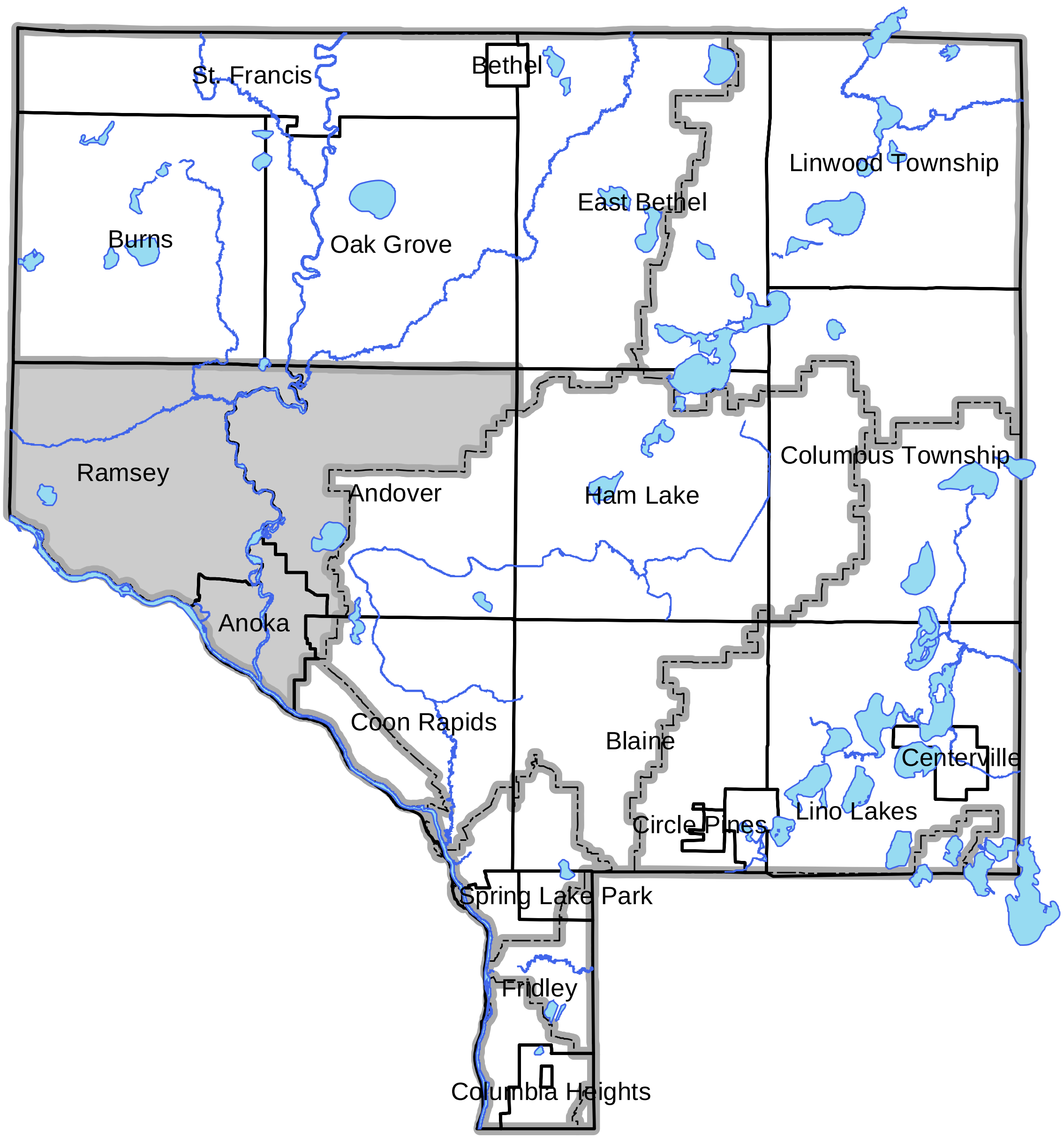
Excerpt from the
2010 Anoka Water Almanac

Chapter 4: Lower Rum River Watershed



Prepared by the Anoka Conservation District

CHAPTER 4: LOWER RUM RIVER WATERSHED

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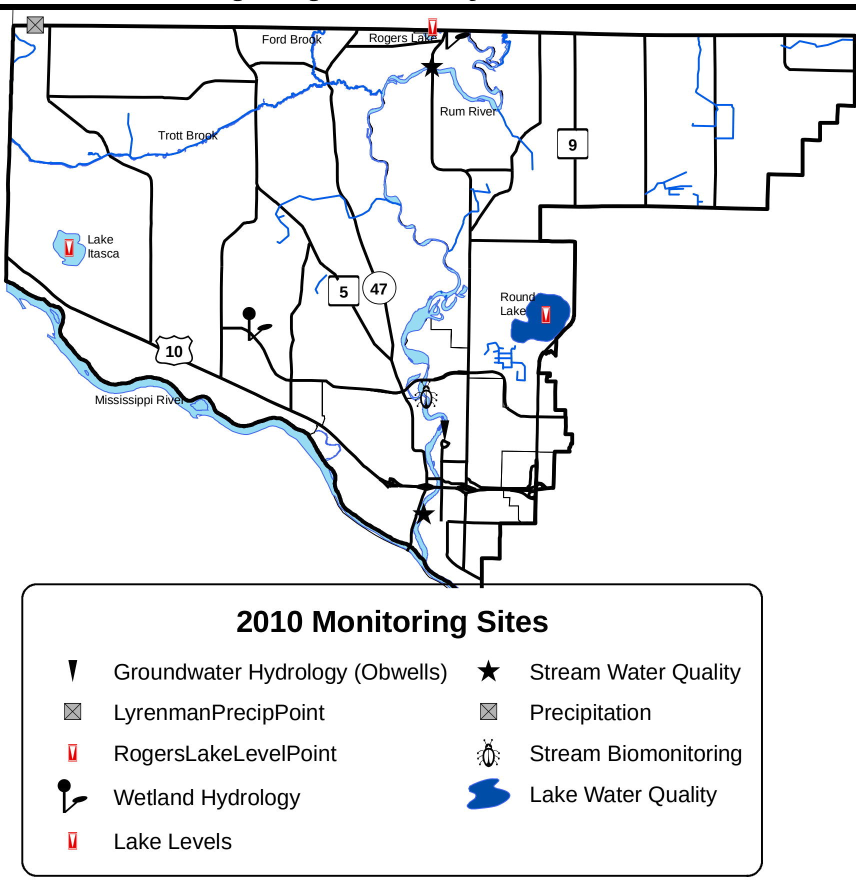
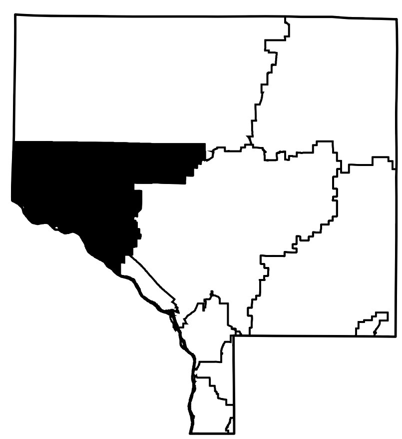
ACAP = Anoka County Ag Preserves, ACD = Anoka Conservation District, LRRWMO = Lower Rum River Watershed Mgmt Org, MC = Metropolitan Council, MNDNR = MN Dept. of Natural Resources





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.

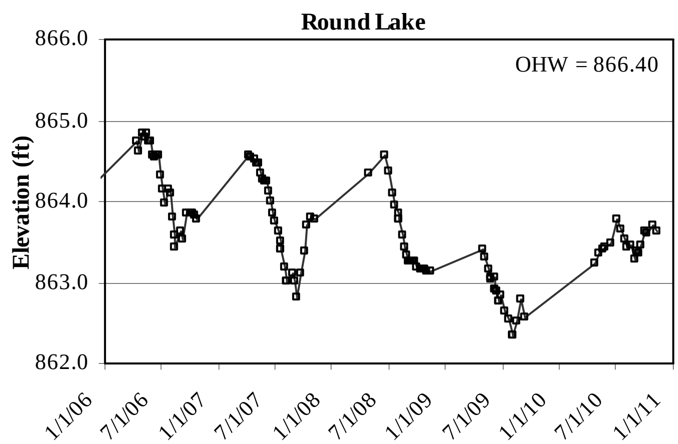
Locations: Lake Itasca, Round Lake, Rogers Lake

Results: Water levels were measured on Rogers, Round, and Itasca lakes 17, 18, and 159 times respectively. The level in Itasca Lake was measured much more frequently because a WL40 data logger was installed to record daily water levels. Reading a manual gauge was not possible because water was low, forcing placement of the gauge far from shore where volunteers could not read it.

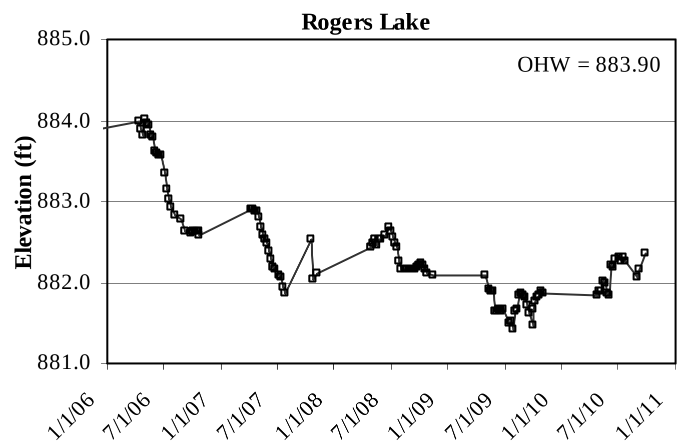
In 2010 these lakes began to rebound from record and near-record low water levels in 2009 because of near normal rainfall. The average water level in Round Lake increased by 0.65 feet between 2009 and 2010. Rogers Lake declined nearly continuously between 2006 and 2009, with a total drop of over two feet. The average Rogers Lake level increased by 0.37 feet between 2009 and 2010. The average Itasca Lake level in was 0.29 feet higher in 2010 than 2009.

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.

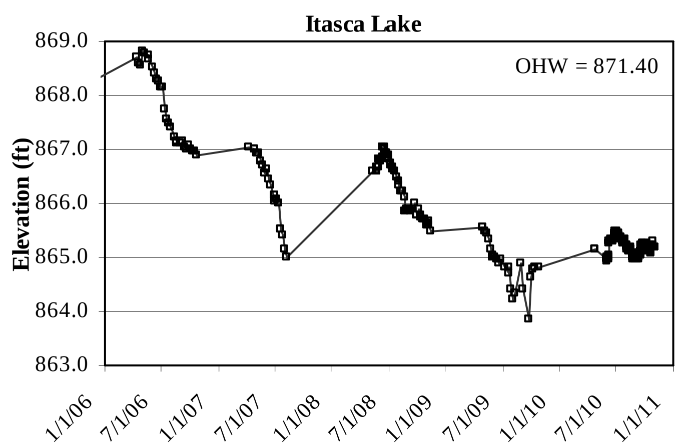
Round Lake Levels 2006-2010



Rogers Lake Levels 2006-2010



Itasca Lake Levels 2006-2010



Lower Rum River Watershed Lake Levels Summary 2006-2010

Lake	Year	Average	Min	Max
Itasca	2006	867.81	866.90	869.77
	2007	866.25	865.01	867.03
	2008	866.36	865.50	867.05
	2009	864.90	863.86	865.57
	2010	865.19	864.92	865.47
Rogers	2006	883.28	882.59	884.02
	2007	882.19	881.79	882.91
	2008	882.33	882.09	882.69
	2009	881.73	881.43	882.08
	2010	882.10	881.84	882.36
Round	2006	864.21	863.44	864.85
	2007	864.21	863.44	864.85
	2008	863.52	863.09	864.54
	2009	862.84	862.35	863.41
	2010	863.49	863.23	863.79

Lake Water Quality

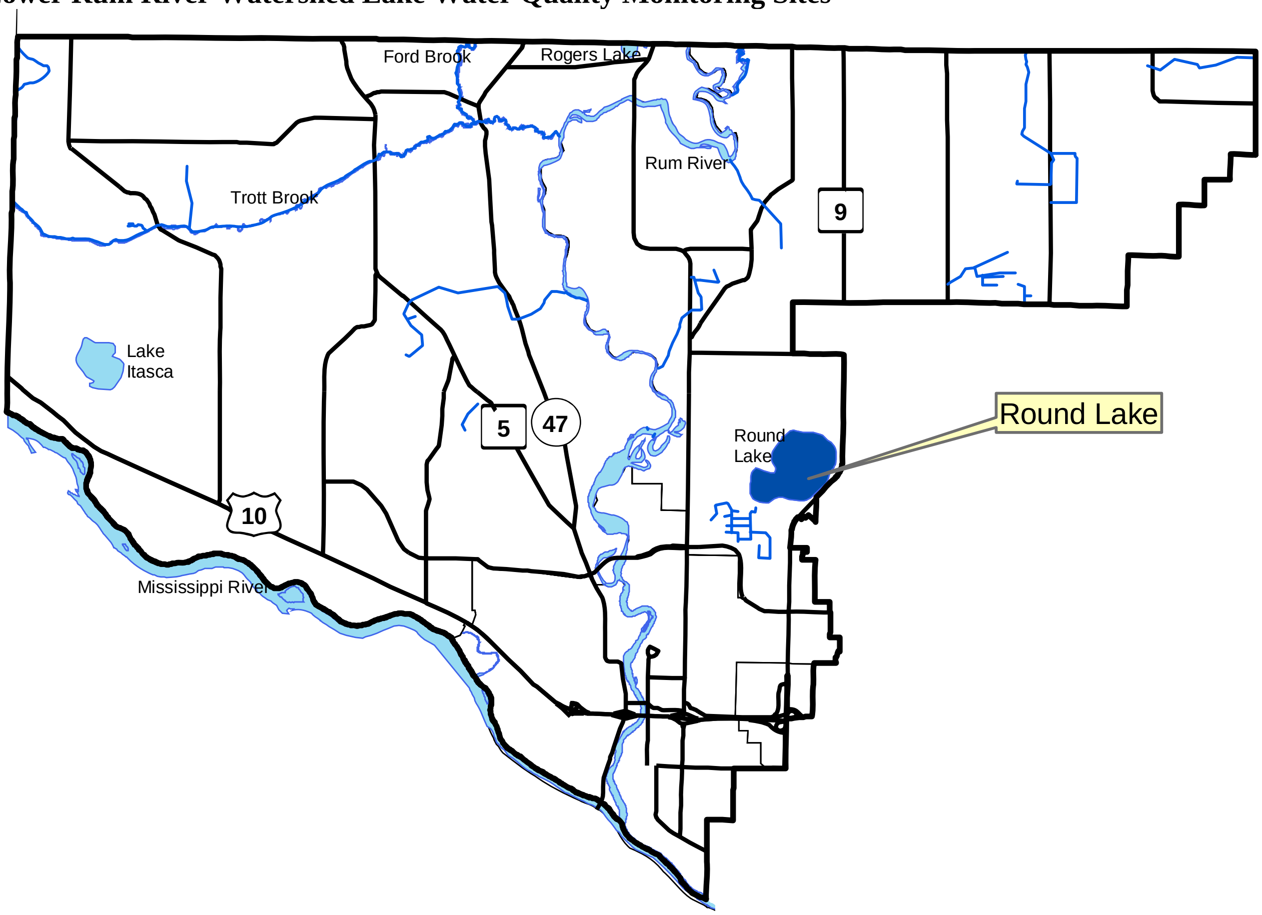
Description: May through September twice-monthly monitoring of the following parameters: total phosphorus, chlorophyll-a, Secchi transparency, dissolved oxygen, turbidity, temperature, conductivity, pH, and salinity.

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

Locations: 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.

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 only wintertime fishing occurs. Wildlife, especially waterfowl, usage of the lake is relatively high.

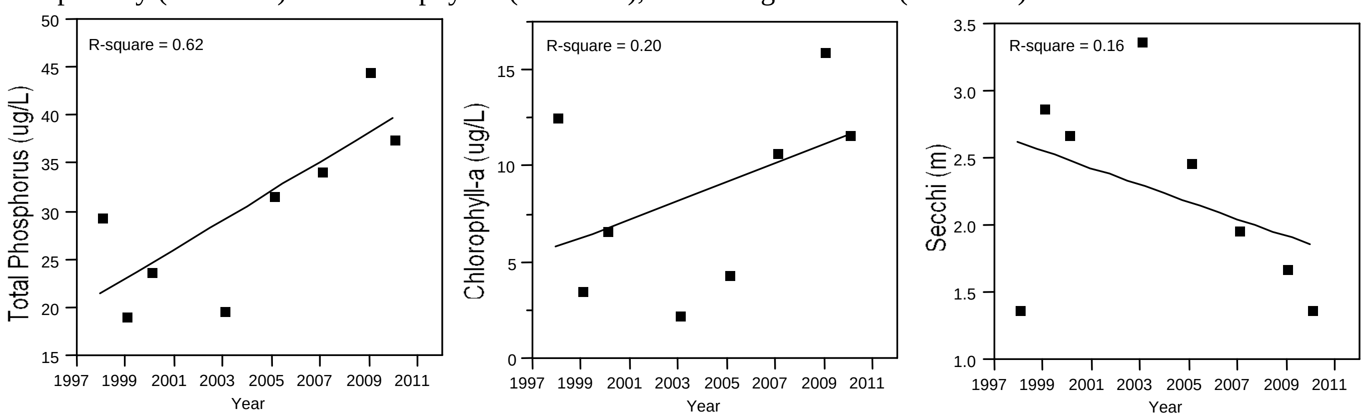
2010 Results

In 2010 Round Lake had average water quality compared with other lakes in this region (NCHF Ecoregion) receiving an overall C letter grade, but water quality was poorer than in most previous years. The lake was slightly eutrophic. Average total phosphorus and chlorophyll *a* were only slightly lower than the highest recorded values from 2009. Secchi transparency was only 4.6 feet, which is the poorest ever observed at this lake.

Lake water quality changed throughout the growing season, but was generally poorer than desired through summer. Total phosphorus concentrations were between 25 and 50 µg/L, which is a relatively large range. This variability in total phosphorus was positively correlated with changes in chlorophyll *a* concentrations. The highest chlorophyll *a* (and total phosphorus) occurred in the spring and mid-late summer. Secchi transparency was consistently poor throughout the summer ranging between 3.4 and 5.7 feet. Subjective ratings of physical condition and recreational suitability by ACD staff indicated minimal problems in the spring, but conditions quickly deteriorated to "definite/high algae" and "swimming impaired" throughout the remainder of 2010.

Trend Analysis

Eight years of water quality monitoring have been conducted by the Anoka Conservation District (1998-2000, 2003, 2005, 2007, and 2009-2010), which is a marginal number of years for a powerful statistical test of trend analysis. Nevertheless, the results of the analysis indicate a significant trend of declining water quality across the years studied (repeated measures MANOVA with response variables TP, Cl-a, and Secchi depth, $F_{2,5} = 9.6065$, $p = 0.0194$). Examined individually, all three parameters are trending poorer, but the relationship is weak for transparency ($R^2 = 0.16$) and chlorophyll *a* ($R^2 = 0.20$), and strongest for TP ($R^2 = 0.62$).



Discussion

There are few obvious impacts to the lake. Shoreline development and recreational use is light, while the watershed is small with residential land uses. Because long term data are lacking for this lake it is unclear what is "normal" water quality, but poorer recent years are concerning. Possible factors affecting water quality include low water levels and expansion of Round Lake Boulevard, but each is speculative and not supported by data.

The low water levels could be negatively affecting water quality by making the unconsolidated bottom sediments more susceptible to wind mixing. These sediments could be a source of non-algal turbidity or phosphorus. But the low water levels have also resulted in expansion of emergent plants which can benefit water quality. At the same time, the submerged plant community seems to be in decline, presumably because of poorer transparency (and therefore light) and/or greater wind mixing.

Another possible impact on water quality is the expansion of Round Lake Boulevard in summer 2004. This road is 100-300 feet from the lake along the entire eastern shore. It was expanded from two lanes to four. Several new stormwater treatment basins were installed next to the roadway to help protect the lake. Yet some residents were concerned. Water quality has continued to deteriorate during the four monitoring years following the road expansion. It seems unlikely that the road would be responsible for this water quality change given the practices in place to protect the lake and the fact that surrounding areas are residential, but it cannot be eliminated as a possiblity.

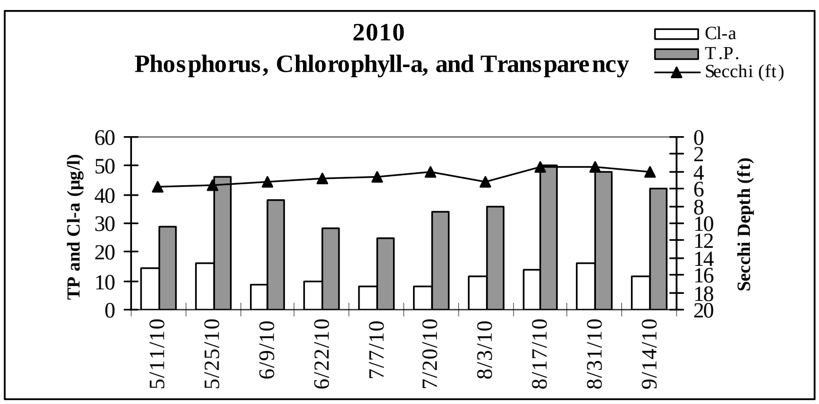
In the end, the reason for poorer water quality in recent years is uncertain. There are no apparent management changes that should be made. This leaves future monitoring and re-evaluation as the only recommendation.

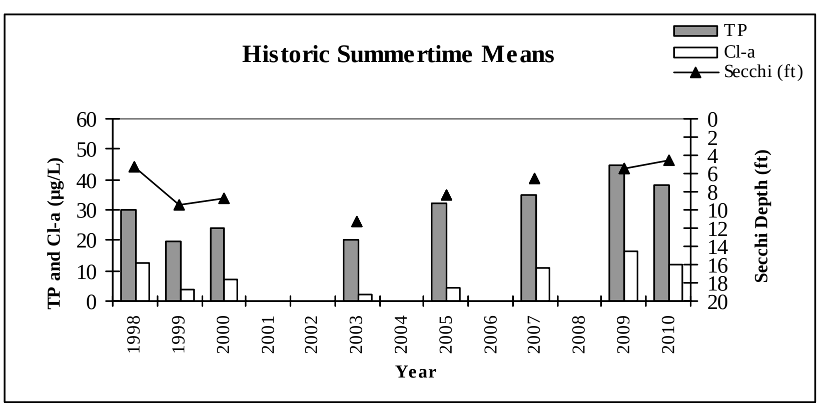
2010 Round Lake Water Quality Data

Round Lake 2010		Date	5/11/2010	5/25/2010	6/9/2010	6/22/2010	7/7/2010	7/20/2010	8/3/2010	8/17/2010	8/31/2010	9/14/2010			
		Time	13:00	9:30	9:30	9:00	11:30	9:30	9:30	9:15	9:45	9:30			
	Units	R.L.*	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Average	Min	Max
pH		0.1	7.62	7.92	7.73	8.00	8.37	8.11	7.97	7.75	7.78	8.10	7.94	7.62	8.37
Conductivity	mS/cm	0.01	0.427	0.432	0.430	0.368	0.335	0.343	0.371	0.377	0.404	0.396	0.388	0.335	0.432
Turbidity	FNRU	1.0	6	11	10	9	12	15	11	11	17	17	12	6	17
D.O.	mg/L	0.01	11.14	7.33	6.44	9.67	8.89	8.97	7.72	11.27	8.37	N/A	8.87	6.44	11.27
D.O.	%	1.0	94	84	66	110	104	100	88	115	90	N/A	95	66	115
Temp.	°C	0.10	10.2	24.5	19.7	24.5	26.9	25.2	26.9	21.5	24.8	19.1	22.3	10.2	26.9
Temp.	°F	0.10	50.4	76.1	67.5	76.1	80.4	77.4	80.4	70.7	76.6	66.4	72.2	50.4	80.4
Salinity	%	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Cl-a	µg/L	1.0	14.6	16.0	8.9	9.8	7.9	8.1	11.5	14.1	16.0	11.3	11.8	7.9	16.0
T.P.	mg/L	0.005	0.029	0.046	0.038	0.028	0.025	0.034	0.036	0.050	0.048	0.042	0.038	0.025	0.050
T.P.	µg/L	5	29	46	38	28	25	34	36	50	48	42	38	25	50
Secchi	ft	0.1	5.7	5.6	5.1	4.9	4.6	4.1	5.1	3.4	3.5	4.1	4.6	3.4	5.7
Secchi	m	0.1	1.7	1.7	1.6	1.5	1.4	1.2	1.6	1.0	1.1	1.2	1.4	1.0	1.7
Field Observations															
Physical			2	2.0	2.0	3.0	4.0	4.0	4.0	4.0	4.0	3.0	3.2	2.0	4.0
Recreational			2	2.0	2.0	3.0	3.0	3.0	4.0	4.0	4.0	3.0	3.0	2.0	4.0

*Reporting Limit

Round Lake Water Quality Results





Round Lake Summertime Historic Mean

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

Carlson's Tropic State Indices

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

Round Lake Water Quality Report Card

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

Stream Water Quality - Chemical Monitoring

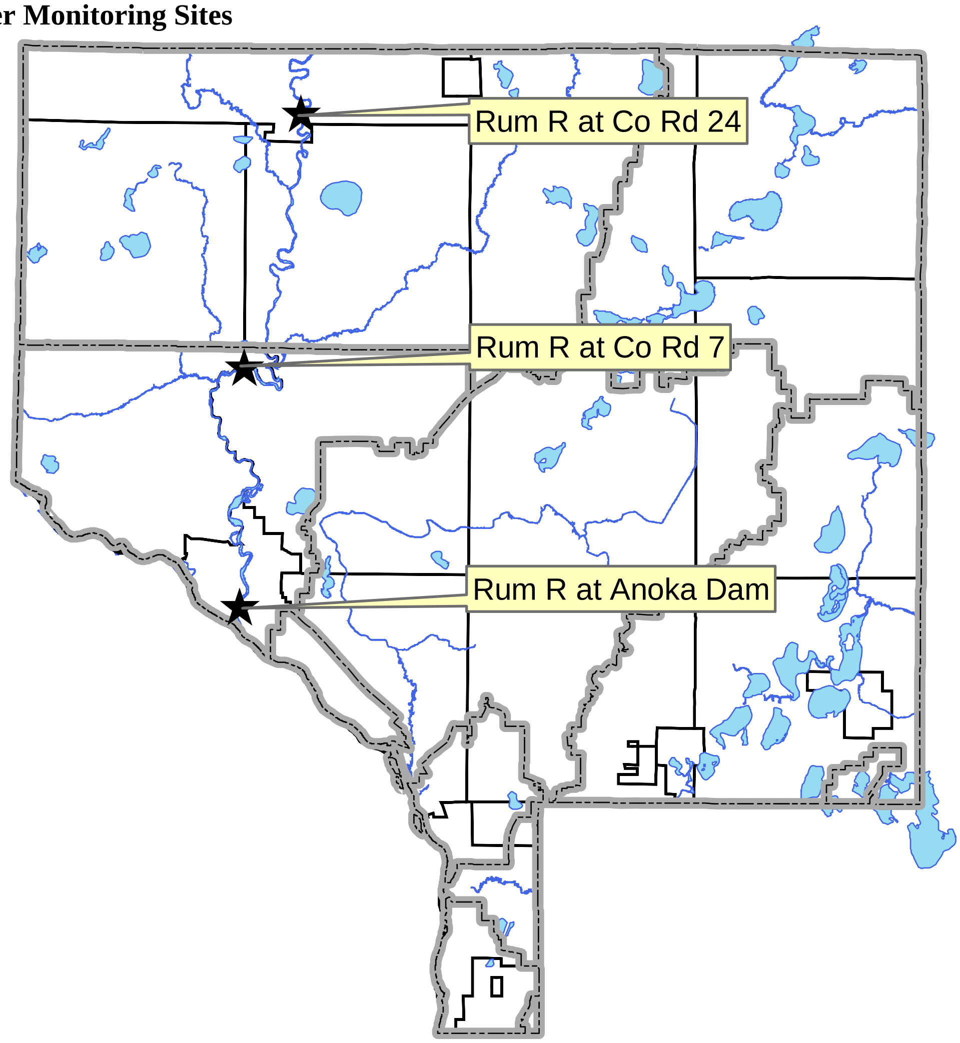
Description: The Rum River has been monitored simultaneously at three strategic locations in 2004, 2009, and 2010. The locations include the approximate top and bottom of the Upper and Lower Rum River Watershed Management Organizations. The two organizations share the middle location. The Metropolitan 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: Rum River at Co Rd 24
Rum River at Co Rd 7
Rum River at the Anoka Dam

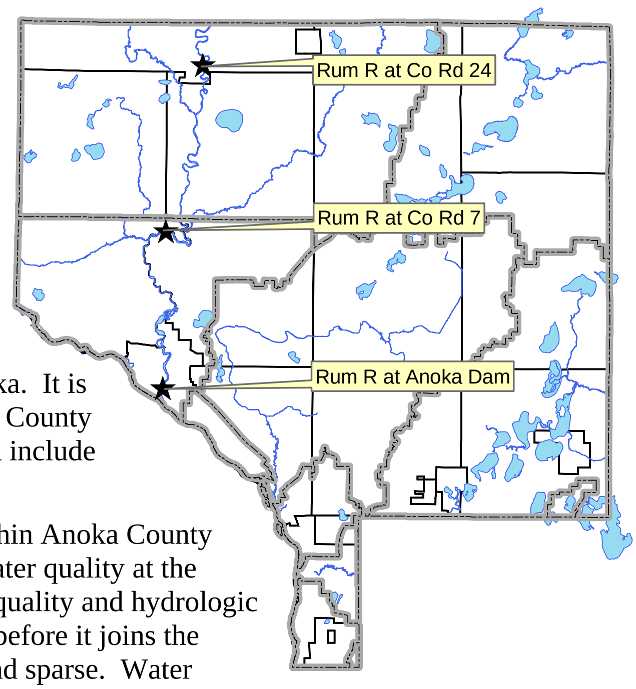
Results: Results are presented on the following page, with a focus on comparing river conditions from upstream to downstream. More detailed reporting for the Metropolitan Council WOMP monitoring station, including additional parameters and analysis are presented elsewhere by the Metropolitan Council (see http://www.metrocouncil.org/Environment/RiversLakes/).

2010 Rum River Monitoring Sites



RUM RIVER

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



Years Monitored

At Co. Rd. 24 –	2004, 2009, 2010
At Co. Rd. 7 –	2004, 2009, 2010
At Anoka Dam –	1996-2010 by the Met Council WOMP program

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, and 2010 monitoring was conducted at three locations simultaneously to determine if Rum River water quality changes in Anoka County, and if so, generally where changes occur. The Upper and Lower Rum River Watershed Management Organizations contributed to this work and monitoring sites were strategically located near the upper and lower boundary of each organization's jurisdictional boundary. The Metropolitan Council maintains a permanent monitoring station at the Anoka Dam, the farthest downstream monitoring site. The Metropolitan Council monitoring was coordinated to occur with the watershed organization monitoring so the data and costs could be shared. The Anoka Conservation District did the field work for both Metropolitan Council and the watershed organizations, ensured monitoring for both programs was conducted simultaneously so the data and costs could be shared, and reports the data together for a more comprehensive analysis of the river from upstream to downstream.

The river was monitored during both storm and baseflow conditions by grab samples. Eight water quality samples were taken each year; 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, and chlorides. Ten additional parameters were tested by the Metropolitan Council at their laboratory for the Anoka Dam site only and are not reported here. 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 and dates that were simultaneously tested at all three sites. 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

Overall, Rum River water quality is good throughout Anoka County, however it does decline slightly below the County Road 7 bridge (i.e. in the Cities of Andover, Anoka, and Ramsey) and during storms. The declines in water quality below that point are modest, as are declines in water quality during storms. Dissolved pollutants (as measured by conductivity and chlorides), total phosphorus, turbidity, and total suspended solids were all generally near or below the median of all 34 Anoka County streams that have been monitored, while pH and dissolved oxygen levels were appropriate.

Two areas of concern were noted. First, dissolved pollutants increased at each monitoring site downstream. Dissolved pollutants were highest during baseflow, indicating pollutants have infiltrated into the groundwater which feeds the river and tributaries during baseflow. Road deicing salts are likely the most significant dissolved pollutant. Secondly, total suspended solids increased notably below County Road 7. This was most pronounced during storms.

It is important to recognize the limitations of this report. The data is only from 2004, 2009, and 2010 when all three sites were monitored simultaneously to allow comparisons. It includes drought years (2009), years with slightly above normal precipitation (2010), and years with some excessively wet and some excessively dry months (2004). We did not sample any extreme floods when river water quality is likely worst. If a more detailed analysis of river water quality is desired, data from many years and a variety of conditions is available for the Anoka Dam site through the Metropolitan Council. Their work includes composite samples throughout storms.

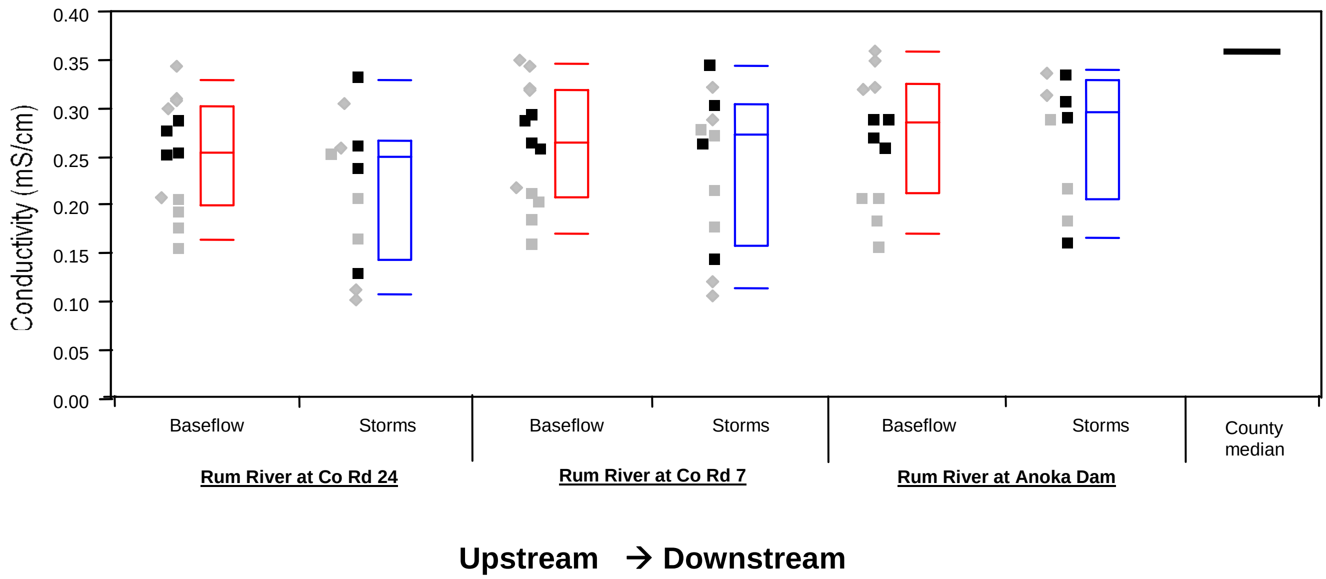
On the following pages data are presented and discussed for each parameter. The last section outlines management recommendations. The Rum River is an exceptional waterbody, and its protection and improvement should be a high priority.

Conductivity and chlorides

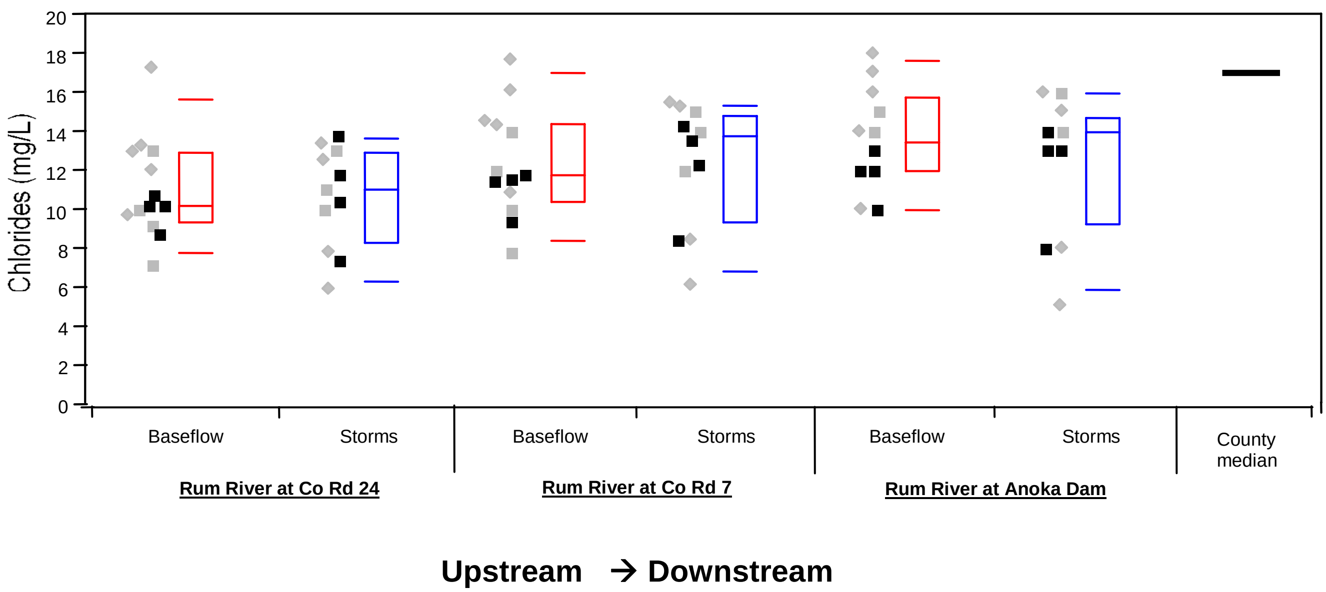
Conductivity and chlorides are measures of dissolved pollutants. Dissolved pollutant sources include urban road runoff, industrial chemicals, and others. Metals, hydrocarbons, road salts, and others are often of concern in a suburban environment. Conductivity is the broadest measure of dissolved pollutants we used. It measures electrical conductivity of the water; pure water with no dissolved constituents has zero conductivity. Chlorides 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. They can also be of concern because the Rum River is upstream from the Twin Cities drinking water intakes on the Mississippi River.

Conductivity is acceptably low in the Rum River, but increases downstream (see figure below) and during baseflow. Median conductivity from upstream to downstream was 0.256 mS/cm, 0.272 mS/cm, and 0.296 mS/cm, respectively. This is lower than the median for 34 Anoka County streams of 0.362 mS/cm. The maximum observed conductivity in the Rum River was 0.365 mS/cm. Conductivity was lowest at all 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. Baseflow conductivity increases from upstream to downstream, reflecting greater road densities and deicing salt application. Storm conductivity, while lower than baseflow, did also increase from upstream to downstream. This is reflective of greater stormwater runoff and pollutants associated with the more densely developed lower watershed.

Conductivity during baseflow and storm conditions Grey squares are individual readings from 2004; grey diamonds are 2009 readings, and black squares are 2010 readings. 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 Grey squares are individual readings from 2004; grey diamonds are 2009 readings, and black squares are 2010 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



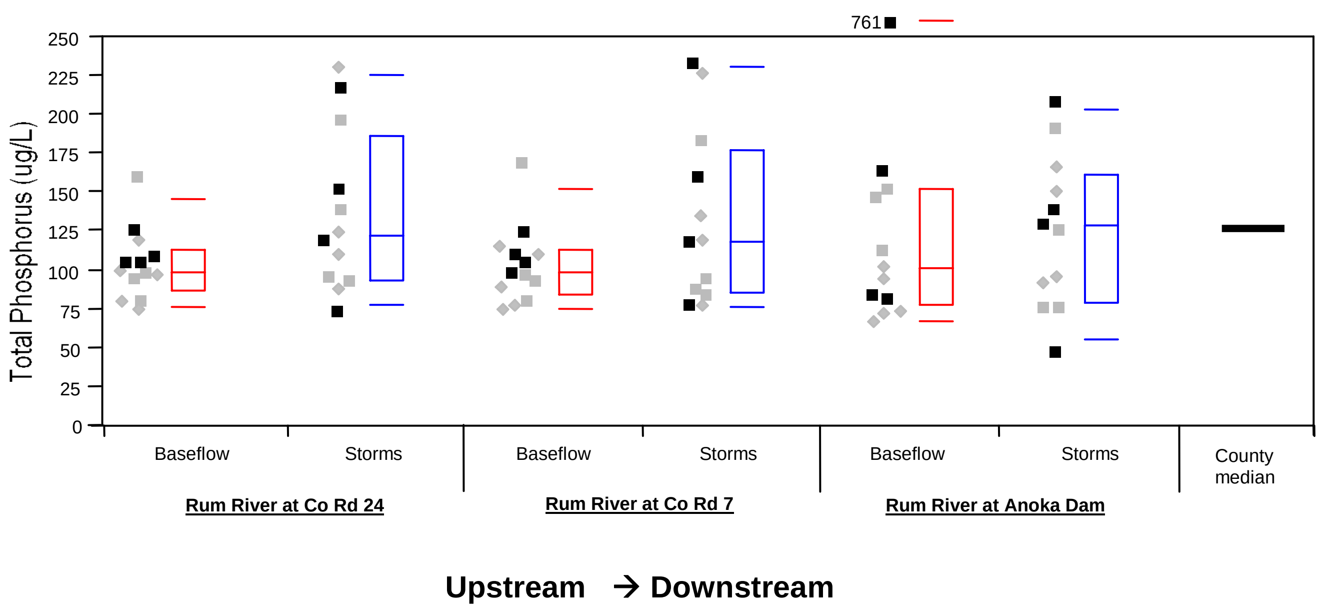
Chloride results parallel those found for conductivity (see figure above), supporting the hypothesis that chloride is an important cause of the conductivity. Chloride levels in the Rum River (median 11, 12, and 14 mg/L from upstream to downstream) are similar to the median for Anoka County streams of 12 mg/L. The highest observed value was 18 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. Like conductivity, chlorides were slightly higher during baseflow than storms at each site and increased from upstream to downstream. Road deicing salt infiltration into the shallow groundwater is likely the primary contributor, as described above.

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). This nutrient is one of the most common pollutants in our region, and can be associated with urban runoff, agricultural runoff, wastewater, and many other sources. The median phosphorus concentration at each of the three monitored sites was 106, 105, and 113 ug/L. These upstream-to-downstream differences are negligible and there is no trend of increasing phosphorus downstream. All sites occasionally experience phosphorus concentrations higher than the median for Anoka County streams of 128 ug/L. All of the highest observed total phosphorus readings were during storms, including the maximums at each site of 230, 234, and 761 ug/L (upstream to downstream). 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.

One 2010 total phosphorus reading was excessively high, but we feel this outlier is likely an error. On September 22 a reading of 761 ug/L was recorded at the Anoka Dam. This was recorded as a baseflow sample because no recent rains had occurred, but was during a period of extended high water. River stage was approximately 0.5 feet higher than during the other baseflow samples. During this event dissolved phosphorus was analyzed in addition to total phosphorus. Dissolved phosphorus was only 13% of total phosphorus. Therefore most of the total phosphorus must be particulate phosphorus. Yet, inconsistently, there were few particulates in the water; total suspended solids was only 6 mg/L. Likewise, nothing in the field notes suggest unusually high turbidity. If this reading of 761 ug/L total phosphorus is excluded, as it probably should be, the next highest observed TP at this site is 209 ug/L.

Total phosphorus during baseflow and storm conditions Grey squares are individual readings from 2004; grey diamonds are 2009 readings, and black squares are 2010 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 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. Suspended solids in the Rum River are moderately high, but only at the Anoka Dam and during storms. The results for turbidity and TSS differ, lending insight into the types of particles that are problematic.

It is important to note the suspended solids can come from sources in and out of the river. 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.

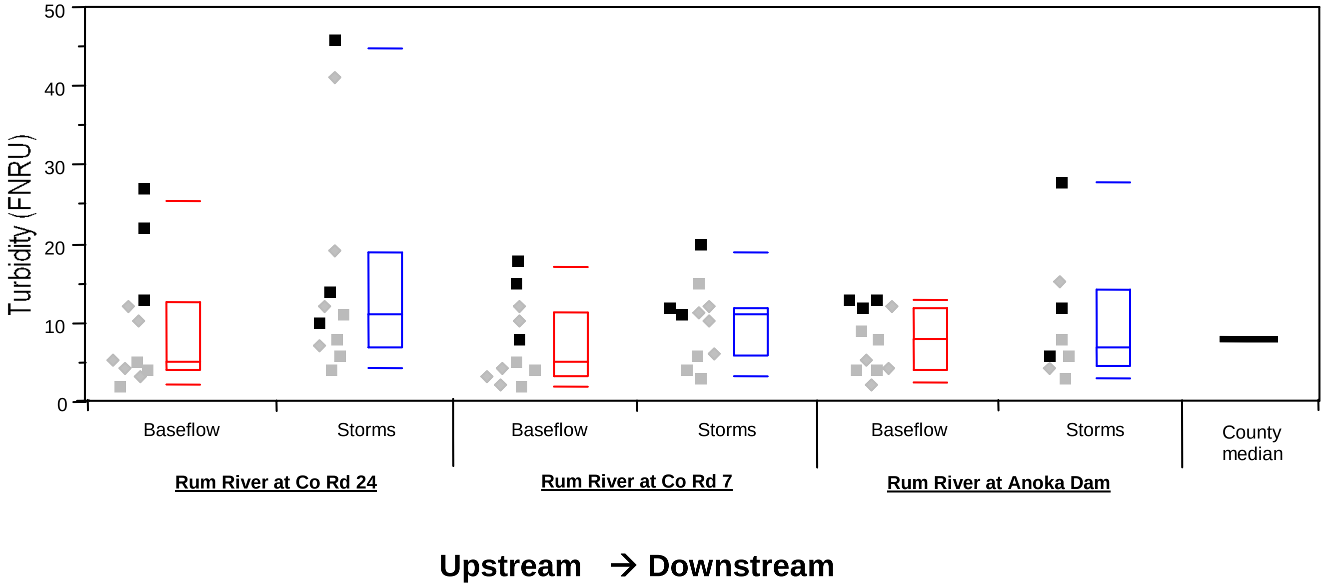
In the Rum River, turbidity was low with only slight increases during storms and no apparent increase at downstream monitoring sites (see figure below). The median turbidity at each site was 10, 8, and 8 FNRU (upstream to downstream), which is similar to the median for Anoka County streams of 8 FNRU. Turbidity was elevated on a few occasions, especially during storms. The maximum observed was 46 FNRU. The Rum River’s turbidity exceeded the Minnesota Pollution Control Agency’s water quality standard of 25 NTU during only four of 65 events (6%).

TSS was similar at the two upstream sites, but higher at the Anoka Dam (see figure below). The countywide TSS median for streams is 12 mg/L. The median at the Rum River sites from upstream to down stream was 8, 9, and 15 mg/L. At all the sites the median during storms was higher than baseflow. At the upstream site the difference between median TSS during storms and baseflow was 2 mg/L, while at County Road 7 it was 4 mg/L and at the Anoka Dam 8 mg/L. TSS during storms was much more variable due to variability in storms sampled. The maximum readings and moderate increases during storms are not unexpectedly high for a large river, and are within the range that should be considered healthy. At the same time, the increase in TSS between County Road 7 and the Anoka Dam is concerning. While it is concerning to have noticeable water quality deterioration in such a short stretch of river, it is not unexpected given the higher levels of land development between these two sites. No sites approached the Minnesota Pollution Control Agency’s surrogate turbidity standard of 100 mg/L TSS.

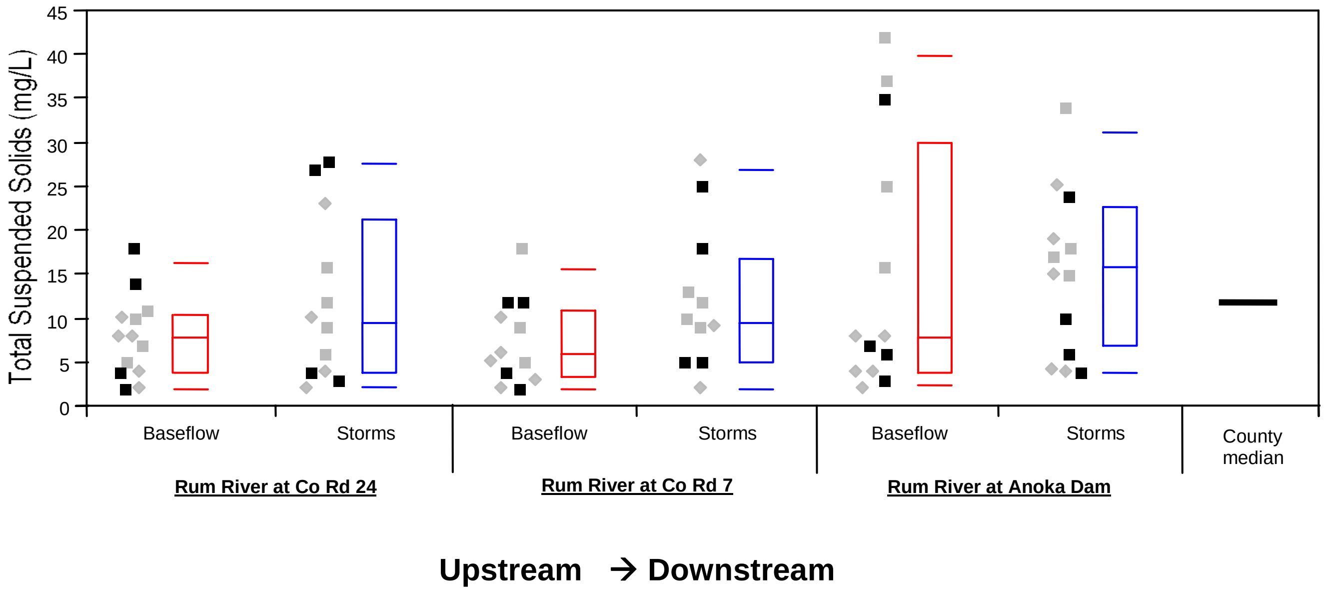
Differences between TSS and turbidity lend insight into the nature of any problems. TSS showed increases at the downstream monitoring site, while turbidity did not. Turbidity is most sensitive to large particles. Therefore, the downstream increases are likely due to smaller particles. Other pollutants, 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.

It should be noted that the data presented here do not include monitoring of any large flood events. The water is known to become muddier during such floods.

Turbidity during baseflow and storm conditions Grey squares are individual readings from 2004; grey diamonds are 2009 readings, and black squares are 2010 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



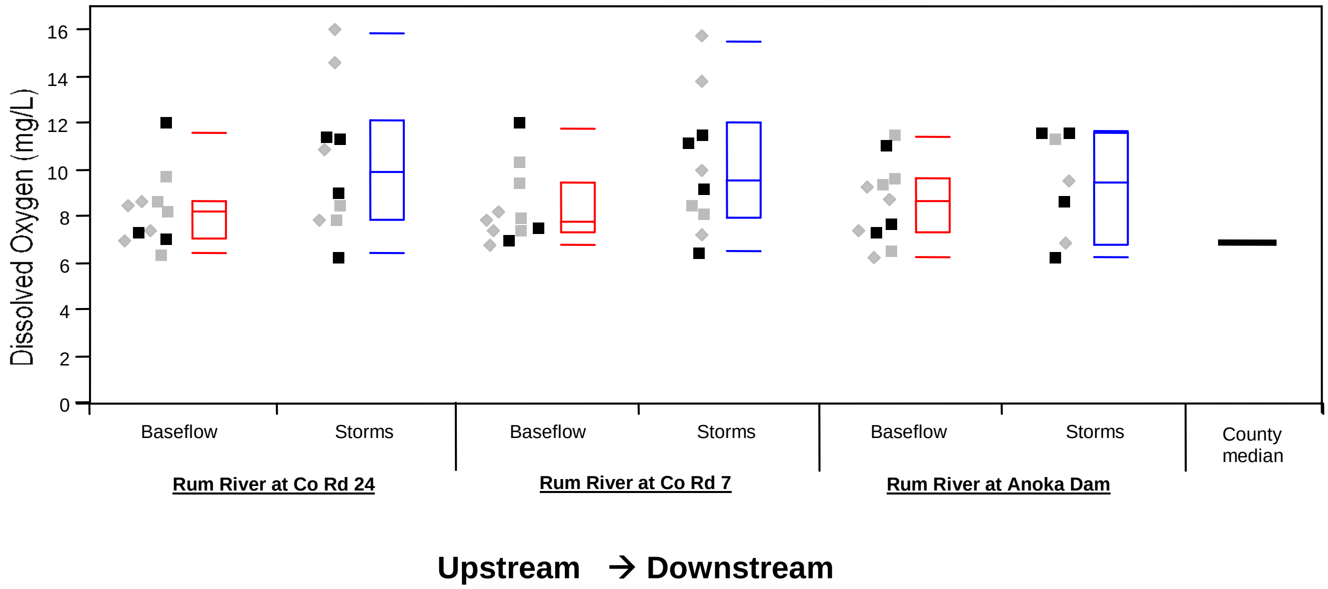
Total suspended solids during baseflow and storm conditions Grey squares are individual readings from 2004; grey diamonds are 2009 readings, and black squares are 2010 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



Dissolved Oxygen

Dissolved oxygen is necessary for aquatic life, including fish. Organic pollution consumes oxygen when it decomposes. If oxygen levels fall below 4 mg/L aquatic life begins to suffer. In the Rum River dissolved oxygen was always above 6 mg/L at all monitoring sites.

Dissolved oxygen during baseflow and storm conditions Grey squares are individual readings from 2004; grey diamonds are 2009 readings, and black squares are 2010 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).

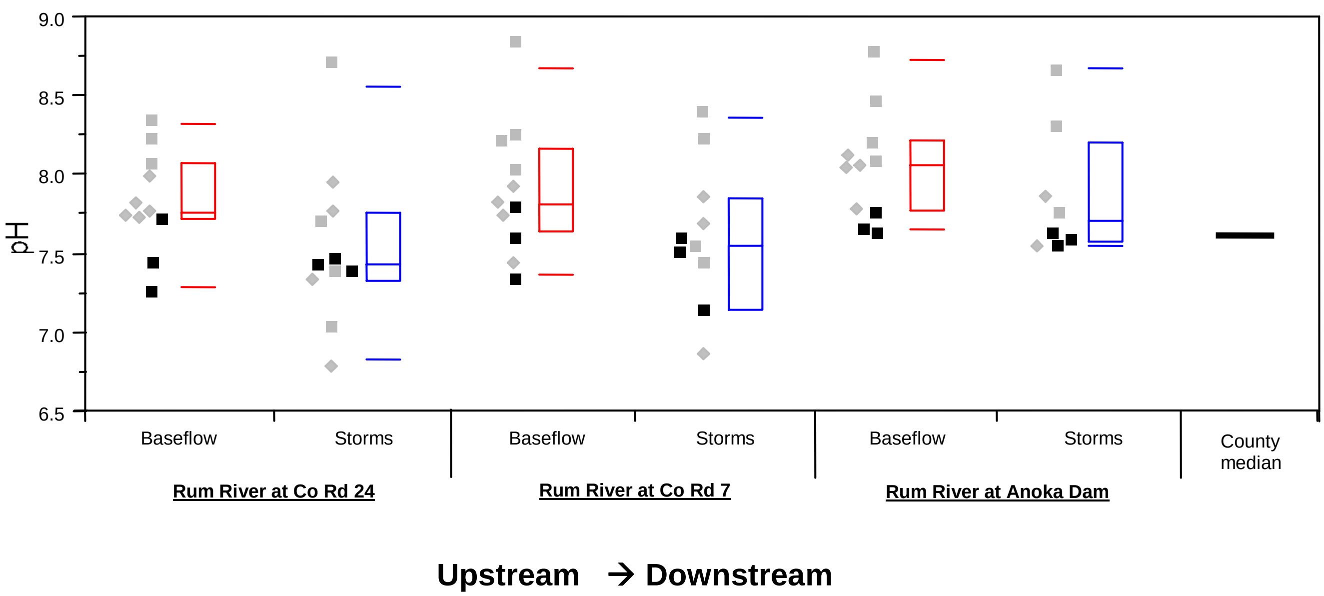


pH

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 regularly within this range (see figure below). Each of the three sites exceeded 8.5 on one occasion, but the highest was only 8.85. This rare and modest exceedance of the state water quality standard is not concerning.

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, it's affect on this aquatic system is small.

pH during baseflow and storm conditions Grey squares are individual readings from 2004; grey diamonds are 2009 readings, and black squares are 2010 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



Recommendations

While the Rum River's water quality is generally good, it does show some deterioration in the downstream areas that are most developed. 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. Measures to maintain the Rum River's good water quality should include:

- Enforce the building and clear-cutting setbacks from the river required by state scenic rivers laws to avoid bank erosion problems and protect the river's scenic nature.
- Use the best available technologies to reduce pollutants delivered to the river and its tributaries through the storm sewer system. Any new development should consider low impact development strategies that minimize stormwater runoff production. Aggressive stormwater treatment should be pursued in all areas of the watershed, not just those adjacent to the river. The area's soils are well suited to stormwater treatment by infiltration.
- Seek improvements to the existing stormwater conveyance system below County Road 7. Total suspended solids in the river increase significantly in this portion of the watershed, reaching their highest concentrations during storms.
- Utilize all practical means to reduce road deicing salt applications. These may include more efficient application methods, application only in priority areas, alternate chemicals, or others. Road salt infiltration into the shallow groundwater has become a regional problem. Deicing salts are apparent year-round in the groundwater that feeds area streams.
- Survey the river by boat for bank erosion problems and initiate projects to correct them.
- Continue education programs to inform residents of the direct impact their actions have on the river's health.
- Continue regular water quality monitoring. In addition to continuous monitoring of the Rum River by Metropolitan Council's Watershed Outlet Monitoring Program (WOMP), additional upstream monitoring should be conducted every 2-3 years. Monitoring should be coordinated to occur on the same days as the Met Council testing so direct comparisons are possible. Additionally, periodic monitoring of the primary tributary streams should also occur every 2-3 year. The Upper and Lower Rum River Watershed Management Organizations are best suited to do this watershed-level monitoring and should coordinate.

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 Industry Ave, 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 2010

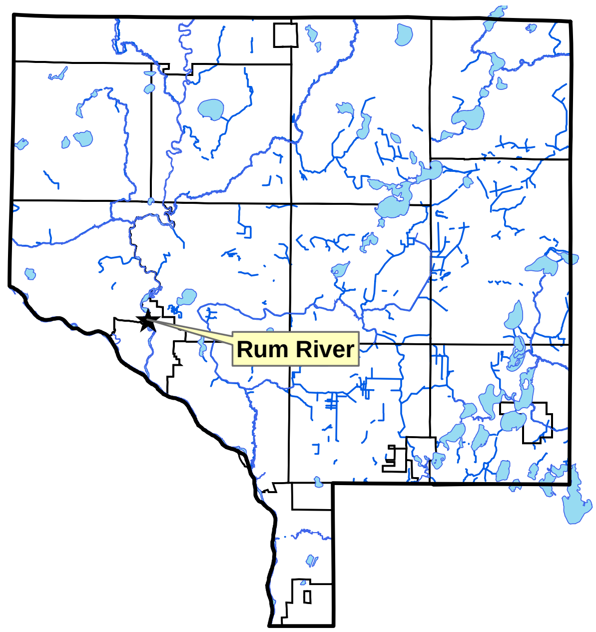
Monitored Since

2001

Student Involvement

40 students in 2010, approximately 410 since 2001

Background

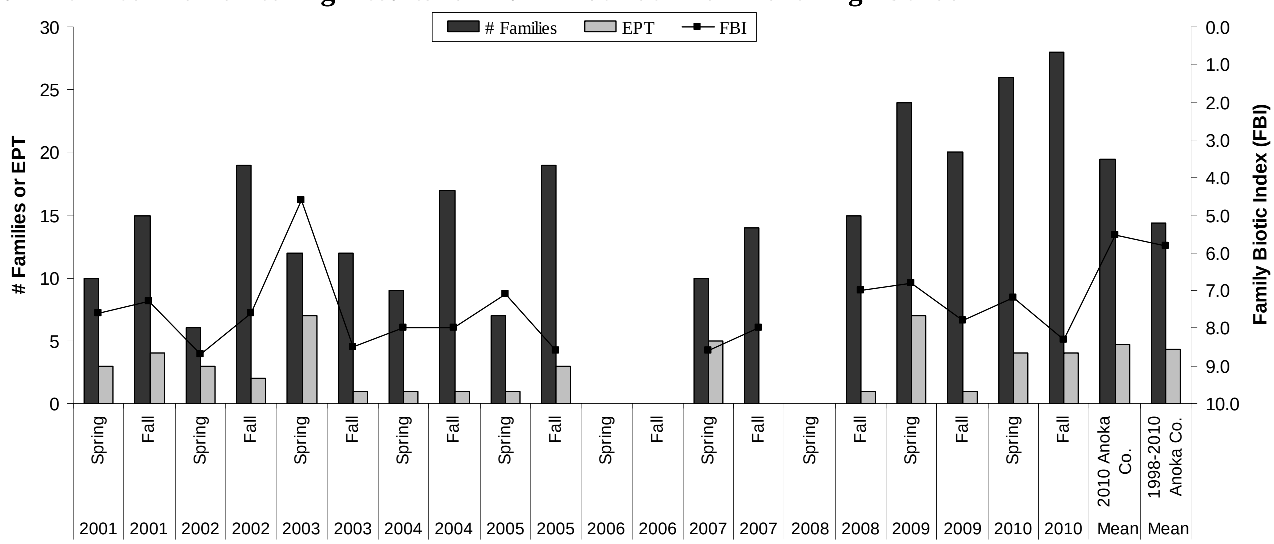


The Rum River originates from Lake Mille Lacs, and flows south through western Anoka County where it joins the Mississippi River in the City of Anoka. Other than the Mississippi, this is the largest river in the county. In Anoka County the river has both rocky riffles (northern part of county) as well 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 the main channel. Rather, it occurs in a backwater area. Water is not flowing in this location and the bottom is mucky. This site is not particularly representative of this reach of the river.

Results

Anoka High School monitored this site in both spring and fall 2010. The results for this site in 2010 were slightly better than most previous years, though this may be due to doubling of the number of students sampling compared to previous years. In 2010 more families (26 and 28) were found than ever before at this site, nearly double the county-wide average. Larger rivers generally have more families than smaller streams. In the spring and fall four pollution-sensitive EPT families were found. Because most species were not particularly sensitive to pollution, the Family Biotic Index was lower than the county average and similar to previous years. One likely reason few sensitive families were found is that sampling was in a mucky backwater. More may have been found in the main channel.

Summarized Biomonitoring Results for Rum River behind Anoka High School



Biomonitoring Data for Rum River at Anoka High School

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

Year	2006	2006	2007	2007	2008	2008	2009	2009	2010	2010	Mean	Mean
Season	**Spring**	**Fall**	**Spring**	**Fall**	**Spring**	**Fall**	**Spring**	**Fall**	**Spring**	**Fall**	**2010 Anoka Co.**	**1998-2010 Anoka Co.**
FBI			8.60	8.00		7.00	6.80	7.80	7.20	8.30	5.5	5.8
# Families			10	14		15	24	20	26	28	19.4	14.3
EPT			5	0		1	7	1	4	4	4.7	4.3
Date			7-May	22-Oct		13-Oct	8-May	28-Sep	18-May	7-Oct		
Sampled By			AHS	AHS		AHS	AHS	AHS	AHS	AHS		
Sampling Method			MH	MH		MH	MH	MH	MH	MH		
Mean # Individuals/Rep.			208	244		626	880	585	443	816		
# Replicates			1	1		1	1	2	1	1		
Dominant Family			Corixidae	Coenagrionidae		Baetidae	Siphlonuridae	Hyalellidae (formerly Talitridae)	Gastropoda	Hyalellidae (formerly Talitridae)		
% Dominant Family			91.8	37.3		26.5	40.7	39.1	31.8	34.1		
% Ephemeroptera			5.3	0		26.5	48.2	0.9	8.1	0.9		
% Trichoptera			0	0		0	0.1	0	0	0.2		
% Plecoptera			0.5	0		0	2.6	0	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
pH	8.5	7.42	7.75	7.91	7.82	7.24	7.22
Conductivity (mS/cm)	0.283	0.243	0.348	0.276	0.421	0.207	0.399
Turbidity (NTU)	17	13	3	6	5	7	7
Dissolved Oxygen (mg/L)	11.41	9.72	8.99	10.82	8.76	6.93	na
Salinity (%)	0.01	0	0.01	0.01	0.01	0	0.01
Temperature (°C)	15.3	10.6	12.3	17.2	15.5	14.8	12.2

Discussion

Biomonitoring results for this site are much different from the monitoring farther 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 Anoka location diversity has been high in recent samplings, but the biotic indices indicate a poorer than average river health. The reason for this dramatic difference is probably habitat differences, and to a lesser extent, water quality.

The habitat and overall nature of the river is different in St. Francis and Anoka. In the upstream areas around St. Francis the river has a steeper gradient, moves faster, 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 heavily silt laden. The area is more developed, so there are more direct and indirect human impacts to the river.

Water quality declines downstream, though it is still quite good at all locations. Chemical monitoring in 2004, 2009, and 2010 revealed that total suspended solids, conductivity, and chlorides were all 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 quite 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 because those families generally favor rocky habitats and require high dissolved oxygen not found in stagnant areas.

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.

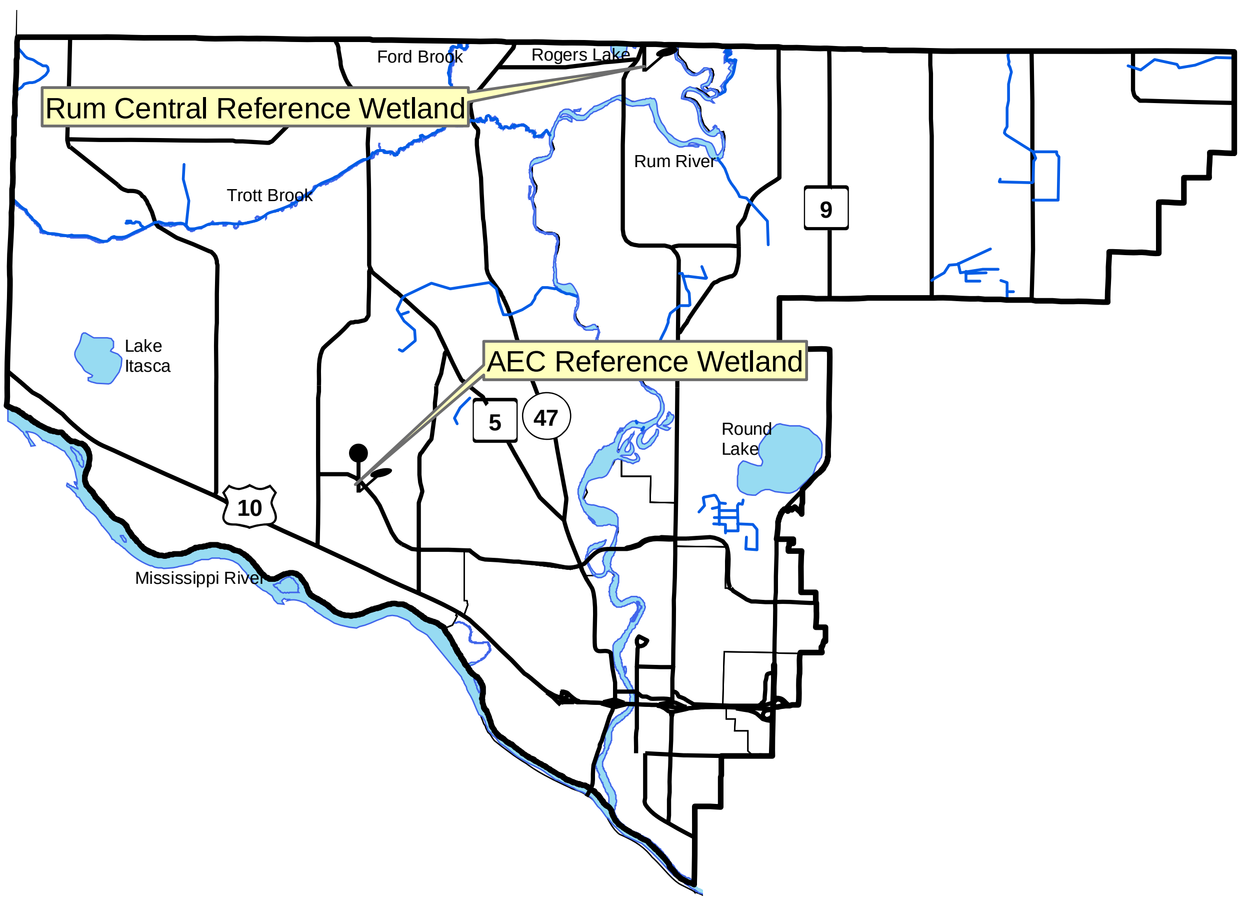
Purpose: To provide understanding of wetland hydrology, including the impact of climate and land use. These data aid in delineation of nearby wetlands by documenting hydrologic trends including the timing, frequency, and duration of saturation.

Locations: AEC Reference Wetland, Connexus Energy Property on Industry Ave, 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.

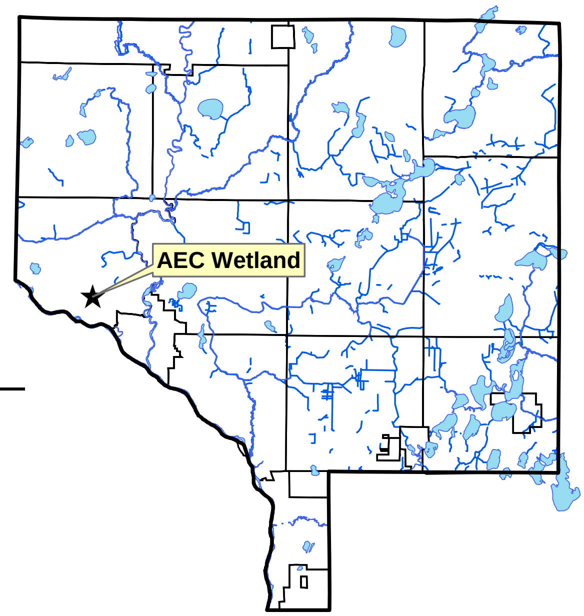
Lower Rum River Watershed Wetland Hydrology Monitoring Sites



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	-

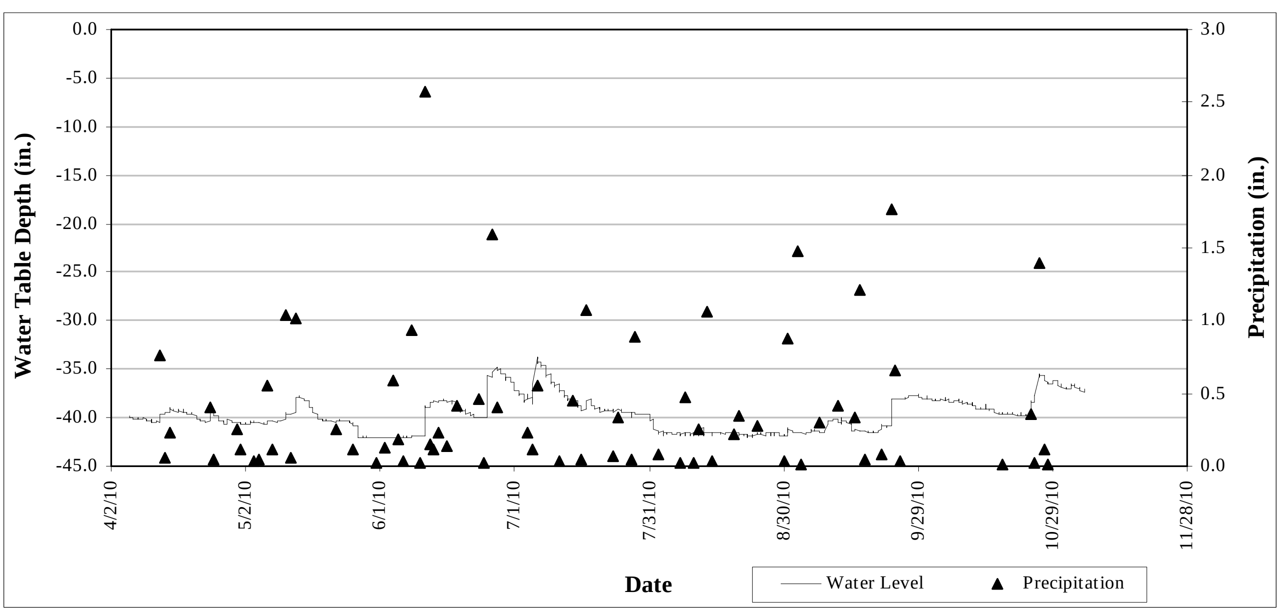
Surrounding Soils: Hubbard coarse sand

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.

2010 Hydrograph

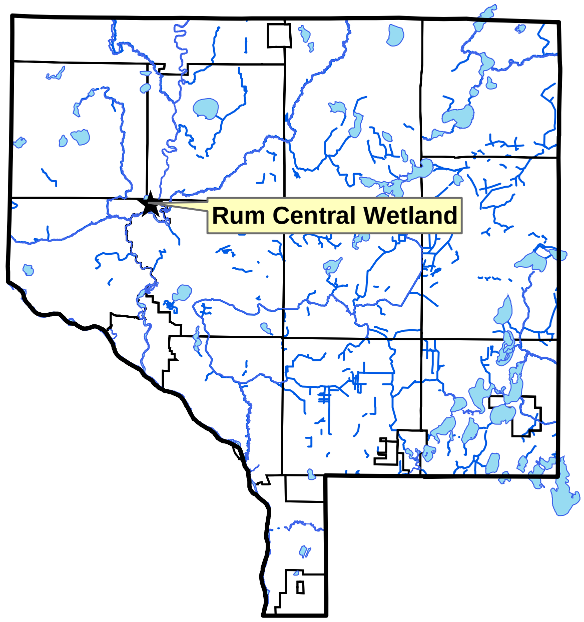


Well depth was 42 inches, so a reading of –42 indicates water levels were at an unknown depth greater than or equal to 42 inches.

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	-

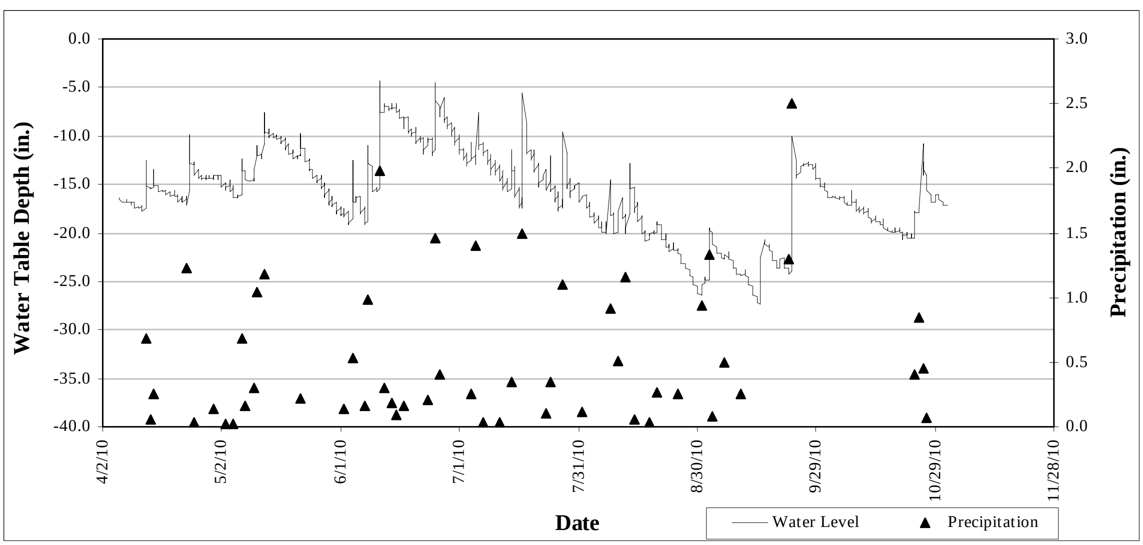
Surrounding Soils: Zimmerman fine sand

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.

2010 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 reported in the year they are installed. No projects were installed in 2010.

LRRWMO Cost Share Fund Summary

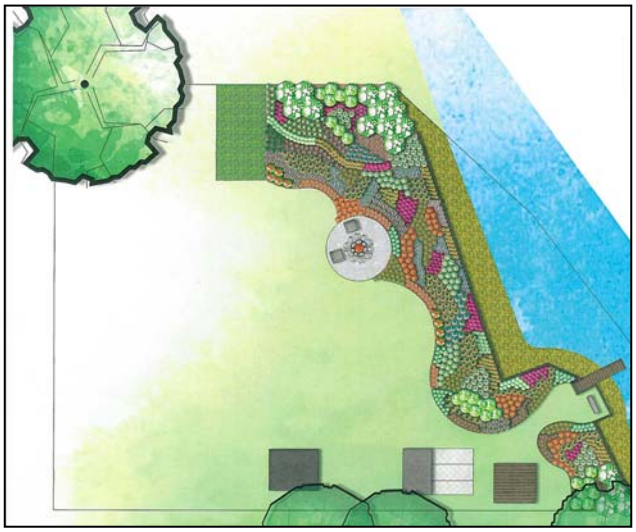
2006 LRRWMO Contribution	+	$1,000.00
2008 Expense – Herrala Rum Riverbank stabilization	-	$ 150.91
2008 Expense – Rusin Rum Riverbank stabilization	-	$ 225.46
2009 LRRWMO Contribution	+	$1,000.00
2009 Expense – Rusin Rum Riverbank bluff stabilization	-	$ 52.05
2010 LRRWMO Contribution	+	$ 0
2010 LRRWMO Expenses	-	$ 0
Fund Balance		**$1,571.58**

Water Quality Improvement Projects

Description: Projects on either public or private property that will improve water quality, such as repairing streambank erosion, restoring native shoreline vegetation, or rain gardens. These projects are partnerships between the landowner, the Anoka Conservation District, and sometimes with grant funding from the watershed organization or the Anoka Conservation District.

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 are described in a separate report produced by the Anoka Conservation District.



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.

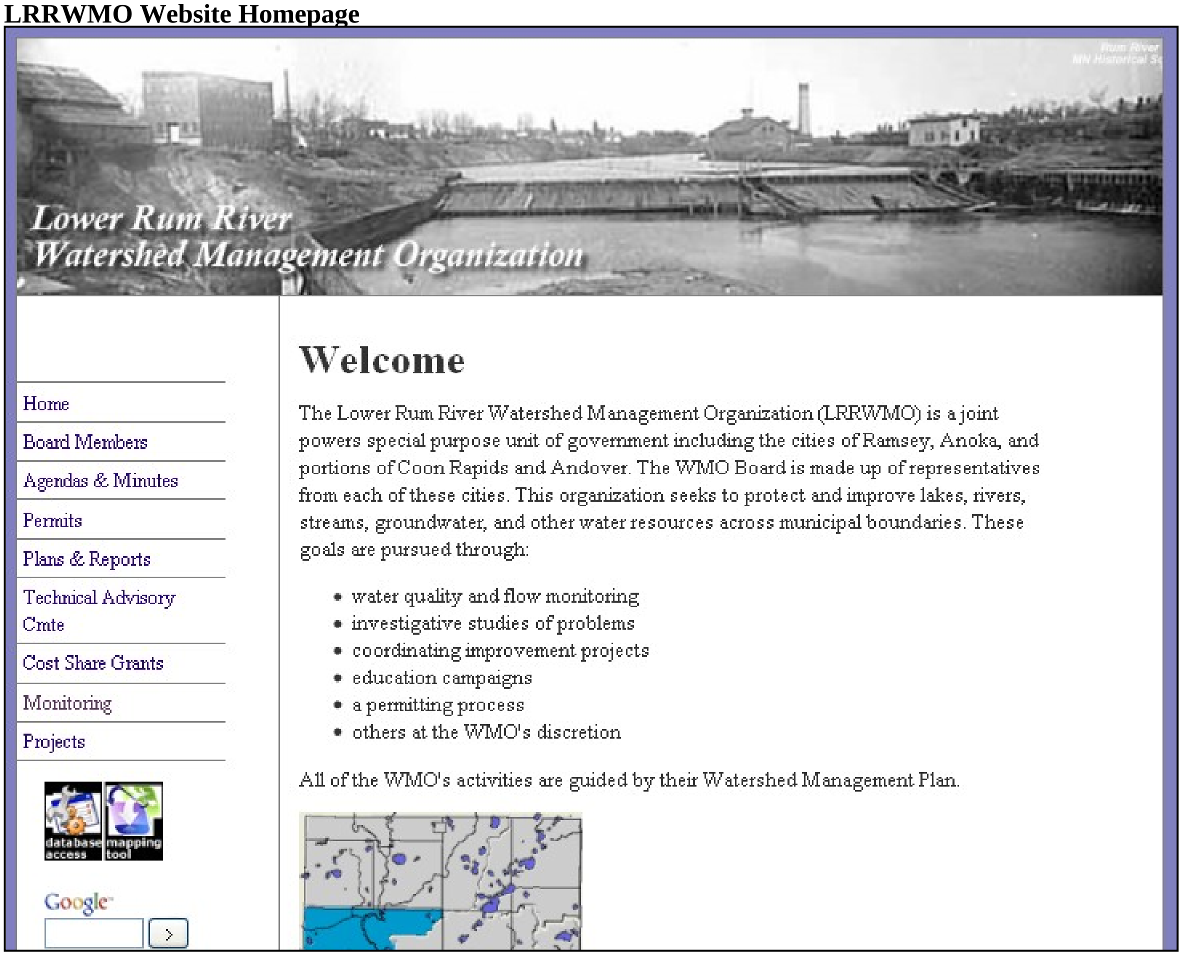
Information about the LRRWMO includes:

- a directory of board members,
- meeting minutes and agendas,
- descriptions of work that the organization is directing,
- highlighted projects,
- permit applications.

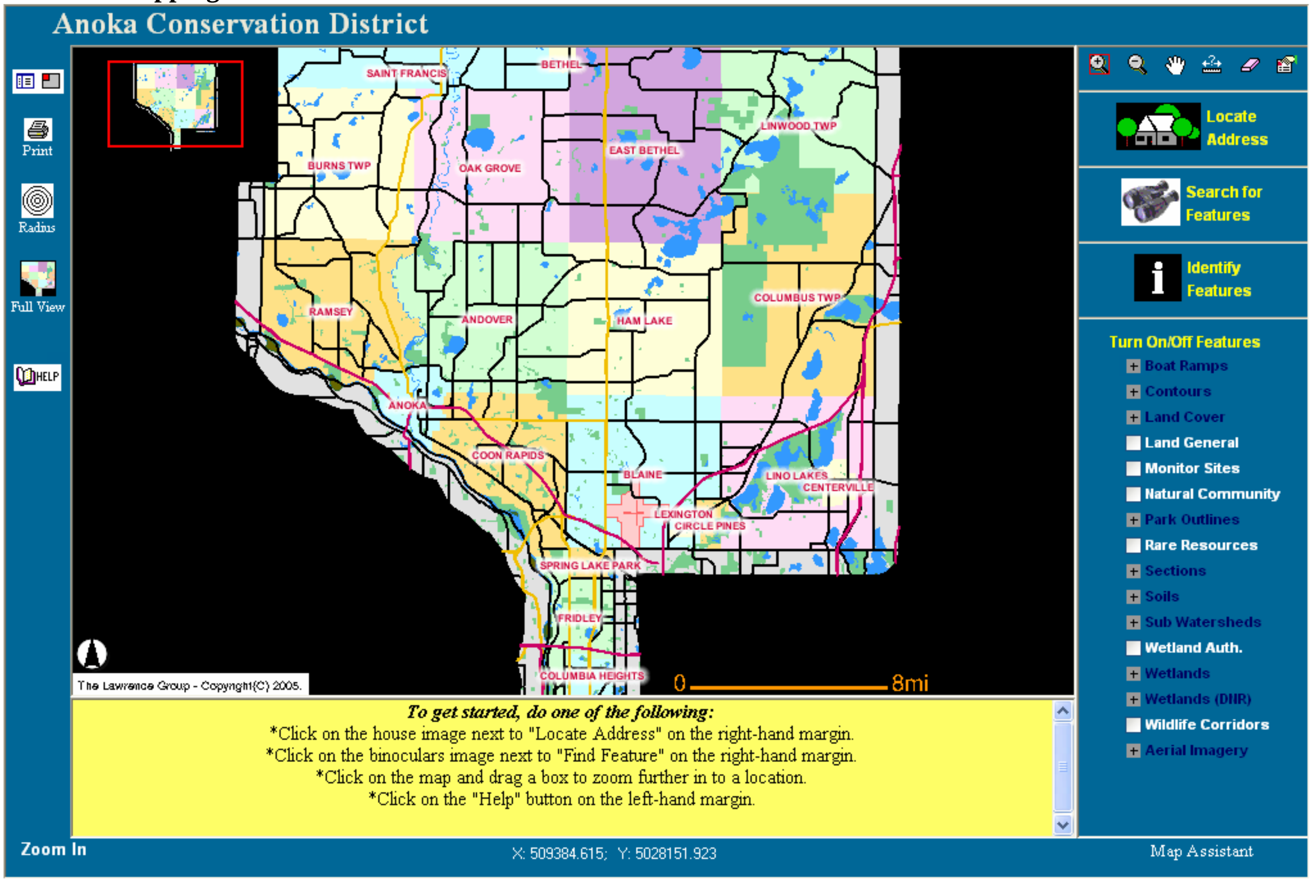
Other tools on the website include:

- 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

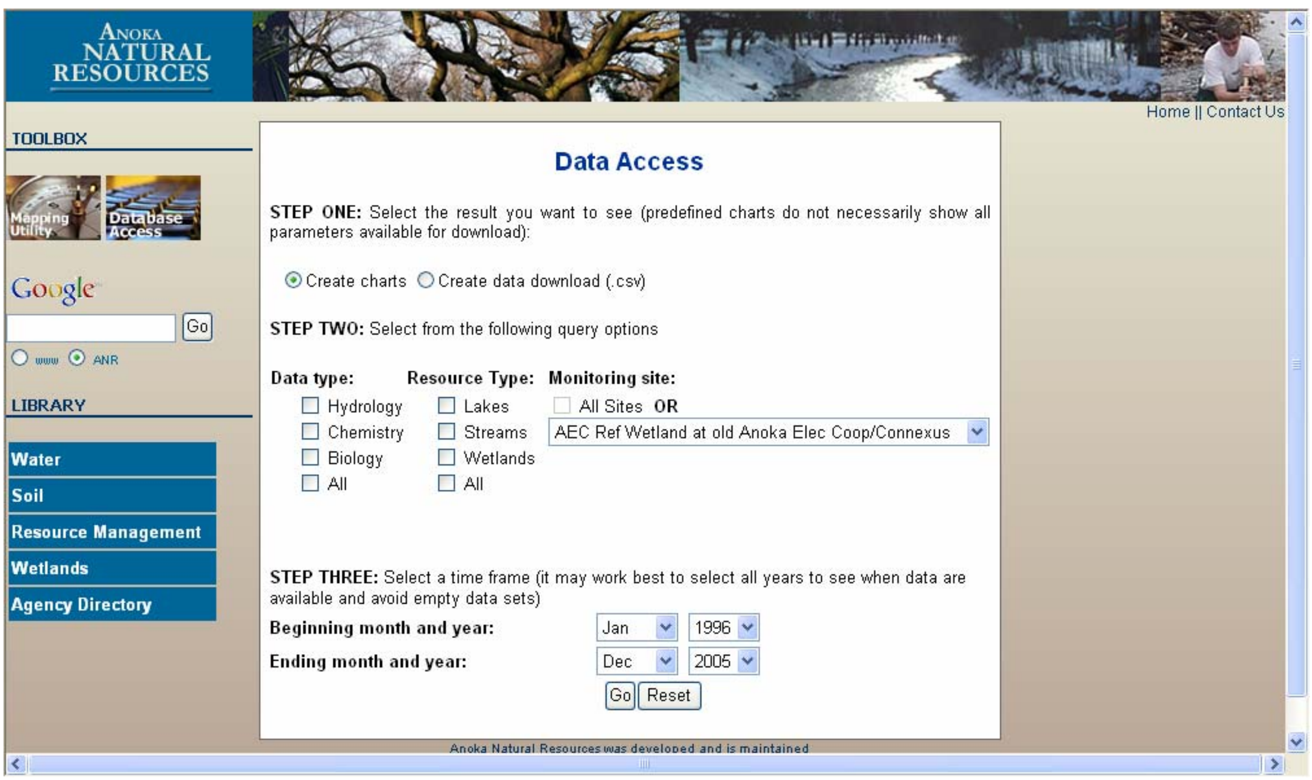
LRRWMO Website Homepage



Interactive Mapping Tool



Interactive Data Access Tool



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	Website	Volunteer Precip	Ref Wet	Lake Lvl	Obwell	Lake WQ	Stream WQ	WO MP	Student Bio	Geologic Atlas	Total
Revenues											
LRRWMO	540	0	535	450	0	1025	1560	0	780	0	4890
State	0	0	0	0	110	0	0	0	0	0	110
Anoka Conservation District	2699	115	36	347	181	34	12	1744	365	1137	6672
County Ag Preserves	0	0	0	0	0	490	0	0	264	0	754
Regional/Local	0	0	0	0	0	0	0	500	0	0	500
Other Service Fees	194	0	0	0	0	0	0	0	0	0	194
Local Water Planning	0	0	0	0	0	1306	84	0	0	0	1389
TOTAL	3433	115	571	797	291	2855	1656	2244	1408	1137	14508
Expenses-											
Capital Outlay/Equip	243	14	44	42	34	396	118	394	50	119	1455
Personnel Salaries/Benefits	1767	80	420	617	203	1595	852	1433	1091	755	8812
Overhead	1296	15	68	89	39	640	381	314	140	204	3186
Employee Training	14	1	3	5	2	10	4	6	11	3	60
Vehicle/Mileage	27	1	6	9	3	26	14	24	16	12	137
Rent	83	4	23	33	10	66	59	70	52	43	443
Program Participants	0	0	0	0	0	0	0	0	0	0	0
Program Supplies	1	0	7	0	0	97	209	4	47	1	366
Equipment Maintenance	1	0	0	1	0	24	19	1	1	1	48
TOTAL	3433	115	571	797	291	2855	1656	2244	1408	1137	14508
NET	0	0	0	0	0	0	0	0	0	0	0

Recommendations

- **Continue monitoring Round Lake** water quality at least every other year to determine if poorer water quality recently is within this lake's natural variation, due to low water levels, or is indicative of new negative influences on the lake.
- **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. Continued retrofitting existing stormwater treatment in built-up areas is recommended.
- **Continue coordinating monitoring of the Rum River** with the neighboring Upper Rum River WMO and the Metropolitan Council, who runs a monitoring site at the Anoka Dam.
- **Diagnose the cause of periodically low dissolved oxygen in Trott Brook.**
- **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. Treatments should occur in early spring, occur on no more than 15% of the lake, be coordinated, and proceed under DNR permits. In early 2010 a meeting for residents was held, interest expressed, but coordination and work needed by residents did not materialize.
- **Continue the existing cost share grant program for water quality improvement projects** on private properties. This program should be actively promoted by identifying problems and contacting landowners.
- **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.
- **Promote groundwater conservation.** Water tables in the LRRWMO appear depressed due to regional over-pumping. Metropolitan Council models predict 3+ft drawdown of surface waters in certain areas by 2030, and 5+ft by 2050.
- **Incorporate the above recommendations into the LRRWMO Watershed Plan**. The Plan is being updated in 2010-11.