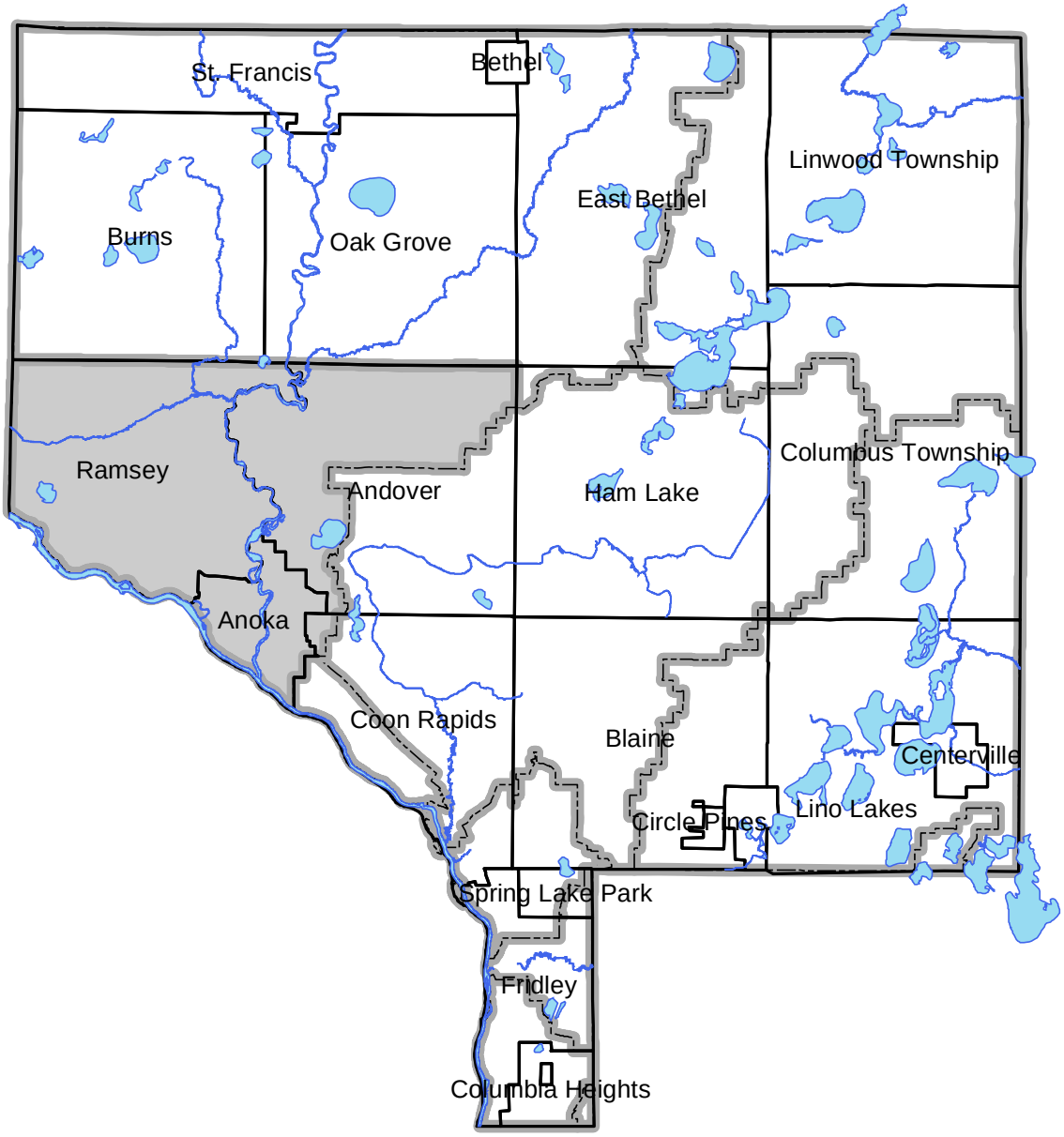
Excerpt from the
2012 Anoka Water Almanac

Chapter 4: Lower Rum River Watershed

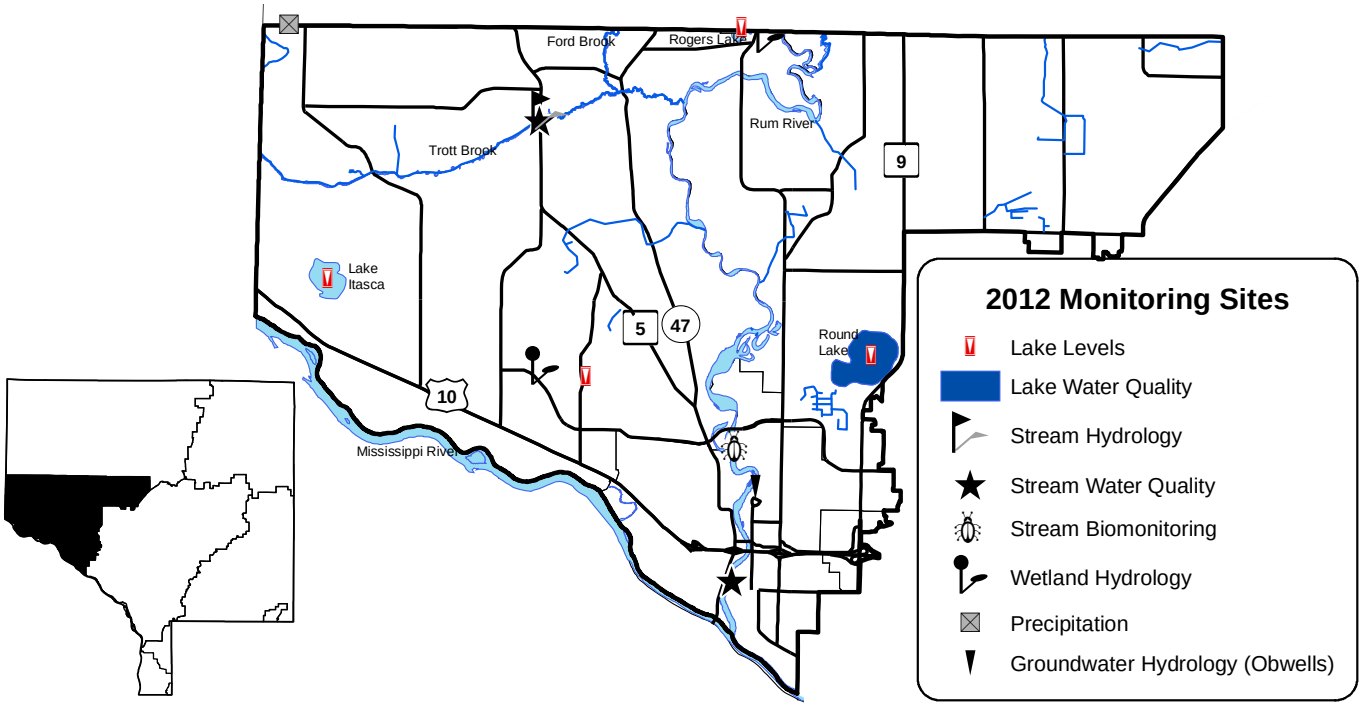


Prepared by the Anoka Conservation District

CHAPTER 4:
LOWER RUM RIVER WATERSHED

Task	Partners	Page
Lake Levels	LRRWMO, ACD, volunteers, MN DNR	4-106
Lake Water Quality	LRRWMO, ACD, ACAP	4-108
Stream Water Quality – Chemical	LRRWMO, ACD	4-112
Stream Water Quality – Biological	LRRWMO, ACD, ACAP, Anoka High School	4-119
Stream Hydrology	LRRWMO, ACD	4-122
Stream Rating Curves	LRRWMO, ACD	4-124
Wetland Hydrology	LRRWMO, ACD	4-125
Water Quality Grant Fund	LRRWMO, ACD, landowners	4-128
Public Education - Web Video	LRRWMO, ACD	4-129
Review Member Community Local Water Plans	LRRWMO, ACD	4-129
LRRWMO Website	LRRWMO, ACD	4-130
Financial Summary		4-131
Recommendations		4-131
Groundwater Hydrology (obwells)	ACD, MNDNR	Chapter 1
Precipitation	ACD, volunteers	Chapter 1

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



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.

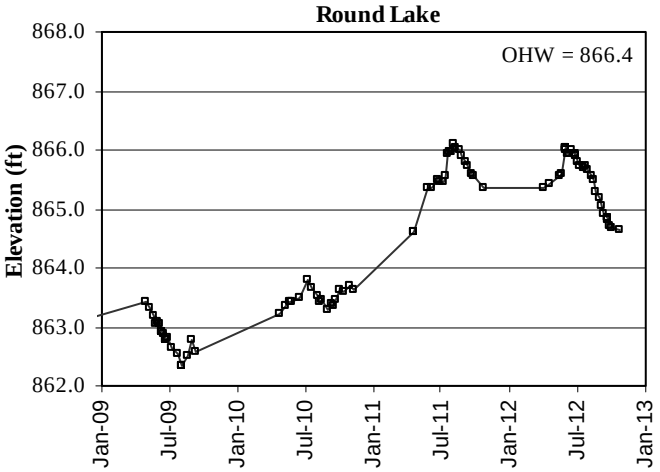
Locations: Itasca, Round, Rogers, and Sunfish/Grass Lakes

Results: Lake levels were measured by volunteers throughout the 2012 open water season. Lake gauges were installed and surveyed by the Anoka Conservation District and MN DNR. Lakes had sharply increasing water levels in spring and early summer 2012 when heavy rainfall totals occurred. Little rainfall fell later in the year and lake levels fell dramatically.

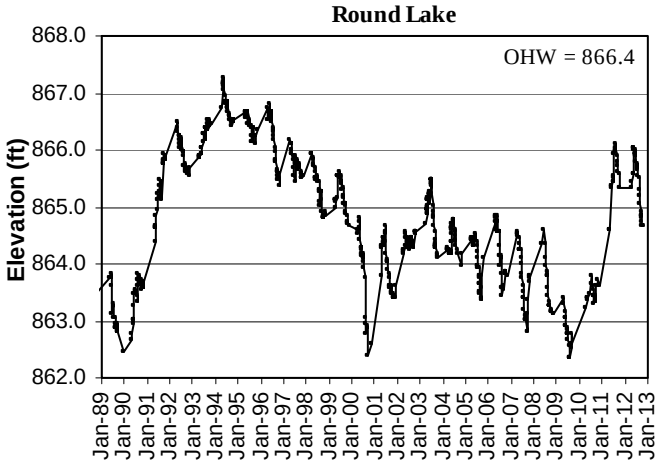
All lake level data can be downloaded from the MN DNR website's Lakefinder feature. Ordinary High Water Level (OHW), the elevation below which a DNR permit is needed to perform work, is listed for each lake on the corresponding graphs below.

In 2012 Sunfish/Grass Lake water levels were measured infrequently. The volunteer for this lake has been asked to take more readings in the future or provide notice that they cannot so another volunteer can be found.

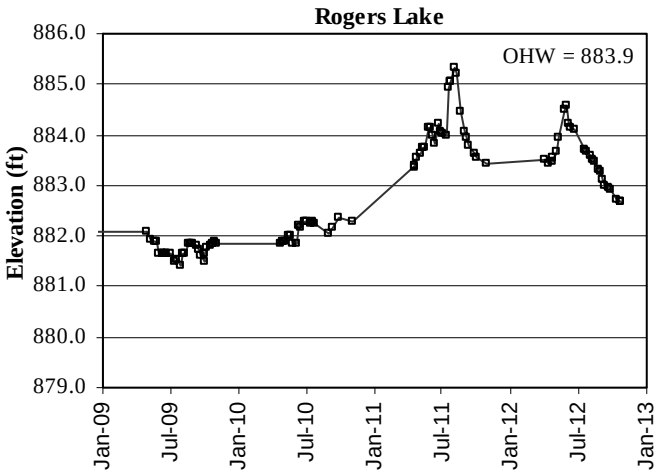
Round Lake Levels – last 5 years



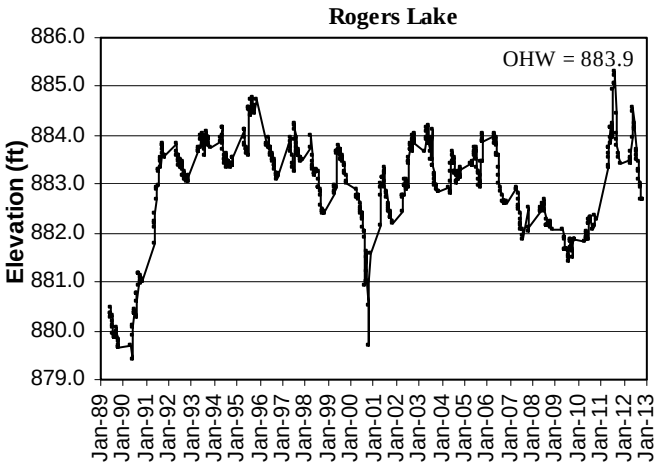
Round Lake Levels – last 24 years



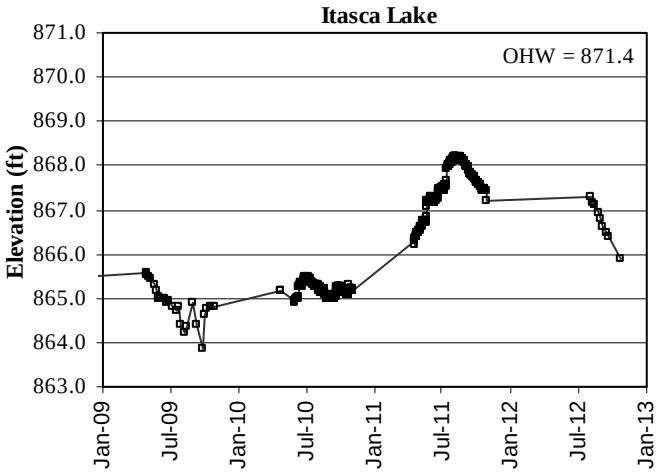
Rogers Lake Levels – last 5 years



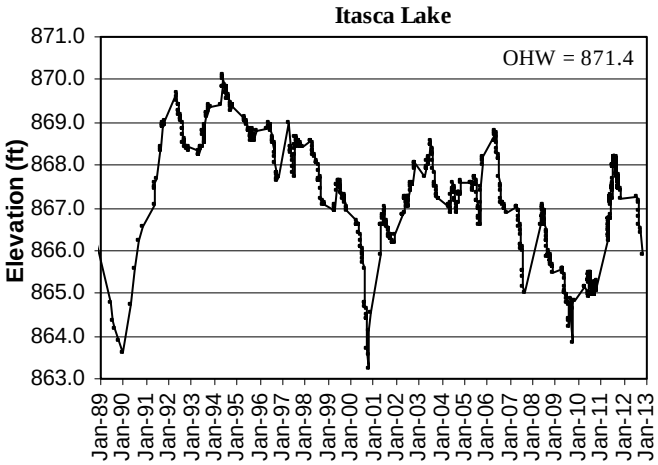
Rogers Lake Levels – last 24 years



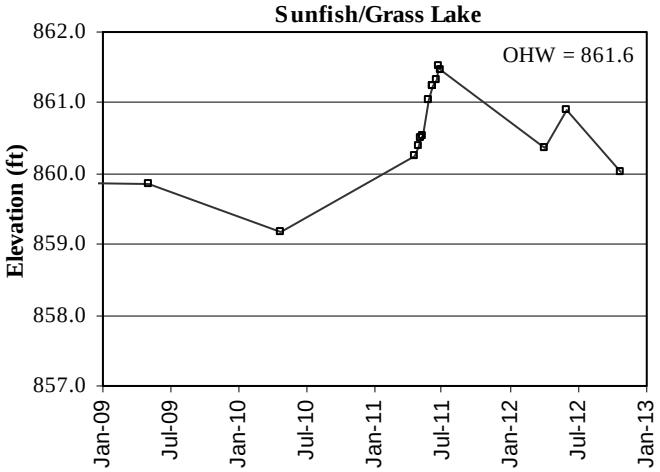
Itasca Lake Levels – last 5 years



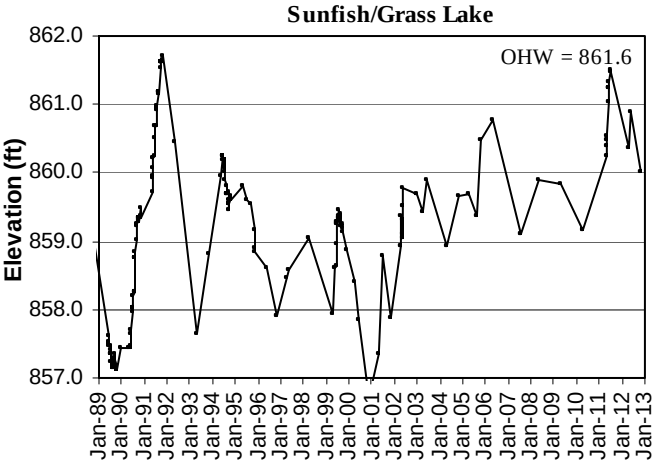
Itasca Lake Levels – last 24 years



Sunfish/Grass Lake Levels – last 5 years



Sunfish/Grass Lake Levels – last 24 years



Lake Water Quality

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

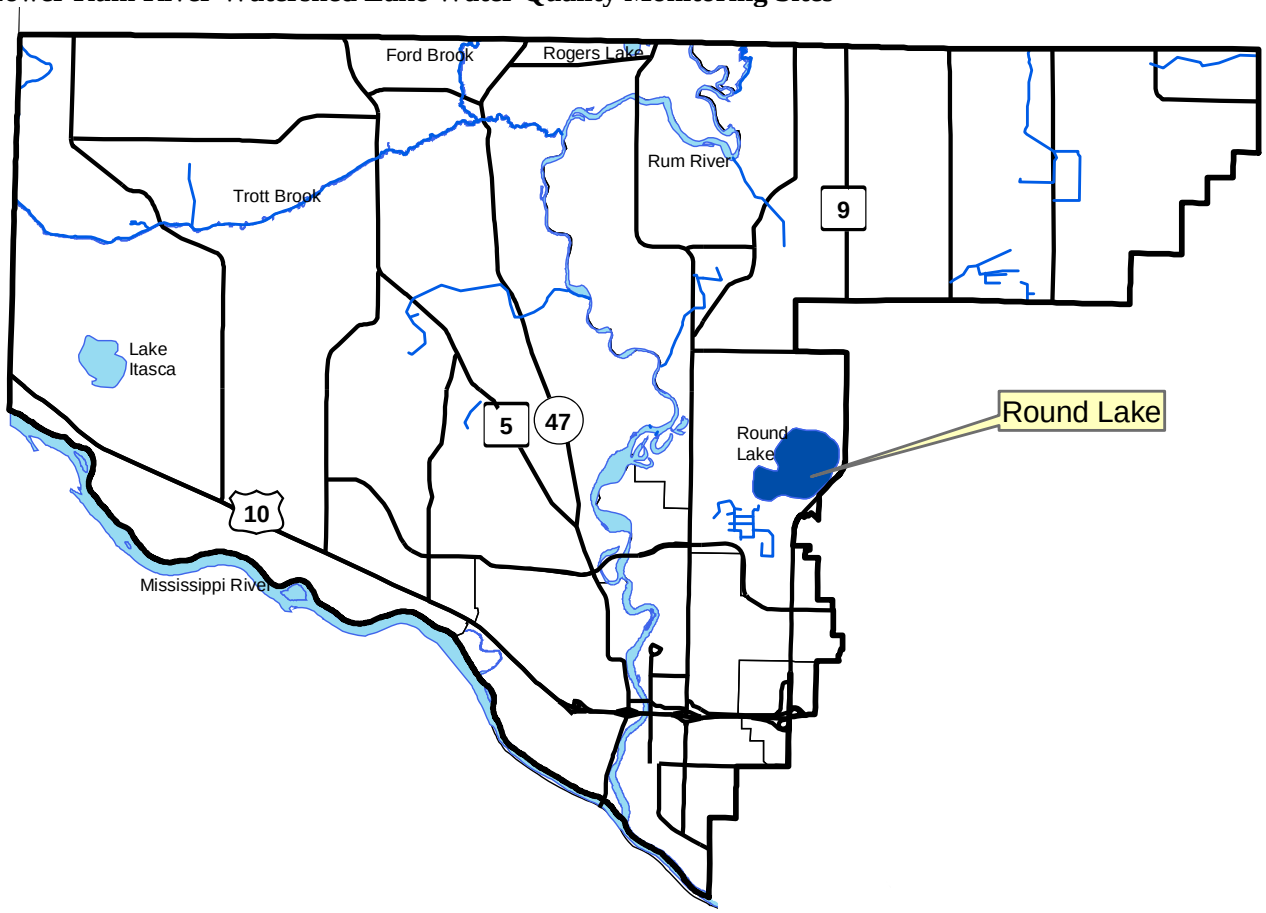
Purpose: To detect water quality trends and diagnose the cause of changes.

Locations: Round Lake

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

Originally, Sunfish/Grass Lake was also to be monitored in 2012. After discovery that the local community college was monitoring it was dropped.

Lower Rum River Watershed Lake Water Quality Monitoring Sites



Round Lake

City of Andover, Lake ID # 03-0089

Background

Round Lake is located in southwest Anoka County. It has a surface area of 220 acres and maximum depth of 19 feet, though the majority of the lake is less than 4 feet deep. The lake is surrounded by cattails and has submerged vegetation interspersed throughout the basin. This lake has a small watershed, with a watershed to surface area ratio of less than 10:1. Public access is from a dirt ramp on the lake's southeast side. Almost no boating and mostly wintertime fishing occurs. Wildlife, especially waterfowl, usage of the lake is relatively high.

2012 Results

In 2012 Round Lake's water quality was very good compared with other lakes in this region (NCHF Ecoregion) receiving an overall A letter grade. Average total phosphorus was the lowest on record (19.0 ug/L) and chlorophyll *a* was only slightly higher than the lowest recorded value from 2003. Secchi transparency was 11.4 feet, which is the best ever observed at this lake.

Phosphorus and algae was highest in early spring. The first water sample taken in mid-May had much higher levels of TP and chlorophyll *a* than subsequent samples. This could be the result of a very mild winter with little snow cover (more light penetration) and early ice out.

Trend Analysis

Nine years of water quality monitoring have been conducted by the Anoka Conservation District (1998-2000, 2003, 2005, 2007, and 2009-2010, 20012), which is a marginal number of years for a powerful statistical test of trend analysis. In 2010, the results of the analysis indicated a significant trend of declining water quality across the years studied (repeated measures MANOVA with response variables TP, Cl-a, and Secchi depth, $F_{2,5}$ = 9.6065, p = 0.0194). When the analysis is run to include the exceptional water quality observed in 2012 no significant water quality changes are apparent ($F_{2,6}$ = 0.66, p = 0.29).

Discussion

2012 was a welcome return to good water quality for Round Lake. There was growing concern about a trend toward poorer water quality. Phosphorus and chlorophyll-a had increased substantially in each of four monitored years from 2005-2009, and 2010 was similar to 2009. These were years of low lake levels. There was speculation that in-lake sources of nutrients, driven by sediment mixing, were a source of phosphorus. During low water there is more wind mixing because of shallow water depths, and in these years there was also a conspicuous reduction of chara (a plant-like algae) carpeting the bottom. In 2012 water levels recovered substantially in spring, chara was once again blanketing the lake bottom, and water quality was dramatically improved. It does seem that low water levels in Round Lake lead to poorer water quality. Additional monitoring in the future can help verify.

Since at least the 1980's there have been complaints about low water in Round Lake. The lake has few surface water in-flows, so groundwater is important to lake hydrology. There have been concerns that local surficial groundwater levels, and hence the lake, are negatively impacted by a variety of causes including irrigation, residential groundwater use, stormwater management, road embankments, and others. Each has been studied by groups including the MN DNR, Anoka Conservation District, Watershed Organizations, and City. None have been found to cause lower-than-expected lake levels. But there is evidence that Round Lake levels do behave differently from other nearby lakes. Moreover, studies by the Metropolitan Council and others have found regional surficial water tables are being drawn down by groundwater pumping thorughout the metro. Several lakes, including Round and Bunker Lakes are believed to be victims of this groundwater overuse.

Conservation of groundwater must become a regional and local priority, least there will be negative impacts on lakes. In fact many negative impacts are already being documented. At Round Lake, where water quality appears linked to water levels, this issue is very important.

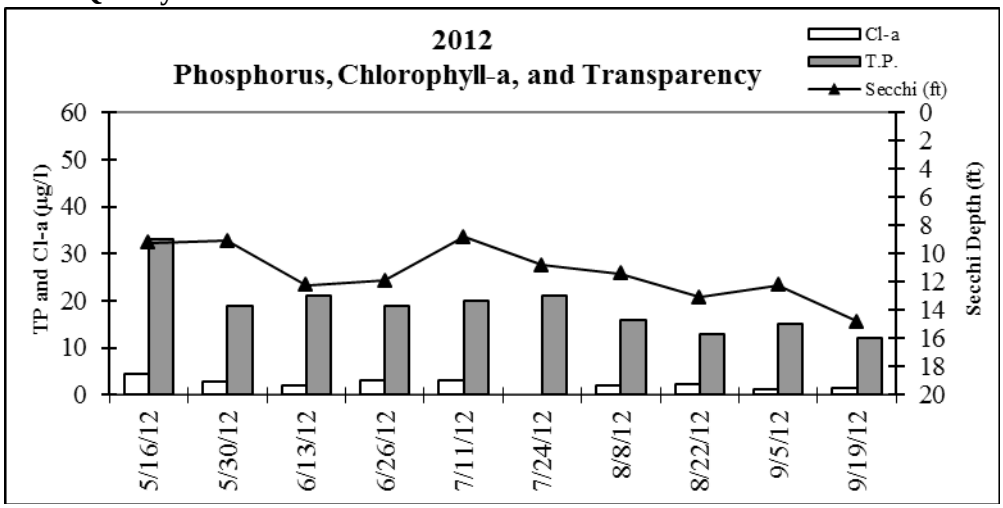
2012 Round Lake Water Quality Data

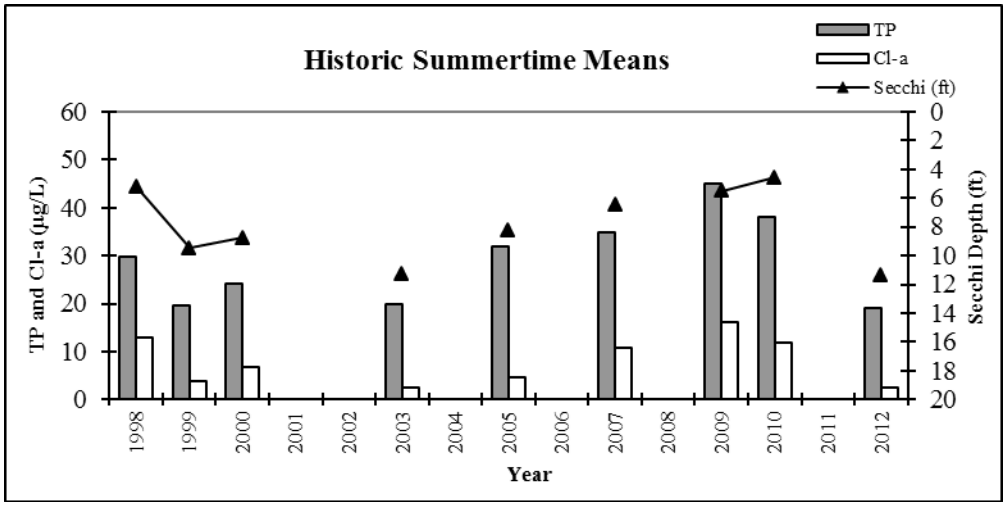
Round Lake
2012 Water Quality Data

		Date	5/16/2012	5/30/2012	6/13/2012	6/26/2012	7/11/2012	7/24/2012	8/8/2012	8/22/2012	9/5/2012	9/19/2012			
		Time	13:50	13:20	14:00	14:25	15:00	14:00	14:35	13:45	13:10	13:00			
	Units	R.L.*	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Average	Min	Max
pH		0.1	8.32	8.14	8.30	8.51	8.34	8.12	8.25	8.41	8.38	8.21	8.30	8.12	8.51
Conductivity	mS/cm	0.01	0.354	0.308	0.286	0.267	0.230	0.214	0.291	0.280	0.266	0.242	0.274	0.214	0.354
Turbidity	FNRU	1.0	3	2	1	4	4	1	1	2	2	1	2	1	4
D.O.	mg/L	0.01	9.60	8.88	10.48				9.06	10.96	8.80	8.69	9.50	8.69	10.96
D.O.	%	1.0	106	90	105				111	128	107	88	105	88	128
Temp.	°C	0.10	21.1	18.7	21.7	24.8	29.4	27.9	25.7	22.7	25.0	16.3	23.3	16.3	29.4
Temp.	°F	0.10	70.0	65.7	71.1	76.6	84.9	82.2	78.3	72.9	77.0	61.3	74.0	61.3	84.9
Salinity	%	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.00	0.01	0.00	0.01
Cl-a	µg/L	1.0	4.6	2.8	1.9	3.1	3.1	<1	2.1	2.2	1.1	1.5	2.5	1.1	4.6
T.P.	mg/L	0.005	0.033	0.019	0.021	0.019	0.020	0.021	0.016	0.013	0.015	0.012	0.019	0.012	0.033
T.P.	µg/L	5	33	19	21	19	20	21	16	13	15	12	19	12	33
Secchi	ft	0.1	9.2	9.1	12.2	11.9	8.8	10.8	11.4	13.1	12.2	14.8	11.4	8.8	14.8
Secchi	m	0.1	2.8	2.8	3.7	3.6	2.7	3.3	3.5	4.0	3.7	4.5	3.5	2.7	4.5
Physical			1	1.0	1.0	1.0	2.0	2.0	1.0	2.0	2.0	1.0	1.4	1.0	2.0
Recreational			1	1.0	1.0	1.0	2.0	1.0	1.0	1.0	2.0	1.0	1.2	1.0	2.0

*Reporting Limit

Round Lake Water Quality Results





Round Lake Summertime Historic Mean

Agency	ACD	ACD	ACD	ACD	ACD	ACD	ACD	ACD	ACD
Year	1998	1999	2000	2003	2005	2007	2009	2010	2012
TP (µg/L)	29.8	19.6	24.1	20.0	32.0	34.7	45.0	38.0	19.0
Cl-a (µg/L)	12.8	3.7	6.9	2.4	4.6	10.9	16.2	11.8	2.5
Secchi (m)	1.6	2.9	2.7	3.4	2.5	2.0	1.7	1.4	3.5
Secchi (ft)	5.2	9.5	8.8	11.3	8.3	6.5	5.5	4.6	11.4

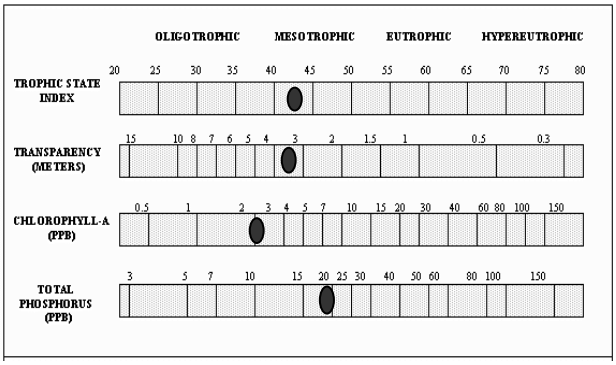
Carlson's Tropic State Indices

Year	1998	1999	2000	2003	2005	2007	2009	2010	2012
TSIP	53	47	50	47	54	55	59	57	47
TSIC	56	44	48	39	46	54	58	55	40
TSIS	55	45	46	42	47	50	52	55	42
TSI	55	45	48	43	49	53	56	56	43

Round Lake Water Quality Report Card

Year	1998	1999	2000	2003	2005	2007	2009	2010	2012
TP (µg/L)	B	A	B	A	B	C	C	C	A
Cl-a (µg/L)	B	A	A	A	A	B+	B	B	A
Secchi (m)	C	B	B	A	B	C	C	C	A-
Overall	**B**	**A**	**B**	**A**	**B**	**C**	**C**	**C**	**A**

Carlson's Trophic State Index



Stream Water Quality - Chemical Monitoring

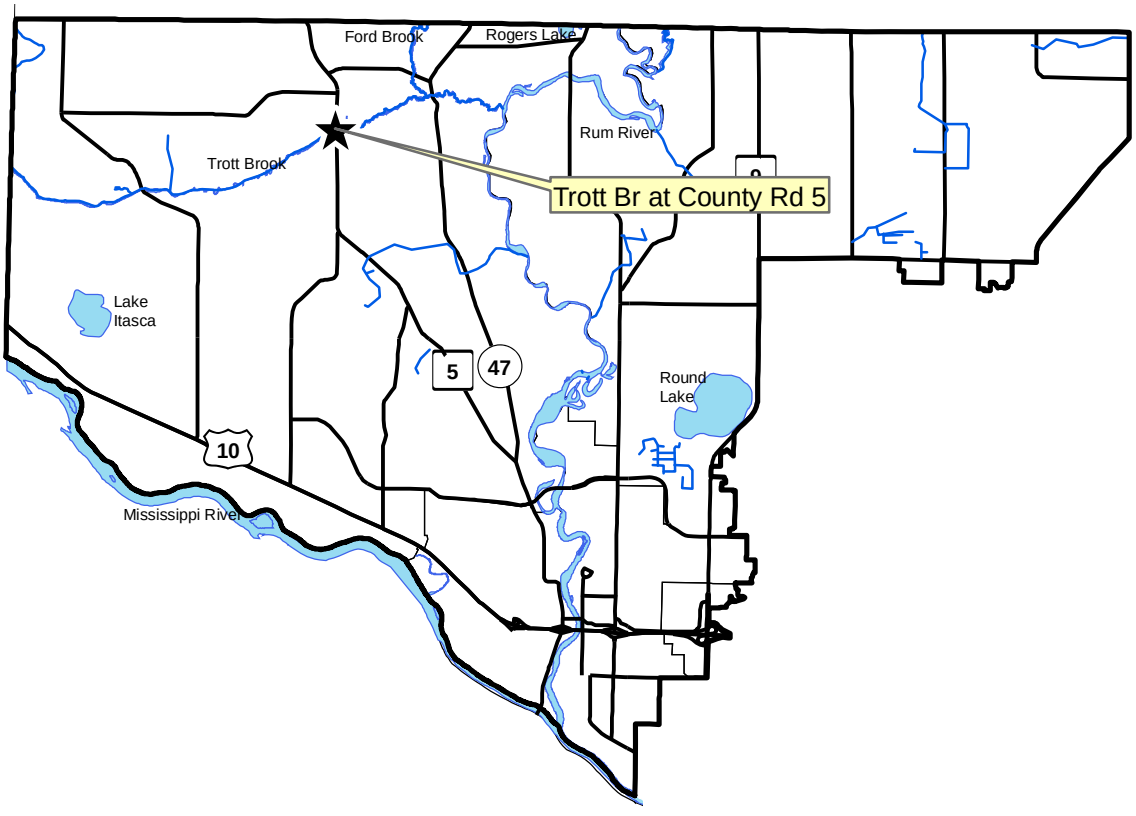
Description: The Rum River has been monitored simultaneously at three strategic locations in 2004, 2009, 2010, and 2011. The locations include the approximate top and bottom of the Upper and Lower Rum River Watershed Management Organizations. The two organizations share the middle location. The Metropolitan Council collects additional data at the farthest downstream location. Collectively, the data collected allow for an upstream to downstream water quality comparison within Anoka County, as well as within each watershed organization. While other Rum River monitoring has occurred, it is excluded from this report in order to include only data that were collected simultaneously for the greatest comparative value.

Purpose: To detect water quality trends and problems, and diagnose the source of problems.

Locations: Trott Brook at County Road 5

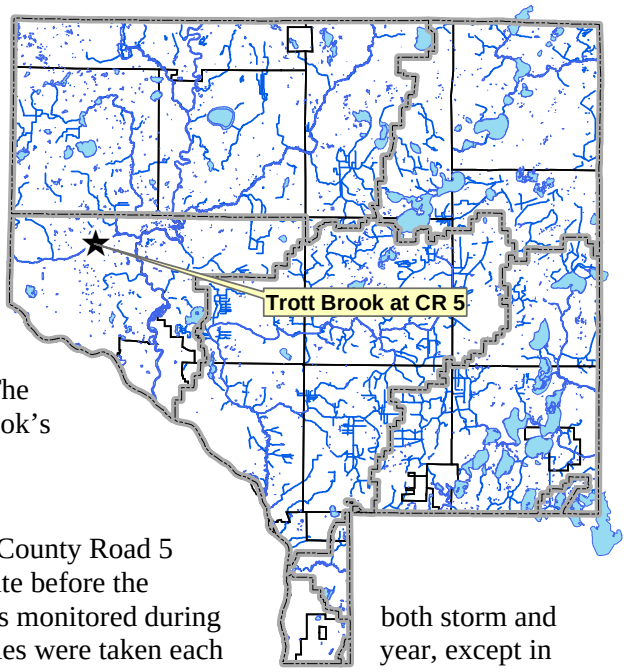
Results: Results are presented on the following pages.
Results from the Metropolitan Council's monitoring station on the Rum River at the Anoka Dam can be obtained from the Metropolitan Council (see http://www.metrocouncil.org/Environment/RiversLakes/).

2012 Rum River Monitoring Sites



TROTT BROOK

Trott Brook at Co. Rd. 5, Ramsey STORET SiteID = S003-176



Years Monitored

Trott at Co. Rd. 5 1998, 2003, 2006, 2012

Background

Trott Brook is a medium-sized creek that flows south through Sherburne County, paralleling the Anoka-Sherburne County boundary before turning east through the City of Ramsey where outlets to the Rum River. Overall, the watershed is rural or suburban residential, and areas within the watershed are undergoing rapid development. The creek is about 25 feet wide and 2.5 feet deep at the monitoring site during baseflow. The monitoring site is approximately one mile upstream of Trott Brook's confluence with Ford Brook.

Methods

In 1998, 2003, 2006 and 2012 monitoring was conducted at the County Road 5 crossing. This is the farthest-downstream, publicly-accessible site before the confluence with Ford Brook or the Rum River. The stream was monitored during both storm and baseflow conditions by grab samples. Eight water quality samples were taken each year, except in 1998 when only four samples were taken. Half of samples were 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, and chlorides. Lab analyses of sulfates and hardness were added in 2012 because these parameters can affect chloride toxicity. During every sampling the water level (stage) was recorded. Continuous water levels were also recorded throughout the 2012 open water season. In 2012 a rating curve was developed for the site, allowing flow to be calculated from the water levels.

All data from monitoring is held in the MN Pollution Control Agency's EQuIS database, which is available through their website. That raw data includes more information that is presented in this report, including the field crew's notes. The raw data is also available from the Anoka Conservation District.

Results and Discussion

Trott Brook water quality is generally good except for low dissovled oxygen. Summarized water quality results include:

- Dissolved pollutants, as measured by conductivity and chlorides, are within the typical range for streams in the area and well below the state chloride standard.
- Phosphorus was low during baseflow and higher during storms. Fourteen of 28 (50%) of samples exceeded 100 ug/L. All but one of these were during storms. Presently there is no state water quality standard for phosphorus in streams, however a standard around 100 ug/L is likely to be adopted soon. Trott Brook might exceed that new standard when it is adopted.
- Suspended solids and turbidity were low during all condtions.

- pH was within the range considered normal and healthy for streams in this area.
- Dissolved oxygen (DO) dips below the state water quality standard routinely. Over all conditions in the last 10 years, eight of 22 measurements (36%) were below the state water quality threshold of 5 mg/L. Based on this information, Trott Brook does not meet state water quality standards for dissolved oxygen, however the state has not yet listed it as such. Additional monitoring with deployable equipment that records around-the-clock DO levels would be the next step to verify this condition.

In 2013-14 the MPCA and local partners will be doing additional monitoring as part of the Rum River Watershed Restoration and Protection Plan project. That monitoring will include the parameters discussed in this report, several other chemcial parameters, and fish and/or invertebrates. If Trott Brook if found to be impaired for any parameter at that time a Total Maximum Daily Load (TMDL) study will be completed. That study will determine pollutant reductions needed to meet water quality standards and likely means to meet those reductions. An implementation plan will be prepared to identify projects to address the water quality problems. It will largely fall to local entities, such as the Anoka Conservation District and Lower Rum River WMO, to install these projects.

Conductivity and chlorides

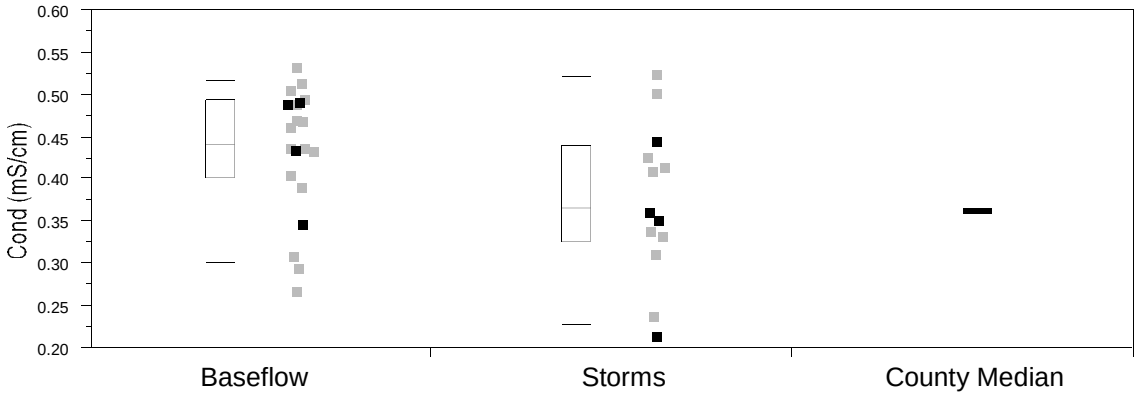
Conductivity and chlorides are measures of dissolved pollutants. Dissolved pollutant sources include urban road runoff, industrial chemicals, and others. Metals, hydrocarbons, road salts, and others are often of concern in a suburban environment. Conductivity is the broadest measure of dissolved pollutants we used. It measures electrical conductivity of the water; pure water with no dissolved constituents has zero conductivity. Chlorides is a test for chloride salts, the most common of which are road de-icing chemicals. Chlorides can also be present in other pollutant sources, such as wastewater. Dissolved 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 Trott Brook is upstream from the Twin Cities drinking water intakes on the Mississippi River.

Conductivity and chlorides in Trott Brook are within the acceptable range, and similar to other nearby streams. The median for both parameters is nearly identical for the median of all monitored streams in Anoka County. The median conductivity for Trott Brook was 0.440 mS/cm; for all streams in Anoka County it is 0.362 mS/cm. The median chlorides for Trott Brook was 19 mg/L; for all streams in Anoka County it is 17 mg/L. The highest observed chloride concentration was 30 mg/L, though higher levels may have occurred during snowmelts which were not monitored. The levels observed are much lower than the Minnesota Pollution Control Agency's (MPCA) chronic standard for aquatic life of 230 mg/L.

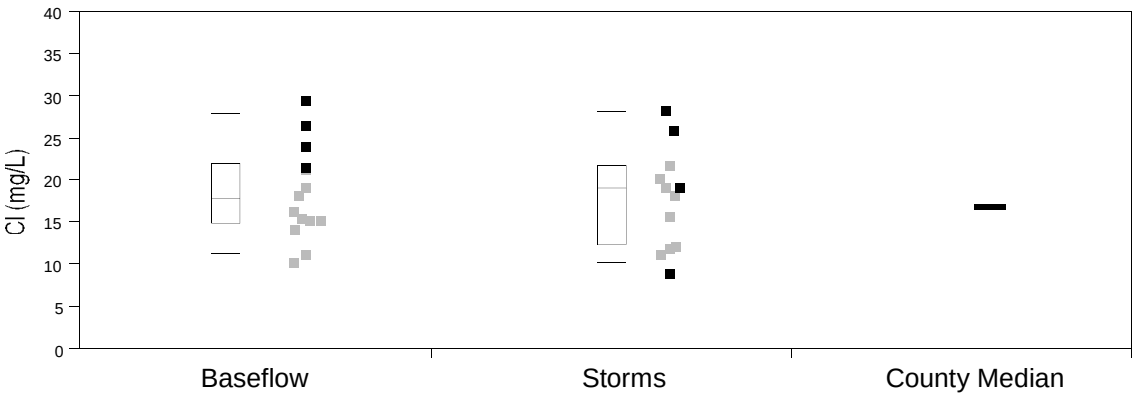
Conductivity and chlorides were similar during storms and baseflow. If runoff were the only source, we would expect these parameters to be highest during storms. An well-documented reason dissolved pollutants are elevated during baseflow too is because of road deicing salt infiltration into the shallow groundwater.

Hardness and sulfate in the water affect the toxicity of chlorides so these parameters were measured in 2012. The State of Iowa has developed equations to adjust the maximum allowable chlorides based upon sulfates and hardness. Minnesota is considering the same approach. Because Trott Brook chlorides are far lower than state standards, the effect of sulfates and hardness is of minimal interst and not investigated.

Conductivity during baseflow and storm conditions Black squares are individual readings from 2012. Grey squares are individual readings from previous years. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



Chloride during baseflow and storm conditions Black squares are individual readings from 2012. Grey squares are individual readings from previous years. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).

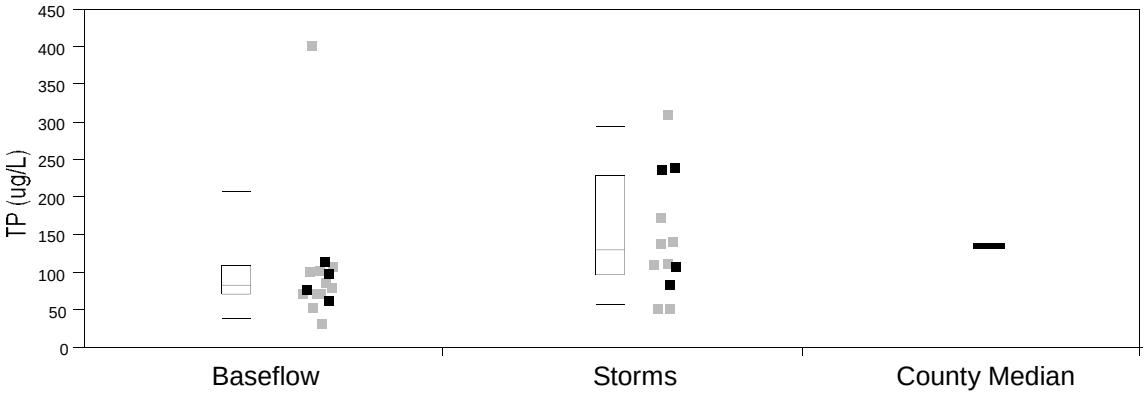


Total Phosphorus

Total phosphorus , a 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.

Total phosphorus concentrations in Trott Brook were acceptable during baseflow but more variable and sometimes high during storms. The median phosphorus for Anoka County streams is 135 *u*g/L. There is no state water quality standard for this parameter in streams, however one is likely to be adpoted soon at around 130 *u*g/L. In Trott Brook the median phosphorus during baseflow was 84 *ug/L*, which is desirable. The median phoshorus during storms was 131 *u*g/L but ranged from 56 *u*g/L to 316 *u*g/L. Across all samples, seven of 28 (25%) of measurements were greater than 130 *u*g/L; all but one were during storms. In all, phosphorus in Trott Brook is flirting with unacceptably high levels and should be an area of pollution control effort as the watershed urbanizes.

Total phosphorus during baseflow and storm conditions Black squares are individual readings from 2012. Grey squares are individual readings from previous years. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



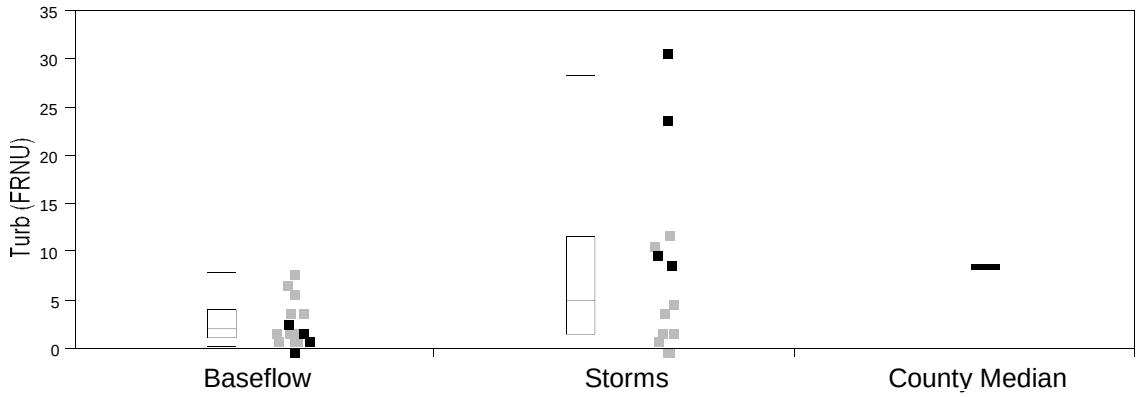
Turbidity and Total Suspended Solids (TSS)

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 is measured by filtering solids from a water sample and weighing the filtered material. The amount of suspended material is important because it affects transparency and aquatic life, and because many other pollutants are attached to particles. Many stormwater treatment practices such as street sweeping, sumps, and stormwater settling ponds target sediment and attached pollutants.

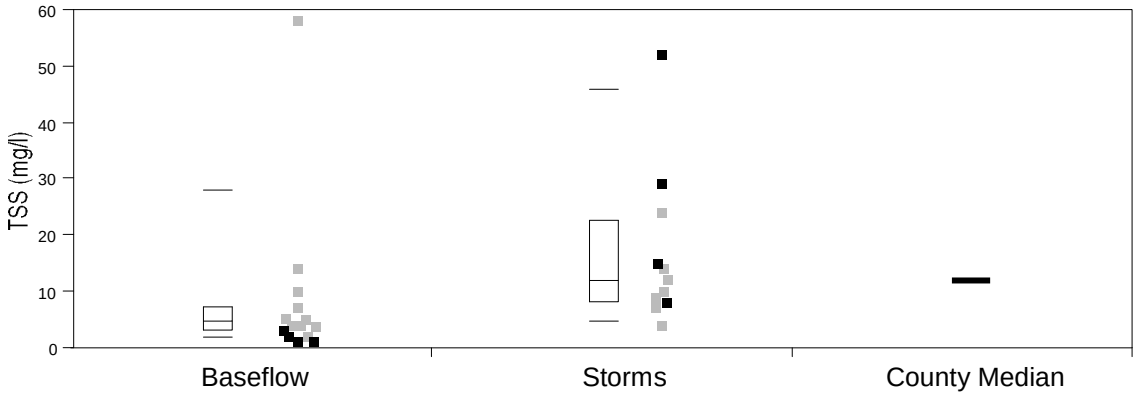
Turbidity in Trott Brook is acceptably low. The current state water quality threshold for turbidity is 25 NTU. If a stream exceeds this value on three occassions and at least 10% of all sampling events, then it is declared impaired for turbidity (20 sample minimum). Trott Brook turibity exceeded 25 NTU only once of 33 measurements. Tubidity was higher during storms (median 5 NTU, range 0-31) than during baseflow (median 2 NTU, range 0-8).

Total suspended solids (TSS) are also acceptably low in Trott Brook. Presently TSS is only used in state water quality standards as a surrogate for turbidity when little turbidity data exists. The threshold is 100 mg/L. In the future the MPCA plans to switch to using TSS for the water quality standard. In Trott Brook the median of all TSS measurements was only 7 mg/L. During baseflow (median 5 mg/L) TSS was lower than during storms (median 12 mg/L). The maximum observed during any conditions was 59 mg/L.

Turbidity during baseflow and storm conditions Black squares are individual readings from 2012. Grey squares are individual readings from previous years. 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 Black squares are individual readings from 2012. Grey squares are individual readings from previous years. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



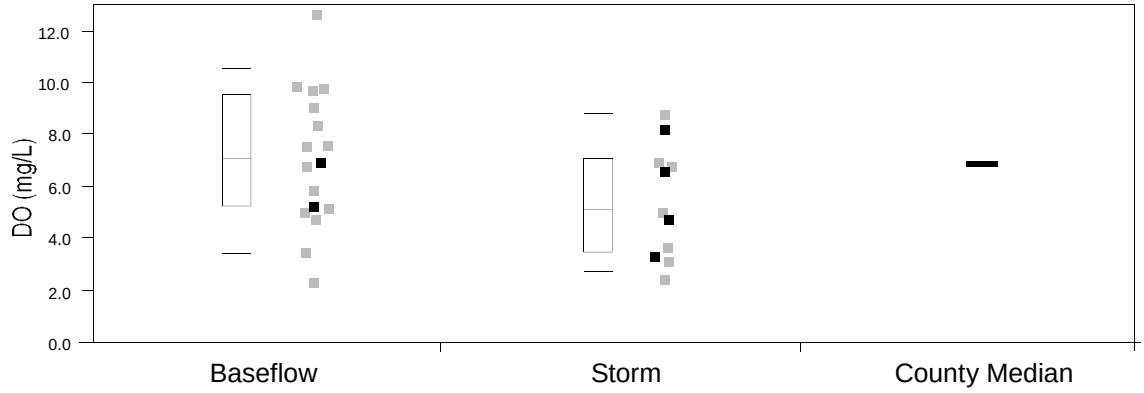
Dissolved Oxygen

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, therefore the state water quality standard is a daily minimum of 5 mg/L. The stream is 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 Trott Brook dissolved oxygen (DO) dips below the state water quality standard routinely. The median DO during baseflow was 7.16 mg/L but during storms was just 5.19 mg/L. Readings below 5 mg/L were observed in all of the four monitored years except 1998. In 1998 the lowest observed DO was 5.36 mg/L. Over all conditions in the last 10 years, eight of 22 measurements (36%) were below 5 mg/L. Based on this information, Trott Brook does not meet state water quality standards for dissolved oxygen although it has not yet been declared "impaired." Additional monitoring with deployable equipment that record aroun-the-clock DO levels would be the next step to verify this condition.

The most common reason for low oxygen is high levels of organic material. Decomposition of these materials consumes oxygen. Trott Brook and its ditch tributaries flow through expanses of wetland where organic soils dominate. Decomposition in those wetlands could contribute to the low stream DO. The relatively low suspended solids and phosphorus in the stream suggest that direct discharges of organic materials into the stream are not a significant cause of low DO.

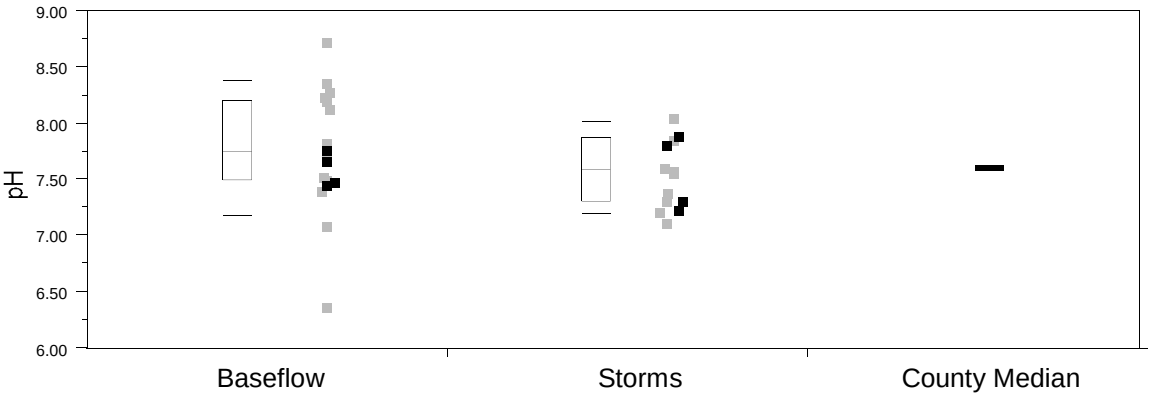
Dissolved oxygen during baseflow and storm conditions Black squares are individual readings from 2012. Grey squares are individual readings from previous years. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



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. All pH measurements at Trott Brook have been within this range. No concerns have been noted.

pH during baseflow and storm conditions Black squares are individual readings from 2012. Grey squares are individual readings from previous years. 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 – 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.

Locations: 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

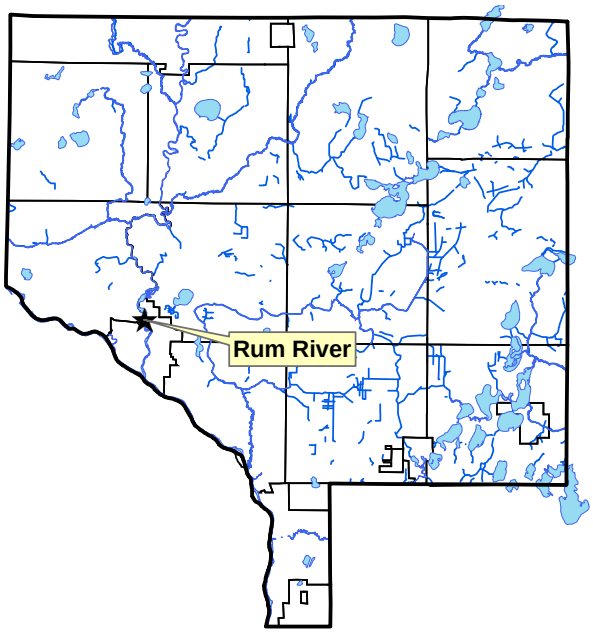
By Anoka High School in 2012

Monitored Since

2001

Student Involvement

70 students in 2012, approximately 480 since 2001



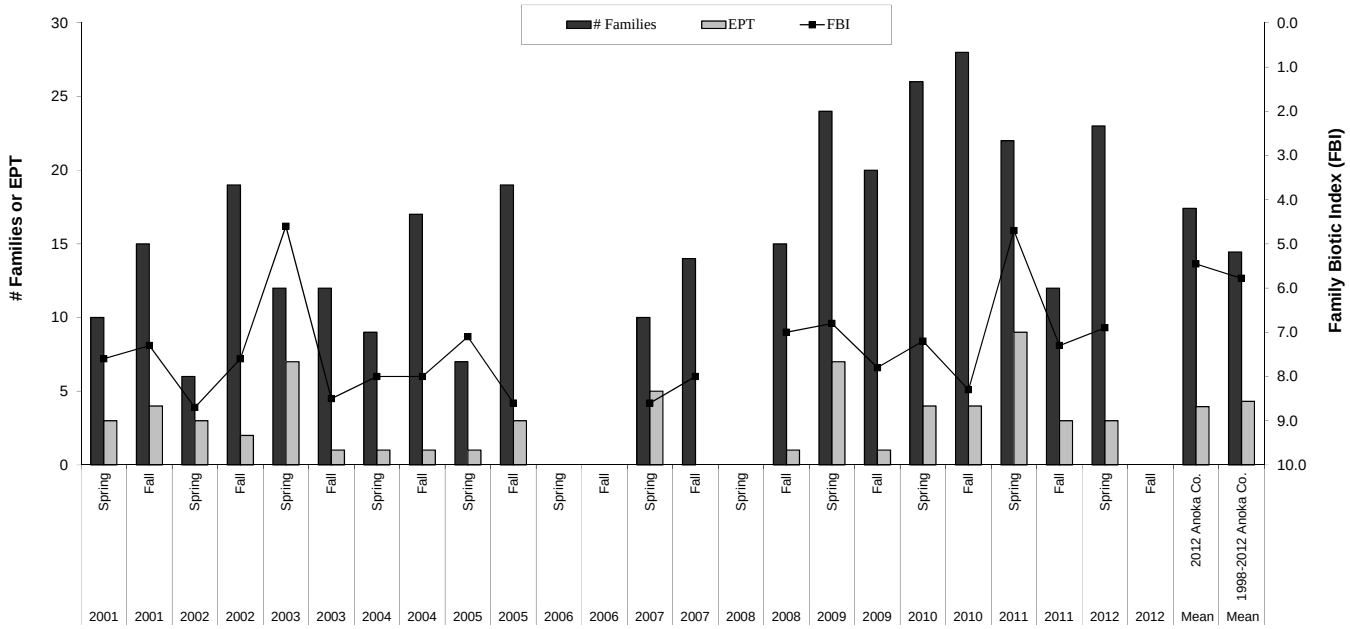
Background

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 is not conducted in a backwater rather than the main channel.

Results

The results for spring 2012 were within the range experienced in previous years. More families were found than the average in Anoka County streams. This should be expected as most other sites are small streams and this is a river. The number of sensitive EPT families and the FBI score were poorer than the county average. Taken together, the invertebrate data indicates poorer river health than is desirable. A complicating factor is that sampling was in backwaters rather than the main channel, and a poorer invertebrate community would be expected there.

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	2008	2009	2009	2010	2010	2011	2011	2012	Mean	Mean
Season	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	2012 Anoka Co.	1998-2012 Anoka Co.
FBI	7.00	6.80	7.80	7.20	8.30	4.70	7.30	6.90	5.5	5.8
# Families	15	24	20	26	28	22	12	23	17.4	14.5
EPT	1	7	1	4	4	9	3	3	4.0	4.3
Date	13-Oct	8-May	28-Sep	18-May	7-Oct	10-Jun	5-Oct	8-May		
Sampled By	AHS	AHS	AHS	AHS	AHS	ACD	ACD	AHS		
Sampling Method	MH	MH	MH	MH	MH	MH	MH	MH		
Mean # Individuals/Rep.	626	880	585	443	816	604	188	502		
# Replicates	1	1	2	1	1	1	1	2		
Dominant Family	Baetidae	Siphlonuridae	Hyalellidae	Gastropoda	Hyalellidae	baetidae	hyalellidae	silphonuridae		
% Dominant Family	26.5	40.7	39.1	31.8	34.1	57.5	63.3	37.8		
% Ephemeroptera	26.5	48.2	0.9	8.1	0.9	59.3	11.2	44.9		
% Trichoptera	0	0.1	0	0	0.2	1	0	1.2		
% Plecoptera	0	2.6	0	0.5	0	3.8	0.5	0		

Supplemental Stream Chemistry Readings

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

Parameter	5/7/2007	10/22/2007	10/10/2008	5/8/2009	9/28/2009	5/18/2010	10/7/2010	6/10/2011	10/5/2011	5/8/2012
pH	8.5	7.42	7.75	7.91	7.82	7.24	7.22	7.84	7.98	8.10
Conductivity (mS/cm)	0.283	0.243	0.348	0.276	0.421	0.207	0.399	0.296	0.296	0.205
Turbidity (NTU)	17	13	3	6	5	7	7	18	10	7
Dissolved Oxygen (mg/L)	11.41	9.72	8.99	10.82	8.76	6.93	na	6.85	7.91	7.87
Salinity (%)	0.01	0	0.01	0.01	0.01	0	0.01	0.01	0.01	0.00
Temperature (°C)	15.3	10.6	12.3	17.2	15.5	14.8	12.2	20.7	15.3	15.7

Discussion

Biomonitoring results for this site are much different from the upstream in St. Francis. In St. Francis the Rum River harbors the most diverse and pollution-sensitive macroinvertebrate community of all sites monitored in Anoka County. At the City of Anoka diversity has been moderately high, but the biotic indices were poorer than average because most families were generalists.

The largest reason difference between St. Francis and Anoka invertebrate communities is likely habitat differences. The river near St. Francis has a steeper gradient, and has a variety of pools, riffles, and runs. Downstream, near Anoka, the river is much slower moving, lacking pools, riffles and runs. The bottom is silt-laden. The area is more developed, so there are more direct and indirect human impacts to the river.

Water quality is good throughout the Rum River, though slightly poorer in Anoka than St. Francis. Chemical monitoring in 2004, 2009, 2010, and 2011 revealed that total suspended solids, conductivity, and chlorides were all slightly higher near Anoka than upstream. This is probably due to more urbanized land uses and the accompanying storm water inputs. Given that water quality is still very good even in these downstream areas, it is unlikely that water quality is the primary factor limiting macroinvertebrates at the City of Anoka.

One additional factor to consider when comparing the up and downstream monitoring results is the type of sampling location. Sampling 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.

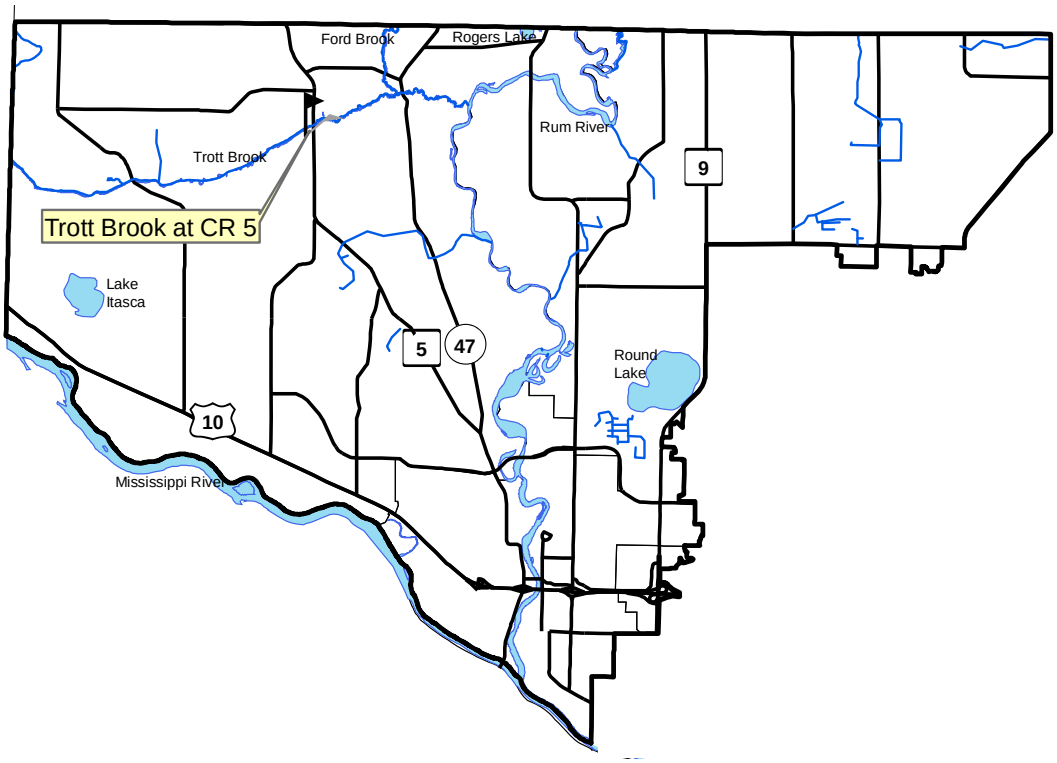
Stream Hydrology

Description: Continuous water level monitoring in streams.

Purpose: To provide understanding of stream hydrology, including the impact of climate, land use or discharge changes. These data are also needed for calculation of pollutant loads and use of computer models for developing management strategies. In the Sunrise River Watershed, the monitoring sites are the outlets of the Sunrise River Watershed Management Organization's jurisdictional area, thereby allowing estimation of flows and pollutant loads leaving the jurisdiction.

Locations: Trott Brook at County Road 5

Lower Rum River Watershed Stream Hydrology Monitoring Sites

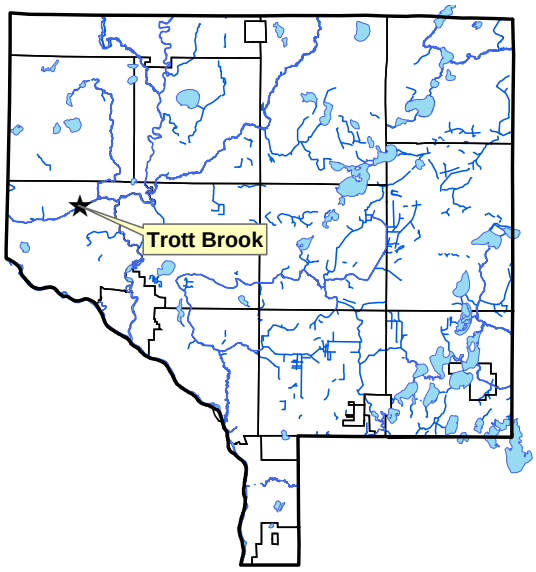


TROTT BROOK

at County Road 5 (Nowthen Blvd NW), Ramsey
STORET SiteID = S003-176

Notes

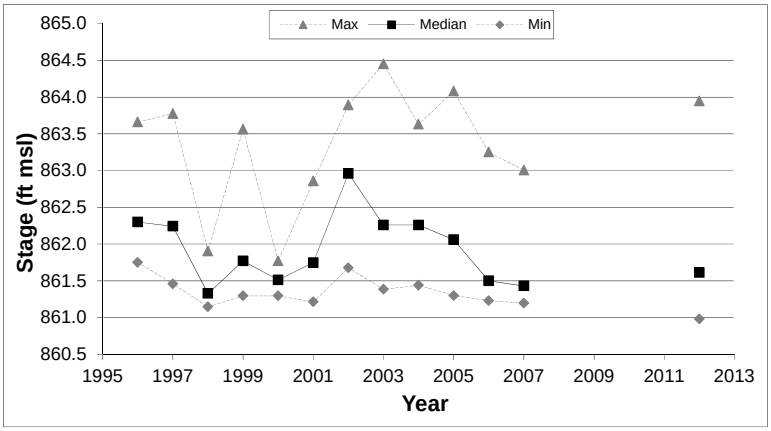
Trott Brook is a medium-sized creek that flows south through Sherburne County, paralleling the Anoka-Sherburne County boundary before turning east through the City of Ramsey where outlets to the Rum River. Overall, the watershed is rural or suburban residential, and areas within the watershed are undergoing rapid development. The creek is about 25 feet wide and 2.5 feet deep at the monitoring site during baseflow.



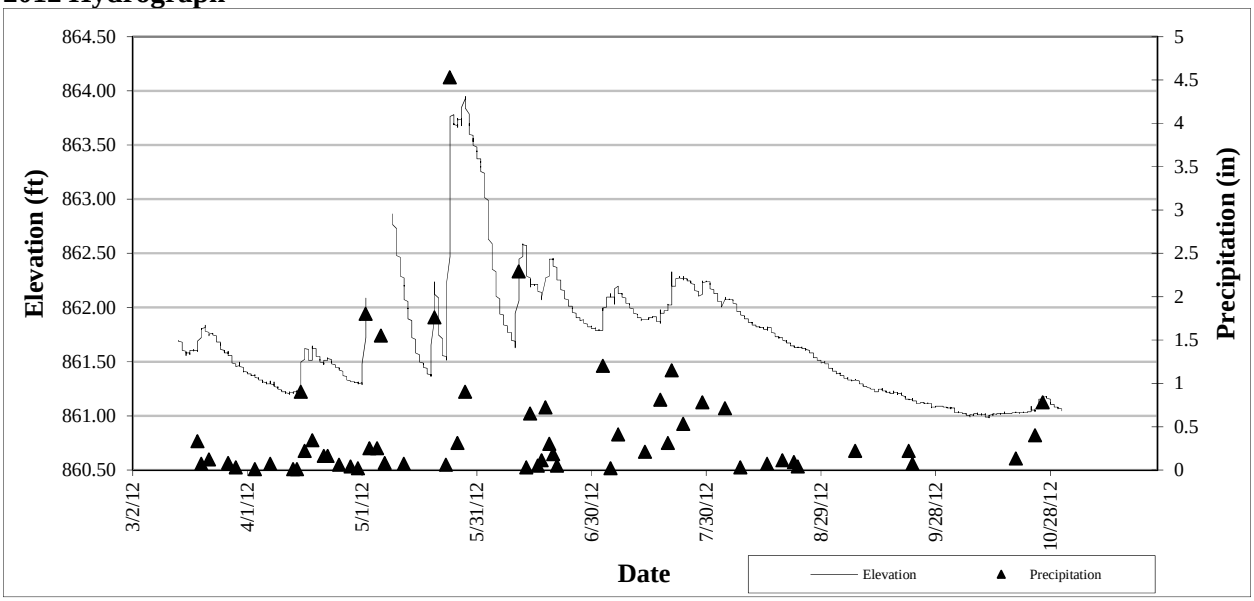
A rating curve for this site was developed in 2012:

Flow (cfs) = $9.1917(\text{stage}-859)^2 - 37.669(\text{stage}-859) + 41.931$

Summary of All Monitored Years



2012 Hydrograph



Stream Rating Curves

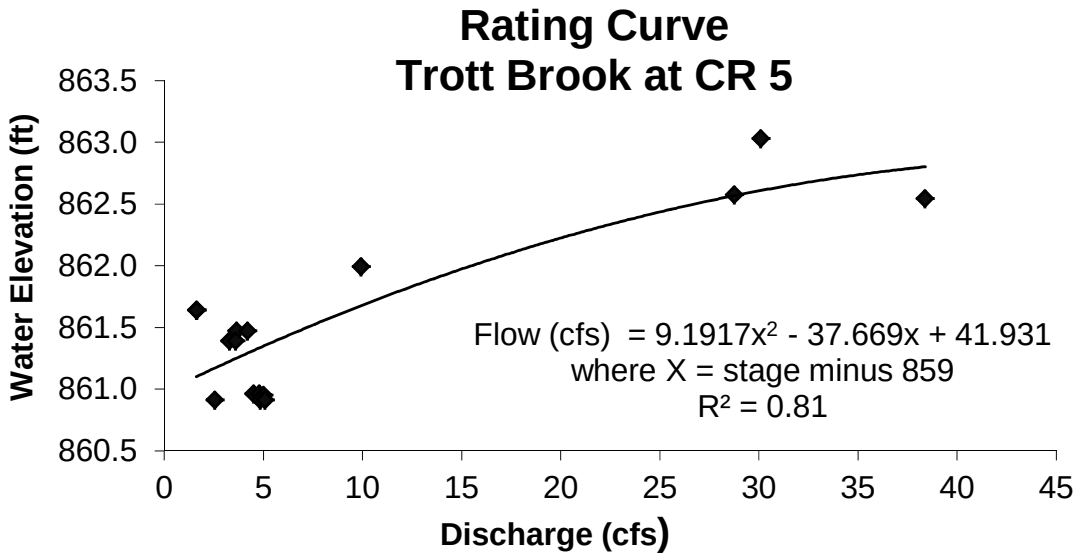
Description: Rating curves are the mathematical relationship between water level and flow volume. They are developed by manually measuring flow at a variety of water levels. These water level-flow measurements are plotted and the equation of a line best fitting these points is calculated. That equation allows flow to be calculated from water level measurements. Continuous water level monitoring in streams.

Purpose: To allow flow to be calculated from water level, which is easier to monitor.

Locations: Trott Brook at County Road 5

Results: In 2012 ACD staff manually measured flow in Trott Brook under a variety of water level conditions. 16 such measurements were used to develop the rating curve presented below. The equation was used to calculate flow from continuous stream water level monitoring measurements.

Trott Brook at County Road 5 Rating Curve



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 21 wetland hydrology monitoring stations.

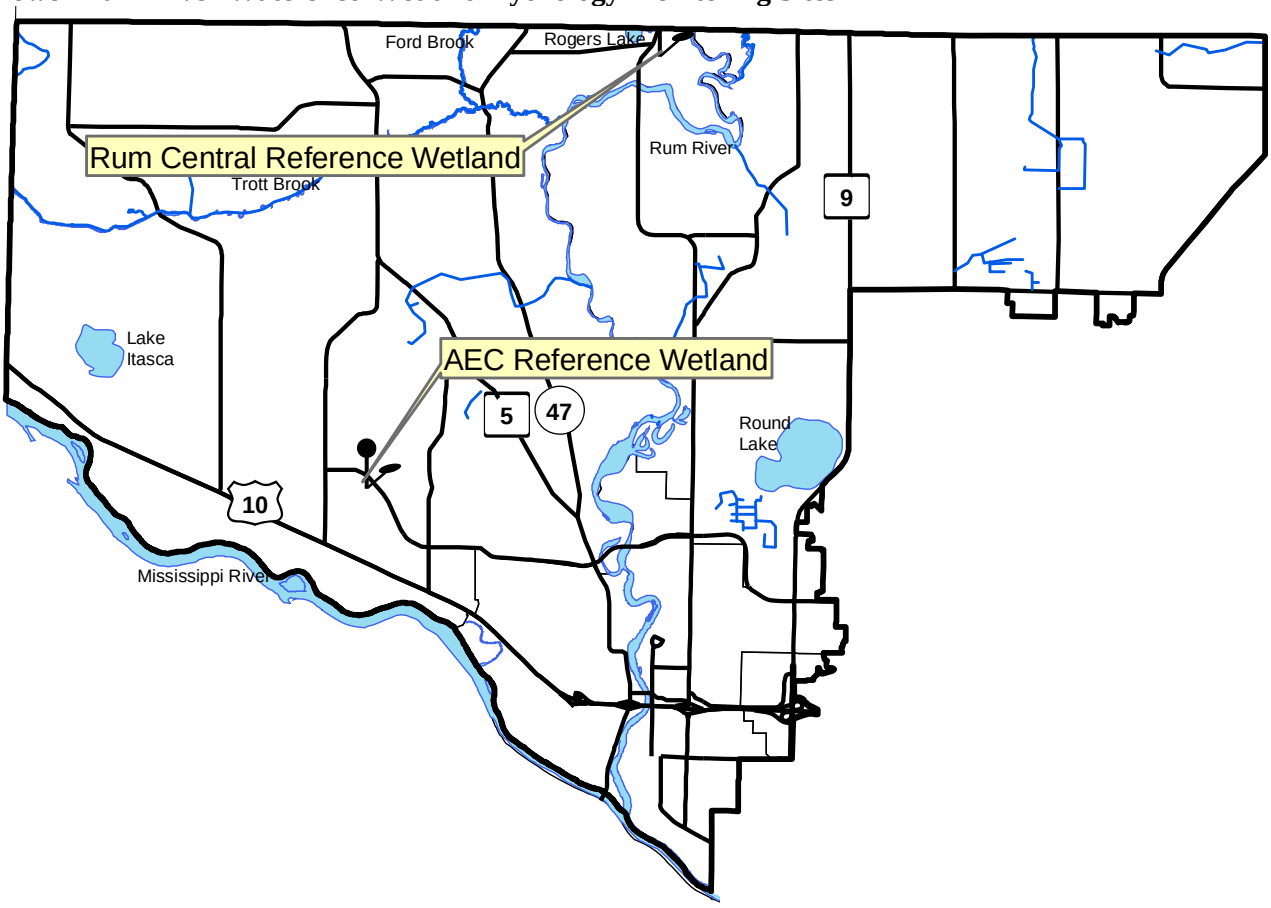
Purpose: To provide understanding of wetland hydrology, including the impact of climate and land use. These data aid in delineation of nearby wetlands by documenting hydrologic trends including the timing, frequency, and duration of saturation.

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

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

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

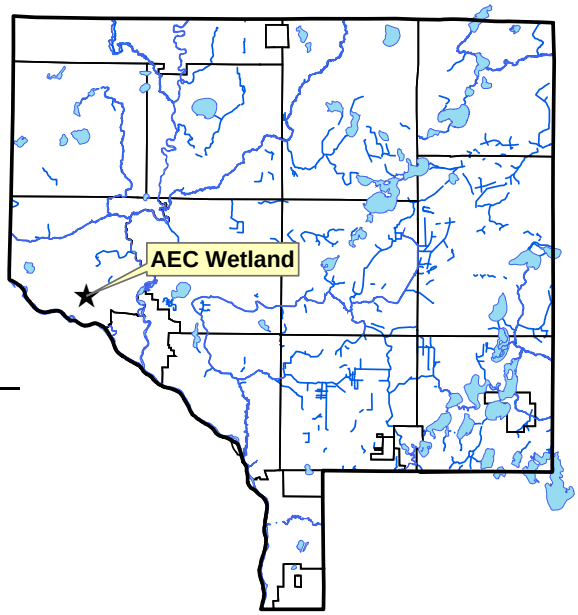


Wetland Hydrology Monitoring

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	-

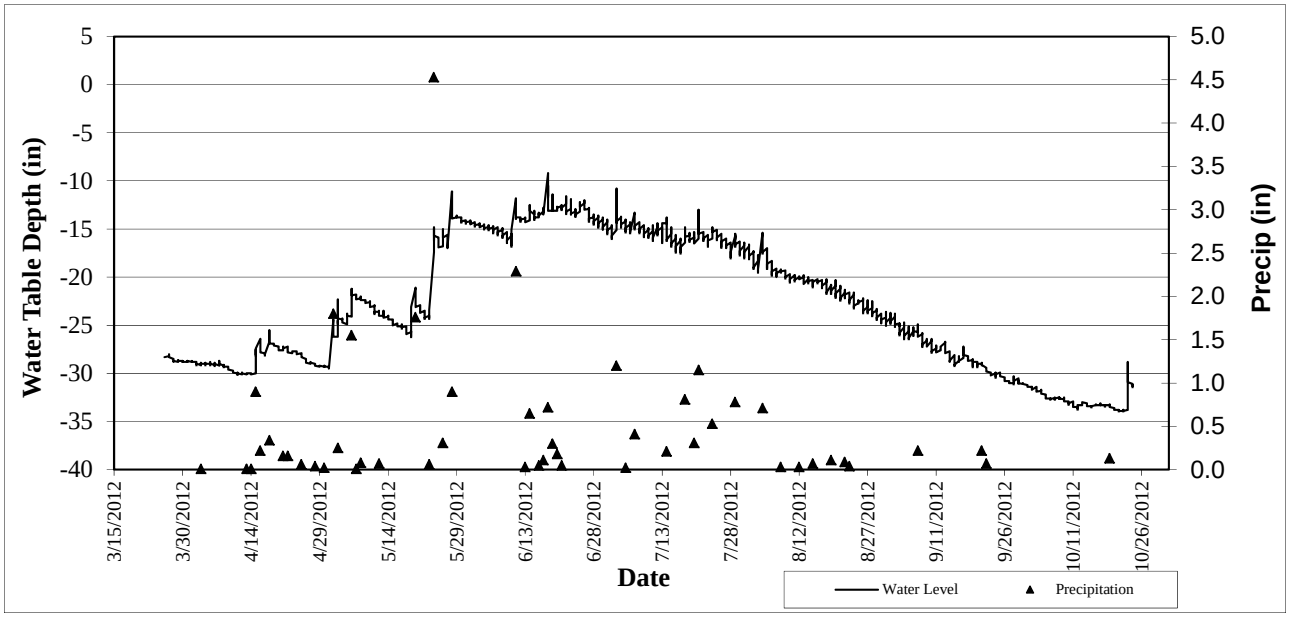
Surrounding Soils: Hubbard coarse sand

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.

2012 Hydrograph



Well depth was 42 inches, so a reading of –42 indicates water levels were at an unknown depth greater than or equal to 42 inches.

Wetland Hydrology Monitoring

RUM RIVER CENTRAL REFERENCE WETLAND

Rum River Central Regional Park, Ramsey

Site Information

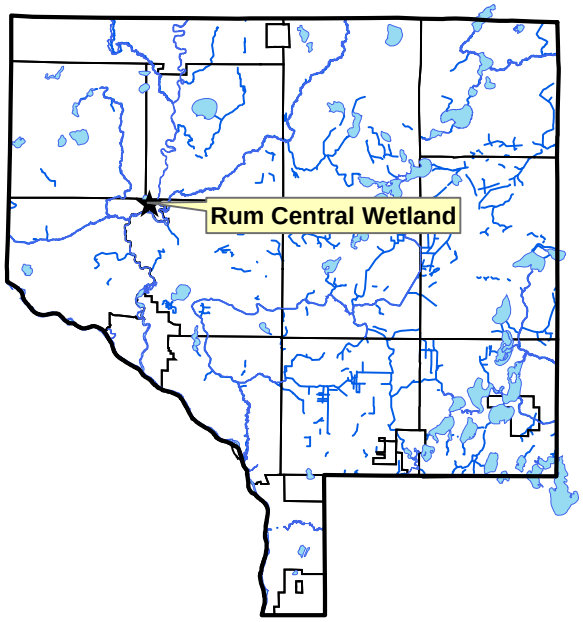
Monitored Since: 1997

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	-

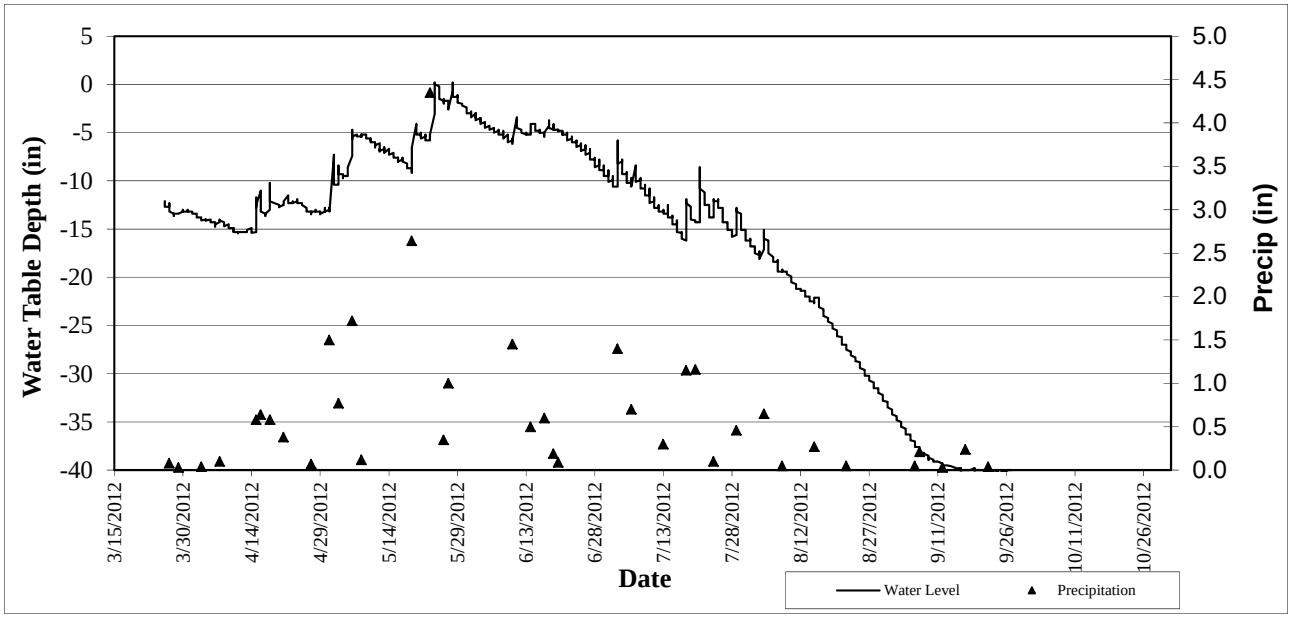
Surrounding Soils: Zimmerman fine sand

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.

2012 Hydrograph



Well depth was 40 inches, so a reading of –40 indicates water levels were at an unknown depth greater than or equal to 40 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 receiving grant funds are reported in the year they are installed. In 2012 the Smith Rum Riverbank Stabilization used $1,596.92 of LRRWMO cost share dollars.

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
Fund Balance		**$ 431.20**

Smith Rum River Stabilization

Anoka Conservation District (ACD) staff installed a cedar tree revetment on a residential property that borders the Rum River in Ramsey during the fall of 2012. Cedar tree revetments are a cost-effective bioengineering practice that can be used to stabilize mild or moderately eroding streambanks. The Smith property had moderate bank undercutting. Installation of the 70 foot cedar tree revetment will slow or stop the erosion and reduce the likelihood of a much larger and more expensive corrective project in the future. Because this project was on a steep slow below a home, it was a high priority for the landowner. It benefits river water quality by reducing sediment delivered to the river, and improves habitat.

Cedar tree revetments are created by anchoring cut cedar trees to the bank. In this case, the trees were harvested at no cost from an Anoka County park where they were undesirable. Each tree was anchored to the toe of the slope using cable, horseshoe clamps, and a duckbill anchor driven 3-4 feet into the bank. The tree's many branches deflect the water's energy from the bank. This low cost treatment is highly effective on mild to moderate problem areas.

Project Funding

LRRWMO Water Quality Cost Share	$1,596.92
Ag PreservesWater Quality Cost Share	$563.88
Landowner	$2,160.80
TOTAL	$4,321.60

Public Education – Web Video

Description: The Lower Rum River Watershed Management Organization (LRRWMO) contracted the Anoka Conservation District (ACD) to create a short web video about state scenic river rules that apply to the Rum River. The video is to be posted on the LRRWMO website.

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

Location: www.AnokaNaturalResources.com/LRRWMO

Results: As of January 27, 2013 the video production is in process. Appropriate video clips have been compiled. Many of these video clips were collected by ACD staff during the LRRWMO's boat tour of the river in September 2011. The video compilation will be completed and presented to the LRRWMO Board before March 31, 2012.

Review Member Communities' Local Water Plans

Description: Member cities must have local water plans and ordinances consistent with the LRRWMO 3rd Generation Watershed Management Plan (MN Rules 8410.0130 and 84100160). Cities might start this process in 2012, and the deadline for completion is December 14, 2013. The LRRWMO has approval authority over the Local Water Management Plans. Once a community submits their updated Local Water Management Plan to the WMO for review, the WMO has 60 days to provide comments. The Metropolitan Council has a simultaneous 45 day review period, and the WMO's review of the Plan must include a review of Metropolitan Council's comments.

The LRRWMO has requested that the ACD assist with their review of local water plans as they are completed. It is anticipated that communities will submit plans for review in both 2012 and 2013.

Purpose: To ensure the policies and actions in the LRRWMO 3rd Generation Watershed Management Plan are implemented consistently across the watershed.

Location: Watershed-wide

Results: As of January 7, 2012 no cities have submitted local water plan updates to the LRRWMO for review. Cities should be reminded of the December 14, 2013 deadline.

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. The LRRWMO pays the ACD annual fees for maintenance and update of the website.

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. The website serves as the LRRWMO's alternative to a state-mandated newsletter.

Location: www.AnokaNaturalResources.com/LRRWMO

Results: The LRRWMO website contains information about both the LRRWMO and about natural resources in the area.

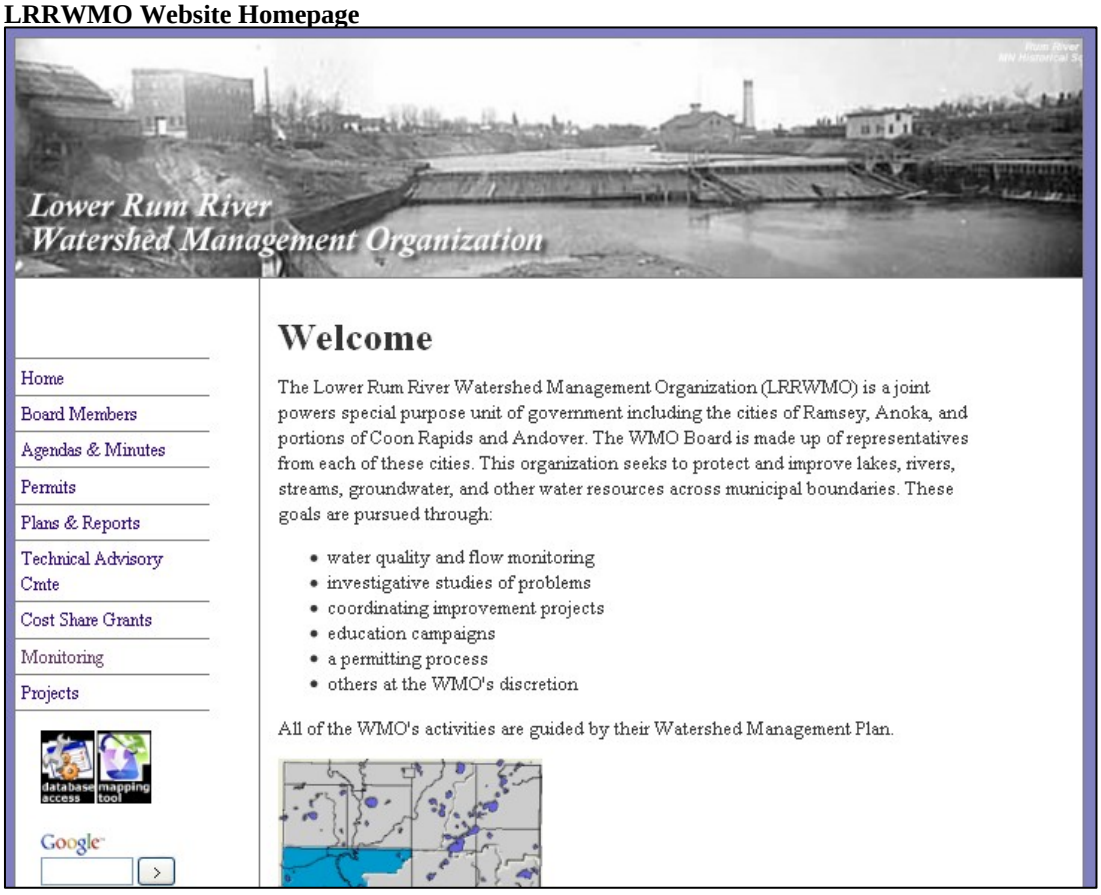
Information about the LRRWMO includes:

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

Other tools on the website include:

- an interactive mapping tool that shows natural features and aerial photos
- an interactive data download tool that allows users to access all water monitoring data that has been collected
- narrative discussions of what the monitoring data mean

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	Ref Wet	Lake Lvl	Stream Level	Rating curve	Lake WQ	Stream WQ	Student Biomon	LRRWMO Admin	Cost Share/ Lakescape/ Rain Garden	LRRWMO Outreach/Promo	Total
Revenues											
LRRWMO	1100	680	550	1800	1370	1330	795	5967	1597	1420	16609
State	0	0	0	0	0	0	0	0	0	0	0
Anoka Conservation District	0	0	0	0	0	0	0	0	0	0	0
County Ag Preserves	0	0	0	0	405	0	145	0	564	0	1114
Regional/Local	0	0	0	0	0	0	0	0	0	0	0
Other Service Fees	0	0	0	0	0	0	0	0	0	0	0
Local Water Planning	0	84	0	0	269	173	0	0	0	0	526
TOTAL	1100	764	550	1800	2044	1503	940	5967	2161	1420	18248
Expenses-											
Capital Outlay/Equip	8	7	3	23	17	9	11	3	0	3	84
Personnel Salaries/Benefits	737	655	426	1333	1287	797	745	303	0	538	6822
Overhead	59	52	35	102	112	65	60	29	0	52	565
Employee Training	2	2	2	1	2	2	1	2	0	4	16
Vehicle/Mileage	16	14	9	27	28	16	16	4	0	9	138
Rent	33	30	22	50	53	38	30	20	0	36	312
Program Participants	0	0	0	0	0	0	0	0	2161	0	2161
Program Supplies	5	4	14	0	545	575	77	0	0	0	1220
McKay Expenses	0	0	0	0	0	0	0	0	0	0	0
TOTAL	860	764	510	1535	2044	1503	940	360	0	641	9157
NET	240	0	40	265	0	0	0	5607	2161	779	9091

Recommendations

- **Actively participate in the MPCA Rum River WRAPP (Watershed Restoration and Protection Plan) which is beginning in 2013.** 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 with regulatory implications will likely arise out of this project.
- **Diagnose low dissolved oxygen in Trott Brook.** Water quality and hydrology monitoring is planned during 2012 for the Rum River WRAPP project. A TMDL study and implementation plan are desirable outcomes.
- **Remind LRRWMO Cities that local water plans must be updated**, reviewed, and approved by the LRRWMO by December 14, 2013. The review process takes several months.
- **Implement water conservation measures** throughout the watershed and promote it metro-wide. Depletion of surficial water tables are having observable, sometimes dramatic, impacts

on some lake levels and wetlands. Metropolitan Council models predict 3+ft drawdown of surface waters in certain areas by 2030, and 5+ft by 2050.

- **Repeat periodic tours of the Rum River by the LRRWMO Board.** These boat tours are useful for identifying problems and the overall condition of the resource.
- **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.
- **Facilitate resident efforts to control aquatic plant growth on Rogers Lake** as a means to improving low dissolved oxygen problems. In early 2010 a meeting for residents was held, interest expressed, but coordination and work needed by residents did not materialize. Treatments should occur in early spring, occur on no more than 15% of the lake, be coordinated, and proceed under DNR permits.
- **Emphasize protection of Rum River water quality.** The river's water quality declines slightly in the LRRWMO and anticipated future development could cause further deterioration.
- **Complete a stormwater retrofitting assessment for the City of Anoka.** The project will identify and rank projects that improve stormwater runoff before it is discharged to the Rum River.
- **Continue the existing cost share grant program for water quality improvement projects** on private properties.
- **Encourage public works departments to implement measures to minimize road deicing salt applications**. Monitoring and special investigations in the LRRWMO and elsewhere nearby have shown that road salts are a serious and widespread sources of stream degradation.