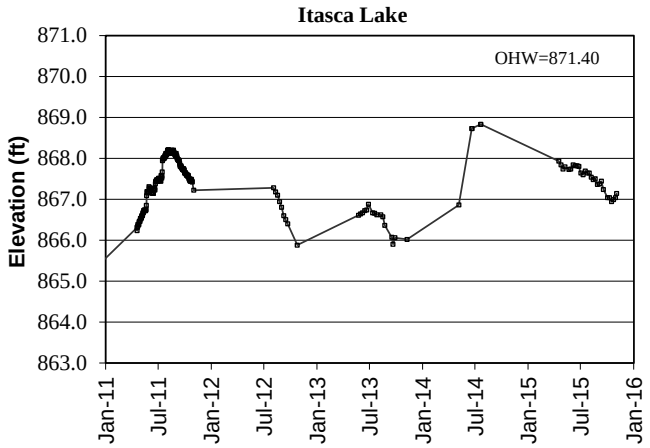
Rogers Lake Levels – last 5 years



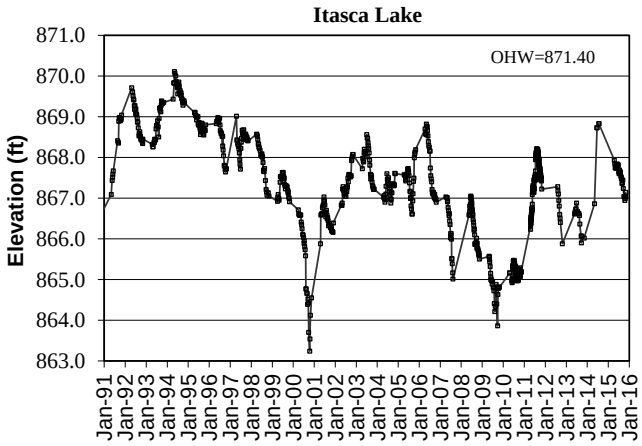
Rogers Lake Levels – last 25 years



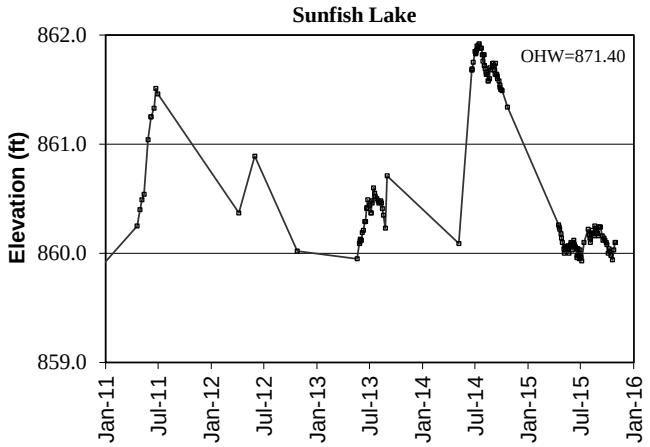
Itasca Lake Levels – last 5 years



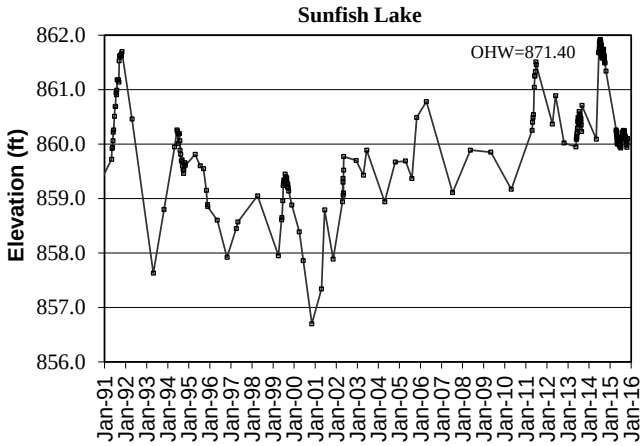
Itasca Lake Levels – last 25 years



Sunfish/Grass Lake Levels – last 5 years



Sunfish/Grass Lake Levels – last 25 years



Stream Water Quality - Chemical Monitoring

Description: In 2015 monitoring events were scheduled May through September for of the following parameters: total suspended solids, e. coli, total phosphorus, Secchi tube transparency, dissolved oxygen, turbidity, temperature, conductivity, pH, and salinity.

Purpose: To provide an initial assessment of water quality to be used in the completion of the Rum River Watershed Restoration and Protection Plan (WRAPP).

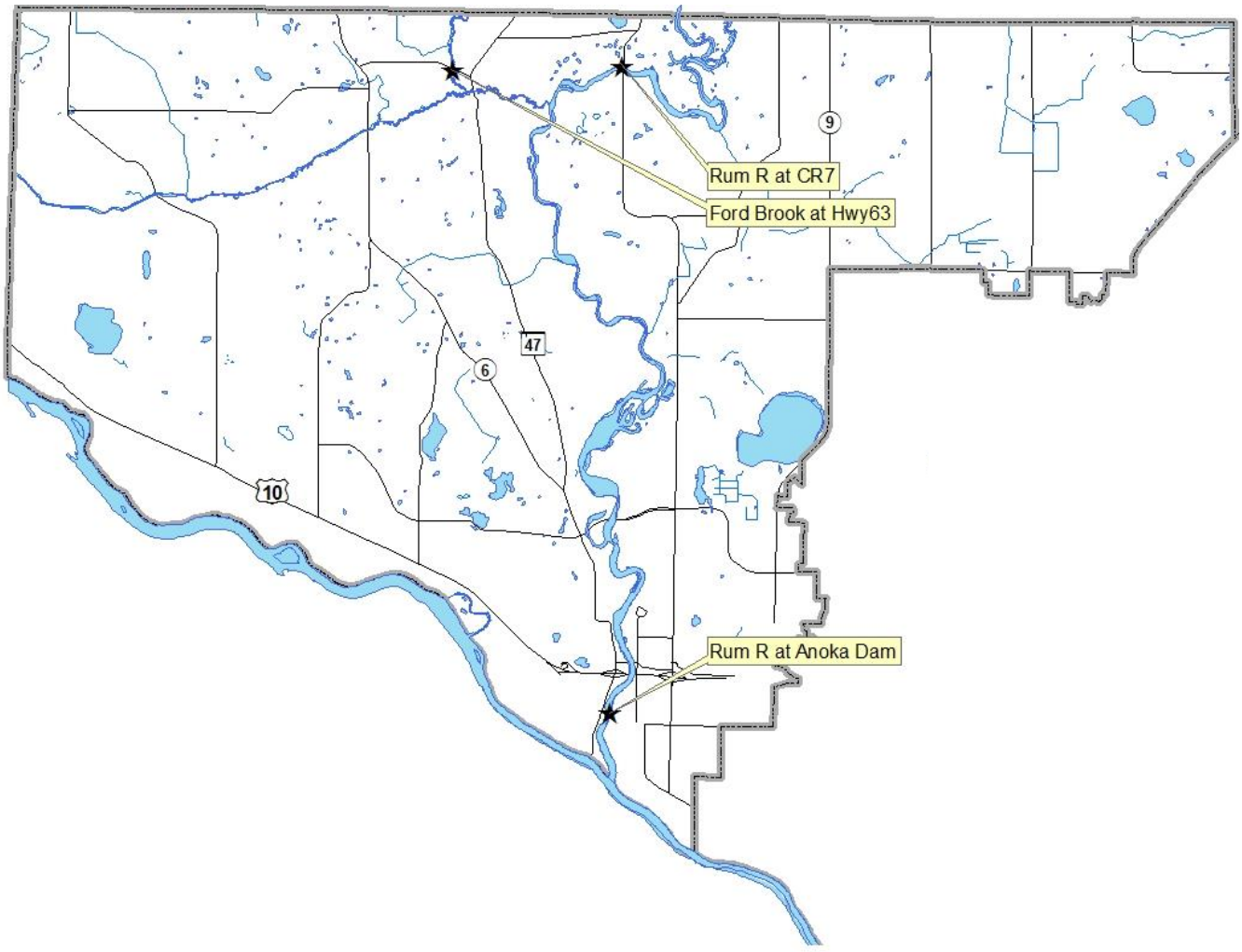
Locations: Ford Brook at Highway 63

Rum River at County Road 7

Rum River at Anoka Dam

Results: Results are presented on the following pages.

2015 Lower Rum River Monitoring Sites



Stream Water Quality Monitoring

FORD BROOK

At Co Rd 63, City of Ramsey, MN

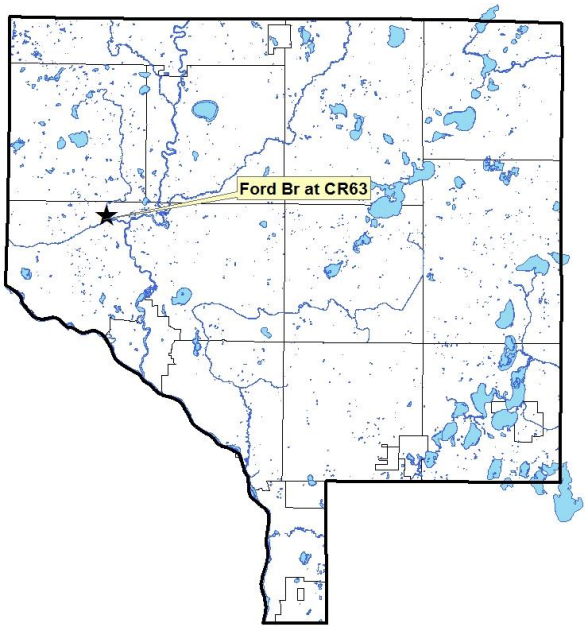
Years Monitored

2001, 2003, 2011, 2014, 2015

Background

Ford Brook originates at Goose Lake in north-western Anoka County and flows south. Ford Brook is a tributary to the Rum River. In north-western Anoka County it flows through the relatively undisturbed community of Nowthen before joining Trott Brook just prior to the Rum River.

Ford Brook is one of the smaller streams in Anoka County. The watershed is moderately developed with scattered single family homes, but continues to grow.



Results and Discussion

This report includes data from 2015. Additional monitoring has been done, particularly in 2003 and 2011. The following is a summary of 2015 results.

- Dissolved constituents, as measured by conductivity, in Ford Brook were slightly above average when compared to similar Anoka County streams. Conductivity averaged 0.419 mS/cm (maximum of 0.505 mS/cm and a minimum of 0.328 mS/cm). The median in Anoka County streams is 0.362 mS/cm.
- Phosphorous averaged much higher than proposed MPCA water quality standard of 100 ug/l, during both baseflow and storms. Phosphorous in Ford Brook averaged 181 ug/l (maximum of 215 ug/l and a minimum of 110 ug/l). Median phosphorus concentration in Anoka County streams is 135 ug/L.
- Suspended solids and turbidity were both below state standards each sampling event and averaged well below the standards. Total suspended solids averaged 22.5 mg/l (maximum of 35 mg/l and a minimum of 8 mg/l). Turbidity averaged 29.70 NTU (maximum of 49 NTU and a minimum of 6.6 NTU). Water flow during the 49 NTU reading was extremely fast and turbulent due to abnormal rainfall. Median turbidity in Anoka County streams is 8.5 NTU and total suspended solids averages 12 NTU.
- pH and dissolved oxygen were in the 6.5-8.5 range considered normal and healthy for streams in this area. pH averaged 7.85 (maximum of 8.68 and a minimum of 7.51).
- Dissolved Oxygen levels observed were above the 5 mg/L state standard threshold needed by most aquatic life. DO averaged 8.62 mg/l (maximum of 11.60 mg/l and a minimum of 6.65 mg/l).

FordBrook at CR63			3/12/2015	4/13/2015	7/6/2015	7/10/2015				
	Units	R.L.*	Results	Results	Results	Results		Average	Min	Max
pH		0.1	8.68	7.51	7.55	7.64		7.85	7.51	8.68
Conductivity	mS/cm	0.01	0.328	0.395	0.448	0.505		0.419	0.328	0.505
Turbidity	NTU	1	19.4	43.8	49.0	6.6		29.70	6.60	49.00
D.O.	mg/L	0.01	11.6	8.83	6.65	7.38		8.62	6.65	11.60
D.O.	%	1	80.4	79	77.3	87.7		81.1	77.3	87.7
Temp.	°C	0.1	0.2	9.2	21.0	22.5		13.2	0.2	22.5
Salinity	%	0.01	0.15	0.19	0.12	0.24		0.18	0.12	0.24
T.P.	ug/L	10	215	198	201	110		181	110	215
TSS	mg/L	2	13	35	34.0	8		22.5	8.0	35.0
Secchi-tube	cm		77	38	21	87		>100	21	87
E coli	MPN									
Appearance										
Recreational										

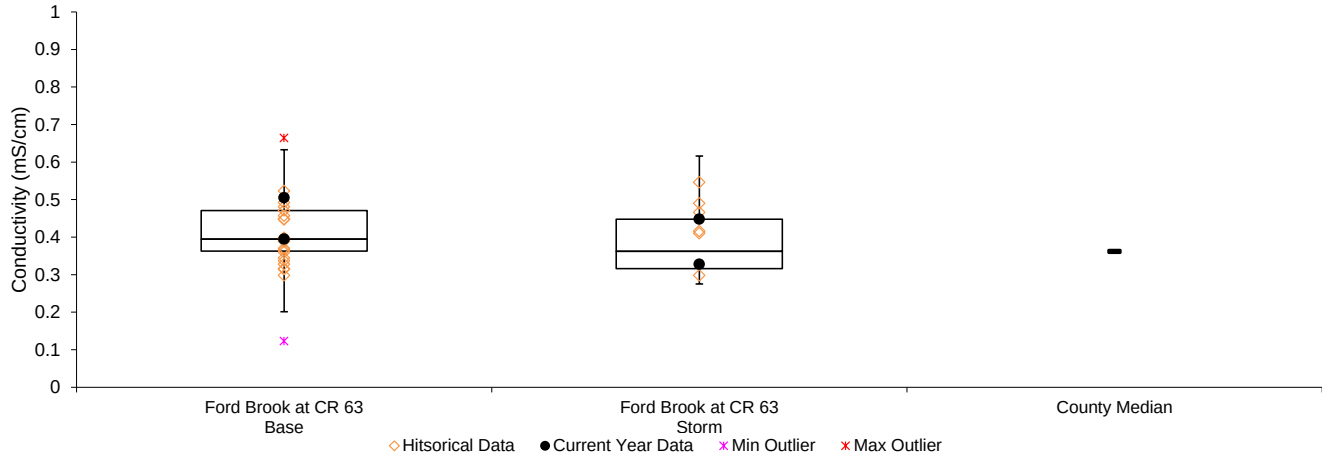
*reporting limit

Conductivity

Conductivity, chlorides, and salinity are all measures of a broad range of dissolved pollutants. Dissolved pollutant sources include urban road runoff, industrial sources, and others. Metals, hydrocarbons, road salts, and others are often of concern in a suburban environment. Conductivity is the broadest measure of dissolved pollutants we use. It measures electrical conductivity of the water; pure water with no dissolved constituents has zero conductivity. Chlorides tests for 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; Ford Brook's rural location indicates that sources of high dissolved pollutants are likely naturally occurring.

Median conductivity results in Ford Brook were low overall and just slightly higher than the median for other Anoka County streams (see table and figures below). Median conductivity in Ford Brook (all years, all conditions) was 0.391 mS/cm compared to the countywide median of 0.362 mS/cm.

Conductivity at Ford Brook. Orange diamonds are historical data from previous years and black circles are 2015 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



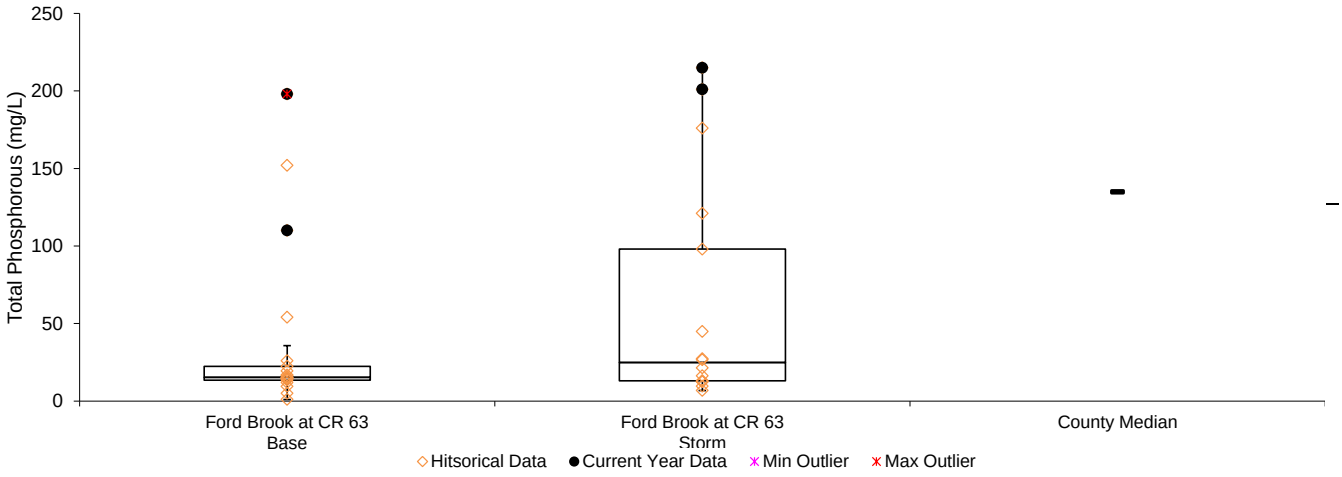
Total Phosphorus

Total phosphorus (TP) is a common nutrient pollutant. It is limiting for most algae growth. Total phosphorus in Ford Brook is typically low during baseflow and storm conditions, we have however observed increases during baseflow and storms (see figures below).

In 2015 TP levels in Ford Brook were much higher than the county median and were an increase from 2014 results. TP was higher during storm events than baseflow. The median TP for Ford Brook (all years, all conditions) was only 17.4. This is substantially lower than the countywide median for streams of 135ug/L, as well as the state water quality standard of 100 ug/L, although more recent results have indicated that this may no longer be the case.

The dominant phosphorus sources are likely increases in water volume and changes in land use around Ford Brook. Mobilization of in-stream sediments and agricultural runoff may be an important phosphorus sources. Drained, organic wetland soils may be another source; much of the wetlands Ford Brook runs through no longer hold back water flow.

Total Phosphorus at Ford Brook. Orange diamonds are historical data from previous years and black circles are 2015 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



Total Suspended Solids and Turbidity

Total suspended solids (TSS) and turbidity both measure solid particles in the water. TSS measures these particles by weighing materials filtered out of the water. Turbidity measures by diffraction of a beam of light sent though the water sample, and is therefore most sensitive to large particles.

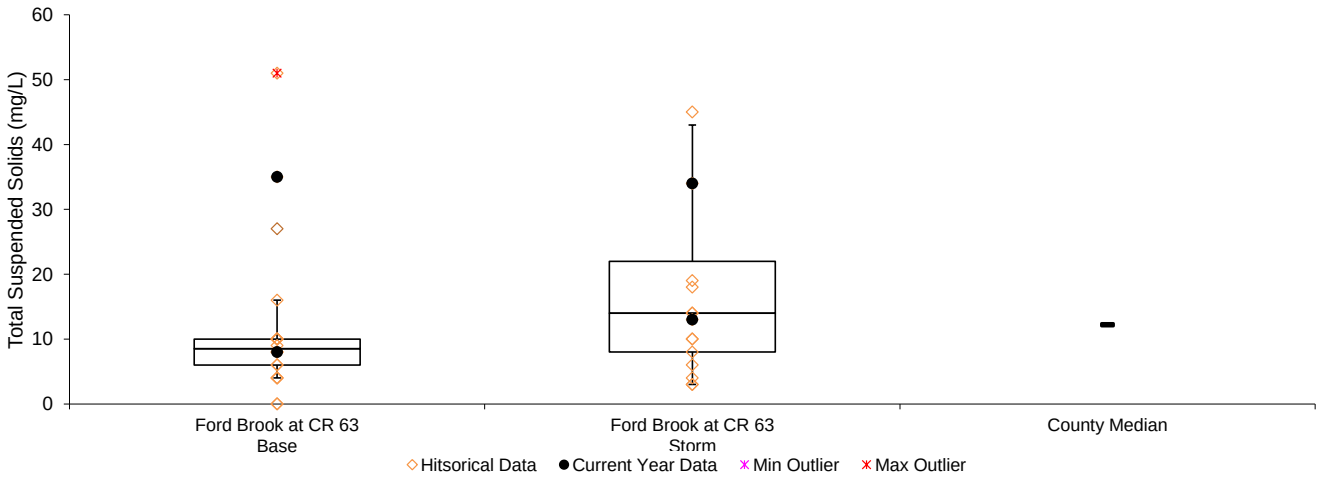
In Ford Brook both TSS and turbidity were generally low and just slightly higher during storm events. Presently the state water quality standard allows turbidity of >25 NTU during no more than 10% of measurements. That standard is being changed to TSS of 30 mg/L. In either case, the stream sometimes exceeds state water quality standards.

Median turbidity for Ford Brook (all years, all conditions) was 9 NTU, respectively. This is similar to the countywide median of 8.5 NTU. Only 4 of 33 (12%) measurements at Ford Brook are greater than MPCA's present water quality standard of 25 NTU. Median TSS was 10 mg/L. This is lower than the median for streams county-wide of 12 mg/L. Only 4 of 34 (12%) of TSS measurements exceeded the new, proposed water quality standard of 30 mg/L.

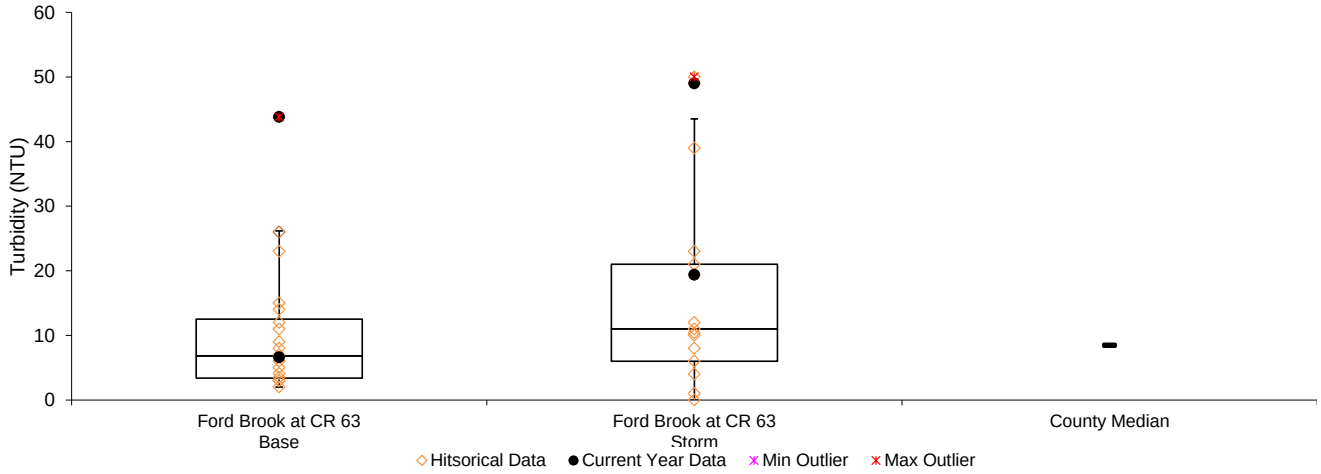
During storms, TSS was often similarly higher at all sites (see figures below). Bank erosion, bedload transport, and stormwater runoff are likely all important sources of suspended solids. Their relative contributions likely differ across the watershed. However given that suspended solids are high throughout the watershed, it is safe to say the problem is not geographically isolated.

Research should be done to determine the extent to which bed load transport of sediment is contributing to high turbidity and TSS. Presently, it appears that it has the potential to be important. High suspended solids in the upper watershed, where land uses are rural residential and sod fields is surprising, given that these are not often sources of high suspended solids. This lends suspicion that near-channel and in-channel sources may be important in the upper watershed. It may be important farther downstream too. On the other hand, Hydrolab continuous turbidity monitoring during storms has found that turbidity does not increase as flow increases, as would be expected if bed load were dominant.

Total Suspended Solids at Ford Brook. Orange diamonds are historical data from previous years and black circles are 2015 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



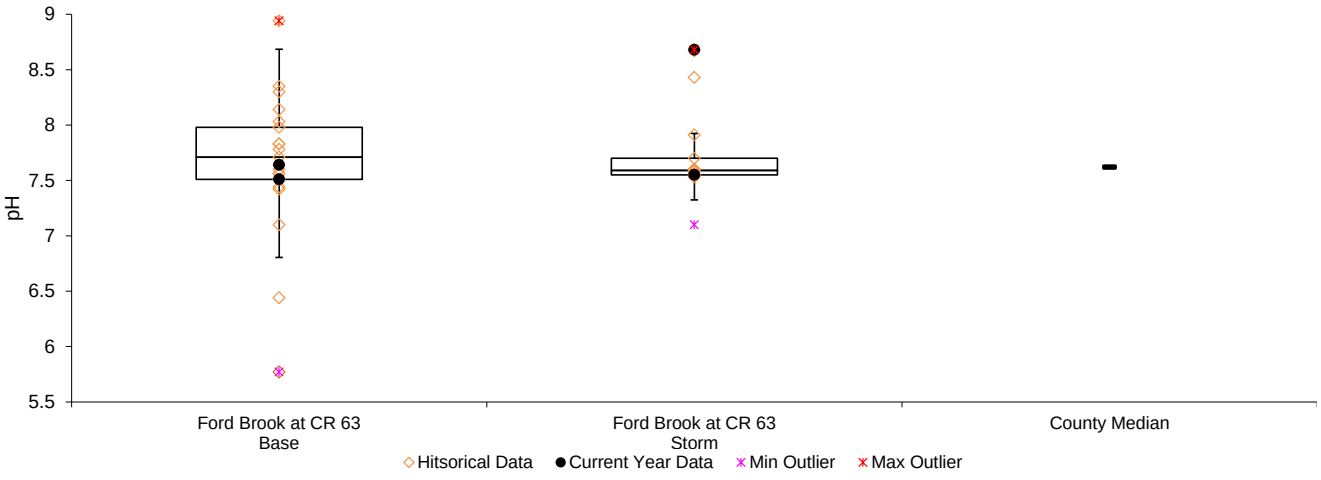
Turbidity at Ford Brook. Orange diamonds are historical data from previous years and black circles are 2015 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



pH

pH was generally within the expected range at all sites for 2015. pH is expected to be between 6.5 and 8.5 according to MPCA water quality standards. While occasional readings outside of this range have occurred in previous years, they were not large departures that generate concerns. On one monitoring event pH exceeded 8.5. pH was similar during baseflow and storm events. lower during all storm events, but this is not surprising because rainfall has a lower pH and the creek serves as a stormwater conveyance for four cities.

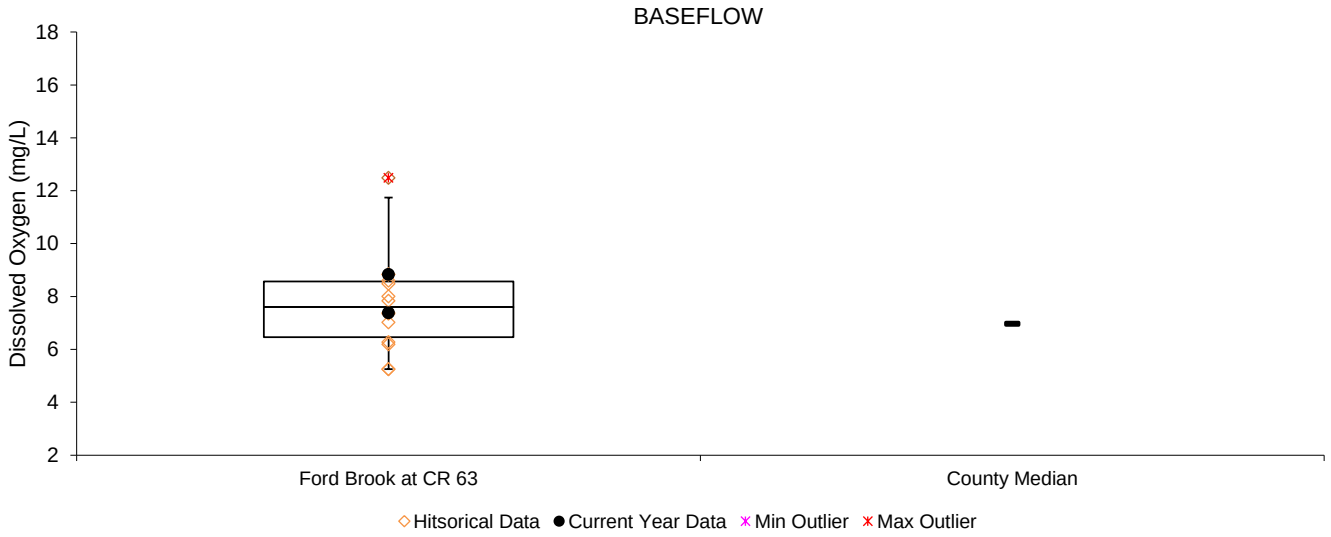
pH at Ford Brook. Orange diamonds are historical data from previous years and black circles are 2015 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



Dissolved Oxygen

Dissolved oxygen in Ford Brook was within acceptable levels in Ford Brok. Of the 29 samples took historically, 0 samples dropped below 5 mg/L. The other sites had no instances of dissolved oxygen below 5 mg/L. In sum, any dissolved oxygen problems observed appear.

Dissolved Oxygen at Ford Brook. Orange diamonds are historical data from previous years and black circles are 2015 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



Stream Water Quality - Chemical Monitoring

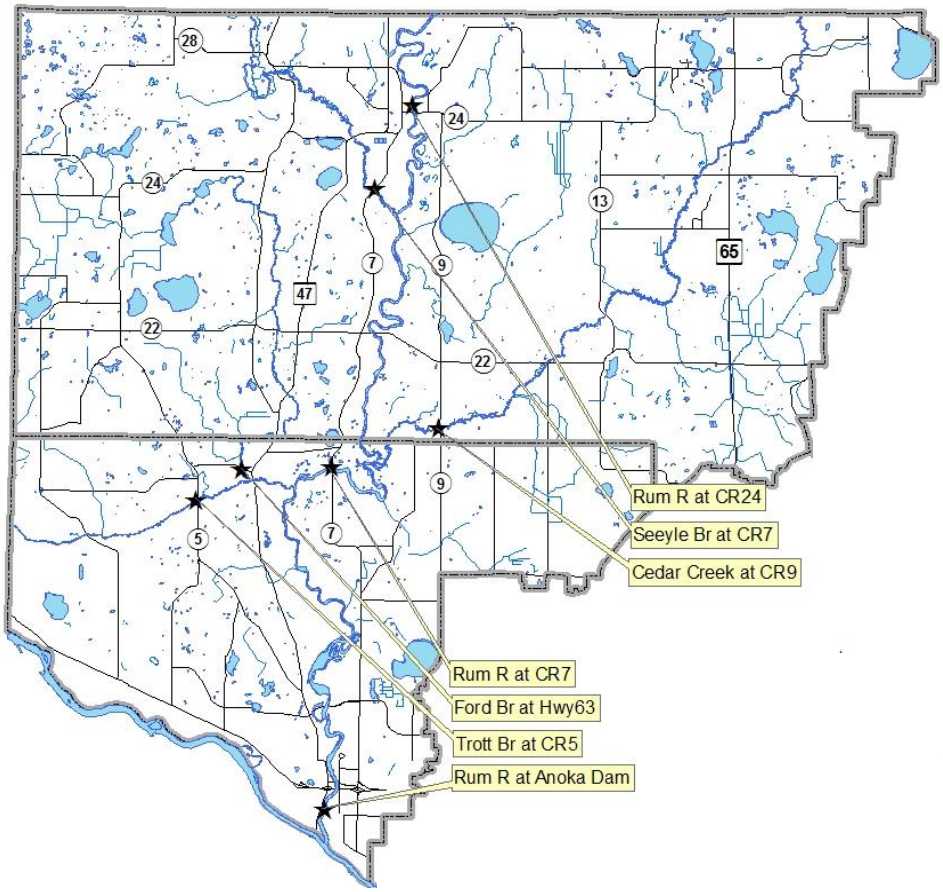
Description: The Rum River and several tributary streams were monitored in 2015. The locations of river monitoring include the approximate top and bottom of the Upper and Lower Rum River Watershed Management Organizations. Tributaries were monitored simultaneous with the Rum River monitoring for greatest comparability near their outfalls into the river. Collectively, these data allow for an upstream to downstream water quality comparison within Anoka County, as well as within each watershed organization. It also allows us to examine whether the tributaries degrade Rum River water quality. Monitoring occurred in May through September for of the following parameters: total suspended solids, e. coli, total phosphorus, Secchi tube transparency, dissolved oxygen, turbidity, temperature, conductivity, pH, and salinity.

Purpose: To detect water quality trends and problems, and diagnose the source as well as provide an initial assessment of water quality to be used in the completion of the Rum River Watershed Restoration and Protection Plan (WRAPP).

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.

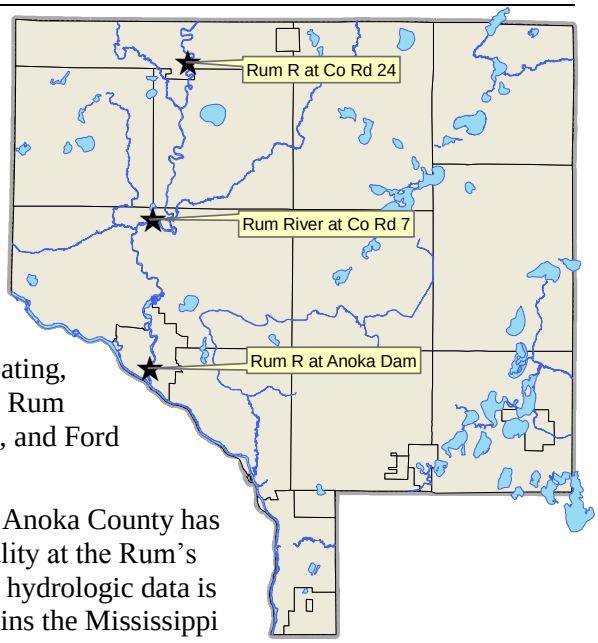
Upper Rum River Watershed Stream Water Quality Monitoring Sites



Stream Water Quality Monitoring

RUM RIVER

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



Years Monitored

At Co. Rd. 24 – 2004, 2009, 2010, 2011, 2014, 2015

At Co. Rd. 7 – 2004, 2009, 2010, 2011, 2014, 2015

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

Background

The Rum River is regarded as 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, Trott, and Ford Brooks, 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 been sporadic and sparse. 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, 2010, 2011, 2014, and 2015 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 together for a more comprehensive analysis of the river from upstream to downstream.

In 2015 the river was monitored during both storm and baseflow conditions by grab samples. Eight water quality samples were taken; half during baseflow and half following storms. Storms were generally defined as one-inch or more of rainfall in 24 hours or a significant snowmelt event combined with rainfall. In some years, particularly the drought year of 2009, smaller storms were sampled because of a lack of larger storms. All storms sampled were significant runoff events. Parameters tested with portable meters included pH, conductivity, turbidity, temperature, salinity, and dissolved oxygen. Parameters tested by water samples sent to a state-certified lab included total phosphorus, total suspended solids. During every sampling the water level (stage) was recorded. The monitoring station at the Anoka Dam includes automated equipment that continuously tracks water levels and calculates flows. Water level and flow data for other sites was obtained from the US Geological Survey, who maintains a hydrological monitoring site at Viking Boulevard.

The purpose of this report is to make an upstream to downstream comparison of Rum River water quality. It includes only parameters tested in 2015. 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 http://www.metrocouncil.org/Environment/RiversLakes. All other raw data can be obtained from the Anoka Conservation District and is also available through the Minnesota Pollution Control Agency's EQuIS database, which is available through their website.

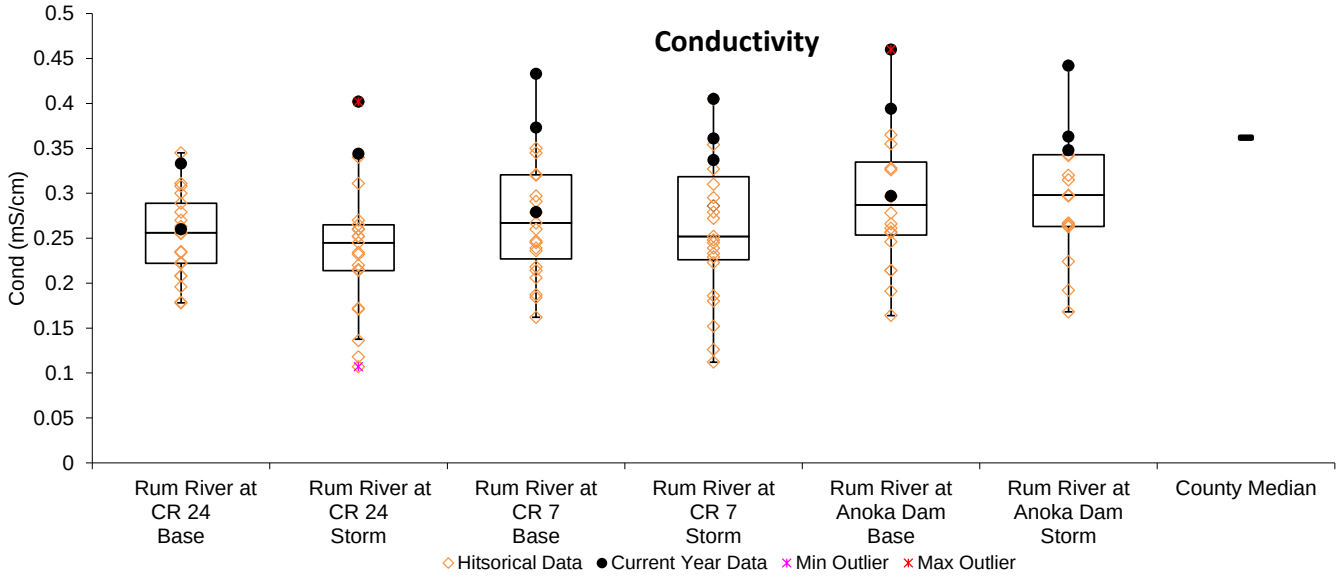
Results and Discussion

On the following pages data are presented and discussed for each parameter. Management recommendations will be included in the 2015 report at the conclusion of this monitoring project. The Rum River is an exceptional waterbody, and its protection and improvement should be a high priority.

Conductivity

Conductivity and chlorides are measures of dissolved pollutants. Dissolved pollutant sources include urban road runoff, industrial chemicals, and others. Metals, hydrocarbons, road salts, and others are often of concern in a suburban environment. Conductivity was the broadest measure of dissolved pollutants used. It measures electrical conductivity of the water; pure water with no dissolved constituents has zero conductivity. Chlorides were not sampled in 2015 and thus not displayed below. 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. These pollutants are of greatest concern because of the effect they can have on the stream's biological community. They can also be of concern because the Rum River is upstream from the Twin Cities drinking water intakes on the Mississippi River.

Conductivity during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2015 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



Conductivity is acceptably low in the Rum River, but increases downstream (see figures above) and is usually higher during baseflow. Median conductivity from upstream to downstream of the sites monitored in 2015 (all conditions) was 0.338 mS/cm, 0.369 and 0.391 mS/cm, respectively. Two of the sites are higher than the median for 34 Anoka County streams of 0.362 mS/cm. The 2015 maximum observed conductivity in the Rum River was 0.46 mS/cm which is the highest on record.

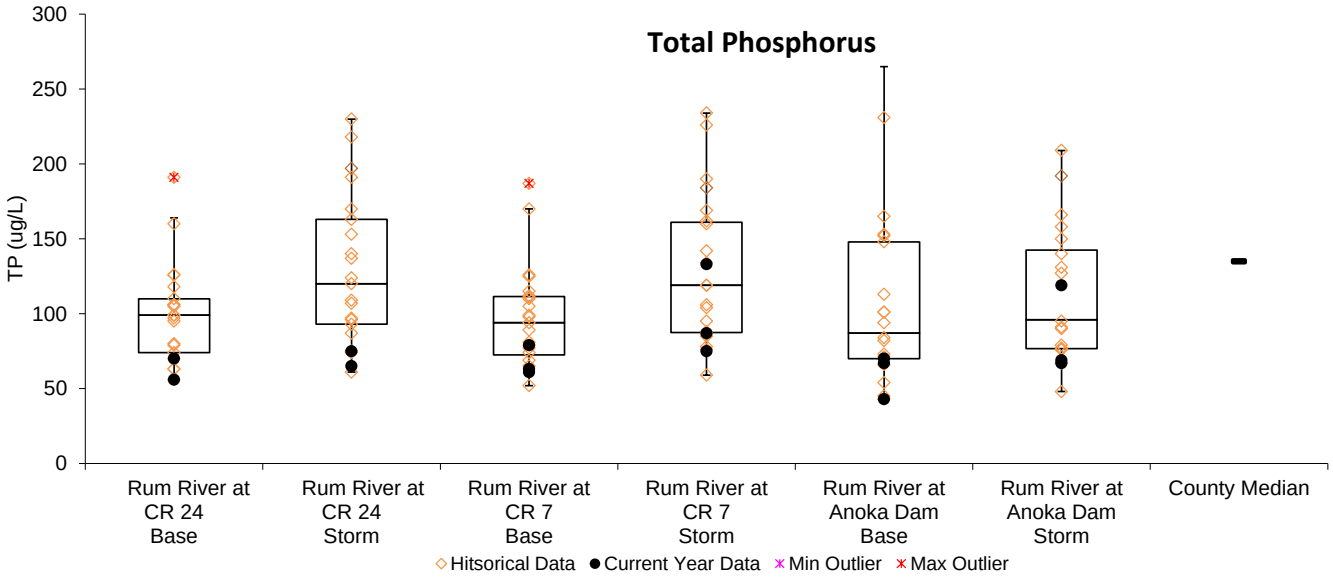
Conductivity was lowest at most sites during storms, suggesting that stormwater runoff contains fewer dissolved pollutants than the surficial water table that feeds the river during baseflow. High baseflow conductivity has been observed in most other nearby streams too, studied extensively, and the largest cause has been found to be road salts that have infiltrated into the shallow aquifer. Geologic materials also contribute, but to a lesser degree.

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

Total Phosphorus

Total phosphorus in the Rum River is acceptably low and is similar to the median for all other monitored 34 Anoka County streams (see figure below). 2015 readings averaged much lower than 2014 results. 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 in 2015 at the three monitored sites (all conditions) was 67.5, 77 and 69.5 ug/L. These upstream-to-downstream differences are negligible and there is no trend of increasing phosphorus downstream. All sites in 2015 had phosphorus concentrations lower than the median for Anoka County streams of 135 ug/L. In 2015 the highest observed total phosphorus reading was during one particular storm event, with a maximum of 133. In all, phosphorus in the Rum River is at acceptable levels but should continue to be an area of pollution control effort as the area urbanizes.

Total phosphorus during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2015 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



Turbidity and Total Suspended Solids (TSS)

Turbidity and total suspended solids (TSS) are two different measurements of solid material suspended in the water. Turbidity is measured by refraction of a light beam passed through a water sample. It is most sensitive to large particles. Total suspended solids are measured by filtering solids from a water sample and weighing the filtered material. The amount of suspended material is important because it affects transparency and aquatic life, and because many other pollutants are attached to particles. Many stormwater treatment practices such as street sweeping, sumps, and stormwater settling ponds target sediment and attached pollutants. In 2015 Suspended solids in the Rum River were low.

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

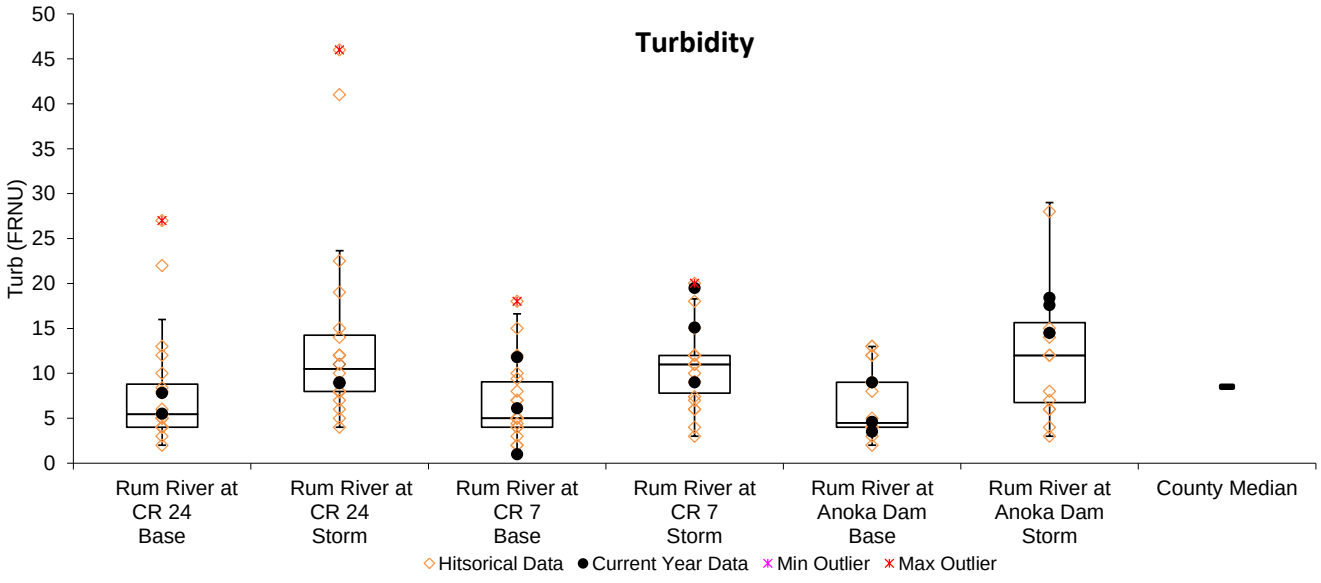
In the Rum River, turbidity was low with increases during storms and a very slight decrease at downstream monitoring sites (see figure below). The median turbidity, in 2015 (all conditions) was 8.35, 10.4 and 9.5 NTU (upstream to downstream), which is similar or higher than the median for Anoka County streams of 8.5 NTU. Turbidity was elevated on a few occasions, especially during storms. In 2015 the maximum observed was 19.5 NTU during a mid-season monitoring event.

TSS in 2015 was similar to 2014 results. The median TSS, in 2015 (all conditions) was 6, 5.5 and 5.5 (upstream to downstream). These are all much lower than the Anoka County stream median for TSS of 12.

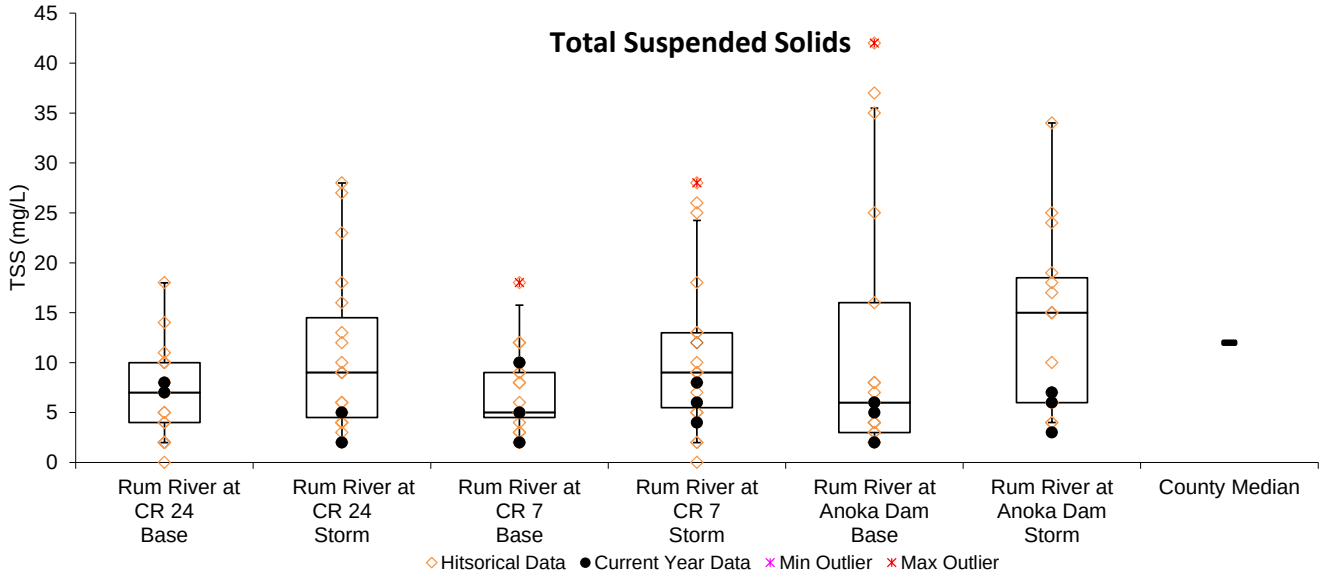
Rigorous stormwater treatment should occur as the Rum River watershed develops, or the collective pollution caused by many small developments will seriously impact the river. Bringing stormwater treatment up to date in older developments is also important.

Differences between TSS and turbidity lend insight into the nature of any problems. TSS showed increases at the downstream monitoring site, while turbidity did not. Turbidity is most sensitive to large particles. Therefore, the downstream increases are likely due to smaller particles. Other pollutants, such as phosphorus and metals, are most highly correlated with smaller particles. These other pollutants can "hitch a ride" on smaller particles because of their greater surface area and, in the case of certain soils, ionic charge. Furthermore, small particles stay suspended in the water column and therefore are more likely to be transported by stream flows and are more difficult to remove with stormwater practices like settling ponds.

Turbidity during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2015 readings Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



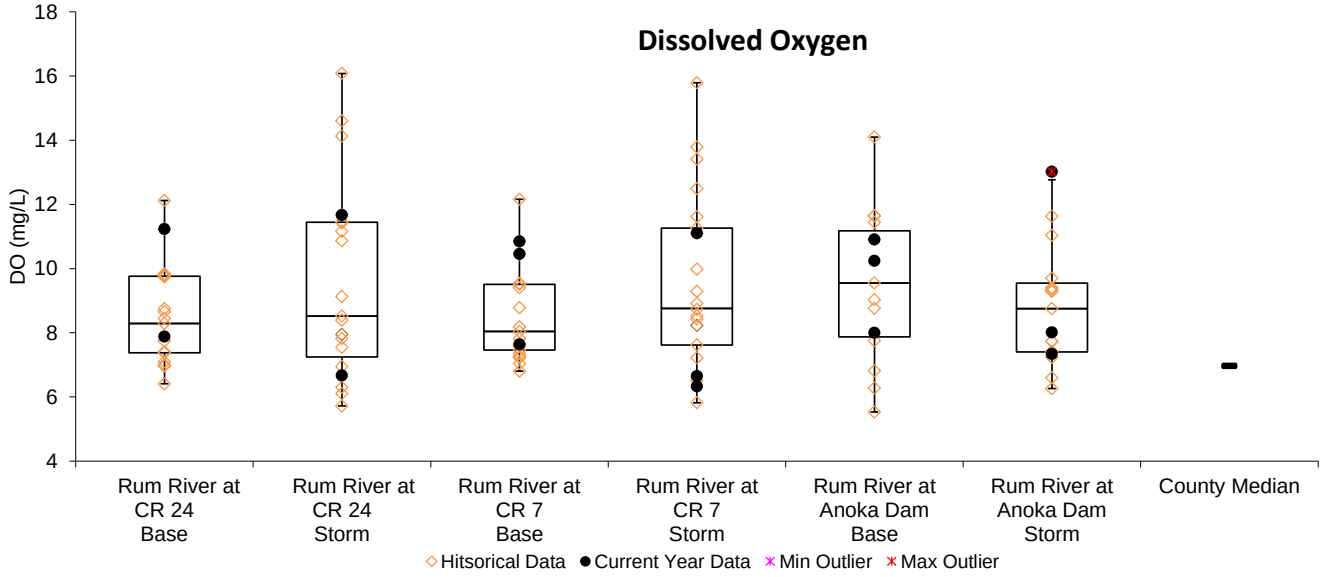
Total suspended solids during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2015 readings Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



Dissolved Oxygen

Dissolved oxygen is necessary for aquatic life, including fish. Organic pollution consumes oxygen when it decomposes. If oxygen levels fall below 5 mg/L aquatic life begins to suffer. In the Rum River dissolved oxygen was always above 5.5 mg/L at all monitoring sites.

Dissolved oxygen during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2015 readings Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).

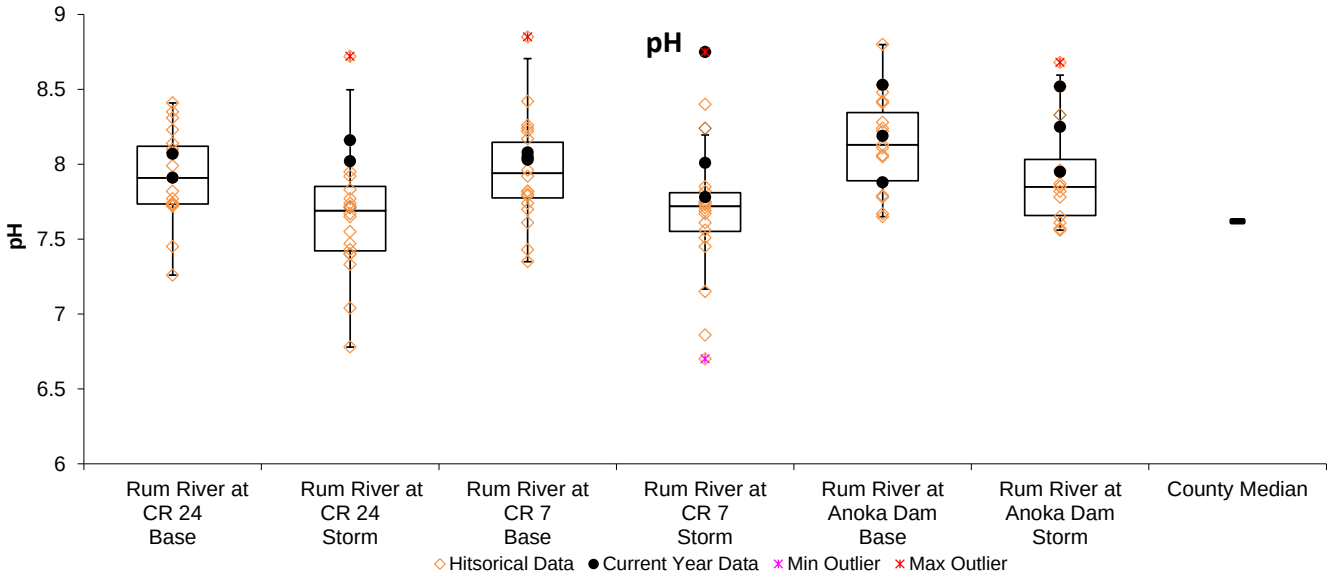


pH

pH refers to the acidity of the water. The Minnesota Pollution Control Agency's water quality standard is for pH to be between 6.5 and 8.5. The Rum River is generally within this range (see figure below).

It is interesting to note that pH is lower during storms than during baseflow. 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 2015 readings Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



Summary and Recommendations

The Rum River's water quality is very good. It does show a slight increase in suspended solids and conductivity downstream. Protection of the Rum River should be a high priority for local officials. Large population increases are expected for the Rum River's watershed within Anoka County and have the potential to degrade water quality unless carefully sited and managed. Development pressure is likely to be especially high near the river because of its scenic and natural qualities.

Stream Water Quality – Biological Monitoring

Description: This program combines environmental education and stream monitoring. Under the supervision of ACD staff, high school science classes collect aquatic macroinvertebrates from a stream, identify their catch to the family level, and use the resulting numbers to gauge water and habitat quality. These methods are based upon the knowledge that different families of macroinvertebrates have different water and habitat quality requirements. The families collectively known as EPT (Ephemeroptera, or mayflies; Plecoptera, or stoneflies; and Trichoptera, or caddisflies) are pollution intolerant. Other families can thrive in low quality water. Therefore, a census of stream macroinvertebrates yields information about stream health.

Purpose: To assess stream quality, both independently as well as by supplementing chemical data.
To provide an environmental education service to the community.

Location: Rum River behind Anoka High School, south side of Bunker Lake Blvd, Anoka

Results: Results for each site are detailed on the following pages.

Tips for Data Interpretation

Consider all biological indices of water quality together rather than looking at each alone, because each gives only a partial picture of stream condition. Compare the numbers to county-wide averages. This gives some sense of what might be expected for streams in a similar landscape, but does not necessarily reflect what might be expected of a minimally impacted stream. Some key numbers to look for include:

Families — Number of invertebrate families. Higher values indicate better quality.

EPT — Number of families of the generally pollution-intolerant orders Ephemeroptera (mayflies), Plecoptera (stoneflies), Trichoptera (caddisflies). Higher numbers indicate better stream quality.

Family Biotic Index (FBI) — An index that utilizes known pollution tolerances for each family. Lower numbers indicate better stream quality.

FBI	Stream Quality Evaluation
0.00-3.75	Excellent
3.76-4.25	Very Good
4.26-5.00	Good
5.01-5.75	Fair
5.76-6.50	Fairly Poor
6.51-7.25	Poor
7.26-10.00	Very Poor

% Dominant Family — High numbers indicates an uneven community, and likely poorer stream health.

RUM RIVER

behind Anoka High School, Anoka
STORET SiteID = S003-189

Last Monitored

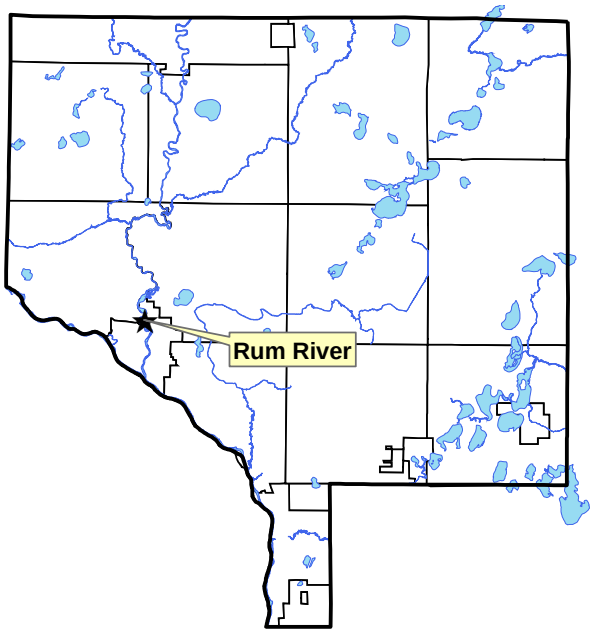
By Anoka High School in 2015

Monitored Since

2001

Student Involvement

162 students in 2015, approximately 900 since 2001



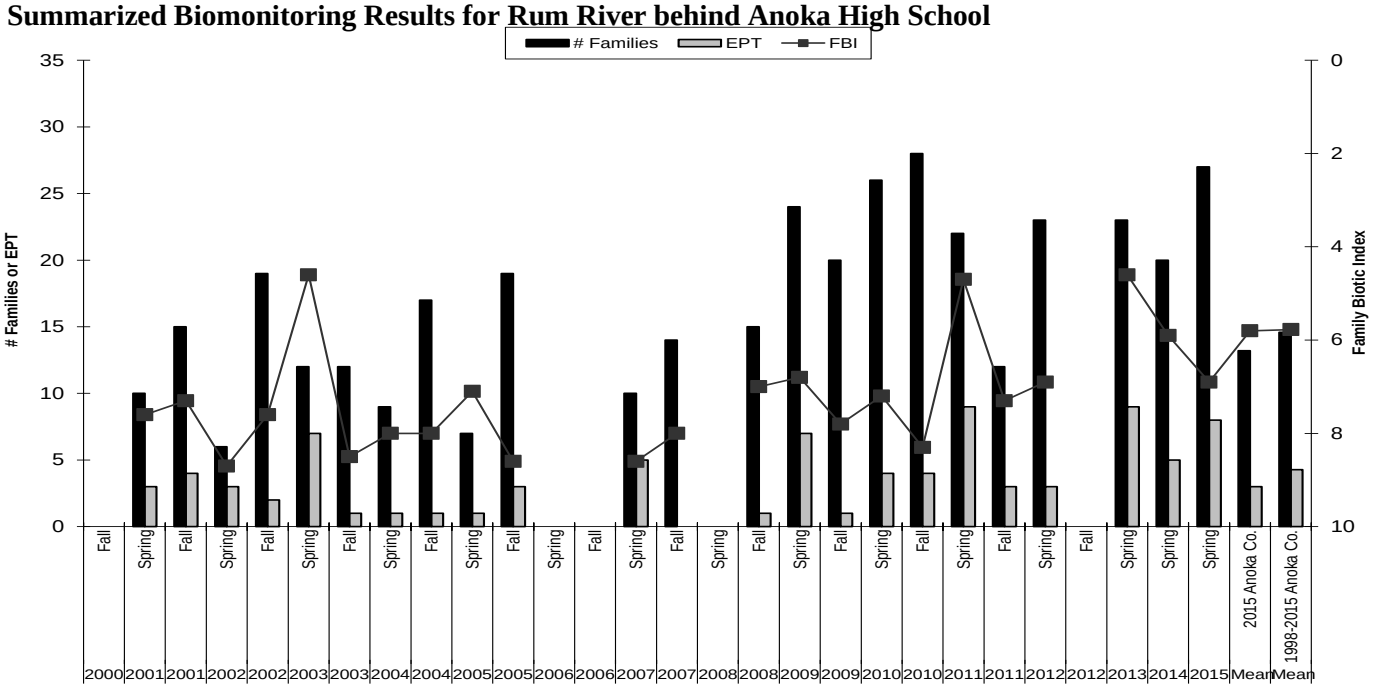
Background

The Rum River originates from Lake Mille Lacs, and flows south through western Anoka County where it joins the Mississippi River in the City of Anoka. In Anoka County the river has both rocky riffles (northern part of county) as well as pools and runs with sandy bottoms. The river's condition is generally regarded as excellent. Most of the Rum River in Anoka County has a state "scenic and recreational" designation. The sampling site is near the Bunker Lake Boulevard bridge behind Anoka High School. Most sampling has been conducted in a backwater rather than the main channel.

Results

Anoka High school classes monitored the Rum River in spring of 2015 with Anoka Conservation District (ACD) oversight. The results for spring 2015 were similar to previous years. More families, 27 in total, were found here than in any other Anoka County stream. This should be expected as most other sites are small streams and this is a larger river. The number of sensitive EPT families (8) and the FBI score (6.9) were the best in Anoka County and above the county averages.

Summarized Biomonitoring Results for Rum River behind Anoka High School



Biomonitoring Data for the Rum River behind Anoka High School

Data presented from the most recent five years. Contact the ACD to request archived data.

Year	2009	2009	2010	2010	2011	2011	2012	2013	2014	Mean	Mean
Season	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Spring	Spring	2014 Anoka Co.	1998-2014 Anoka Co.
FBI	6.80	7.80	7.20	8.30	4.70	7.30	6.90	4.60	5.90	5.8	5.8
# Families	24	20	26	28	22	12	23	23	20	13.2	14.6
EPT	7	1	4	4	9	3	3	9	5	3.0	4.3
Date	8-May	28-Sep	18-May	7-Oct	10-Jun	5-Oct	8-May	14-May	20-May		
sampling by	AHS	AHS	AHS	AHS	ACD	ACD	AHS	AHS	AHS		
sampling method	MH	MH	MH	MH	MH	MH	MH	MH	MH		
Mean # individuals	880	585	443	816	604	188	502	357	350		
# replicates	1	2	1	1	1	1	2	4	4		
Dominant Family	Siphlonuridae	Hyalellidae	Gastropoda	Hyalellidae	baetidae	hyalellidae	silphonuridae	Perlodidae	Siphlonuridae		
% Dominant Family	40.7	39.1	31.8	34.1	57.5	63.3	37.8	42.1	33.4		
% Ephemeroptera	48.2	0.9	8.1	0.9	59.3	11.2	44.9	19.4	57.8		
% Trichoptera	0.1	0	0	0.2	1	0	1.2	0.2	0.1		
% Plecoptera	2.6	0	0.5	0	3.8	0.5	0	42.6	0.5		

Supplemental Stream Chemistry Readings

Data presented from the most recent five years. Contact the ACD to request archived data.

Parameter	5/18/2010	10/7/2010	6/10/2011	10/5/2011	5/8/2012	5/13/2013	5/20/2014
pH	7.24	7.22	7.84	7.98	8.10	7.69	8
Conductivity (mS/cm)	0.207	0.399	0.296	0.296	0.205	0.181	0.237
Turbidity (NTU)	7	7	18	10	7	5	14.2
Dissolved Oxygen (mg/L)	6.93	na	6.85	7.91	7.87	10.00	13.05
Salinity (%)	0	0.01	0.01	0.01	0.00	0.00	0.11
Temperature (°C)	14.8	12.2	20.7	15.3	15.7	13.0	13.5

Discussion

Both chemical and biological monitoring indicate the good quality of this river. Habitat is ideal for a variety of stream life, and includes a variety of substrates, plenty of woody snags, riffles, and pools. Water chemistry monitoring done at various locations on the Rum River throughout Anoka County found that water quality is also good. Both habitat and water quality decline, but are still good, in the downstream reaches of the Rum River where development is more intense and the Anoka Dam creates a slow moving pool.

Historically, biomonitoring near Anoka was conducted mostly in a backwater area that has a mucky bottom and does not receive good flow. This area is unlikely to be occupied by families which are pollution intolerant. In recent years more sampling occurred in the main channel which has more diverse habitat. This change in sampling likely explains the apparent improvement in the invertebrate community in recent years. In 2014 and 2015 sampling returned to the backwater area, however high water levels likely altered its normal functions.

Wetland Hydrology

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

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

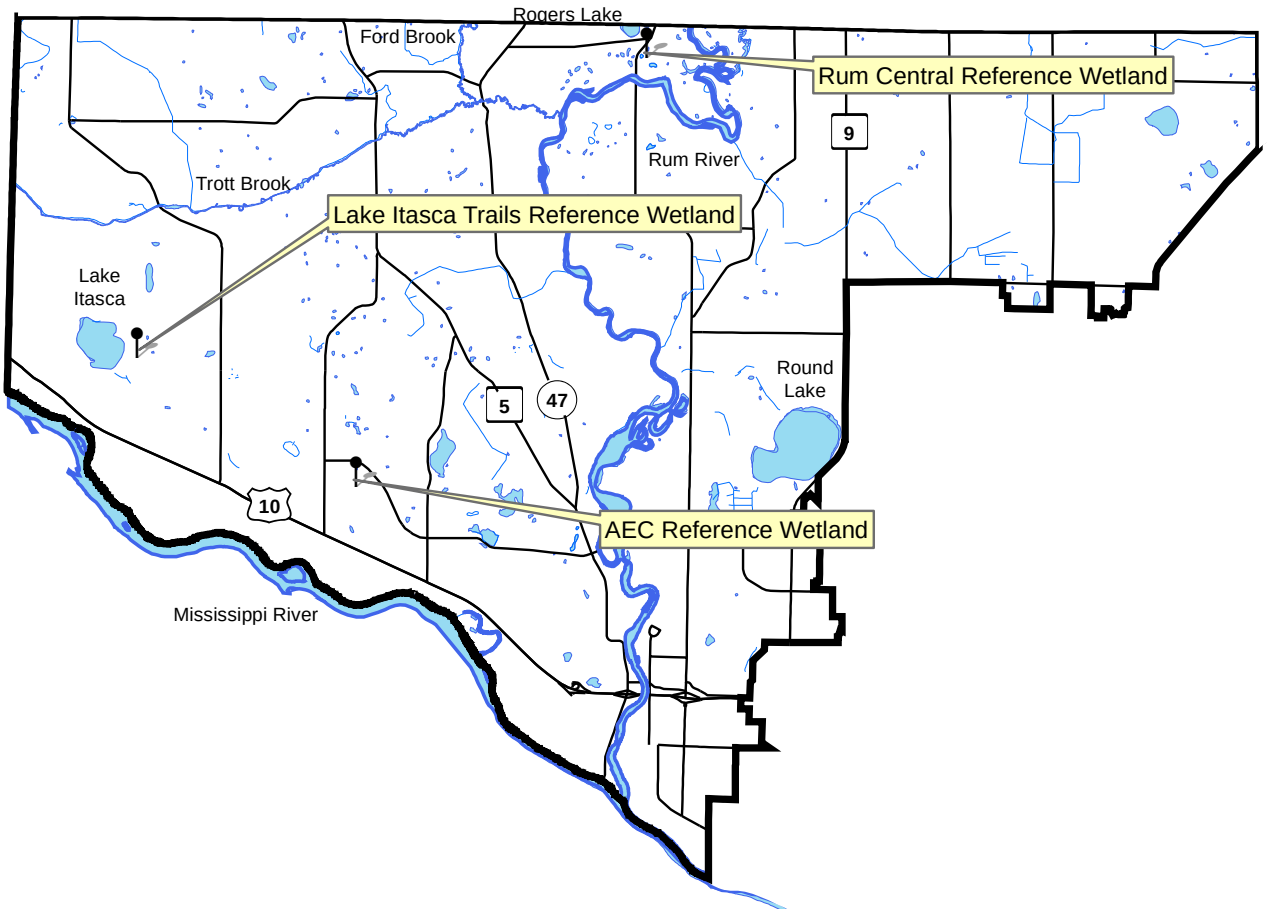
Locations: AEC Reference Wetland, Connexus Energy Property on Bunker Lake Blvd, Ramsey

Rum River Central Reference Wetland, Rum River Central Park, Ramsey

Lake Itasca Trail Reference Wetland, Lake Itasca Park, Ramsey

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

Lower Rum River Watershed Wetland Hydrology Monitoring Sites

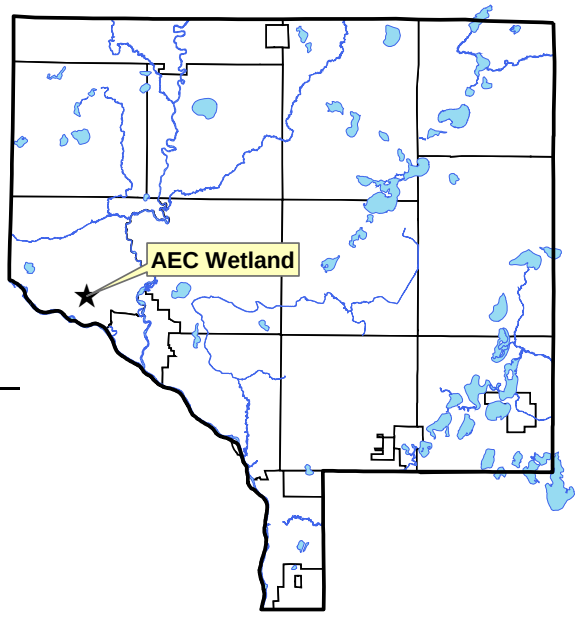


Wetland Hydrology Monitoring

AEC REFERENCE WETLAND

Cottonwood Park, adjacent to Connexus Energy Offices (formerly Anoka Electric Coop), Ramsey

Site Information



Monitored Since: 1999

Wetland Type: 3

Wetland Size: ~18 acres

Isolated Basin? No, probably receives storm water

Connected to a Ditch? No

Soils at Well Location:

Horizon	Depth	Color	Texture	Redox
A	0-15	10yr2/1	Sandy Loam	-
Bw	15-40	10yr3/2	Gravelly Sandy loam	-

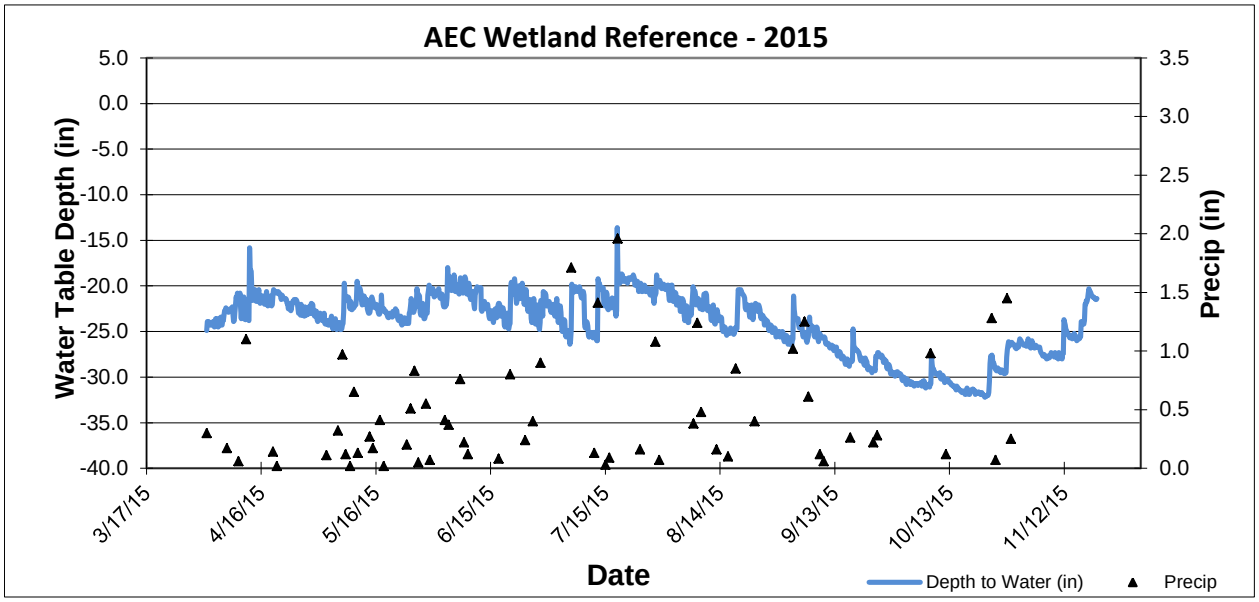
Surrounding Soils: Hubbard coarse sand

Vegetation at Well Location:

Scientific	Common	% Coverage
Populus tremuloides	Quaking Aspen	30
Salix bebbiana	Bebb Willow	30
Carex Spp	Sedge undiff.	30
Solidago canadensis	Canada Goldenrod	20

Other Notes: Well is located at the wetland boundary.

2015 Hydrograph



Well depth was 39 inches, so a reading of –39 indicates water levels were at an unknown depth greater than or equal to 39 inches.

Wetland Hydrology Monitoring

RUM RIVER CENTRAL REFERENCE WETLAND

Rum River Central Regional Park, Ramsey

Site Information

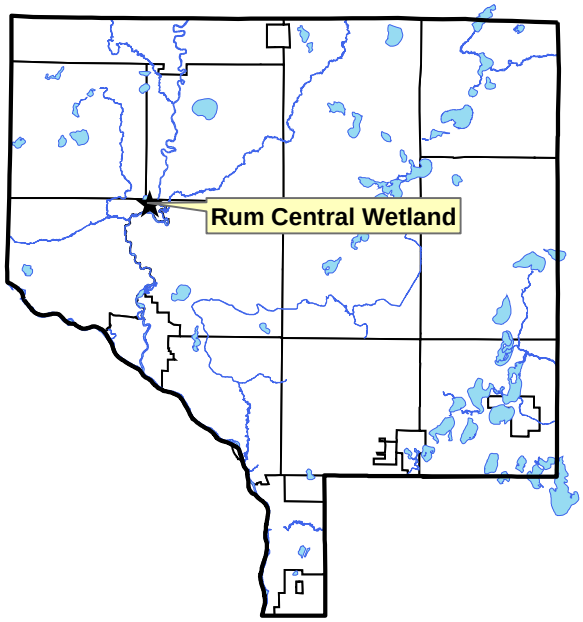
Monitored Since: 1997

Wetland Type: 6

Wetland Size: ~0.8 acres

Isolated Basin? Yes

Connected to a Ditch? No



Soils at Well Location:

Horizon	Depth	Color	Texture	Redox
A	0-12	10yr2/1	Sandy Loam	-
Bg1	12-26	10ry5/6	Sandy Loam	-
Bg2	26-40	10yr5/2	Loamy Sand	-

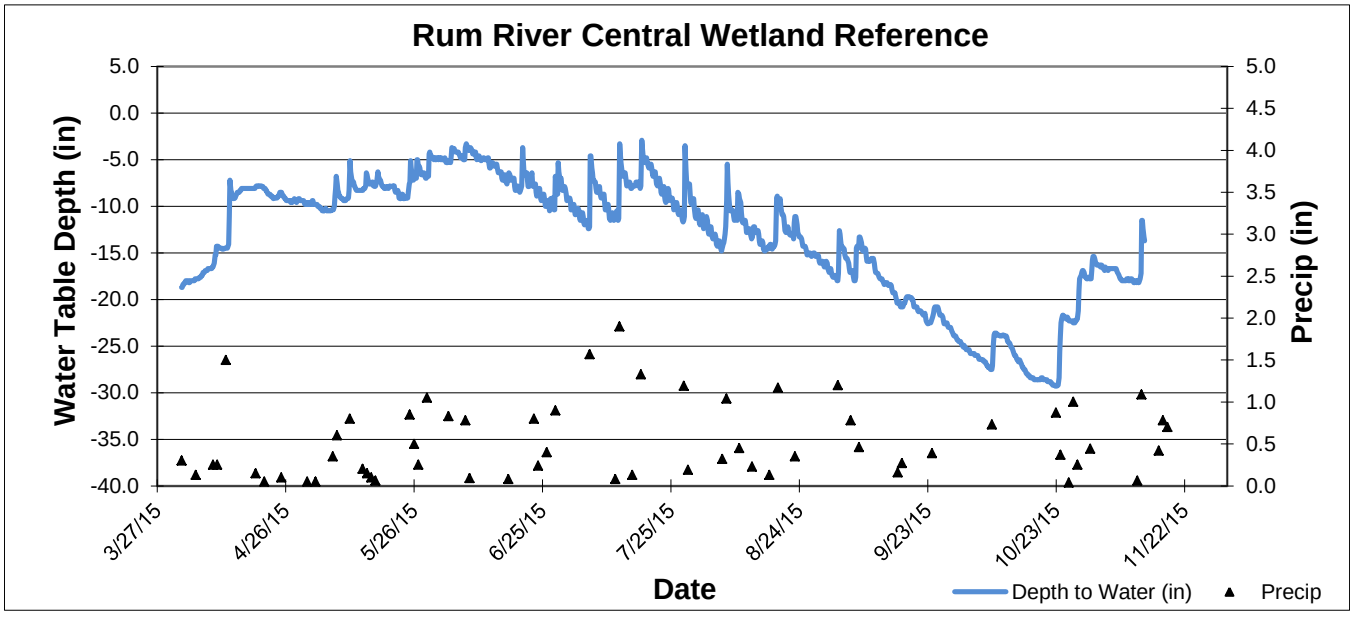
Surrounding Soils: Zimmerman fine sand

Vegetation at Well Location:

Scientific	Common	% Coverage
Phalaris arundinacea	Reed Canary Grass	40
Corylus americanum	American Hazelnut	40
Onoclea sensibilis	Sensitive Fern	30
Rubus strigosus	Raspberry	30
Quercus rubra	Red Oak	20

Other Notes: Well is located at the wetland boundary.

2015 Hydrograph



Well depth was 37.7 inches, so a reading of –37.7 indicates water levels were at an unknown depth greater than or equal to 37.7 inches.

Wetland Hydrology Monitoring

LAKE ITASCA TRAILS REFERENCE WETLAND

Lake Itasca Trails Park, Ramsey

Site Information

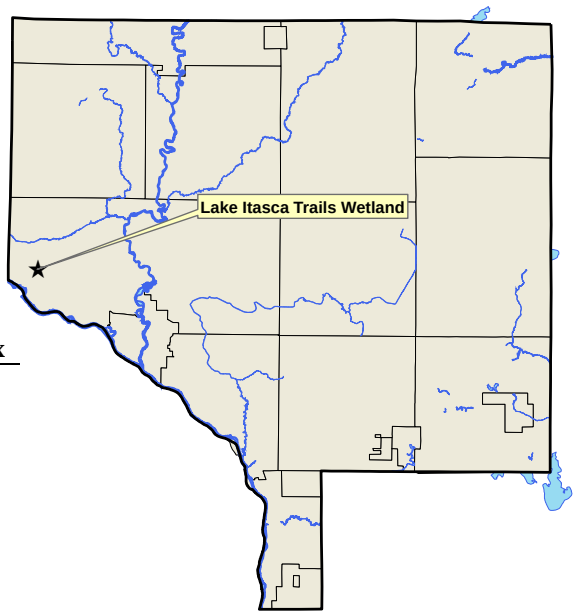
Monitored Since: 2013

Wetland Type: 2/6

Wetland Size: ~10 acres

Isolated Basin? Yes

Connected to a Ditch? No



Soils at Well Location:

Horizon	Depth	Color	Texture	Redox
A1	0-12	10yr2/0	Mucky sand	-
A2	12-20	10ry2/1	Sand	-
B1	20-36	10yr4/1	Sand and fine gravel	-
B2	36-48	10yr6/1	Sand and fine gravel	-

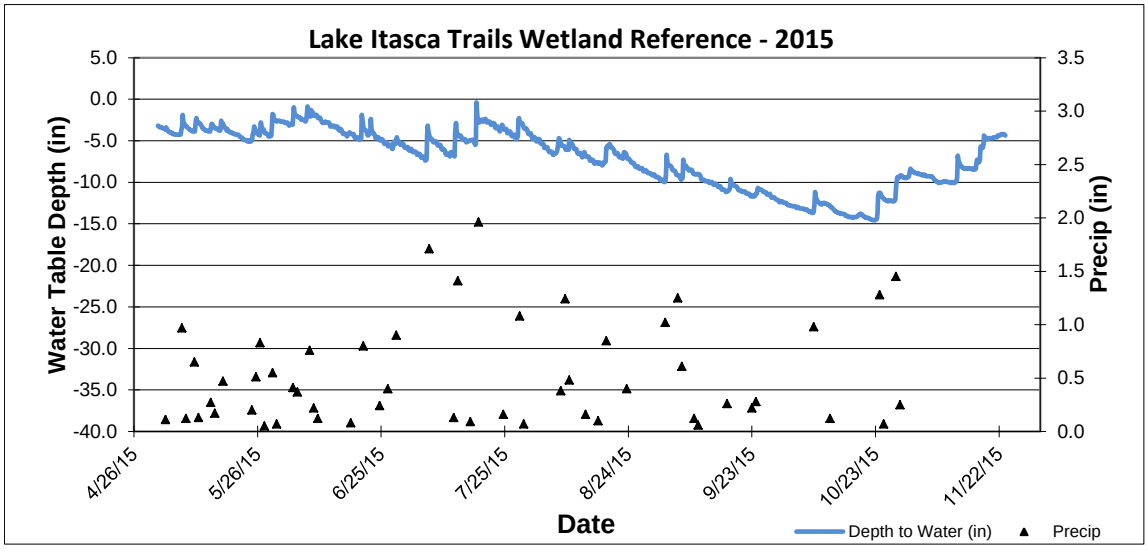
Surrounding Soils: Hubbard coarse sand

Vegetation at Well Location:

Scientific	Common	% Coverage
Carex stricta	Hummock Sedge	80
Phalaris arundinacea	Reed Canary Grass	20
Salix sp.	Willow	20
Rubus sp.	Bristle-berry	5

Other Notes: Well is located about 10 feet east and about 6 inches downslope of the wetland boundary. DNR Public Water Wetland 2-339.

2015 Hydrograph



Well depth was 41.4 inches, so a reading of –41.4 indicates water levels were at an unknown depth greater than or equal to 41.4 inches.

Water Quality Grant Fund

Description: The LRRWMO provided cost share for projects on either public or private property that will improve water quality, such as repairing streambank erosion, restoring native shoreline vegetation, or rain gardens. This funding was administered by the Anoka Conservation District, which works with landowners on conservation projects. Projects affecting the Rum River were given the highest priority because it is viewed as an especially valuable resource.

Purpose: To improve water quality in lakes streams and rivers by correcting erosion problems and providing buffers or other structures that filter runoff before it reaches the water bodies.

Results: Projects reported in the year they are installed. No projects were installed in 2015.

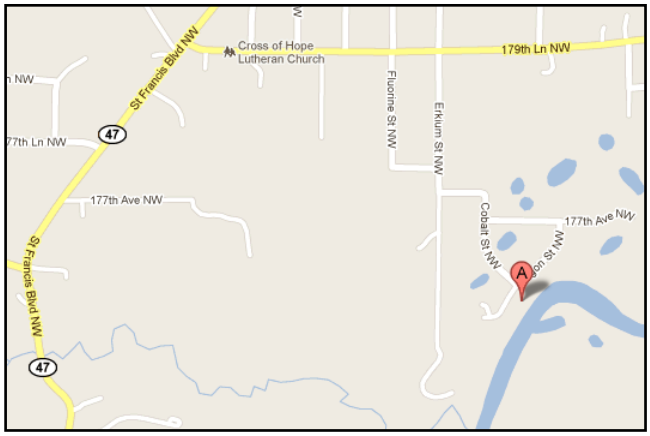
LRRWMO Cost Share Fund Summary

2006 LRRWMO Contribution	+	$1,000.00
2008 Expense – Herrala Rum Riverbank stabilization	-	$ 150.91
2008 Expense – Rusin Rum Riverbank stabilization	-	$ 225.46
2009 LRRWMO Contribution	+	$1,000.00
2009 Expense – Rusin Rum Riverbank bluff stabilization	-	$ 52.05
2010 LRRWMO Contribution	+	$ 0
2010 LRRWMO Expenses	-	$ 0
2011 LRRWMO Contribution	+	$ 0
2011 Expense - Blackburn Rum riverbank	-	$ 543.46
2012 LRRWMO Contribution	+	$1,000.00
2012 Expense – Smith Rum Riverbank	-	$1,596.92
2013 LRRWMO Contribution	+	$1,000.00
2013 Expense – Geldacker Mississippi Riverbank	-	$1,431.20
2014 LRRWMO Contribution	+	$2,050.00
2015 LRRWMO Contribution	+	$1,000.00
2015 Expense – Smith Rum Riverbank	-	$ 533.65
Fund Balance		**$2,516.35**

2015 funded project – Smith Rum Riverbank, City of Ramsey

100 feet of undercut, eroding riverbank was stabilized using a cedar tree revetment. This was phase two of efforts on this property. In 2012, approximately 70 feet of riverbank were stabilized using a cedar tree revetment. A design was completed for the entire 170 feet of riverbank on the property, but a full installation in 2012 was cost prohibitive. The remaining 100 feet of riverbank was stabilized in 2015.

The landowner paid half of the expense of this project; LRRWMO were used to cover the other half. Installation was primarily done by the Minnesota Conservation Corps with oversight from the Anoka Conservation District.



MISSISSIPPI RIVERBANK INVENTORY

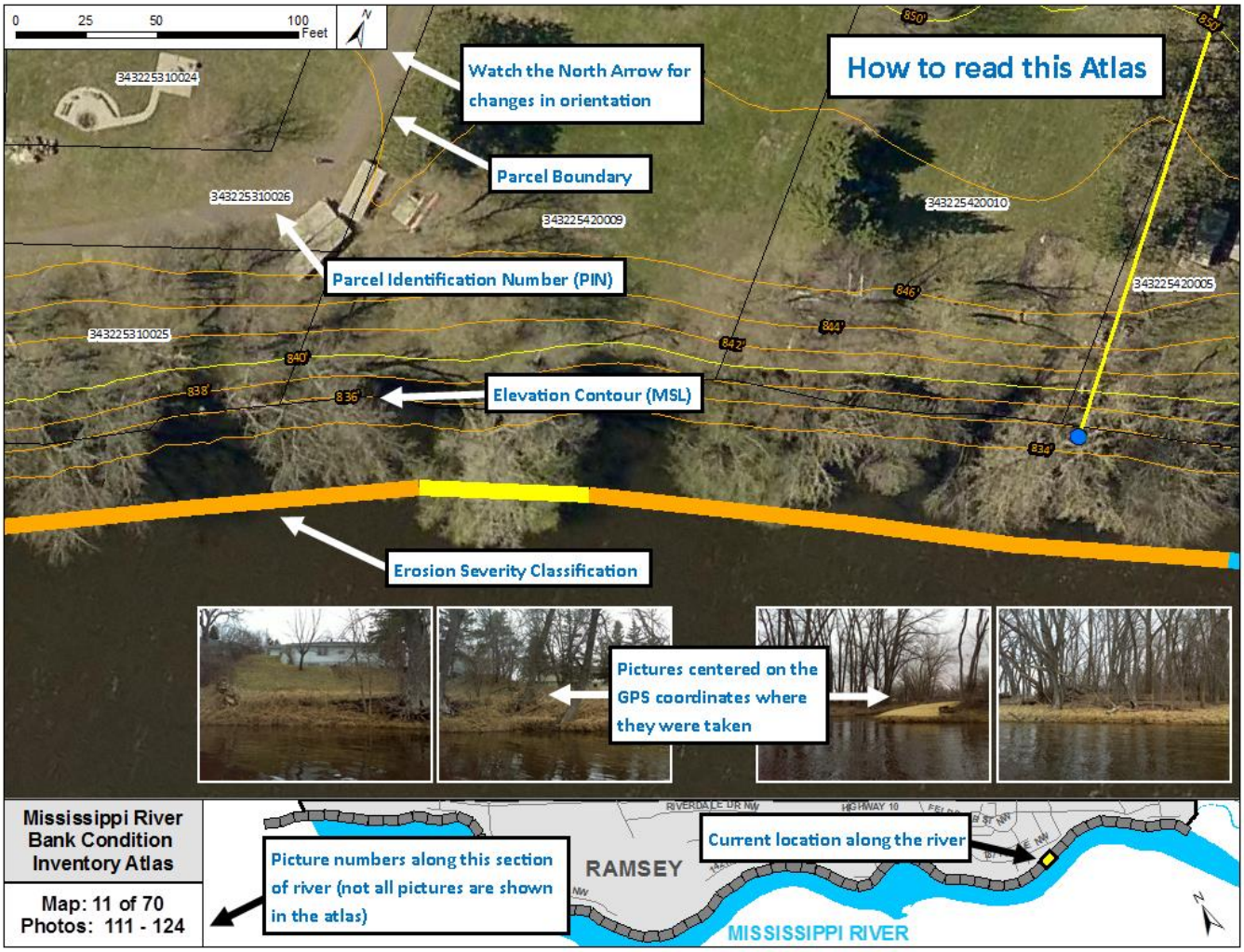
Description: This City of Ramsey contracted the Anoka Conservation District to complete an inventory of riverbank condition along the 5.8 miles of City that border the Mississippi River. The inventory will provide the city with a comprehensive record of riverbank condition. This inventory is structured as a report and atlas. The report will provide details on the methodology used to estimate bank erosion severity and provide insight and recommendations on stabilizing severely eroding sections of the riverbank. The atlas will provide a complete record of aerial photographs with corresponding erosions categories as well as key pictures collected during field work.

Location: City of Ramsey

Purpose: To gather information about current riverbank conditions in order to better address future concerns.

Results: Along the 5.8 miles of Mississippi Riverbank in Ramsey, ten stretches of severely eroding riverbank were identified, consisting of 39 properties. If stabilized sediment loading into the river would be reduced by by 5,148 tons per year. Other less severely eroding areas were also documented. A separate report is available.

Example from Mississippi Riverbank Inventory report



Wetland Education Signs & Displays

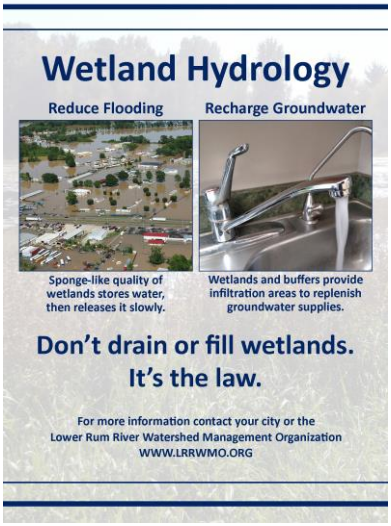
Description: Two separate projects were completed to increase residents' awareness of the values of wetlands, wetland protection laws, and voluntary actions that can be taken to protect wetlands. The projects included trailside signage and a trade-show style display.

Purpose: To increase public awareness of wetland values, boundaries, best management practices and regulations.

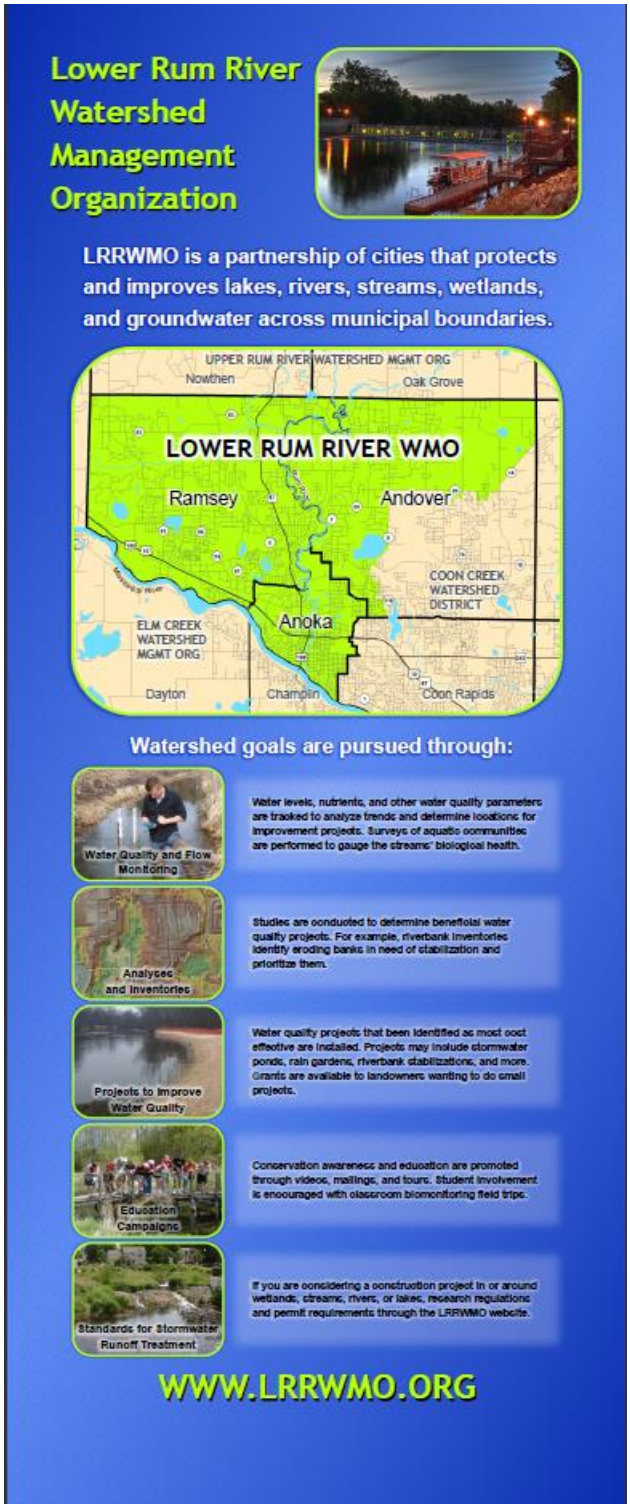
Results: Five signs were designed, printed and will be installed alongside walking trails in the Cities of Ramsey, Anoka and Andover. The signs are shown below and will be installed by city staff in spring 2016.

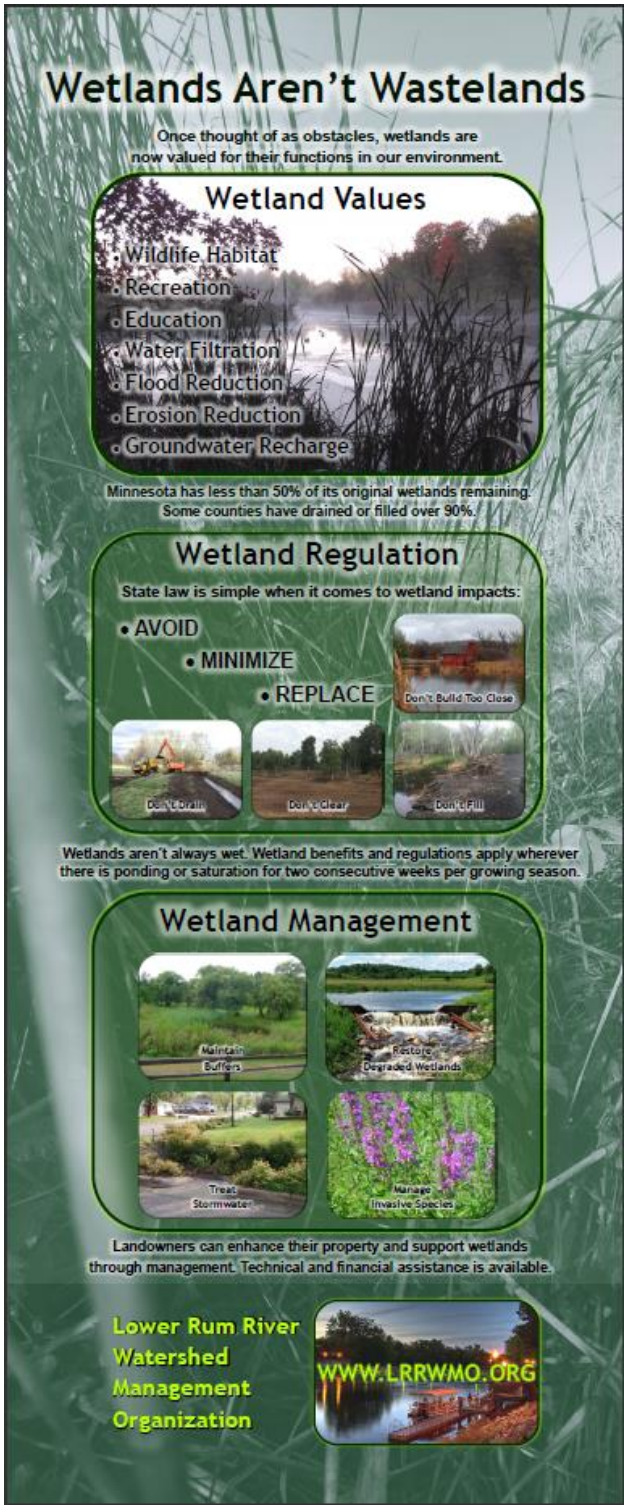
Two trade-show-style displays were designed and printed. One highlighted wetland values and protection. The second display was about the Lower Rum River WMO. Both displays are 33"x80" and will be used by the LRRWMO at local events and other environmental presentations.

Wetland education signs



Displays about Wetlands and the LRRWMO





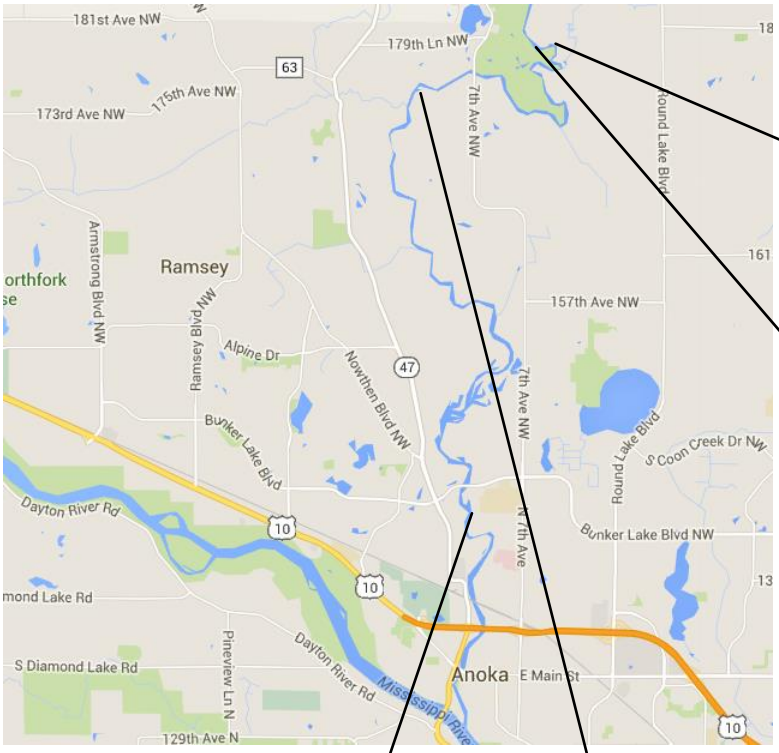
Rum River Stabilizations

Description: Four riverbank stabilization projects were installed on the Rum River in 2015 in partnership with the Lessard-Sams Outdoor Heritage Council, the Anoka County Parks Department, and Conservation Corps Minnesota. A combination of hard armoring (riprap and Flexamat), regrading, native vegetation, cedar tree revetment, and live willow staking were used to stabilize the severely eroding banks.

Location: Cedar Creek Conservation Area, Rum River Central Regional Park, near Anoka High School, and a residential property in Ramsey.

Purpose: To stabilize areas of riverbank with severe erosion and reduce the sediment loading in the Rum River.

Results: Stabilized a total of 1,150 linear feet of riverbank on the Rum River.



Anoka and Ramsey Stormwater Retrofit Studies

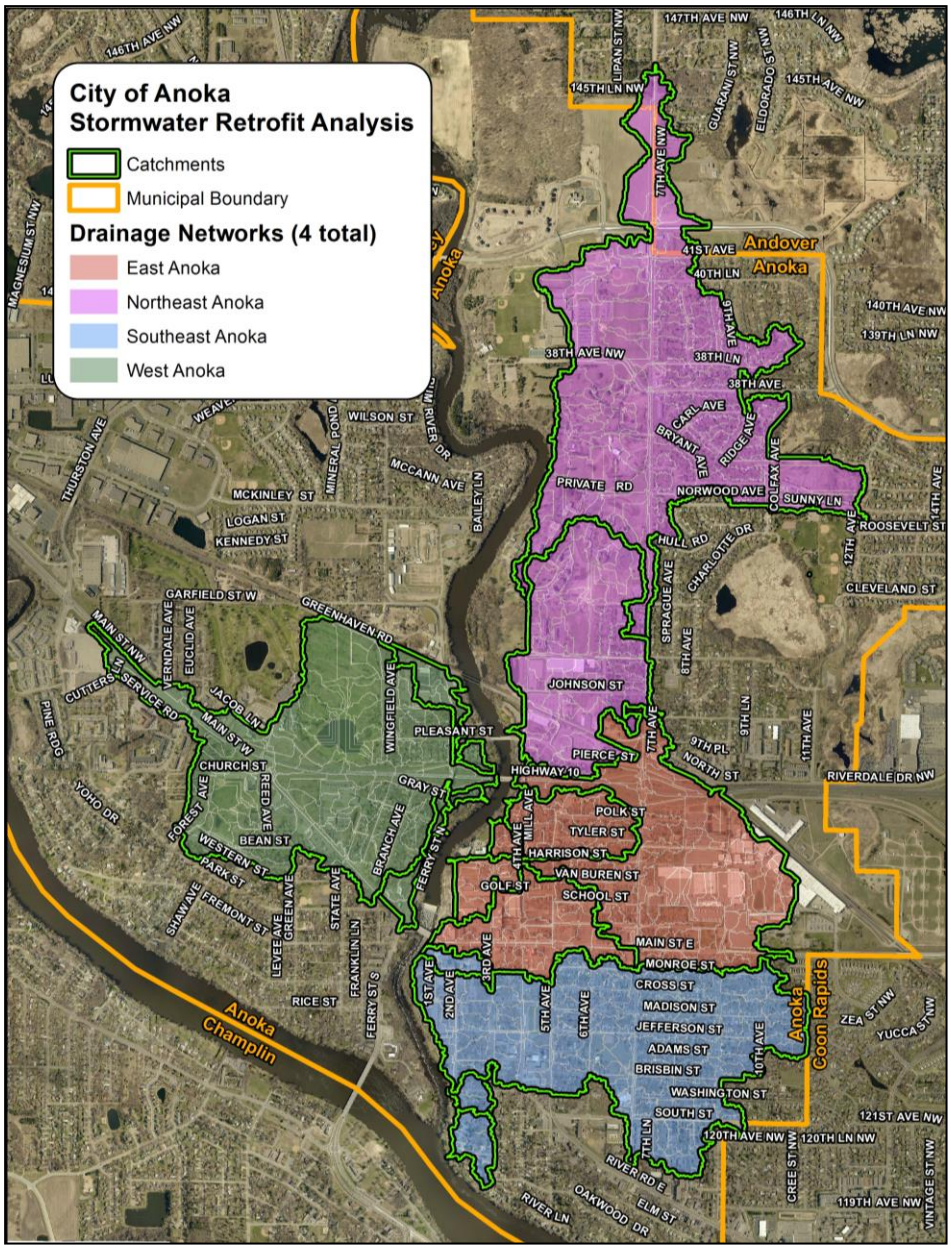
Description: Studies identify new stormwater treatment opportunities in neighborhoods identified by cities and rank those potential projects by cost effectiveness (amount of pollutant kept out of area rivers per dollar spent). The studies provide sufficient detail for pursuit of funds to install the most cost effective projects. The studies are conducted in areas with little or no stormwater treatment, which are often older neighborhoods.

Location: Selected areas in the Cities of Ramsey and Anoka.

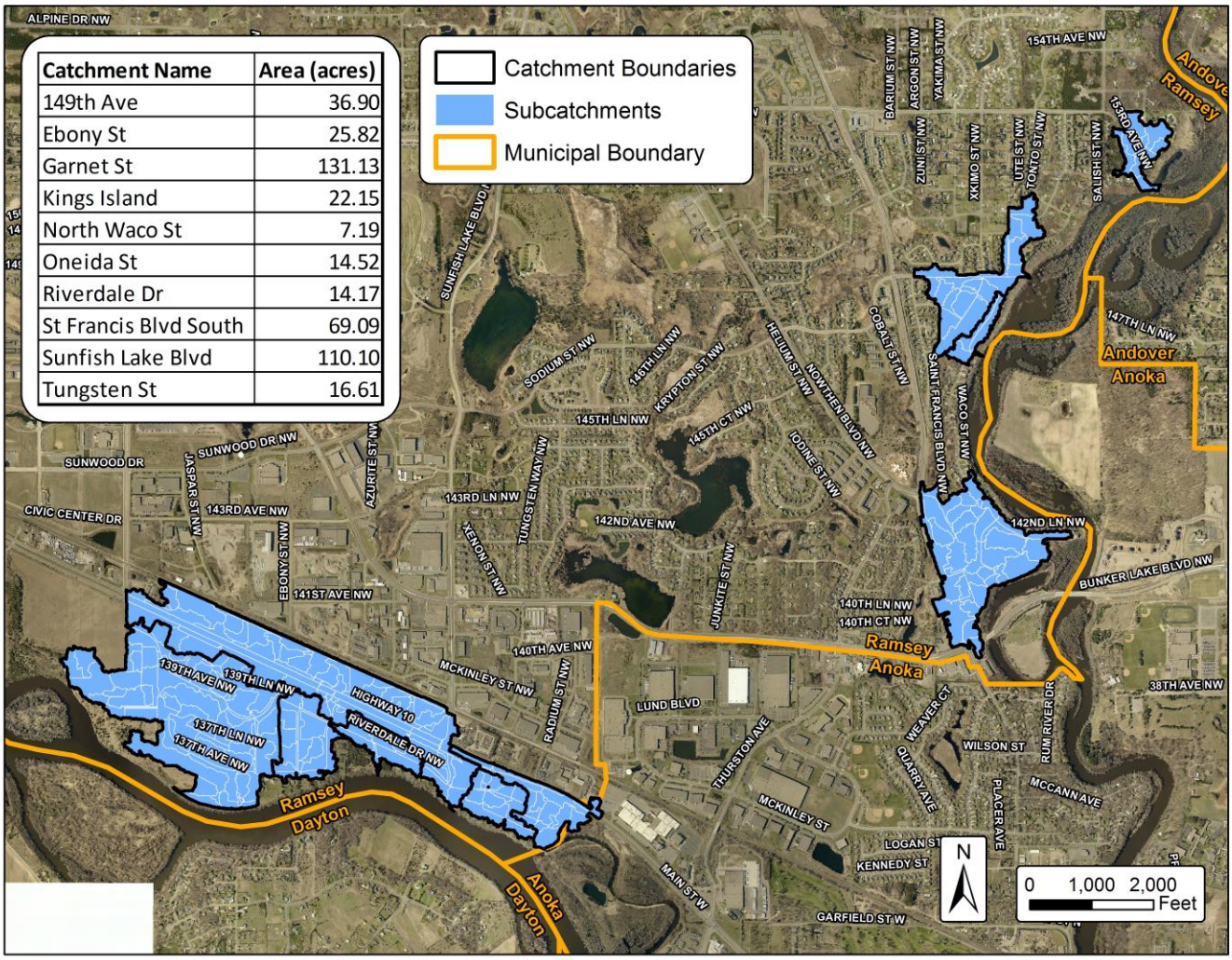
Purpose: To improve water quality in the Rum and Mississippi Rivers.

Results: Work began in 2015 and will be completed in 2016. Maps of the study areas are provided below.

City of Anoka Stormwater Retrofit Study Area



City of Ramsey Stormwater Retrofit Study Area



Newsletters

Description: The Lower Rum River Watershed Management Organization (LRRWMO) contracted the Anoka Conservation District (ACD) to create a series of public education newsletter articles. The LRRWMO is required to publish an annual newsletter under State Rules.

Purpose: To improve public understanding of the LRRWMO, its functions, and accomplishments.

Location: Watershed-wide

Results: The Anoka Conservation District (ACD) drafted two newsletters and sent them to cities for inclusion in their newsletters.

Both 2015 newsletters focused on public education regarding wetlands. One articles included information what homeowners can do to help wetlands on their property. The other focused on wetland regulation and the new "wetland" section on the ACD website.

2015 Newsletter Articles

Be Good To Your Wetland

23% of southwestern Anoka County is water or wetland. Development within our city has wound its way around these wetlands, creating quaint, private neighborhoods. We've protected these ecologically important areas. Now, the condition of these wetlands is in the hands residents, each of whom may own only a small portion.

Each homeowner can do a few simple things to be good to their wetland.

- **Leave an unmowed buffer**. The edge of a wetland is particularly valuable habitat. Leave a 20 foot unmowed strip.
- **Plant natives**. Native plants are those to which native wildlife is adapted. There are several native plant nurseries in our area.
- **Plant for pollinators**. Bees and other pollinators are on the decline. Treat yourself to some color, and treat the pollinators to some habitat by planting native flowers.

The collective actions of homeowners make a difference for wildlife and clean water.

A message from the Lower Rum River Watershed Management Organization www.LRRWMO.org

Wetland Law Made Clearer

Digging ponds, filling in low areas, and removing cattails. All are regulated under complex wetland laws leaving landowners wondering, "can I do that on my property?" A new web tool is available to provide direct answers in one place.

With support from the Lower Rum River Watershed Management, the Anoka Conservation District has added a new "wetlands" section to their website. The website includes a summary of wetland rules, answers to frequently asked questions, a map with permitting contact information and a way to request advice without going through a permitting process.

Three sets of wetland law apply in Minnesota. First is the MN Wetland Conservation Act which applies to all wetlands. Second are DNR rules which apply only to larger, generally open water, "public waters." Third is the Army Corps of Engineers rules which apply to "navigable waters of the US" which can include smaller wetlands that seem "un-navigable" in common language. All apply regardless of whether the property is private or public.

Go to **www.AnokaSWCD.org** and click the "Wetlands" tab before beginning a project in or near low areas. And remember…even an area that is dry today, or even most of the time, may legally be a wetland.

A message from the Lower Rum River Watershed Management Organization www.LRRWMO.org

LRRWMO Website

Description: The Lower Rum River Watershed Management Organization (LRRWMO) contracted the Anoka Conservation District (ACD) to design and maintain a website about the LRRWMO and the Lower Rum River watershed. The website has been in operation since 2003.

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

Location: LRRWMO.org

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

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

LRRWMO Website Homepage

Financial Summary

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

Lower Rum River Watershed Financial Summary

Lower Rum River Watershed	WMO Asst (no charge)	Volunteer Precip	Reference Wetlands	Ob Well	Lake Level	Stream Water Quality	Student Biomonitoring	LRRWMO Admin	City Water Plan Reviews for WMOs	WMO Annual Rpts to State	LRRWMO Outreach/Promo	URRWMO Outreach/Promo	WMO Website Maintenance	Anoka Nat. Pres. Restoration	Rum River Stabilization	BMP Maintenance	Mississippi Riverbank Inventory - Ramsey	Shoreland NRBG	Rum River WRAPP	Anoka SRA (Rum River WRAPP)	Ramsey SRA (Rum River WRAPP)	Project Hours	Total
Revenues																							
LRRWMO	0	0	1725	0	1000	2240	825	0	2000	850	12700	0	585	0	0	0	0	0	0	0	0	534	22459
State	0	0	0	320	0	0	0	0	0	0	0	0	0	0	110000	0	0	0	38373	4289	3486	0	156468
Anoka Conservation District	0	0	88	0	0	0	0	70	331	0	0	0	0	0	0	0	0	0	0	0	0	0	489
Anoka Co. General Services	379	0	1176	0	0	0	0	0	0	0	0	0	0	1567	0	2481	0	0	853	45	61	0	6561
County Ag Preserves/Projects	0	0	0	0	0	0	384	0	0	0	0	0	0	0	69549	0	0	0	0	0	0	9325	79258
Regional/Local	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Service Fees	0	0	46	0	0	0	0	0	0	0	0	0	0	0	0	0	2873	0	0	0	0	3540	6459
BWSR Cons Delivery	0	0	0	0	271	0	46	1153	0	0	0	0	0	0	1363	0	0	0	0	0	0	0	2834
BWSR Cost Share TA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2555	0	0	0	0	0	0	0	2555
Local Water Planning	0	166	852	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1018
TOTAL	379	166	3887	320	1271	2240	1255	1223	2331	850	12700	0	585	1567	183467	2481	2873	0	39226	4334	3547	13398	278100
Expenses-																							
Capital Outlay/Equip	3	1	1110	3	11	10	11	11	20	1	72	0	3	14	163	21	25	0	52	37	31	101	1700
Personnel Salaries/Benefits	333	146	2378	282	1113	1035	1105	1077	2052	134	7365	0	275	1379	16652	2181	2529	0	5309	3815	3122	10354	62635
Overhead	21	9	152	18	71	66	71	69	131	9	472	0	18	88	1067	140	162	0	340	244	200	663	4012
Employee Training	2	1	15	2	7	7	7	7	13	1	47	0	2	9	106	14	16	0	34	24	20	66	399
Vehicle/Mileage	5	2	34	4	16	15	16	15	30	2	106	0	4	20	239	31	36	0	76	55	45	149	901
Rent	14	6	99	12	46	43	46	45	85	6	305	0	11	57	690	90	105	0	220	158	129	429	2596
Program Participants	0	0	0	0	0	0	0	0	0	0	0	0	0	0	122023	0	0	0	0	0	0	1635	123658
Program Supplies	0	0	99	0	7	492	0	0	0	0	649	0	0	0	42526	4	0	0	33195	0	0	0	76970
McKay Expenses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	379	166	3887	320	1271	1668	1255	1223	2331	152	9015	0	312	1567	183467	2481	2873	0	39226	4334	3547	13398	272871

Recommendations

- **Actively participate in the MPCA Rum River WRAPP (Watershed Restoration and Protection Plan) which will conclude in early 2017.** This WRAPP is an assessment of the entire Rum River watershed. This is an opportunity for the LRRWMO to prioritize and coordinate efforts with upstream entities and state agencies. TMDL studies for impaired waters, including Trott Brook, will be completed as part of this project.
- **Engage in the Upper Rum River WMO's watershed plan update** process in 2016.
- **Diagnose low dissolved oxygen in Trott Brook.** Diagnostic monitoring is complete and will be incorporated into the TMDL study for that stream. Local review is advised.
- **Install projects identified in the stormwater retrofitting studies for the Cities of Anoka and Ramsey.** These, which will be completed in 2016, will identify and rank projects that improve stormwater runoff before it is discharged to the Rum or Mississippi Rivers. The projects may be good candidates for State grants.
- **Implement water conservation measures** throughout the watershed and promote it metro-wide. Depletion of surficial water is a concern.
- **Continue lake level monitoring, especially on Round Lake** where residents have expressed concerns with levels. Other nearby lakes should be monitored for comparison and problems.