

# **I. Water Quality**

## **General Water Quality Monitoring**

In 2003, the Red Lake Watershed District water quality staff conducted quarterly monitoring at 31 stream sampling sites. For 2003, 2 previously monitored sites were dropped: the Mud River in Redby (NEB-2), and the Bee Lake inlet. Three new sites were then added to the monitoring program: the Lost River north of Brooks (PL30), the Hill River in Brooks (PL40), and the Black River northwest of Red Lake Falls (BL18). These new sites were identified as secondary sites (tributaries to major rivers in the Red River Basin) for the Red River Basin Monitoring Network. The water quality staff also continued to monitor Clearwater Lake with the assistance of the Clearwater Lake Area Association and monitored an additional lake-monitoring site, Cameron Lake, in 2003.

Samples are analyzed for different parameters for lake samples than for stream samples. At lake sites the main concerns are total phosphorus, chlorophyll-a, transparency (Secchi disk readings), dissolved oxygen, and water temperature along with numerous site observations such as the color of the water, suitability for swimming, erosion, and recreational activity. In stream sites, results are obtained for water temperature, dissolved oxygen, pH, conductivity, total dissolved solids, total suspended solids, total phosphorus, orthophosphorus, total Kjeldahl nitrogen, nitrates and nitrites, chemical oxygen demand, ammonia nitrogen, alkalinity, and fecal coliform.

One notable finding from the 2003 monitoring results was a water quality problem on the Thief River during the spring. Conductivity and total dissolved solids were extremely high in the early spring, 2535 and 1930 mg/L respectively. High conductivity/TDS levels normally indicate erosion. In this case, they may have been caused in part by concentrated runoff from sediment deposited in ditches during the winter. There was a high amount of wind erosion during the winter of 2002-2003, but not much snow (to dilute runoff). Ditches generally do not carry much sediment (TSS levels were okay) but the minerals dissolved from the newly deposited sediment into runoff from melting snow would have contributed to the high concentration of TDS and the resulting high conductivity levels. The amount of water existing as ice on the river (>3' thick) may have further minimized any chance of dilution, therefore exacerbating the problem and preventing the reoxygenation of the water as well (low dissolved oxygen levels are common during the winter on the Thief River). When Agassiz NWR started releasing water later in the spring (late April – early May), it caused a different water quality problem on the river. High amounts of organic matter were flushed downstream. This contributed to a spike in total phosphorous (208 ppb) and TSS (76 mg/L) levels. Phosphorous is contained in sediment and organic matter. Organic matter doesn't dissolve in water (TDS levels were back to normal by this time), so it would be a constituent of the suspended solids in the water. Studies have also shown that much of the sediment loads in the Thief River come from channel erosion. More erosion occurs during high flows (such as when large amounts of water are released into the river) than at low or average flows, so the sudden influx of large amounts of water may have increased the amount of sediment from channel and stream bank erosion as well. Water quality on the Thief River is of great importance to the City of Thief River Falls because it contributes to the city's water supply as a tributary of the Red Lake River.

## **Clearwater Lake Water Quality Model and the Clearwater Lake Management Plan**

The Red Lake Watershed District received two Local Water Planning Challenge Grants related to Clearwater Lake through the Board of Water and Soil Resources in 2001. The projects funded by those grants were the Clearwater Lake Water Quality Model Project and the Clearwater Lake Management Plan Project. Both projects were completed in 2003.

For the Clearwater Lake Management Plan, the Clearwater Lake Area Association (CLAA) applied for the challenge grant through the RLWD. The purpose of this project is to develop a lake management plan to improve lake water quality through active educational efforts with lakeshore owners and partnerships with local agencies.

Elements of the management plan include:

- A property owners' survey to gather information about existing septic systems, aquatic vegetation, sedimentation, and lakeshore damage
- An extensive collection of historical lake information
- A parcel-based database for both Excel and ArcView
- Results and recommendations from the Clearwater Lake Water Quality Model Project
- Development of a vision statement, mission statement, short and long-term goals, and an action plan with implementation goals

In 2002 the Clearwater Lake Area Association met several times to continue the planning process. In 2003 a final draft of the water quality part of the management plan was developed using the Sustainable Lake Planning Guide from the Minnesota Lake Association. The purpose of the Clearwater Lake Water Quality Model was to assess the feasibility of various nutrient and sediment reductions and their effects on lake water quality.

Action items for this project included:

- Surveying and stream gauging of selected water quality monitoring sites
- Collection of water quality data from January 2002 to October 2002. The monitored parameters included water temperature, pH, conductivity, dissolved oxygen, nitrates and nitrites, ortho-phosphorous, total phosphorous, fecal coliform, chemical oxygen demand, total Kjeldahl nitrogen, ammonia, total dissolved solids, and total suspended solids.
- Collection of evaporation pan data and continuously recorded rain gauge data
- Data entry and statistical analysis
- Development of annual loading and hydrologic budgets for Clearwater Lake
- Development of a water quality model for Clearwater Lake.

The recommendations were published in a technical memorandum. This document is available at the RLWD office and online on the projects page of the RLWD website (<http://www.redlakewatershed.org/projects.html>) under the Clearwater Lake Water Quality Model Study section. Local partners in this project included: Beltrami County, Clearwater County, the CLAA, the Clearbrook-Gonvick River Watch Program, and partial funding provided through the Red River Watershed Management Board. State Agencies such as the Minnesota DNR and the MPCA are also participating in this project.

## **Red River Watershed Assessment Protocol Project**

In 2003, the Red Lake Watershed District continued progress on the Red River Watershed Assessment Protocol Project. This is a multi-faceted project aimed at examining water quality data collected on a long-term basis at the RLWD and establishing protocols for the future long-term water quality program. One part of this project is the establishment of a RLWD website. The website was completed in December 2002 with final edits and improvements completed in March 2003.

The website has many features, including the following

- A water quality section that includes:
- Interactive GIS map of the watershed and can be used in searching for water quality sites.
- Online water quality database.
- Water quality report card designed to give the public a qualitative sense of the state of water quality throughout the Red Lake Watershed.
- Site description, including pictures, a table of all existing water quality data for the site.
- Analyze and Download page. Water quality data can be statistically analyzed online. One can download water data, a data dictionary for the database, and quality assurance information.
- A projects page that lists RLWD projects and makes available project reports and work plans
- A permits page that offers a printable application and will also feature a permit database.

Other accomplishments for this project include:

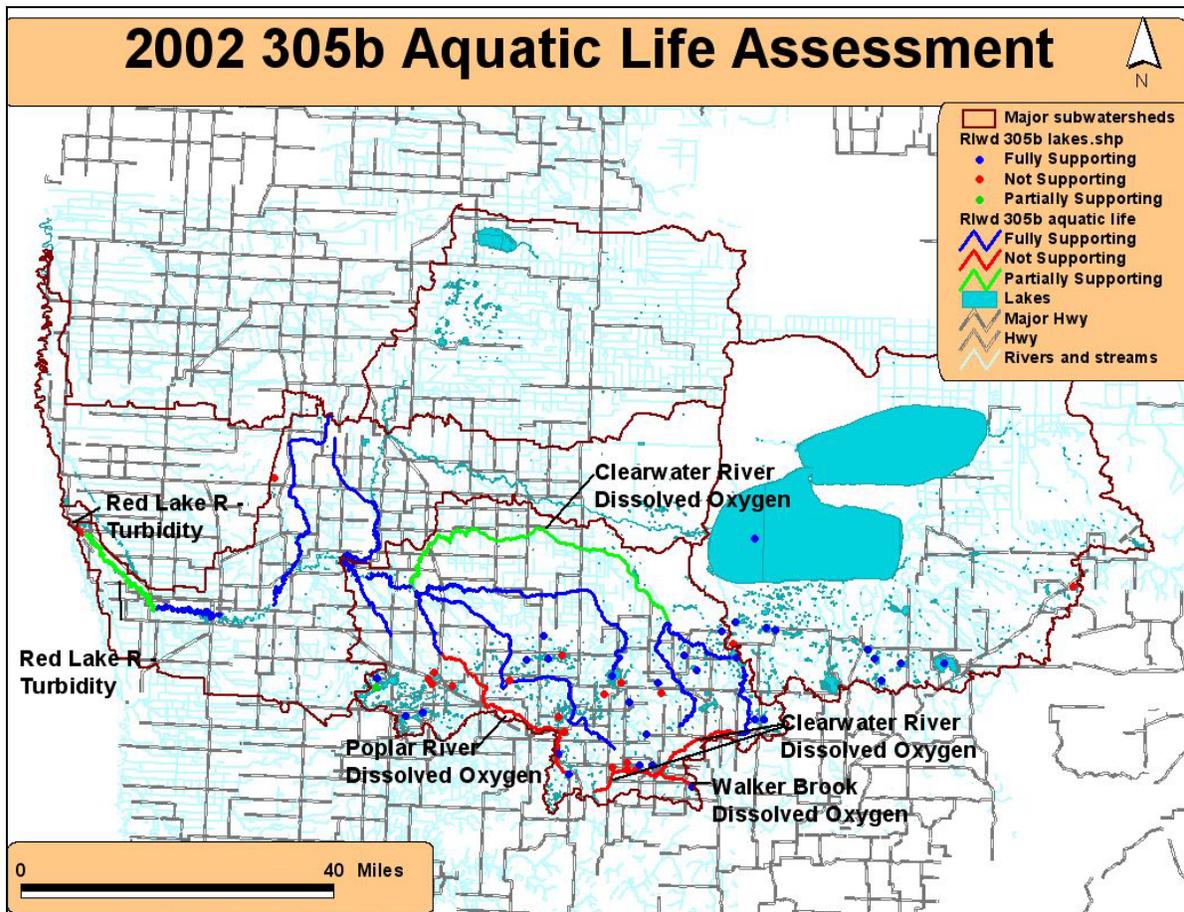
- Entering existing water quality data for the district into the EPA's STORET database for the first time since 1994.
- Time series graphs by parameter and correlation matrixes were created for each site.
- The present monitoring goals and network are being reviewed. The monitoring network and schedule are being revised in order to coordinate better with the monitoring activities of other agencies and MPCA assessment guidelines.
- A final draft of a Standard Operating Procedures (SOP) manual was created.
- A Quality Assurance Project Plans (QAPPs) for RLWD monitoring and Riverwatch
- Computing annual loads at gauging stations
- Demonstrated statistical analysis techniques applied to RLWD and other organizations' water quality data
- A water quality report format for use in the RLWD

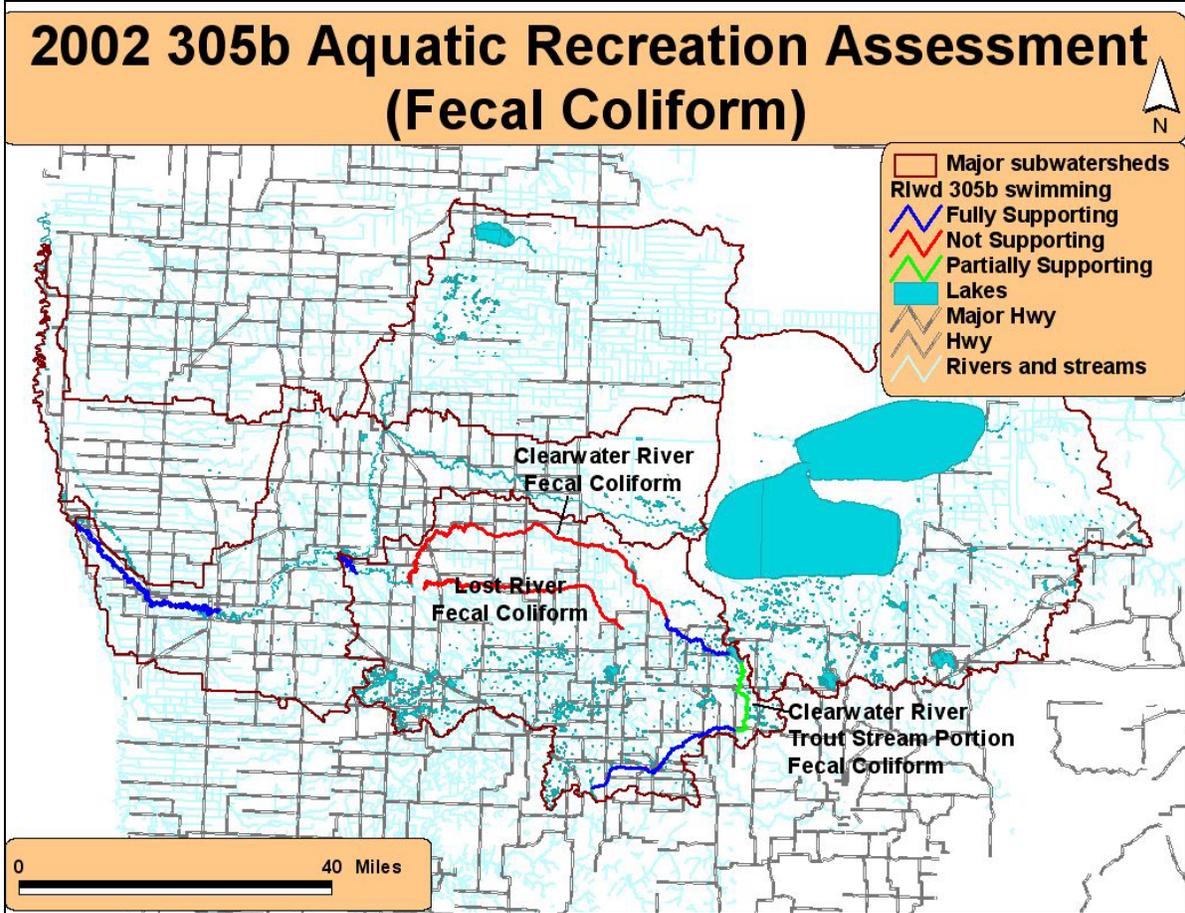
The project was funded through a Local Water Planning Challenge Grant through the Board of Water and Soil Resources in 2001. The Red River Basin Team is acting as the local advisory committee for the project.

You can find our website at [www.redlakewatershed.org](http://www.redlakewatershed.org)

## TMDLs in the Red Lake River Watershed

TMDL stands for Total Maximum Daily Load. The TMDL program came about as a result of the Federal Clean Water Act, which is enforced by the US Environmental Protection Agency. Each state is required to assess its waters, determine which waters are impaired, conduct TMDL studies to determine the causes of impairments, develop load reduction recommendations, and publish TMDL reports that include the results of the studies. Impairments are based on whether or not a body of water meets water quality standards. There currently are 8 river/stream reaches within the RLWD that are listed as impaired. The MPCA has also assessed 49 lakes within the RLWD. Some of the lakes listed as fully supporting of aquatic life included Blackduck, Buzzle, Cable, Clearwater, Lomond, Pine, Red, Sarah, Union, Walker Brook, and others. The lakes listed as not supporting of aquatic life (based on nutrient and algae levels as well as water transparency) included Badger, Bartlett, Cameron, Mitchell, Oak, Turtle and some smaller lakes. Maple Lake was listed as partially supporting of aquatic life. The maps below show the results of the latest MPCA assessment for the RLWD.





Many reaches within the RLWD have not been assessed. The MPCA only uses data from STORET (the EPA’s national water quality database) for assessing the waters of the state. For past assessments, the only data from the RLWD in STORET was from the 1992-93 monitoring conducted for the Clearwater River Nonpoint Study. RLWD district monitoring program data will soon be entered into this database, greatly increasing the amount of data used for assessing the waters within the RLWD. RLWD staff recently assessed the data collected at district monitoring sites using the methods outlined in the MPCA Guidance Manual for Assessing the Quality of Minnesota Surface Waters for Determination of Impairment. The results show that in the next round of assessment by the MPCA in 2005 for the 2006 list of impaired waters, more reaches within the RLWD will be listed as impaired. This analysis will be part of a RLWD water quality report that will be completed in 2004; all results are available for viewing in the office. The following tables summarize the impairments identified by this analysis. The EPA standards for Minnesota are:

Dissolved Oxygen	Minimum of 5.0 mg/L
pH	6.5-8.5 allowable range
Conductivity	1000 mg/L maximum
Total Suspended Solids	25 mg/L maximum
Total Dissolved Solids	500 mg/L maximum
Fecal Coliform	200 colonies/100 ml

### Thief River Subwatershed

<b>Site #15, Moose River at Hwy 89</b>			
<b>Parameter</b>	<b>% Exceedances</b>	<b>Would it be Listed?</b>	<b>Designated Use Support</b>
Dissolved Oxygen	23.53%	Yes	Partial
<b>Site # 757-0, Mud River at Hwy 89</b>			
<b>Parameter</b>	<b>% Exceedances</b>	<b>Would it be Listed?</b>	<b>Designated Use Support</b>
TSS/Turbidity	10.00%	Yes	Partial
<b>Site # 98, Thief River at the Thief Lake Outlet</b>			
<b>Parameter</b>	<b>% Exceedances</b>	<b>Would it be Listed?</b>	<b>Designated Use Support</b>
Fecal Coliform	11.11%	No	Full
<b>Site # 40, Thief River at Agassiz MWR Outlet</b>			
<b>Parameter</b>	<b>% Exceedances</b>	<b>Would it be Listed?</b>	<b>Designated Use Support</b>
Dissolved Oxygen	18.75%	Yes	Partial
TSS/Turbidity	22.58%	Yes	Partial
<b>Site # 760 Thief River at the Hillyer Bridge</b>			
<b>Parameter</b>	<b>% Exceedances</b>	<b>Would it be Listed?</b>	<b>Designated Use Support</b>
Dissolved Oxygen	20.59%	Yes	Partial
TSS/Turbidity	25.00%	Yes	Non

### Red Lake River Subwatershed

<b>Red Lake River #790 Sampson Bridge, in City of Crookston</b>			
<b>Parameter</b>	<b>% Exceedances</b>	<b>Would it be Listed?</b>	<b>Designated Use Support</b>
TSS/Turbidity	45.45%	Yes	Non
<b>Burnham Creek #799, near City of Crookston</b>			
<b>Parameter</b>	<b>% Exceedances</b>	<b>Would it be Listed?</b>	<b>Designated Use Support</b>
TSS/Turbidity	16.67%	Yes	Partial
<b>Grand Marais Creek #826, on US Hwy #220, near City of East Grand Forks</b>			
<b>Parameter</b>	<b>% Exceedances</b>	<b>Would it be Listed?</b>	<b>Designated Use Support</b>
Dissolved Oxygen	22.22%	Yes	Partial
TSS/Turbidity	64.29%	Yes	Non
<b>Red Lake River Murray Bridge in City of East Grand Forks</b>			
<b>Parameter</b>	<b>% Exceedances</b>	<b>Would it be Listed?</b>	<b>Designated Use Support</b>
TSS/Turbidity	48.48%	Yes	Non

## Clearwater River Subwatershed

Clearwater River #128 near City of Bagley			
Parameter	% Exceedances	Would it be Listed?	Designated Use Support
Dissolved Oxygen	15.87%	Yes	Partial
Clearwater River #O-6 on US Hwy #2 Bridge outside of Bagley			
Parameter	% Exceedances	Would it be Listed?	Designated Use Support
Dissolved Oxygen	25.71%	Yes	Non
Clearwater River #780 on US Hwy #59 Bridge near Plummer			
Parameter	% Exceedances	Would it be Listed?	Designated Use Support
TSS/Turbidity	18.92%	Yes	Partial
Clearwater River #785 Klondike Bridge in Red Lake Falls			
Parameter	% Exceedances	Would it be Listed?	Designated Use Support
TSS/Turbidity	28.13%	Yes	Non

Lost River #50-I Inlet to Pine Lake			
Parameter	% Exceedances	Would it be Listed?	Designated Use Support
Dissolved Oxygen	14.29%	Yes	Partial
Fecal Coliform	13.79%	Yes	Partial
Lost River #50-O Outlet to Pine Lake			
Parameter	% Exceedances	Would it be Listed?	Designated Use Support
Dissolved Oxygen	14.29%	Yes	Partial
Fecal Coliform	13.79%	Yes	Partial
Badger Creek #59 on US Hwy #59 near Erskine			
Parameter	% Exceedances	Would it be Listed?	Designated Use Support
Dissolved Oxygen	38.00%	Yes	Non
Poplar River #63 on US Hwy #2, near Erskine			
Parameter	% Exceedances	Would it be Listed?	Designated Use Support
Dissolved Oxygen	12.12%	Yes	Partial
Bee Lake #85			
Parameter	% Exceedances	Would it be Listed?	Designated Use Support
Dissolved Oxygen	39.29%	Yes	Non

Ruffy Brook #797 near City of Gonvick			
Parameter	% Exceedances	Would it be Listed?	Designated Use Support
Fecal Coliform	27.59%	Yes	Non
Silver Creek #81 near City of Gonvick			
Parameter	% Exceedances	Would it be Listed?	Designated Use Support
Fecal Coliform	20.00%	Yes	Non
Lost River #782, in City of Oklee			
Parameter	% Exceedances	Would it be Listed?	Designated Use Support
Fecal Coliform	12.90%	Yes	Partial
Hill River #PL40, in City of Brooks			
Parameter	% Exceedances	Would it be Listed?	Designated Use Support
TSS/Turbidity	23.08%	Yes	Partial
Poplar River #109, near City of Brooks			
Parameter	% Exceedances	Would it be Listed?	Designated Use Support
Dissolved Oxygen	11.43%	Yes	Partial
Poplar River #62, on US Hwy #92, near City of Brooks			
Parameter	% Exceedances	Would it be Listed?	Designated Use Support
Fecal Coliform	12.50%	Yes	Non

## **TMDLs on the Clearwater River**

A local TMDL workgroup consisting of the RLWD, MPCA, local SWCDs, MNDNR, a professor emeritus of Geology, and citizens are studying the low dissolved oxygen impairment on Walker Brook and the fecal coliform impairment on the trout stream portion of the Clearwater River. This project will be completed in the early summer of 2004.

The low dissolved oxygen impairment on Walker Brook may be occurring due to natural causes. Walker Brook is fed by ancient ground water that is depleted of oxygen. The stream also flows through a bog with organic soil that further depletes the oxygen levels. Additionally, a combination of beaver dams and natural topography in Walker Brook and the headwaters of the Clearwater River results in low flow velocities. This leads to nearly stagnant water in and further depletion of dissolved oxygen levels.

The fecal coliform impairment on the trout stream portion of the Clearwater River has had several potential sources such as wildlife, pastures, feedlots, and the City of Bagley. The City of Bagley should no longer be a major source of fecal coliform. The city updated its wastewater/sewage treatment facility in 2002 so raw sewage will not be bypassed directly into the river. The city also constructed several stormwater retention ponds in 2003. Fecal coliform levels have actually improved to the point that the trout stream reach would not be listed as impaired based upon the most recent 10 years of data. However, the guidelines for delisting a reach are different. During a 2.9-inch rain event in August of 2002, there was a high spike in fecal coliform levels in the trout stream reach (the headwaters reaches did not exceed the standard). Since the guidelines for delisting use monthly averages instead of the percentage of exceedences, the high results for samples taken on this one day will prevent the trout stream reach from being delisted. The workgroup will now have to focus on find the possible sources of this high spike and how to reduce them.

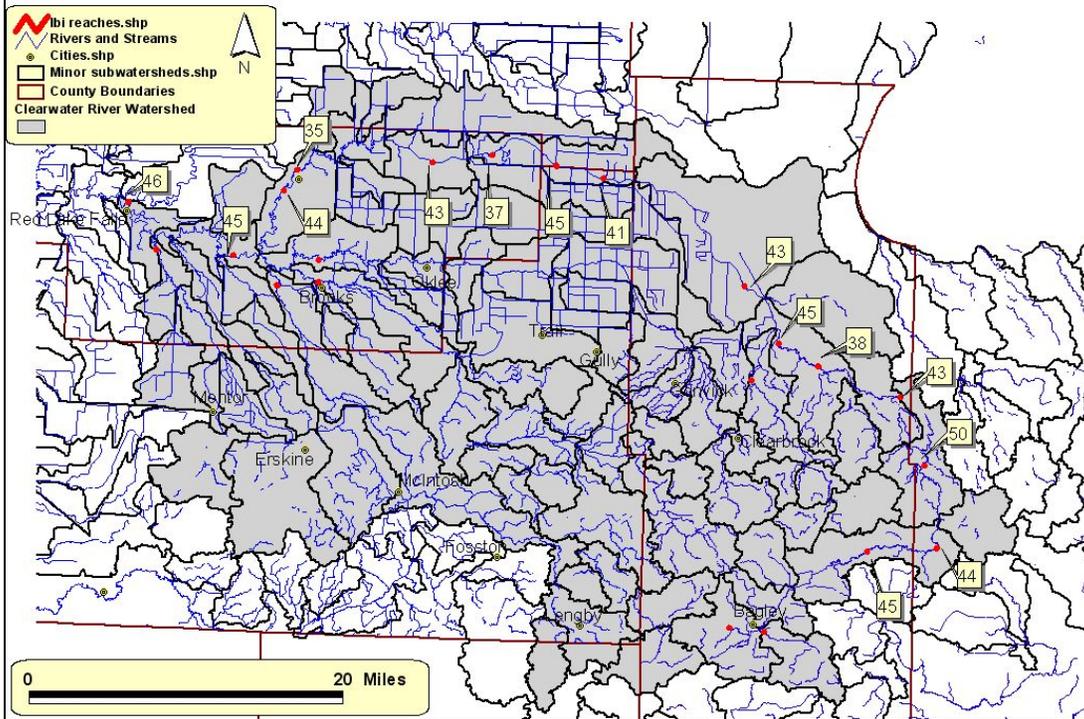
## **Clearwater River Habitat/Bioassessment Study**

The purpose of the Clearwater River Habitat/Bioassessment Study is to perform an index of biological integrity (IBI) along the entire Clearwater River. For each site, a 100-meter reach was scored based upon metrics for habitat, macroinvertebrates, and fish. The project involved sampling of fish at 15 sites along the Clearwater River as well as habitat and macroinvertebrate sampling at 8 additional sites on the Clearwater River and its major tributaries.

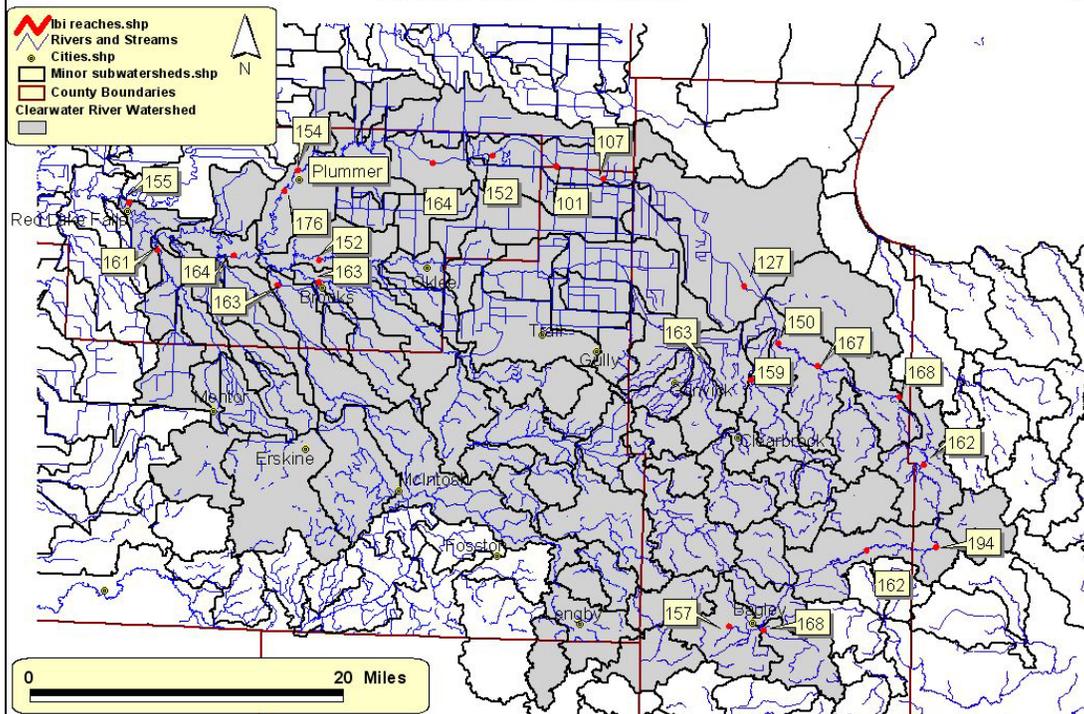
Clearwater Lake was also surveyed and sampled for fish by the MN DNR. RLWD and Beltrami SWCD staff mapped aquatic vegetation plants and sampled macroinvertebrates. Zooplankton samples were also collected on the lake along with water quality samples with the assistance of the Clearwater Lake Area Association.

Stream sampling occurred in August of 2003. The fish and habitat results have been tallied and scored. Macroinvertebrate sample analysis is being conducted by the MN DNR Aquatic Invertebrate Biology Lab and has not yet been completed. The final report for the study will be completed in 2004. Below are the fish and habitat scores for the river.

## Clearwater River Habitat/Bioassessment Fish IBI Scores



## Clearwater River Habitat/Bioassessment Habitat Scores



## River Watch Program Update

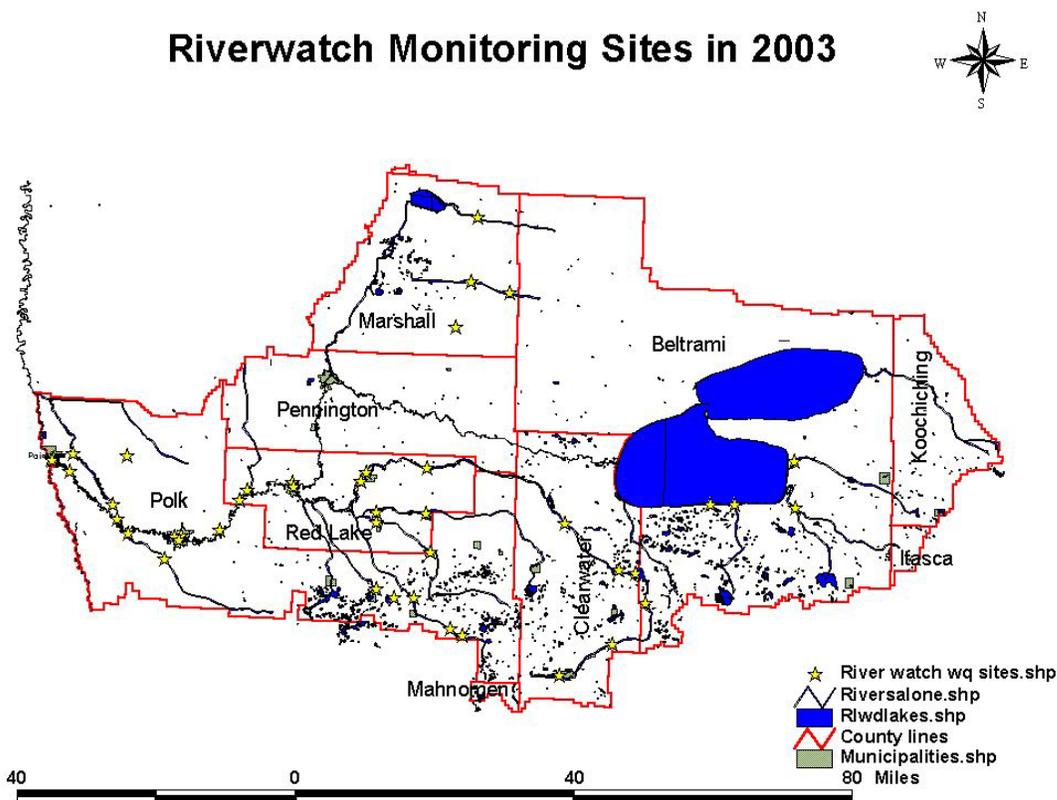
The River Watch Program has been continuing at several area schools in the RLWD. The goal of the River Watch Program is to educate students in natural resources fields while collecting meaningful water quality, quantity and other natural resource data. Students are provided “hands-on” experience in subjects ranging from chemistry and biology to hydrology and geology.

In 2003, the RLWD continued funding for the program in eight area schools in the district. The schools enter a contract for 10-years with the watershed.

The RLWD is providing supplies as well as substitute teacher and transportation costs to monitoring sites. The schools involved in the program include Red Lake County Central (Oklee/Plummer), Red Lake Falls, Clearbrook-Gonvick, Crookston, East Grand Forks, East Grand Forks Sacred Heart, and Grygla. Also half funding goes to Win-E-Mac and Fosston.

Future plans for the River Watch Program in the RLWD include maintaining annual River Watch data display forums. The data collected is entered into the RLWD database to be utilized by resource managers.

### Riverwatch Monitoring Sites in 2003

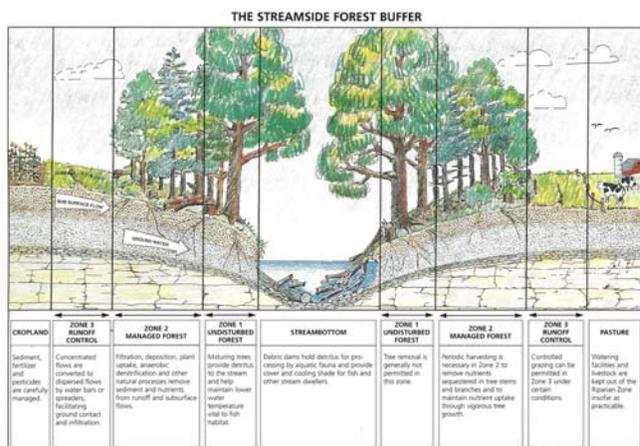


Riverwatch Monitoring Sites

## Silver Creek Buffer Strip Implementation

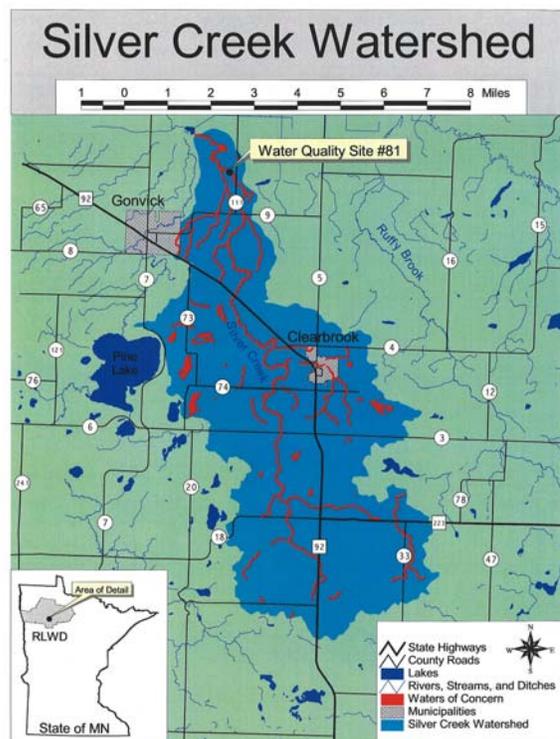
The Silver Creek Buffer Strip Initiative was initiated to work with the Clearwater Soil and Water Conservation District and the Clearwater County Natural Resources Conservation Service to determine areas where riparian buffer strips are needed within the Silver Creek watershed and to enroll these areas into the Conservation Reserve Program. Silver Creek is a tributary of the Lost River, which is a tributary of the Clearwater River. The size of the watershed is approximately 36 square miles. One reason for focusing on this small watershed is to demonstrate an effective strategy for establishing buffer strips and monitoring their success. The RLWD has a long-term water quality monitoring site on Silver Creek near its confluence with the Lost River from which pre- and post-implementation water quality can be compared. The CRP program funds the easements for the buffers. The RLWD is providing the funding necessary for staff time at the Clearwater SWCD and NRCS to implement this project, which includes collecting applications from landowners, evaluating applications, determining eligibility of the land, developing contracts, GPS work on eligible sites, planting of the buffer strips, and the enrollment of the areas into CRP. The RLWD funding was extended through December 31, 2003. The Red River Basin Commission received funding to continue the project implement similar projects elsewhere in the Red River Basin beginning in 2004 as part of the Red River Basin Buffer Strip Initiative.

Riparian buffer strips are strips of permanent vegetation next to a river or stream. They can consist of native grasses, trees, and shrubs planted next to a waterway. They help stabilize stream banks and reduce nutrient runoff from agricultural, lawn, or urban landscapes. They also provide habitat for wildlife, increase species diversity, and moderate water temperature (to benefit fish and other aquatic life).



David J. Willich, USDA Forest Service—NA-FR-07-91  
 "I consider riparian buffers to be the most important factor influencing nonpoint source pollutants entering surface water in many parts of the USA."  
 J.W. Gilliam

### Riparian Buffer Strip



## Future Water Quality Program Information

In 2004, goals for the water quality program include:

- Continue the water monitoring program, improve the monitoring network by adding lake and stream monitoring sites.
- Continue monitoring and working with local SWCD on riparian buffer strips projects.
- Complete the Red River Watershed Assessment Protocol Project.
- Complete the Clearwater River Habitat/Bioassessment Project.
- Continue working with local schools involved in the Riverwatch Program.
- Continue working with the MPCA and local partners on TMDL studies within the Red Lake Watershed District.
- Continue to pursue funding for new projects such as the Clearwater River Small Cities Stormwater Project and the Clearwater River Watershed Initiative Project.

For more information or questions on water quality projects, water quality data, mapping or GIS data contact Corey Hanson or Stephanie Klamm at the Red Lake Watershed District Office or e-mail at [coreyh@wikel.com](mailto:coreyh@wikel.com) or [stephanieh@wikel.com](mailto:stephanieh@wikel.com).

