The Red Lake Watershed District
Index of BioIntegrity for the Clearwater River
Habitat and Bioassessment Project #46K
Sampling and Analysis Plan

In Cooperation with:
Beltrami County SWCD
Red Lake DNR

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The Red Lake Watershed District
Index of Biotic Integrity Sampling and Analysis Plan
Clearwater River Habitat/Bioassessment Project 46K

Background Information

The Index of Biotic Integrity (IBI) is designed to include a range of attributes of fish assemblages. Its twelve measures, or metrics, fall into three broad categories: Species Composition, Trophic Composition, and Fish Abundance and Condition (Karr 1981). Data are obtained for each of these metrics at a given site and evaluated in light of what might be expected at an unimpacted or relatively unimpacted site. A number rating is then assigned to each metric based on whether its evaluation deviates strongly from, deviates somewhat from, or approximates expectations. The sum of the twelve ratings, in turn, yields an overall site score. The strength of IBI is its ability to integrate information from individual, population, community, zoogeographic, and ecosystem levels into a single ecological based index of the quality of water resources. Calculation and interpretation of the IBI involves a sequence of activities, including; fish sample collection, data tabulation, and regional modification, and calibration of metrics and expectation values. By carefully monitoring fishes, one can rapidly assess the health ("biotic integrity") of the Clearwater River. (***RLWD IBI Clearwater River Bank Stabilization 1999, pg. 1***).

Previously Collected Water Quality Data and Information

A considerable amount of data has been collected on the Clearwater River in the past; this section summarizes the data collected to this point and some findings. (***RLWD IBI Clearwater River Bank Stabilization 1999. pg 1***).

<u>Clearwater River Nonpoint Study (RLWD)</u>

During this study, data was collected over about one year (1992-1993). The study found that during 1992, the Clearwater Lake was mesotrophic with a mean total phosphorus concentration of 29 ug/L and a mean secchi disk reading of 3.3 ft. The lake was found to be moderately efficient at retaining phosphorus as well as retention of nitrogen.
The difference in mass loads between nitrogen and phosphorus determined by the Nonpoint Study suggests that the Clearwater Lake is phosphorus limited.

<u>Quarter Annual Monitoring (RLWD)</u>

The Red Lake Watershed District has collected baseline water quality data on a periodic basis (mainly quarter annually) since 1984 at the outlet of Clearwater Lake, and along the Clearwater River and some of it's reaches. The Red River Watershed Assessment Protocol Project currently being conducted by the Red Lake Watershed District will perform statistical analysis of this data. This will be done to compare these sites within the RLWD and determine the long-term range of water quality parameters.

<u>Clearwater Lake Study (RLWD & Beltrami SWCD)</u>

In 2002, the Red Lake Watershed District in cooperation with the Beltrami Soil and Water Conservation District collected water quality data and samples on a bi-weekly basis on Clearwater Lake since and along the Clearwater River. This monitoring took place in the months of January through October of 2002. Data will be compiled and statistical analysis performed by May of 2003

General Lake Monitoring (Beltrami and Clearwater Counties, Clearwater Area Lake Association)

The Beltrami and Clearwater County Soil and Water Conservation Districts in cooperation with the Clearwater Lake Area Association have collected in-pool measurements of total phosphorus, chlorophyll-a, and secchi disk. The information shows that the Clearwater Lake is between mesotrophic and eutrophic. (***Clearwater Lake Water Quality Model Proj. 46J pg. 4-5***).

Problem Description

Concerns about the lack of quality fishing as a recreational use of the river and the overall perception that the water quality within that river was being degraded. Phase I of the Clearwater Nonpoint Study, identified the lack of physical integrity within certain reaches of the Clearwater River, which may help explain part of this problem. Concerns about water quality also exist on Clearwater Lake, which has helped spur the Clearwater Lake Water Quality Model and Clearwater Lake Management Plan Projects.

Study Purpose and Goals

The purpose of this study is to evaluate stream condition using an Index of Biotic Integrity (IBI) with collection of fish communities. The main objective is to collect baseline data to determine the biological quality of the Clearwater River by performing an assessment/survey at select sites throughout the entire Clearwater River. This information would be used to help quantify aquatic habitat and assist in the detection of aquatic life impairments.

The project will also include surveying of Clearwater Lake using certain indices such as plants, macroinvertebrates, fish and phytoplankton. This information will be used to determine the suitability of Clearwater Lake and River to support certain fish species as well as determine the severity of perceived water quality and currently perceived problems with phytoplankton and aquatic plant growth.

Desired Outcomes

The desired outcomes of this project include the following:

- An index of biologic integrity for the Clearwater River.
- Identification of aquatic life impairments on the Clearwater River, including areas where habitat should be improved and in what manner. Particularly to assist with assessments and the TMDL process occurring on the Clearwater River and its watershed.
- Preparation of technical report for the Clearwater River assessment.
- Identification of problem plant growth in Clearwater Lake.
- Identification of current impairment/problems of Clearwater Lake though algal surveys.

Period of Study

The proposed period of study will start on March 2002 and go until December 2003. The period of biointegrity data collection will occur from June to September of 2003. Assessment of the data will occur from October to December of 2003, with the final report due in April 2003.

Procedures for the Biological Integrity Survey

Fish Community Sampling Procedures

All sites will be rigorously sampled in order to get representative, quantitative estimates of species richness and biomass. Sampling will be conducted from June to September 2003. Equipment selection is dependent on stream size, velocity, substrate, and depth. Adult and juvenile specimens from each site will be counted and identified to species by a trained fisheries biologist. Smaller and more difficult to identify taxa will be preserved for laboratory examination and identification. Young-of-the-year fish (less than 20 mm in length) will not be included in the analysis. All samples should be "vouchered."

All fish will be examined for the presence of gross external anoamalies. Incidence of these anomalies is defined as the presence of externally visible morphological anomalies (i.e. deformities, fin or gill erosion, lesions/ulcers and tumors). Specific anomalies include fin rot; pugheadedness; aeromonas (causes ulcers, lesions, and skin growth, and formation of pus-producing surface lesions accompanied by scale erosion); dropsy (puffy body); swollen eyes; fungus; ich; curved spine; swollen-bleeding mandible or opercle. Incidence will be expressed as a percent of anomalous fish among all fish collected. Incidence of occurrence will be computed for each species at each station. Hybrid species encountered in the field (e.g. hybrid centrarchids, cyprinids) will be recorded on the data sheet, and when possible, potential parental combinations recorded. All samples should be "vouchered". The Fish Sampling Field Data Sheets are located in Appendix C.

Habitat

A general site evaluation for each sampling location will be conducted using the Rapid Bioassessment Protocol (RBP) (1998). The RBP measures important features of the habitat not only in the channel but also the surrounding environment. Scoring will include information on substrate composition, instream cover, channel morphology, riparian zone and bank erosion, and pool and riffle quality. Physical-chemical parameters will be recorded for each site including; dissolved oxygen, pH, temperature, total dissolved solids, and specific conductivity using a Hydrolab model DataSonde 4 and Surveyor 4. The Hydrolab will be calibrated in the RLWD office before use according to the DataSonde 4 User's Manual. General water chemistry samples (e.g. alkalinity, nitrogen, phosphorous) will be sent to RMB Environmental Laboratories, Inc. in Detroit Lakes, MN, for analysis. This lab is certified for environmental water analysis by the Minnesota Department of Health. The Physical Characterization/Water Quality Field Data sheets and Habitat Assessment Field Data Sheets for High and Low Gradient Streams are located in Appendix D.
Sampling will only occur when there are normal water levels in the stream, usually from June to September.

There needs to be a field crew leader, which must have a Bachelor of Science degree in Aquatic Biology or related field, also should have excellent map reading and GPS skills. Also there needs to be field technicians which must have at least one year of college education and coursework in environmental or biological sciences. Also all of the crew must be in good physical condition as the nature of the work can be hard and on uneven terrain and for long periods of walking time.

Criteria for Selecting Reference Sites

We used the following criteria to help distinguish a candidate reference site from other sites: 1) The site had a natural stream geomorphology. The stream channel had not been altered by dredging or channelization; 2) There was a continuous riparian area along the reach extending laterally about three times the channel width. Land use was consistent laterally, soils and vegetation are not disturbed; 3) The vegetation was undisturbed within the riparian area. Woody vegetation was not logged or removed. Grasses were not cut, burned, or treated with herbicides. If vegetation was altered historically, the plant community within the riparian area should have had sufficient time to grow back to its predisturbed condition; 4) The stream segment had not been stocked with forage or game fish species; 5) There was no point sources or in-flowing springs, ditches, or drainage canals; 6) The reach geomorphology was consistent with segment geomorphology; 7) There was no stream habitat improvement (wing dams, rip rap, etc.); 8) The site was not snagged. All woody debris remained in the stream unless moved by natural processes; 9) There were no dams or diversions upstream or downstream within two meander cycles or two replications of major geomorphological units; 10) There were no bridges upstream within two meander cycles or two replications of major geomorphological units.

Few sites met all of these criteria. Therefore, the candidate reference sites could not be considered pristine or undisturbed. Rather, these sites represented the best available conditions. Using topographic maps of the Clearwater River we selected 13 sites with alternates. (***Clearwater River Bank Stabilization 1999. pg. 2-3***).

***Sites*:**

Site #1: Clearwater River, Reach 1
Recommended:
The best site chosen for the headwaters of Clearwater River is in sections 25 of Popple Tsp. and Section 30 of Copley Tsp. in Clearwater County. Landowner is State of Minnesota.

Site #2: Walker Brook
Recommended:
Best site chosen is Section 35 and 36 of Copley Tsp. near County Road 30. Has good defined channel with apparent limited grazing, seems unaffected by beaver dams here. Landowner is Faye Jacobs upstream and Douglas Ramsrud downstream.

Site #3: Clearwater River, Reach 1
Recommended:
3 mile road crossing in Section 10 and 11 of Copley Tsp. Already a water quality site for the Clearwater Lake Project. Landowner is Clearwater County upstream and Marvin and Bonnie Bellefy downstream.
Alternative:
County Road 2 crossing north of Shevlin in Sections 4 and 5 of Shevlin Tsp. Landowner is Edward and Debra Gitz upstream and Potlach Corporation downstream.

Site #4: Clearwater River, Reach 1
Recommended:
Beltrami County Road 22 crossing on Section 29 and 32 of Buzzle Township about a mile west of Pinewood. This site is near handicapped trout fishing access from DNR. Landowner is State of Minnesota. Considered a trout stream reach.
Alternatives:
Clearwater County Road 23 crossing in Sections 34 and 35 of Dudley Tsp. where gradient of river changes, steeper. Landowner upstream is Daryl, Carol and Marie Hinrichs and downstream Leslie and Sandra Hinrichs.
Or Clearwater County Road 17 on border of Clearwater and Beltrami Counties. In Sections 36 of Dudley Township and Section 31 of Buzzle Township. Landowner upstream is Delbert Maruska and downstream Charles and Pearl Evenwoll.

Site #5: Clearwater River, Reach 1
Recommended:
Beltrami County Road 24 (Aure Road) on Sections 6, Buzzle Township and 31-32 Roosevelt Township. Water quality site for Clearwater Lake Project (#131 Inlet Site). Landowner is State of Minnesota.

Site #6: Clearwater River, Reach 1
Recommended:
Clearwater County Road 15 crossing on Sections 36 of Greenwood Township and 31 of Clover Township. Landowner is Kenny J. Johnson upstream and downstream. Good wadable site.
Alternative:
Clearwater County Road 14 crossing on Sections 9 and 10 of Sinclair Township. Landowner upstream is Clearwater County and downstream is Todd Johnson, Yvonne Smith and Joyce Larson.
Or Section 5 of Sinclair Township on half mile access trail. Access here is difficult. Landowner is either Clearwater County or Warren Bardwell.
Or Clearwater County Road 11 crossing in Section 26 and 35 of Greenwood Township. Gaging site. Potential effects from landuse. Landowner Dennis and Jolene Moser, George and Alvina Johnson.
Or old bridge crossing in Section 27 and 26 Greenwood Township with landowner Knutson and Loren Nelson. Good access but close to next site.

Site #7: Clearwater River, Reach 1
Recommended:
Section 27 of Greenwood Township where restoration project occurred. Owned by Sandlands and RLWD.

Site #8: Clearwater River, Reach 2
Recommended:
Clearwater County Road 5 in Section 8 of Greenwood Township. Good Access in channelized stretch, Clearbrook-Gonvick River Watch site. Landowner is Red Lake Reservation.
Extra Site: Clearwater River, Reach 2
Recommended:
Speak with Red Lake DNR about site along border of Reservation maybe somewhere near Kiwosay outlet or downstream of there.

Site #9: Clearwater River, Reach 2
Recommended:
Polk County Road 2 north of Gully in Section 2 and 3 of Johnson Township, good access in channelized stretch. Landowners John Gunvalson and Paul Imle.

Site #10: Clearwater River, Reach 2
Recommended:
Any of 4 bridges crossing in North Equality or North Garnes, Red Lake County. Could choose County Road 5 north of Oklee, is an Oklee River Watch site. In channelized stretch.

Site #11: Clearwater River, Reach 3
Recommended:
Site near Plummer Park bridge crossing in Section 9 of Emardville Township. Landowner is likely city of Plummer or local residents.
Alternative:
Around Red Lake County Road 20 crossing south of Plummer in Sections 19 and 30 of Emardville Township.

Site #12: Clearwater River, Reach 3
Recommended:
Terrebonne Bridge on County Road 12 crossing NE of Terrebonne. Good access and may provide another spot in Reach 3.

Site #13: Clearwater River, Reach 3
Recommended:
Red Lake Falls city park near USGS gaging station and Klondike bridge. Water quality site and former IBI site. (***Taken from Site Tour of 46K 5/31/02***).

Equipment and Supplies List

The following equipment lists are necessary for this study (some lists are also found in RLWD SOP document but are given here for project reference):

Water Chemistry and Physical Measurements (Including D.O. Profiles):
-Field Report forms and D.O. profile sheets
-Ball point pen and pencil
-Waders
-Kemmerer Sampler on 100-foot line (marked at every foot)
-Hydrolab's DataSonde and Surveyor (RLWD and/or Beltrami SWCD) w/100 foot cable (marked at every foot)
-GPS unit or maps
-Sample Beaker
-Sample Bottles and Cooler w/Ice packs

-Boat with pulley system for sampling and measurements (Oars, life jackets, motor, gas mixture)
-Sulfuric Acid for Sample Preservation (RMB)
-Deionized Water for Field Blanks
-Secchi disk (rope marked at every foot)

- *Lists also found in Section 7.1 and 7.2 of the RLWD SOP Manual*

Equipment for Index of Biological Integrity:
-Two D-frame dipnets with 500-micron mesh nets, preferably Wildco, turtox design
-Two sieve buckets with 500-micron sieves
-Stream Invertebrate Visit Form
-Stream verification form, previously completed with attached copies of 1:24,000 USGS topographical map
-Minnesota Atlas and Gazetteer (Delorme)
-Pencils and Pens
-Permanent/Alcohol proof markers
-Labeling tape
-Invertebrate sample identification labels
-100% reagent alcohol, enough to preserve one days worth of samples, ca. 1 gallon/site
-Waterproof notebook
-Chest-high waders
-Rain-gear
-Jars or bottles in which sample is to be preserved; preferably non-breakable synthetic, minimum of 1 liter capacity
-Box or crate to store sample bottles
-Canoe or boat
-Backpack to hold supplies

Electro-fishing equipment:

-*Supplies stay the same except that you will need one of the following depending on the type of stream and size of stream that you are sampling.*

-Backpack: Typically used in small wadable streams (< 8-m mean stream width and < 50-sq. mi. drainage area). A single electrofishing run is conducted in an upstream direction meandering from bank to bank. Two personnel are necessary; one to carry the unit and operate the anode and another to collect the fish.

-Stream-shocker: Used in larger wadeable streams (> 8m mean stream and 50-500 sq. mi. drainage area). A single electrofishing run is conducted in an upstream direction meandering from bank to bank. The stream-shocker is a towable unit that can effectively sample larger streams because it has additional power capabilities and employs two anodes, thus increasing the electrified zone. Five personal are required for operation, one to run the electrofisher, two to anode, and two to net fish. In rare instances, it may be considered necessary to sample larger streams utilizing two backpack electrofishers simultaneously instead of the stream-shocker. This is generally done only when stream-shocker access is too difficult or the site is a wide, shallow riffle.

-Mini-boom: Used in non-wadable streams and rivers that are either to small or that do not afford the access necessary to utilize a boom-shocker. A single electrofishing run is conducted in a downstream direction, meandering from bank to bank. A mini-boom is a lightweight boat that can be portaged, yet provides a stable work platform for one fish collector and a boat operator.

-Boom-shocker: Used to sample sites on large rivers where adequate boat access is available and navigation to and from the sampling site is possible. Three electrofishing runs are made in a downstream direction, one each along the right bank, left bank, and mid-channel. Boom-shocking personnel consists of two fish collectors and one boat operator. (***Fish Community Sampling Protocol for Stream Monitoring Sites. pg. 3***).

Station Features Data Sheet:

This data sheet provides a quantitative description of the length and location of the major morphological features within a sampling station (bends, pools, riffles, runs, log jams, islands, and beaver dams). The Station Features data is collected in conjunction with the Transect data. The variables on this data sheet are as follows:

1. *Field Number*-A seven-digit code that uniquely identifies the station. The first two digits identify the year of sampling, the second two identify the major river basin, and the last three are numerically assigned in sequential order.
2. *Date*-The date habitat sampling is conducted in month/day/year format (MM/DD/YY).
3. *Crew*-The personnel who collected the habitat data.
4. *Distance from Start* (column)-The distance from the downstream end of the station to the downstream end of each stream feature that is encountered. Bends, log jams, and beaver dams are measured only to their midpoint because they are features that are located within one of the channel morphology types (i.e. riffles, run or pool). The distance should be measured with a tape measure to the nearest tenth of a meter following the center of the stream channel. The first value in this column is always “0” to indicate the stream feature at the beginning of the station.
5. *Stream Feature* (column)-Record the major morphological features encountered as you proceed from the downstream end to the upstream end of the station. If a cross-section of stream contains two or more channel morphology types (i.e. riffles, run or pool) record the dominant type. Stream features include:

    Riffles: Portions of the water column where water velocity is fast and water depth are relatively shallow. Steeper stream gradient results in obvious surface turbulence. Areas of high gradient that are deep, fast and turbulent are called rapids.

    Runs: Water velocities may be moderately fast to slow but the water surface appears generally smooth, little to no surface turbulence. Generally has greater depths than a riffle and shallower than a pool. Runs with very slow velocities are sometimes called glides.

    Pools: Slow water velocities and generally greater depths than a riffle or run. Water surface is smooth, no turbulence. A general rule that can be used to distinguish a pool is if two or more of the following conditions apply; the stream channel is wider, deeper, or slower then average.

    Bends: A change in the direction of the stream channel of at least 60 degrees

    Islands: Channel features that are dry even when the stream is experiencing bank full flow. Islands are surrounded on all sides by water with considerable flow, and usually contain vegetation. Bars, channel features below the bank full flow level that are dry during baseline conditions, are not recorded.

    Log Jams: A ground of intertwined logs or sticks that substantially alter the direction of flow. Large log jams can be similar in effect and appearance to beaver dams.

    Beaver dams: Structures constructed by beavers that span the entire stream channel and block flow. Dams consist of sticks and mud, but older dams may be overgrown with vegetation.

    Other noteworthy features include bridges, culverts, dams, and tributaries. The last feature noted in this column is the upstream end of the reach.

6. *Length* (column)-The length measured to the nearest tenth of a meter, of each stream feature encountered within the reach. The lengths of bends, log jams, and beaver dams are not recorded as they are only measured to their mid-point.

7. *Distance Between Bends*-The distance between successive bends contained within the station. The first row is the distance between the mid-point of the first and second bend, and so forth.
8. *Distance Between Riffles*-The distance between successive riffles contained within the station. The first row is the distance between the upstream end of the first riffle, and so forth.
9. *Length of Individual Riffles, Pools, and Runs*-The individual length of each riffle, pool, or run within the station, which can be obtained using the Stream feature and Length columns. The sum of their lengths is also recorded here.

Transect Data Sheet:

Record the data generated from each of the thirteen transects on this data sheet. One data sheet is needed for each transect. The X-site, upstream end, and downstream end of the station will have been located and flagged during the reconnaissance procedure conducted prior to the sampling date. To determine the placement of each of the thirteen transects within the station divide the station length by thirteen, this number is the transect spacing or distance each transect is apart from one another. The first transect is located one half of the transect spacing distance from the downstream end of the station. Each subsequent transect is then the distance of one transect spacing from the previous transect. All numbers are rounded to the nearest half number.
For example, if the station is 150 m, 150/13 = 11.5 (equals the transect spacing). The first transect would then be located a distance of 6 m from the downstream end of the station 11.5/2 = 5.75 (round up). The second transect would be located 17.5 m from the downstream end of the station 6 = 11.5 = 17, and so forth.

Location Information:

1. Field Number-Same as Stream Features data sheet
2. Date-Same as Stream Features data sheet
3. Crew-Same as Stream Features data sheet
4. Transect-The number (1 through 13) of the current transect as you proceed upstream.
5. Distance from start-The distance from the downstream end of the station to the current transect following the center of the stream channel
6. Stream Width-The wetted width of the stream channel at the current transect, measured to the nearest tenth of a meter. Exposed bars and boulders are included, but islands are not. Backwaters not in contact with the stream are also excluded. If a channel is split by an island, then both sides of the channel are measured and combined so as to have a single number
7. Habitat Type-Circle the predominant habitat type at the transect line

Transect Point Measurements:
At each transect measurements or visual estimates are made at five points along the transect line. Four of these points are equally spaced across the stream channel and the fifth point is the thalweg, or deepest point along the transect. Divide the stream width into fifths, measurements are made at each of these four locations moving across the stream channel at the transect from right to left (Right would be as you are facing downstream). For example, if the stream is 10 m wide, each segment is 2.0 m wide, and measurements are taken along the 2, 4, 6, and 8 from the right bank and at the deepest point. Sometimes the deepest point will occur at one of the other four points. Measurements or estimates that are made at each of the points include water depth, depth of fines and water, enbeddedness, substrate, percent algae, and percent macrophytes.

1. *Water Depth*-The depth of the stream channel at each point, measured with a wading rod or meter stick
2. *Depth of Fines and Water*-The water depth of the stream plus the depth of any fine sediments at each point. Fine sediments are those that are less than 2.0 mm in diameter and usually are sand, silt, clay, or detritus. Without using the weight of your body, push the rod or stick into the sediment as far as possible and take the reading.
3. *Embeddedness of Coarse Substrates*-The extent to which coarse substrates are surrounded by or covered with fine sediments. Coarse substrates consist of gravel, rubble/cobble, and boulders. Estimate the amount of coarse substrates and enter it into the column.

4. *Dominant Substrate*-The substrate type that is dominant with each quadrate. Visually estimate which substrate is dominant within each quadrate, centered on the channel position, and place a check mark in the appropriate column. If water clarity is low, use your hand to feel the stream bottom to determine
    Bedrock: A solid slab of rock >4000mm in length (larger than a car)
    Boulder: Larger rocks that range from 250 mm to 4000 mm (basketball to car size)
    Rubble/Cobble: Rocks that range from 64 mm to 250 mm (tennisball to basketball size)
    Gravel: Rocks that range from 2 mm to 64 mm (BB to tennisball size)
    Sand: Inorganic material that range from 0.06 mm to 2.0 mm, sand is visible and feels gritty between fingers
    Silt: Fine inorganic material that is dark brown in color, it feels greasy between fingers and does not retain its shape, and a person's weight will not be supported if the stream bottom is silt
    Clay: Very fine inorganic material, not visible to the naked eye, will support a person's weight and retain its shape, feels sticky in hands and slippery underfoot
    Detritus: Decaying organic material such as macrophytes, woody debris, etc. that may appear similar to silt
    Other: Any substrate not listed here, possibilities could include woody debris, culverts, tires, or mussel beds.
5. *Algae (%)*-Visually estimate the amount of algae within the quadrate, to the nearest 5%, algae can either be attached or flowing
6. *Macrophytes (%)*-Visually estimate the amount of aquatic vegetation within the quadrate, to the nearest 5 %, aquatic macrophytes can be either submergent or emergent and are defined as cover for fish

<u>Cover and Land Use Characteristics</u>

1. *Cover for Fish (%)*-The amount of cover or shelter available for fish along the transect. Visually estimate the percentage to the nearest 5%. If the cover is absent, enter zero.
    Undercut banks: Stream banks where the channel has cut underneath the bank.

REFERENCES:

Clearwater River Habitat/Bioassessement Project 46K
Site Identification Notes from Tour 5/31/02

The Red Lake Watershed District
Index of Biotic Integrity Plan for the Clearwater River Bank Stabilization 1999

The Red Lake Watershed District
Clearwater Lake Water Quality Model Project 46 J Sampling and Analysis Plan

Fish Community Sampling Protocols for Stream Monitoring Sites

Physical Habitat and Water Chemistry Assessment Protocol for
Wadeable Stream Monitoring Sites