# Quality Assurance Project Plan

For

# Red River Basin River Watch Program

Prepared for:

Schools, Citizens, and Volunteers conducting River Watch monitoring in the Red River Basin
Agency personnel assisting with River Watch monitoring in the Red River Basin
Entities utilizing data generated from the River Watch Program


Prepared by:

Wayne Goeken, Monitoring Coordinator-Red River Watershed Management Board
Danni Halvorson, Monitoring Specialist-Red River Watershed Management Board
Corey Hanson-Water Quality Specialist-Red Lake River Watershed District


This quality assurance project plan (QAPP) has been prepared to ensure that environmental and related data collected, compiled, and/or generated for this program/project are complete, accurate, and of the type, quantity, and quality required for their intended use. The work conducted will be in conformance with the *Standard Operating Procedures for Water Quality Monitoring in the Red River Watershed* (Red Lake Watershed District, October 24, 2003), the *Red River Basin Water Quality Monitoring Volunteer Manual* (River Keepers 2004) and with the procedures described in this QAPP.

**Approvals:**

| | |
|---|---|
| _____ _____ | _____ _____ |
| Wayne Goeken Date | Corey Hanson Date |
| Monitoring Coordinator, RRWMB | Water Quality Coordinator, Red Lake Watershed District |
| Erskine, MN 56535 | Thief River Falls, MN 56701 |
| _____ _____ | _____ _____ |
| Joe Courneya Date | Bruce Paakh Date |
| Director, Center for Watershed Education | Red River Basin Monitoring Coordinator, MPCA |
| Fargo, ND 58105 | Detroit Lakes, MN 56501 |

**Adopted: _____**

**Amended: _____**


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## DISTRIBUTION LIST

| Name | Affiliation/Role | Address | Phone | Email |
|---|---|---|---|---|
| **Red River Basin Monitoring Advisory Committee** | | | | |
| **Wayne Goeken** | RRWMB-Monitoring Coordinator | 40048 160th Ave SE Erskine, MN 56535 | 218-574-2622 | wrg@gvtel.com |
| **Danni Halvorson** | RRWMB-Monitoring Specialist | 23493 155th Avenue NW Viking, MN 56760 | 218-523-6171 | dannihalvorson@wiktel.com |
| **Bruce Paakh** | MPCA-QC Supervisor | 714 Lake Ave. Suite 220 Detroit Lakes, MN 56501 | 218-846-0747 | bruce.paakh@pca.state.mn.us |
| **Dan Wilkens** | Sand Hill Watershed District-RRBMAC | 200 West Main Fertile, MN 56540 | 218-945-6529 | shrwd@gvtel.com |
| **Jim Ziegler** | MPCA-Program Director | 714 Lake Ave. Suite 220 Detroit Lakes, MN 56501 | 218-847-1519 | james.ziegler@pca.state.mn.us |
| **Brian Dwight** | Minnesota Board of Water & Soil Resources | 3217 Bemidji Avenue North Bemidji, MN 56601 | (218) 755-3963 | brian.dwight@bwsr.state.mn.us |
| **Tom Groshens** | MN DNR Fisheries | | (218)-755-4488 | tom.groshens@dnr.state.mn.us |
| **Dan Money** | Two Rivers Watershed District Administrator | P.O. Box 5 Hallock, MN 56728 | 218-843-3333 | daniel.money@mn.usda.gov |
| **Corey Hanson** | Red Lake Watershed District-Water Quality Coordinator | P.O. Box 803 Thief River Falls, MN 56701 | 218-681-5800 | coreyh@wiktel.com |
| **Darrell Schindler** | Red Lake DNR-Water Quality Coordinator | | 218-679-3959 | dschindl@paulbunyan.net |
| **Lisa Botnen** | Energy &Environmental Research Center-Research Scientist | University of North Dakota 15 North 23rd Street Grand Forks, ND 58202 | 701-777-5144 | lbotnen@undeerc.org |
| **Charles Fritz** | Red River Basin Institute-Director | | 701-231-9747 | Charles.Fritz@ndsu.nodak.edu |
| **Joe Courneya** | Red River Center for Watershed Education-Director | 219 FLC Box 5016 Fargo ND 58105-5016 | 701-231-6184 | jcourney@ndsuext.nodak.edu |
| **Teachers/Citizens Coordinating River Watch Programs in Schools/Communities** | | | | |
| **Cathy Dickey** | Clearbrook/Gon-vick High School-RW advisor | PO Box 8 Elm St. Clearbrook, MN 56634 | 218-776-3112 218-968-2381 | cldickey32@hotmail.com |
| **Spencer Oland** | Lafayette High School (RL Falls) | PO Box 399 Red Lake Falls, MN 56750 | 218-253-2163 218-253-4664 | soland@redlakefalls.k12.mn.us |
| **Steve Strutz** | Red Lake County Central High School-RW advisor | 100 Government St. Oklee, MN 56742 | 218-796-5136 218-681-3724 | sstrutz@oklee.org |
| **Tim Mostrom** | Grygla-Gatzke High School-RW advisor | Fladeland Ave. Grglya, MN 56727 | 218-294-6155 218-294-6301 | tim_mostrom@mail.grygla.k12.mn.us |
| **Kristen Pederson** | Fosston High School-RW advisor | 301 1st St. E. Fosston, MN 56542 | 218-435-1909 218-435-6008 | peterson@fosston.k12.mn.us |
| **Bob Nephew** | Win-E-Mac High School-RW advisor | 23130 345 St. SE Erskine, MN 56535 | 218-687-2236 218-687-4521 | rnephew@host1.win-e-mac.k12.mn.us |
| **Pat Hurley** | East Grand Forks Public High-RW advisor | 1420 4th Ave NW East Grand Forks 56721 | 218-773-3494 | phurley@egf.k12.mn.us |
| **Mike Marek** | East Grand Forks Sacred Heart | 200 3rd St NW East Grand Forks 56721 | 218-773-0877 | mmarek@sacredheartegf.net |
| **Greg Garmen/** | Crookston High School- | 420 Fisher Ave | 218-281-2144 | jzehrer@crookston.k12. |

| | | | | |
|---|---|---|---|---|
| **Jessica Hanson** | RW advisor | Crookston 56716 | | mn.us |
| **Karri Basler** | Fisher High School-RW advisor | 313 Park Ave<br>Fisher 56723 | 218-891-4905 | |
| **Nathan Anderson/ Karen Good** | Red Lake High School-RW advisors | Hwy 1 North<br>Red Lake 56671 | 218-679-3733 | nathana@redlake.k12.mn.us |
| **Ann Dalbey** | Lancaster HS RW advisor | | 218-762-5400 | ADalbey@lancaster.k12.mn.us |
| **Mark Gerhls** | Kittson Co. Central HS RW advisor | | 218-843-3682 Ext.240 | mgehrls@kittson.k12.mn.us |
| | Roseau HS RW advisor | | | |
| **Jim Pederson** | Marshall Co. Central HS RW advisor | | 218-874-7225 | jimpeder@newfolden.k12.mn.us |
| **Kevin Johnson** | Warren HS RW advisor | | 218-745-4646 | kjohnson@wao.k12.mn.us |
| **Julie Reitmeier** | Fertile RW advisor | | 218-945-3399 | brookhaven@gvtel.com |
| **Karen Thoreson** | Climax RW advisor | | 218-857-2810 | kthoreson@climax.k12.mn.us |
| **Randy Zimmerman** | Norman Co. West RW advisor | | | rzimmerman@ncw.k12.mn.us |
| **Dale Erickson** | Mahnomen HS RW advisor | | 218-935-2211 | derickson50@hotmail.com |
| **Nathan Purrington** | Ada HS RW advisor | | | NATHANP@ada.k12.mn.us |
| **Danielle Differding** | Hawley HS RW advisor | | 218-483-3666 | ddifferding@hawley.k12.mn.us |
| **Sheila Carlson** | Barnesville HS RW advisor | | 218-354-2228 | skc@rrt.net |
| **Dave Himmelspach** | Campbell HS RW advisor | | 218-630-5311 | himmelspachd@campbell.k12.mn.us |
| **Tim Frew** | Wheaton HS RW advisor | | 320-563-8282 | tfrew@wheaton.k12.mn.us |
| **Matyas Sundim** | Herman HS RW advisor | | 320-677-2291 | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| **Other Cooperators/Data Users/etc. (Watershed/SWCD/etc.)** | | | | |
| **Jon Roeschlein** | Bois De Sioux Watershed District-RW coordinator/data user | 1002 Broadway<br>Wheaton, MN 56296 | 320-563-4185 | bdswd@traversenet.com |
| **Jerry Bennett** | Wild Rice Watershed District-RW coordinator/data user | 11 E. 5th Ave.<br>Ada, MN 56510 | 218-784-5501 | wrwd@loretel.net |
| **Bruce Albright** | Buffalo-Red Watershed District-RW coordinator/data user | 123 Front St., P.O. Box 341<br>Barnesville, MN 56514 | 218-354-7710 | brrwd@bvillemn.net |
| **Ron Adrian** | Middle River Snake Tamarac WD Administrator | 453 N. McKinley St., P.O. Box 154<br>Warren, MN 56762 | 218-745-4741 | mrsrwd@ruralaccess.net |
| **Rob Sando** | Roseau River WD | P.O. Box 26 | 218-463-0313 | rrwd@mncable.net |

| | | | | |
|---|---|---|---|---|
| | Administrator | Roseau, MN 56751 | | |
| | | | | |
| **Christine Holland** | River Keepers Water Quality Coordinator | 325 7th St. S.<br>Fargo, ND 58103 | 701-235-2895 | riverkeepers@i29.net |
| **Dan Driessen** | RRBI-Center for Watershed Education Outreach Coordinator | | 701-780-8229 | ddriesse@ndsuext.nodak.edu |
| **Chris Klucas** | RRBI-Center for Watershed Education RiverWatch Coordinator | 219 FLC Box 5016 Fargo ND 58105-5016 | 701-231-7252 | Christopher.Klucas@ndsu.nodak.edu |
| **Janine Lovold** | Roseau Co SWCD Water Plan Coordinator | 502 7th St. SW, Suite 8<br>Roseau, MN 56751 | 218-463-1903 | janine.lovold@mn.nacdnet.net |
| **Tanya Hanson** | Red Lake Co SWCD Water Plan Coordinator | 2602 Wheat Drive<br>Red Lake Falls, MN 56750 | (218) 253-2593 | tanya.hanson@mn.nacdnet.net |
| **Gary Lee** | E. Polk Co SWCD Water Plan Coordinator | P.O. Box 57<br>McIntosh, MN 56556 | (218) 563-2777 | gary.lee@nacdnet.net |
| **Paige Guetter** | W. Polk Co SWCD Water Plan Coordinator | 528 Strander Avenue<br>Crookston, MN 56716 | (218) 281-6070 | paige.guetter@mn.nacdnet.net |
| **Jan Kaspari** | Marshall/Pennington Co Water Plan Coordinator | | (218)-745-4217 | jan.kaspari@mn.nacdnet.net |
| **Aaron Neubert** | Mahnomen SWCD Water Plan Coordinator | 123 W. Monroe Ave., P.O. Box 381<br>Mahnomen, MN 56557 | 218-935-2987 Ext. 3 | acn@mn.nrcs.usda.gov |
| **Steve Hofstad** | Clay Co SWCD Water Plan Coordinator | 1506 30th Ave S<br>Suite B<br>Moorhead, MN 56560-5150 | 218-287-2255 | Steve.Hofstad@mn.nacdnet.net |
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# A. PROJECT MANAGEMENT

## A1. Project/Task Organization

The Red River Watershed Management Board (RRWMB) has been the primary entity responsible for supporting and coordinating the River Watch program in the Red River Basin. RRWMB monitoring staff provides primary coordination and support services to the program including training, equipment coordination, sampling assistance, and assistance with data entry, analysis, and reporting. The Red River Basin Monitoring Advisory Committee (RRBMAC), comprised of various partners involved with water quality monitoring in the Red River Basin (see first section of distribution list above), provides technical assistance and coordination to the River Watch monitoring efforts as well as utilizes the data generated for analysis and decision making. This advisory committee serves as the Quality Control Manager for this project. Lead staff Wayne Goeken of the RRWMB and Bruce Paakh of the MPCA are responsible for maintaining the official, approved Quality Assurance Project Plan.

Staff from several soil and water conservation districts, Red Lake Watershed District, RRWMB, and the Red River Basin Institute's Center for Watershed Education (CWE) generally accompany students and teachers when sampling to provide training and guidance. In the Red Lake River, Sand Hill, Buffalo-Red, and Bois de Sioux watersheds, transportation, substitute teacher, and some equipment expenses are reimbursed to participating schools by their respective watershed district. The Red Lake Watershed District has ten-year contracts with each school in their watershed for this arrangement.

The distribution list on pages i-iii provides a comprehensive list of agency personnel, teachers, and others involved in various capacities as noted above with the River Watch program—from monitoring participants to data users. In addition to those identified, students from participating schools are involved in the monitoring, data management, and reporting. As students are involved their names are recorded for every sample event they participate in as part of the program's permanent records. Due to regular ongoing turnover of students they will not be individually listed in this plan.

## A2. Background/Problem Definition

The River Watch program began in the Red River Basin as a pilot project with four schools on the Sand Hill River in1995 with funding from a Minnesota Board of Water and Soil Resources Challenge Grant. At the time the Sand Hill Watershed District had no water quality monitoring program in place and had been frustrated in obtaining needed permits due in part to their lack of water quality data acceptable for permitting agencies' reviews. Developing sound baseline water quality data using scientifically credible methods to help address the District's needs was a primary goal of the River Watch program. Additional goals were to provide hands-on "real world" science opportunities for students, and to promote greater citizen awareness and understanding of watersheds and the role of watershed districts in regional resource management.

Other watershed districts faced similar needs to develop or supplement their monitoring programs to document baseline conditions and/or meet basic monitoring requirements of Flood Damage Reduction/Natural Resource Enhancement (FDR/NRE) projects. The niche filled by the River Watch program is the building of a long-term baseline of sound water quality data while also fulfilling its goals of education and awareness. Sites being monitored are selected to represent a diversity of stream reaches of the vast network of waterways in the Red River Basin, many which will serve as comparative upstream or downstream sites for current or future projects undertaken by watershed districts. River Watch participants can provide additional data at existing agency monitoring sites where needed and can monitor other strategic sites that local agencies have been unable to monitor due to resource constraints.

The main water quality concern in the Red River basin and its tributaries is the tremendous loss of topsoil via wind and water erosion. Sediment being blown into and transported down the basin's waterways is nothing short of an ecological and economic disaster. Costs include loss of valuable topsoil, ditch clean-outs, extra treatment costs to water plant operators, habitat destruction, and recreation impairments to name a few. Sediment also carries with it nutrients, especially phosphorus, which have been a major concern due to the eutrophication of Lake Winnipeg. The network of River Watch sites being monitored and the parameters being assessed including turbidity and dissolved oxygen levels will contribute greatly to an understanding of where to best target limited resources to address these problems.

From its inception with four schools monitoring the Sand Hill River the River Watch program has grown to include 27 schools monitoring over 150 sites on rivers, streams, creeks, and major drainage ditches throughout the Minnesota portion of the Red River Basin as of the 2004 monitoring season. Schools in the North Dakota and Manitoba portions of the basin are also following these proven standard methods as they initiate local monitoring efforts. Support for the program lies in the need for consistent, comparable data throughout the Red River Basin. By following standard operating procedures, providing ongoing training and support, and engaging in working partnerships between schools and resource managers in the Basin, the River Watch program continues to fulfill its goals and contributes to a better understanding of water quality conditions throughout the Red River Basin.

While not currently a regular part of the River Watch program, benthic macroinvertebrate monitoring will be briefly noted here as some River Watch teams are beginning to experiment with this form of biological monitoring. Benthic macroinvertebrate monitoring involves collection and identification of organisms that live on the river bottom, specifically animals without backbones that live at least part of their life cycles in or on the bottom of a body of water. These organisms are indicators of the biological health of rivers and streams. While chemical monitoring provides a "snapshot" of water quality conditions at a particular point in time, macroinvertebrate monitoring can provide a better indication of water quality over a longer period of time as these organisms live in the stream throughout their life cycles. Macroinvertebrate sampling is done near the same locations as the chemical monitoring however only two samples are generally collected per year--in the spring and fall. Biological monitoring is not currently being done due to resource limitations, scheduling difficulties and lack of standard methods and agency support. It is anticipated that biological monitoring will be part of the River Watch program as these difficulties are addressed. More detailed information will be added to this QAPP as this monitoring is further developed.

## A3. Project Description

Following is a basic operational overview of the River Watch program.

- **Sampling Team:** From 6-20 students may comprise a typical school River Watch sampling team. Some schools have set up an application/screening process due to more students desiring to be involved in the program than can be accommodated. Expectations are made clear that students are also to help with summer sampling (realizing some flexibility is needed to accommodate jobs). A mix of students from grades 9-12 is suggested for program continuity and to provide for new students to be trained by experienced students. The program would also work well with citizen volunteers.

- **Sampling Sites:** The number of sites sampled per school primarily depends on the proximity of sites to the school, safe access, and school scheduling flexibility. Schools have monitored from four to sixteen sites per school. Local SWCD and Watershed District personnel take the lead in selecting sites which contribute to a better understanding of a diversity of watershed conditions, complement

existing monitoring programs, or address FDR/NRE project monitoring needs. The school River Watch team, MN DNR, and MPCA also provide input to the site selection process based on their experience and monitoring needs. A complete inventory of monitoring sites including maps and a table of sites are included as Appendix A. The sites have been entered into the STORET data-base where complete site descriptions can be found.

- **Sampling Frequency:** Sampling generally occurs once a month during open water months of April/May through Oct./Nov.—including summer months. As more equipment becomes available and further training is completed, schools will be able to monitor more frequently as local conditions dictate with a special interest in monitoring immediately following significant rain events.

- **Variables being monitored:** Students take a standard set of field measurements including air and water temperature, conductivity, dissolved oxygen, pH, turbidity, transparency, river depth, and ratings for appearance, recreation suitability, and stream condition. A Hach 2100P Turbidimeter and a YSI or HydroLab multi-parameter meters and their respective protocols are used for dissolved oxygen, pH, conductivity, and water temperature measurements. A transparency tube is used for transparency readings. General observations are recorded of vegetation, crop status, and other conditions in the watershed that could influence water quality at a given site. Photos are taken of conditions and monitoring activities for documentation and communication purposes.

- **Data Management, analysis, and reporting:** Students enter their data into a standardized Excel spreadsheet template used by all River Watch participating schools to allow for efficient entry, sharing and analysis of data. Data will be accessible to any public data user at http://www.rrbdin.org/tools/mapviewer/basinviewer.htm. Data will also be available from the EPA's national water quality database, STORET, which is accessible through the MPCA's environmental data access (EDA) website at http://www.pca.state.mn.us/data/eda/index.cfm#monitoring. Teams of students and resource managers perform data analysis. Students prepare an annual summary report and display of their analysis and findings to be shared with their respective local watershed district, soil and water conservation districts, and other interested parties.

## A4. Data Quality Objectives for Measurement Data

Assuring consistency of data collection methods over time and among River Watch participants is the primary purpose of this document. The methods used will be consistent with standard methods used by other entities such as state and local government agencies. The accuracy of field parameter measurements will vary somewhat based upon the type of instrument used. For example, YSI sondes may have a different accuracy than Hydrolab sondes. When conducting a monitoring study on a particular water body, use the same instrument for all the monitoring at a site, if possible. Data quality objectives include collecting data that is representative of the waterbody being sampled, comparable to other data, and complete enough to fulfill the goals of the monitoring program. Proper training, oversight and coordination is an on-going basic service of the program to ensure reliable, quality data is being generated that can be used for resource management and awareness/educational purposes.

River Watch monitoring is generally exploratory and focuses on evaluating baseline ambient water and biological quality parameters of surface waters in the Red River Basin. The data quality objectives will be targeted as such. The data generated from the River Watch program will primarily be treated as "screening" level data—not only to identify areas of concern but also to help identify sites with good water quality that may serve as reference condition sites. When River Watch participants engage in monitoring and research partnerships, this QAPP will be reviewed and amended to suit the particular monitoring needs of the project and partners with additional equipment, training, and assistance provided

as per project needs. FDR/NRE project monitoring will be performed according to Watershed District's Project Team Project Monitoring Plans and at locations specified by the project team.

The **representativeness** of the data will be a function of the sampling locations selected and the number of samples collected representing a variety of flow regimes of a waterway. One of the factors in designing the monitoring program is to select sites that represent different and distinct reaches of rivers throughout a watershed, exhibiting variations in land use, slope, soil types, vegetative cover, stream modification, and other factors that may impact water quality. Monthly sampling over a number of years will increase the likelihood that sampling will occur over a representative range of flow conditions.

Another way to increase the representativeness of sampling is to sample streams at the point of average flow in the section of the river where the most of the flow is occurring (thalweg). Samples and field data should be collected from a depth that is 3/5 of the depth down from the surface at the deepest point in the river. Integrated sampling can also be used if sufficient time and necessary equipment is available. Integrated stream samplers collect more water at higher flow velocities and vice versa in order to collect a sample that proportionally represents the water column along its entire depth. For macroinvertebrate sampling, representativeness can be optimized by avoiding reaches influenced by bridges or culverts and by sampling several different habitat types proportionally.

In order to ensure **comparability** of data, samples should all be collected using the same methods. Documents such as this QAPP and Standard Operating Procedures documents serve as standard guides that can be used by all monitoring groups for all monitoring that is conducted. This will ensure that data is not only comparable from sample to sample, from volunteer monitor to volunteer monitor, and from River Watch team to River Watch team, but also comparable to data collected by resource managers using the same procedures. Red River Basin River Watch participants will use the Standard Operating Procedures-Revision 6, October 23, 2003 developed by the Red Lake Watershed District (hereafter referred to as RLWD SOP) for field sampling (available at http://www.redlakewatershed.org/default.html and http://www.ndsu.nodak.edu/tricollege/watershed/riverwatch/download.htm). A Volunteer Manual that presents a variation of the RLWD SOP that is more specific to operations of the standard River Watch program in the Red River Basin was developed by River Keepers through an EPA grant (September 2003)—hereafter referred to as RK-VM. It can be downloaded from http://www.ndsu.nodak.edu/tricollege/watershed/riverwatch/download.htm). Both documents utilize procedures based on EPA/MPCA guidelines and standard methods for water quality collection, assessment, and analysis. With thorough training and consistent use of the methods listed in these documents, data collected by River Watch participants will be comparable to data collected by any other agency or volunteer monitoring group using these methods.

**Precision** is a measure of mutual agreement among individual measurements, usually under demonstrated similar conditions. River Watch participants will collect one duplicate set of field measurements on each sample run. Precision will be calculated as the relative percent difference (RPD) between the original and duplicate sample. A 10% RPD will be used as the acceptance threshold for this project. The RPD is calculated by dividing the difference between two duplicate samples by their mean. Data for all variables will be compared with historic data, where available, to determine how well they agree with previous analytic techniques and results.

**Accuracy** is the degree of agreement between an observed or measured value and the true or expected value of the measured quality. Many kinds of error, including unintentional bias affect the inherent accuracy of data. Unfortunately, the true population values are rarely known. This is especially true when working with natural biological communities. Therefore, the best that can be done is to strive for repeatability of measurements and avoid bias by assuring consistency in adherence to calibration and

sampling procedures, sample processing, and data management. The accuracy values shown in Table 1 below relate to performance specifications as reported by the equipment manufacturer.

**Completeness** is defined as the percentage of measurements made that are judged to be valid according to specific criteria and entered into the data management system. To optimize completeness, every effort is made to obtain all sample measurements. Errors in equipment calibration, misuse of equipment, improper sampling techniques, and mistakes made in recording of sample results can all result in loss of valid sample results, which will reduce the ability to perform analysis, integrate results, and prepare reports. Percent completeness (%C) for measurement parameters is defined as: %C = (v/T x 100), —where v = the number of measurements judged valid, and T = the total number of possible measurements to be recorded.

Although there are no anticipated legal issues or requirements at stake concerning results of the River Watch monitoring program, the data collected will be used to establish baseline water quality conditions and problem screening for waterways in the Red River Basin. The variables identified in the project description will be consistently sampled on an on-going basis. Completeness of this data set is expected to range from 90%-100%. Each River Watch group should choose an appropriate number of sites so that each site can be monitored on each sampling date whenever possible. In order to fulfill statistical criteria, measurements will be taken at 100% of the sites unless conditions (i.e. bad weather, impassable roads, no flow, etc.) prevent sampling.

Table 1 provides a summary of data quality objectives for this project. Values for water temperature, pH, dissolved oxygen, and conductivity represent specifications for the YSI sensors used in the YSI 600QS sonde. Similar specifications are available for the HydroLab and other manufacturer's equipment. Turbidity values correspond to specifications of the Hach 2100P turbidimeter. Air temperature values correspond to field pocket thermometers normally used in the program. Transparency values correspond to use of standard 60 and 120 cm transparency tubes.

**TABLE 1**

**Precision, Measurement Range, Accuracy, and Resolution for River Watch Parameters**

| Matrix | Parameter | Precision | Measurement Range* | Accuracy* | Resolution* |
|---|---|---|---|---|---|
| Air | Temperature | 10% | -5 to 50˚C | | 0.5°C |
| Water | Temperature | 10% | -5 to 45˚C | +/- 0.15°C | 0.01°C |
| Water | pH | 10% | 0-14 units | +/- 0.2 units | 0.01 units |
| Water | Dissolved Oxygen, mg/l | 10% | 0 to 50 mg/l | +/- 2% of the reading | 0.01 mg/l |
| Water | Dissolved Oxygen, % sat. | 10% | 0 to 500% air saturation | +/- 2% of the reading | 0.1 % air saturation |
| Water | Conductivity | 10% | 0-100 mS/cm | +/- 0.5% of reading | Range dependent |
| Water | Turbidity | 10% | 0-1000 NTU | +/- 2% of reading | 0.01 on lowest range |
| Water | Transparency | 10% | 0-120+ cm | +/- 5% of reading | 0.2 cm |

*Measurement Range, Accuracy, and Resolution are shown as per instrument manufacturer's specifications.

**A5. <u>Training</u>**

The training of volunteer monitors and supervising staff is important for collecting accurate and reliable data and making this data available for analysis in a usable format. River Watch participants are trained in the skill areas of equipment maintenance, collecting samples, field analysis, and data management (recording, analysis, and reporting). Training sessions on field methods and analysis will be held on an annual basis for monitoring staff and volunteers prior to the beginning of each monitoring year and as needed for new start-up schools or if there is a large transition of team members during the year. Data management training is on-going with a special emphasis on analysis at the conclusion of the monitoring year as reports and displays are prepared.

RRBMAC lead staff Wayne Goeken and Bruce Paakh will be responsible for overall training coordination. Red River Watershed Management Board, Center for Watershed Education, Watershed District, SWCD, MPCA staff, or other resource experts will coordinate and conduct training in the necessary skill areas. Upon demonstrating proficiency in the topics covered, training session participants will receive certification to serve as proof that qualified individuals are collecting and managing project data. This will provide assurance of data quality to anyone utilizing River Watch data for resource assessments and planning.

## A6. Documentation and Records

A downloadable version (with current version and date shown) of this QAPP will always be located at: http://www.redlakewatershed.org/h2oquality.html. It will also be found at http://www.ndsu.nodak.edu/tricollege/watershed/riverwatch/download.htm along with other downloadable instructions, forms, and links including:

- YSI MDS 650 Handheld Introduction—basic operational overview of the YSI 650
- Standard Operating Procedures for Water Quality Monitoring in the Red River Watershed—the basic SOP for Red River basin monitoring-October 24, 2003
- Red River Basin Water Quality Monitoring Volunteer Manual—River Keepers, Sept. 2003
- YSI calibration procedures—detailed step-by-step procedures for calibrating the YSI 650
- YSI calibration worksheet—form for recording calibration information
- Equipment Calibration log—Excel data entry template for tracking calibration information
- Hach 2100P calibration worksheet—Excel form for recording turbidity calibration checks
- Field data sheet-multiple sites—standard form for entry of field data from multiple sites
- Field data sheet-single site—optional form for entry of field data for single site
- °F to °C conversion chart—for use when thermometer is in °F and °C is needed
- River Watch Data Entry Format—Excel template for entering data from field data sheet
- Data Analysis—basic explanation of the general water quality variables being monitored
- MPCA Citizen Stream Monitoring Guide—guide to establishing a monitoring program
- MN DNR Adopt-A-River Guide—guide to becoming involved in river clean-ups
- References/Resources/Contact Info/Suppliers/Web sites

Thorough documentation of all calibration, equipment maintenance, field sampling and handling activities is necessary for proper field analysis, data reduction, and ultimately for the interpretation of study results. For each regular River Watch field sampling event that occurs, a field data sheet must be completed on-site at the time sampling occurs. Documentation includes recording of measurements taken

in the field, results from the meters used, and any observations that River Watch participants notice at the site which may have an influence on water quality results including recording of any deviations from prescribed sampling procedures.

River Watch participants will maintain a hard copy (original or copy) of results from each sample outing with their records and provide a copy or the original to the local natural resource agency serving as their monitoring partner. The River Watch team will also enter their data into an Excel electronic spreadsheet that is to be shared with their local monitoring partner. Data will receive final review and verification by the participating schools, RRWMB Monitoring staff, and local cooperators at the end of the sampling season, after which it will be forwarded to the MPCA for inclusion in the STORET database. Data will also be maintained on the RRBDIN website, http://www.rrbdin.org/. Calibration and equipment maintenance records will also be reviewed at the end of each sampling season by the lead quality control coordinators with the MPCA, RRWMB, CWE, and/or other evolving lead partners to verify that all equipment was in proper working order.

## B. MEASUREMENT/DATA ACQUISTION

### B1. Sampling Process Design

The goal of meeting watershed district data needs is one reason why the River Watch program places a strong emphasis on data quality and the collection of scientifically sound data. Sampling occurs monthly during open water months of April/May through Oct./Nov. River Watch field measurements to be collected will minimally include dissolved oxygen, pH, conductivity, water temperature, turbidity, transparency (transparency tube or Secchi disk readings), and stage. These variables will provide a general understanding of baseline water quality conditions throughout the Red River Basin.

Samples will be collected at 60% of the depth below the surface at the deepest section of the stream at each sampling site to obtain a representative sample. Water depth and 60% of the water depth will be calculated using measurements performed with a weighted tape measure. Site photos and general observations will also be recorded to document changing conditions throughout the sampling season. Field measurements will be taken at all sites following the RLWD SOP as cited earlier. Monitoring will occur monthly during ice-free conditions except where high water precludes sampling due to safety considerations.

The number of sites sampled per school primarily depends on proximity of sites to the school, safe access, and school scheduling flexibility. Local SWCD and Watershed District personnel take the lead in selecting sites that contribute to a better understanding of a diversity of watershed conditions, compliment existing monitoring efforts or address FDR/NRE project monitoring needs. The school River Watch team, MN DNR, and MPCA also provide input to the site selection process. Rationale for selecting other sampling sites will be documented as other monitoring programs and FDR/NRE projects are developed. Flow data will be collected via web-based access from the USGS gauging stations where available. Stage levels will be recorded at sites without USGS flow gauges. Rating curves to estimate flow will be developed by watershed district staff as their schedules and budgets allow. A complete list of current sites are included in Appendix A. The sites have been entered into the STORET data base where complete site descriptions can be found.

### B2. Sampling Method

(Note: references to specific equipment is not an endorsement of a particular manufacturer, equipment from other manufacturers may be used that provide equivalent results.) Water quality samples will be collected using a Kemmerer or Van Dorn sampler if water is not wadeable. The sampler will be rinsed three times with the given source water before samples are taken. When water is wadeable, samples will be hand dipped by wading into the stream from a point downstream of the sampling location so as not to disturb the sampling area. If measurements are taken from a pool situation at a site when there is no discernible flow, field notes should clearly indicate this and these results should not be used in statistical analysis of the site's condition.

Field measurements including air temperature, water temperature, depth, dissolved oxygen, conductivity, pH, and turbidity will be measured at each sampling location. Air temperature will be measured by use of a pocket thermometer. Turbidity will be measured via a Hach 2100P turbidimeter. A transparency tube will be used for transparency readings. A YSI 600 QS Sonde and 650 Handheld will be used for measuring water temperature, conductivity, dissolved oxygen, and pH. Field measurements will be recorded on field data sheets and placed in the permanent site file maintained by the sampling entity as well as entered into an Excel data file for sharing with cooperators. Global positioning system (GPS) readings will not be taken at sampling locations until signals from at least four satellites are received.

## B3. Sample Handling and Custody

All standard River Watch monitoring is field based thus no sample handling procedures are included for laboratory processing. In the event River Watch participants do collect samples for delivery to a lab, they are to refer to the procedures described in the RLWD SOP. As for samples collected for field analysis of turbidity and transparency, care must be taken to ensure that the sample has not been allowed to settle before drawing off a representative sample for analysis. Gently agitating the sample prior to filling the sample vial or transparency tube to ensure a thorough mixing will yield accurate results.

## B4. Analytical Methods

Methods for field measurement of air temperature and transparency will follow the RLWD SOP. Methods for measurement of water temperature, conductivity, dissolved oxygen, and pH will follow the procedures defined in the YSI QS 600 sonde and 650 handheld Operations Manual while turbidity measurement methods will follow procedures defined in the Hach 2100P Turbidimeter Manual.

## B5. Quality Control

River Watch participants will collect one duplicate set of field measurements on each sample run. This will consist of collecting a regular set of data for all variables being monitored at a given site followed by collection of a second set of data at the same site immediately following conclusion of the first sample. This will be used to determine whether the sampling procedures are being consistently applied and whether the instruments being used are producing consistent results.

A relative percent difference (RPD) between the original and duplicate sample will be calculated by dividing the difference between two duplicate samples by their mean. A 10% RPD will be used as the acceptance threshold for this project. If QC samples reveal a sampling or analytical problem, field personnel will troubleshoot the problem and attempt to identify the source of error or cause of failure. Upon working out a solution, personnel will take necessary steps to avoid similar problems in future sampling events. Data may need to be flagged and qualified depending upon the nature and extent of the problem. RRWMB and MPCA staff will assist in the review of QC data and implementation of corrective measures if deemed necessary.

## B6. Instrument/Equipment Testing, Inspection, and Maintenance

All equipment will be inspected and tested each day prior to use in the field. All field equipment will be maintained according to manufacturer's specifications. Membranes on DO probes will be inspected routinely for air bubbles or tears. Steps will be taken to fix any problems that are noted. If any equipment is beyond repair, replacement equipment will be used. Expired buffer solutions and calibration standards will be replaced with new solutions prior to the initiation of calibration procedures. Batteries on all meters will be replaced when meters show power-related problems. Spare batteries for all meters are to be available if needed. If a backup meter is needed, arrangements will need to be made with other partners in the Red River Basin Monitoring Network to cover sampling needs until repair or replacement can be achieved. All maintenance procedures will be documented in the meter maintenance logs or the field notebook.

## B7. Instrument Calibration and Frequency

Instruments used in this project are those commonly used in most water quality studies and are widely available. Calibration of the instruments will follow manufacturer instructions, and the calibration results will be recorded on calibration log sheets and entered into an Excel calibration spreadsheet that will be reviewed by RRWMB and MPCA staff immediately if problems are detected by River Watch Advisors or minimally at the end of each sampling season. Calibration of the YSI QS 600 sonde is to be done on each sample outing for dissolved oxygen; every two weeks for pH; and monthly for conductivity. The DO membrane is to be changed at least every 30 days. The Hach 2100P Turbidimeter is to be calibrated quarterly with formazin solution at which time secondary Gelex standards are assigned calibration values. The secondary Gelex standards are then checked on each sample outing between the quarterly calibration to ensure the meter has maintained calibration. Calibration procedures for the YSI sonde, and Hach 2100P Turbidimeter, and calibration log sheets and spreadsheet can all be found at: http://www.ndsu.nodak.edu/tricollege/watershed/riverwatch/download.htm.

Transparency measurements using a transparency tube will be collected following MPCA's Citizen Stream-Monitoring Program protocols which are found in the RLWD SOP and RK-VM.

## B8. Inspection/Acceptance of Supplies and Consumables

Careful and thorough planning is necessary to ensure the efficient completion of the field sample collection tasks. A general checklist of field equipment and supplies is included in the RLWD SOP and the RK-VM. It is the responsibility of the River Watch Advisor to gather and inspect the necessary sampling gear prior to each sampling trip.

Equipment, reagents, and field sampling supplies can be obtained from a variety of vendors. Care must be taken to closely observe the expiration dates of reagents used for calibration and not use expired reagents. Some reagents such as conductivity standards also must be used within a certain time period from when they are opened, thus manufacturer's specifications must be followed for proper use of these standards. For technical assistance, servicing, and replacement parts associated with the meters currently used in the River Watch program, the manufacturers can be contacted directly. The Hach Company can be reached at 1-800-227-4224. YSI Inc. can be reached at 1-937-767-7241.

## B9. Data Acquisition Requirements (Non-direct Measurements)

To assist in analysis and decision-making, outside sources of data will be accessed to obtain historical or supplemental information. This may include, but not be limited to information regarding land use, precipitation, flow volume, soil characteristics, ecoregion values, and water quality designated use standards. Such data will be obtained from sources that have scientifically sound background and documented quality control protocols. Such sources may include:

- Watershed Districts and Soil and Water Conservation Districts
- RRBMAC members
- MPCA Environmental Data Access website (access to STORET data)
- MPCA Citizen Lake Monitoring Program
- DNR Biological surveys
- U.S. Geological Survey

### B10. Data Management

The monitoring team (generally the school) keeps a hardcopy of the original field data sheet with their records and makes a copy that is provided to their local natural resource agency partner. The monitoring team also transfers the information to an Excel spreadsheet that is shared electronically with the RRWMB Monitoring staff, the local watershed district, local soil and water conservation district cooperators, and/or other parties identified as having an interest in the data. Data will receive final review and verification by the participating schools, RRWMB Monitoring staff, and local cooperators at the end of the sampling season, after which it will be forwarded to the MPCA for inclusion in the STORET database. RRWMB will maintain a master data set of all results.

Future plans involve creating an Access database and posting the data on the RRBDIN website, http://www.rrbdin.org/ to allow for wider access. The web sites will include interactive maps of the sampling sites, background information, monitoring data, and a report card on site conditions. Some schools also maintain their own web pages that include their data along with photos of the sites and their sampling teams in action.

## C. – ASSESSMENT AND OVERSIGHT

### C1. Assessment and Response Actions

River Watch Advisors, generally the teachers in the participating schools, with the assistance of their students will be responsible for all field activities. If any problems arise, the RW Advisors are to contact RRWMB and/or local cooperators immediately as to the nature of the problem and any corrective actions taken to rectify the problem in order to obtain accurate and useful data. RRWMB and/or local cooperators will verify if proper corrective actions were taken or further assist in troubleshooting the situation and implementing appropriate actions. The RW Advisor will document as part of the field data records the situation and corrective actions taken.

RW Advisors and team members will also be responsible for forwarding of data to RRWMB and local cooperators for inspection. After proofing the data, RRWMB staff will be responsible for transferring the data to the STORET system and to the RRBDIN website. RRWMB staff will work with the River Watch teams and local cooperators in reviewing the data, assessing conditions, and reporting findings. RRWMB WQ and RRBI Center for Watershed Education staff will oversee and assess field sampling and data collection activities at each of the River Watch participants sample runs a minimum of once a year to ensure that the procedures specified in the QAPP and SOP are being followed.

### C2. Reports

An annual report of the findings of this project will be prepared by RRWMB WQ staff with assistance from the RRBMAC and distributed to the affected watershed district project teams, the Flood Damage Reduction Work Group and the Red River Watershed Management Board. This will include a section describing the results of data quality assessments, any quality assurance problems, and recommended solutions.

## D – DATA VALIDATION AND USABILITY

### D1. Data Review, Verification, and Validation

All data entered into the Excel data templates will be double-checked with the original data on the field data sheets by the River Watch school teams. Data quality will be assessed by comparing entered data to original data with any errors being corrected as they are found. An assessment of field duplicates will also be performed by the RW school teams with data found outside of the QC limits identified in B5 flagged for further review. RRWMB and MPCA WQ staff will perform a final data review and validation with outliers and inconsistencies and decisions made regarding their use documented.

### D2. Data Usability

Field data and field QC sample sets will be reviewed by RRWMB and MPCA WQ staff to determine if data meet the QAPP objectives. Data that does not meet the QC requirements identified in B5 may be flagged or rejected. Decisions to reject or qualify data will be made by RRWMB and MPCA WQ staff.

### D3. Reconciliation with Data Quality Objectives

Calculations and determinations for precision, completeness, and accuracy will be made as soon as possible after each sampling event and corrective action will be implemented if needed. This will represent the final determination of whether the data collected are of the correct type, quantity, and quality to support their intended use for this project. Any problems in meeting the performance criteria (or uncertainties and limitations in use of the data) will be discussed with the RW sampling team, and will be reconciled, if possible. If data quality indicators do not meet the project's specifications, data may be discarded and resampling may occur. The cause of failure will be evaluated. If the cause is found to be equipment failure, calibration/maintenance techniques will be reassessed and improved. If the problem is found to be sampling team error, team members will be retrained. Any limitations on data use will be detailed in any project-related reports and other documentation, as needed.

# Appendix A.

## River Watch Sample Sites by Watershed, Water Body, County, and School

| Site I.D. | Watershed | Water Body | County | School |
|---|---|---|---|---|
| Red210By | Bois de Sioux | Red R | Wilkin | Breckenridge |
| Tyler | Bois de Sioux | Bois de Sioux R | Wilkin | Breckenridge |
| BdS26 | Bois de Sioux | Bois de Sioux R | Wilkin | Campbell |
| BdS28 | Bois de Sioux | Rabbit R. | Wilkin | Campbell |
| BdS30 | Bois de Sioux | Judicial Ditch 12 | Traverse | Campbell |
| BdS51 | Bois de Sioux | Judicial Ditch 2 | Wilkin | Campbell |
| BdS8 | Bois de Sioux | Judicial Ditch 11 | Wilkin | Campbell |
| BdS27 | Bois de Sioux | Rabbit R. | Wilkin | Campbell |
| BdS49 | Bois de Sioux | Rabbit R. | Wilkin | Campbell |
| BdS 13 | Bois de Sioux | 12 Mile Cr.-E.Fk | Stevens | Graceville |
| BdS 15 | Bois de Sioux | 12 Mile Cr.-W.Fk | Traverse | Graceville |
| BdS 18 | Bois de Sioux | 12 Mile Cr.-W.Br-E.Fk | Traverse | Graceville |
| BdS 19 | Bois de Sioux | 12 Mile Cr.-W.Br | Traverse | Graceville |
| BdS20 | Bois de Sioux | 12 Mile Cr.-W.Br | Big Stone | Graceville |
| WToqCR52 | Bois de Sioux | Rothwell Outlet | Big Stone | Graceville |
| BdS 01 | Bois de Sioux | Mustinka R | Grant | Herman |
| BdS 02 | Bois de Sioux | Mustinka R | Grant | Herman |
| BdS 11 | Bois de Sioux | Grant CD 8 | Grant | Herman |
| BdS 23 | Bois de Sioux | 5 Mile Cr | Traverse | Herman |
| BdS 33 | Bois de Sioux | Mustinka R | Grant | Herman |
| BdS 16 | Bois de Sioux | 12 Mile Cr-E.Br | Traverse | Wheaton |
| BdS 34 | Bois de Sioux | 12 Mile Cr-W.Br | Traverse | Wheaton |
| BdS 5 | Bois de Sioux | 12 Mile Cr-MS | Traverse | Wheaton |
| BdS LkTr | Bois de Sioux | Bois de Sioux R | Traverse | Wheaton |
| BdS W.Rock | Bois de Sioux | Bois de Sioux R | Traverse | Wheaton |
| BdSWRockN | Bois de Sioux | Bois de Sioux R | Traverse | Wheaton |
| BdS 32 | Bois de Sioux | Mustinka R | Traverse | Wheaton |
| BufDown | Buffalo-Red | Buffalo R SB | Wilkin | Barnesville |
| BufTrout | Buffalo-Red | Wilkin CD 40 | Wilkin | Barnesville |
| BufUp | Buffalo-Red | Buffalo R SB | Wilkin | Barnesville |
| DeerH E | Buffalo-Red | Deer Horn Cr. | Wilkin | Barnesville |
| DeerH W | Buffalo-Red | Deer Horn Cr. | Wilkin | Barnesville |
| Whisky E | Buffalo-Red | Whisky Cr. | Clay | Barnesville |
| Whisky W | Buffalo-Red | Whisky Cr. | Clay | Barnesville |
| Brushvale | Buffalo-Red | Red R | Wilkin | Breckenridge |
| BRD39 | Buffalo-Red | BufRed Ditch 39 | Clay | Hawley |
| BufMN9 | Buffalo-Red | Buffalo R | Clay | Hawley |
| Cederberg | Buffalo-Red | Buffalo R | Clay | Hawley |
| Haw31 | Buffalo-Red | Buffalo R | Clay | Hawley |
| HawMN32 | Buffalo-Red | Buffalo R | Clay | Hawley |
| HawUS10 | Buffalo-Red | Buffalo R | Clay | Hawley |
| ManJct | Buffalo-Red | Buffalo R | Clay | Hawley |

| Site I.D. | Watershed | Water Body | County | School |
|---|---|---|---|---|
| Muskoda | Buffalo-Red | Buffalo R | Clay | Hawley |
| M1 | Middle R Snake | Middle R | Marshall | Newfolden |
| MCC 30 | Middle R Snake | Middle R | Marshall | Newfolden |
| OM | Middle R Snake | Middle R | Marshall | Newfolden |
| MRA | Middle R Snake | Middle R | Marshall | Stephen |
| 2nd Street | Middle R Snake | Snake R | Marshall | Warren |
| 5th Street | Middle R Snake | Snake R | Marshall | Warren |
| AVO | Middle R Snake | Judicial Ditch 25 | Marshall | Warren |
| RR | Middle R Snake | Snake R | Marshall | Warren |
| Foxhome | Otter Tail | Otter Tail R | Wilkin | Breckenridge |
| Orwell | Otter Tail | Otter Tail R | Otter Tail | Breckenridge |
| Everdale | Otter Tail | Otter Tail R | Wilkin | Breckenridge |
| Breck Lk | Otter Tail | Otter Tail R | Wilkin | Breckenridge |
| 11th St. | Otter Tail | Otter Tail R | Wilkin | Breckenridge |
| CG #10 | Red Lake | Clearwater R | Clearwater | Clearbrook-Gonvick |
| CG #20 | Red Lake | Clearwater R | Clearwater | Clearbrook-Gonvick |
| CG #30 | Red Lake | Clearwater R | Beltrami | Clearbrook-Gonvick |
| CG #40 | Red Lake | Clearwater R | Clearwater | Clearbrook-Gonvick |
| CG #50 | Red Lake | Clearwater R | Clearwater | Clearbrook-Gonvick |
| CG Dam | Red Lake | Clearwater R | Clearwater | Clearbrook-Gonvick |
| #75 Bypass | Red Lake | Red Lake R | Polk | Crookston |
| Burnham | Red Lake | Burnham Cr. | Polk | Crookston |
| Gentilly | Red Lake | Red Lake R | Polk | Crookston |
| Sampson | Red Lake | Red Lake R | Polk | Crookston |
| PC19 | Red Lake | Grand Marais | Polk | East Gr Fks Pub |
| Sorlie | Red Lake | Red R | Polk | East Gr Fks Pub |
| Mallory | Red Lake | Red Lake R | Polk | East Gr Fks SH |
| Murray | Red Lake | Red Lake R | Polk | East Gr Fks SH |
| Point | Red Lake | Red R | Polk | East Gr Fks SH |
| BAD8 | Red Lake | Badger Cr | Polk | Erskine |
| Oak15 | Red Lake | Badger Cr | Polk | Erskine |
| WinPop | Red Lake | Poplar R | Polk | Erskine |
| BC 1 | Red Lake | Burnham Cr. | Polk | Fisher |
| FGM1 | Red Lake | Grand Marais | Polk | Fisher |
| FiRLR15 | Red Lake | Red Lake R | Polk | Fisher |
| Keywest | Red Lake | PolkCD 126 | Polk | Fisher |
| Pop10 | Red Lake | Poplar R | Polk | Fosston |
| Pop20 | Red Lake | Poplar R | Polk | Fosston |
| D 11 | Red Lake | JD 11 | Marshall | Grygla |
| Dike | Red Lake | Mud R | Beltrami | Grygla |
| MarCD20 | Red Lake | Co. Ditch 20 | Marshall | Grygla |
| Moose | Red Lake | Moose R | Beltrami | Grygla |
| OK #10 | Red Lake | Clearwater R | Red Lake | OK |
| OK #20 | Red Lake | Lost R | Red Lake | OK |
| OK #30 | Red Lake | Hill R. | Red Lake | OK |
| PL #10 | Red Lake | Clearwater R | Red Lake | PL |
| PL #20 | Red Lake | Clearwater R | Red Lake | PL |

| Site I.D. | Watershed | Water Body | County | School |
|---|---|---|---|---|
| PL #30 | Red Lake | Lost R | Red Lake | PL |
| PL #40 | Red Lake | Hill R | Red Lake | PL |
| Battle | Red Lake | Battle Cr | Beltrami | Red Lake |
| Blackduck | Red Lake | Blackduck Cr | Beltrami | Red Lake |
| Mud | Red Lake | Mud Cr | Beltrami | Red Lake |
| Pike | Red Lake | Pike Cr | Beltrami | Red Lake |
| BL10 | Red Lake | Black R | Red Lake | Red Lake Falls |
| Old RLR site | Red Lake | Red Lake R | Red Lake | Red Lake Falls |
| RL 10 | Red Lake | Red Lake R | Red Lake | Red Lake Falls |
| RLF10 | Red Lake | Clearwater R | Red Lake | Red Lake Falls |
| RL20 | Red Lake | Red Lake R | Red Lake | Red Lake Falls |
| 7MC | Roseau | Roseau E Br | Roseau | Roseau |
| C. St. | Roseau | Roseau MS | Roseau | Roseau |
| Hay | Roseau | Hay Cr-Ros | Roseau | Roseau |
| Hay 2 | Roseau | Hay Cr-Ros | Roseau | Roseau |
| Mal | Roseau | Roseau SB | Roseau | Roseau |
| Ross | Roseau | Roseau MS | Roseau | Roseau |
| RR 310 | Roseau | Roseau MS | Roseau | Roseau |
| S. Cr. | Roseau | Sprague Cr | Roseau | Roseau |
| Belt10 | Sand Hill | Sand Hill R | Polk | Climax |
| CL 01 | Sand Hill | Sand Hill R | Polk | Climax |
| CL10 | Sand Hill | Sand Hill R | Polk | Climax |
| CL15 | Sand Hill | Sand Hill R | Polk | Climax |
| CL20 | Sand Hill | Sand Hill R | Polk | Climax |
| RR10 | Sand Hill | Red R | Polk | Climax |
| CD16 | Sand Hill | Polk CD 16 | Polk | Erskine |
| WEM10 | Sand Hill | Sand Hill R | Polk | Erskine |
| WEM20 | Sand Hill | Sand Hill R | Polk | Erskine |
| FB10 | Sand Hill | Sand Hill R | Polk | Fertile |
| FB15 | Sand Hill | Sand Hill R | Polk | Fertile |
| FB20 | Sand Hill | Sand Hill R | Polk | Fertile |
| Lewis | Sand Hill | Sand Hill R | Polk | Fertile |
| Rindal | Sand Hill | Sand Hill R | Polk | Fertile |
| Fos10 | Sand Hill | Sand Hill R | Polk | Fosston |
| Fos20 | Sand Hill | Sand Hill R | Polk | Fosston |
| Fos5 | Sand Hill | Sand Hill R | Polk | Fosston |
| Tam1 | Tamarac | Tamarac R. | Marshall | Karlstad |
| Tam2 | Tamarac | Tamarac R. | Marshall | Karlstad |
| 6MC | Tamarac | Tamarac R. | Marshall | Stephen |
| GC | Tamarac | Tamarac R. | Marshall | Stephen |
| Hwy 220 | Tamarac | Tamarac R. | Marshall | Stephen |
| Hwy 34 | Tamarac | Tamarac R. | Marshall | Stephen |
| Hwy 75 | Tamarac | Tamarac R. | Marshall | Stephen |
| T01 | Two River Joe | Two River MS | Kittson | Hallock |
| T05 | Two River Joe | Two River MS | Kittson | Hallock |
| T08 | Two River Joe | Two River SBr | Kittson | Hallock |
| T10 | Two River Joe | Two River MidBr | Kittson | Hallock |

| Site I.D. | Watershed | Water Body | County | School |
|---|---|---|---|---|
| K Bridge | Two River Joe | Two River SB | Kittson | Karlstad |
| Klondike | Two River Joe | Lateral #1 | Kittson | Karlstad |
| Pelan | Two River Joe | Two River SB | Roseau | Karlstad |
| T04 | Two River Joe | Two R NBr | Kittson | Lancaster |
| T02 | Two River Joe | Two R NBr | Kittson | Lancaster |
| T02A | Two River Joe | Twp R NBr | Kittson | Lancaster |
| T03 | Two River Joe | Two R NBr | Kittson | Lancaster |
| BR | Warroad | Warroad R WB | Roseau | Warroad |
| DCN | Wild Rice | Dalen Coulee | Norman | Ada |
| FD | Wild Rice | Felton Ditch | Norman | Ada |
| WRSB | Wild Rice | Wild Rice SB | Norman | Ada |
| WRMSNor | Wild Rice | Wild Rice MS | Norman | Hendrum |
| MAR | Wild Rice | Marsh Cr-Mahnomen | Norman | Mahnomen |
| SCM | Wild Rice | Spring Cr-Ma | Norman | Mahnomen |
| WER | Wild Rice | White Earth R | Mahnomen | Mahnomen |
| WRMSM | Wild Rice | Wild Rice MS | Mahnomen | Mahnomen |
| CC | Wild Rice | Coon Cr | Norman | Twin Valley |
| MASH | Wild Rice | Mashaug Cr | Norman | Twin Valley |
| MOC | Wild Rice | Moccassin Cr | Norman | Twin Valley |
| FC Ulen | Wild Rice | Felton Cr | Clay | Ulen |
| St Cr | Wild Rice | Stiner Cr | Clay | Ulen |
| WRSB42 | Wild Rice | Wild Rice SB | Clay | Ulen |
| WRSBUU | Wild Rice | Wild Rice SB | Clay | Ulen |
| WRSB27 | Wild Rice | Wild Rice SB | Clay | Ulen |
| WRSBU | Wild Rice | Wild Rice SB | Clay | Ulen |

Appendix A1. (map)

## Schools/Communities Involved in River Watch-2004

Appendix A2. (map)

## River Watch Sampling Site Distribution in Red River Basin - 2004