Little Fork River Watershed Monitoring and Assessment Report

Minnesota Pollution Control Agency

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Executive Summary

The Little Fork River Watershed, located in northeastern Minnesota, drains a 1,843 square mile area. The river travels approximately 160 miles before its confluence with the Rainy River 11 miles west of International Falls.

The watershed is sparsely populated and is commonly referred to as a remote and wild. Prior to intensive logging beginning in the 1890's, the Little Fork River Watershed was densely covered with vast stands of mixed conifers and various hardwood species. During the time of logging, the river served as an important means of transporting the harvested timber downstream to the Rainy River. Today, the primary economic activities within the watershed are logging of second-growth timber and tourism. Recreational activities are numerous throughout the watershed due to several state forests and the Superior National Forest, providing ample opportunities for hunting, fishing, and canoeing. The watershed's wealth of surface waters is a valuable resource for aquatic recreation and its health is essential to resident aquatic life.

In 2008, the Minnesota Pollution Control Agency (MPCA) undertook an intensive watershed monitoring effort of the Little Fork River Watershed's surface waters. 54 locations were sampled for biology at the outlets of sub-watersheds of varying size in the Little Fork River Watershed including: the mouth of the Little Fork River, the outlet of its major tributaries, and the outlets of headwater tributaries. In 2010, a holistic approach was taken to assess all of the watershed's surface water bodies for aquatic life, recreation and consumption use support, where data was available; 43 stream reaches and 15 lakes were assessed in this effort.

Of the 43 stream reaches that were assessed, 37 were found to be fully supporting of aquatic life while six were non-supporting of aquatic life. 12 stream reaches were assessed for aquatic recreation and all were fully supporting. All 15 assessed lakes were also fully supporting of aquatic recreation. Aquatic consumption impairments span the entire length of the Little Fork and Sturgeon Rivers due to excess levels of mercury. The single aquatic life biological impairment was found on the Rice River, while the remaining aquatic life impairments were turbidity driven and located along the Little Fork River.

Overall, the results from the intensive watershed monitoring and holistic assessment process reveals that the Little Fork River Watershed remains as one of Minnesota's most treasured resources. The vast tracts of forests and wetlands throughout the watershed, along with limited development pressure, have helped to sustain a high quality aquatic resource. However, non-point source pollution that contributes to the excess levels of turbidity found throughout the Little Fork River continues to impact the quality of its surface waters and to downstream waters as well.

I. Introduction

Water is one of Minnesota's most abundant and precious resources. The MPCA is charged under both federal and state law with the responsibility of protecting the water quality of Minnesota's water resources. MPCA's water management efforts are tied to the 1972 Federal Clean Water Act (CWA) requiring states to adopt water quality standards to protect their water resources and the designated uses of those waters, such as for drinking water, recreation, fish consumption, and aquatic life. States are required to provide a summary of the status of the state's surface waters and to develop a list of water bodies that do not meet established standards. Such waters are referred to as "impaired waters" and the state must take appropriate actions to restore these waters, including the development of Total Maximum Daily Loads (TMDLs). A TMDL is a comprehensive study identifying all pollution sources causing or contributing to impairment, the assimilative capacity of the waterbody, and the reductions needed to restore a water body so that it can support its designated use.

The MPCA currently conducts and oversees a variety of surface water monitoring activities that support its overall mission of helping Minnesotans protect the environment. To be successful in preventing and addressing problems, decision makers need good information about the status of the resources, potential and actual threats, options for addressing the threats, and data on how effective management actions have been. The MPCA's monitoring efforts are focused on providing that critical information. Overall, the MPCA is striving to provide information to assess - and ultimately to restore or protect - the integrity of Minnesota's waters.

The passage of Minnesota's Clean Water Legacy Act (CWLA) in 2006 provided a policy framework and the initial resources to state and local governments to accelerate efforts to monitor, assess, restore and protect surface waters. Funding from the Clean Water Fund from the constitutional amendment passed by voters in 2008 allowed for a continuation of this work. In response, the MPCA has developed a watershed monitoring strategy that promotes an effective and efficient integration of water monitoring activities, to provide a more comprehensive assessment of water quality and expedite the restoration and protection process. The monitoring strategy identifies a goal to assess the condition of Minnesota's surface waters via a 10-year cycle, and provides an opportunity to more fully integrate MPCA water resource management efforts in cooperation with local government and stakeholders. This ultimately allows for coordinated development and implementation of water quality restoration and improvement projects.

The rationale behind the watershed monitoring approach is to intensively monitor the streams and lakes within a major watershed to identify impaired waters and to identify waters in need of additional protection efforts. The watershed approach provides the opportunity to begin to address most, if not all, of the impairments through a coordinated TMDL process at a watershed scale, rather than the reach by reach and parameter by parameter approach typically employed in the past. The watershed monitoring approach was initiated in the Little Fork River Watershed in the summer of 2008. This report provides a summary of all water quality assessment results in the Little Fork River Watershed. The waterbody assessments incorporated all available data including MPCA monitoring, volunteer monitoring, and monitoring conducted by local government units.

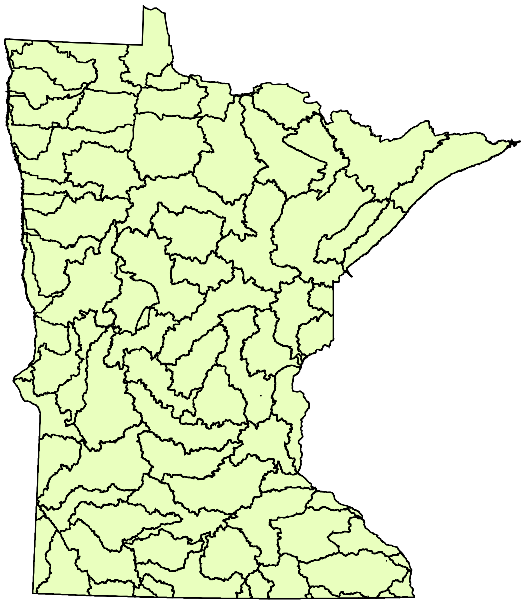
II. The Watershed Monitoring Approach

The watershed approach is a 10-year rotation for monitoring and assessing waters of the state on the level of Minnesota's 81 major watersheds (Figure 1). The primary feature of the watershed approach is that it provides a unifying focus on the water resources within a watershed as the starting point for water quality assessment, planning, and results measures. The major benefit of this approach is the integration of monitoring resources to provide a more complete and systematic assessment of water quality at a geographic scale useful for the development and implementation of effective TMDLs and protection strategies. The following descriptions provide details on each of the four principal monitoring components of the watershed approach. For additional information see: Watershed Approach Report (MPCA 2009) (http://www.pca.state.mn.us/index.php/water/water-monitoring-and-reporting/water-quality-and-pollutants/water-quality-condition-monitoring/water-quality-condition-monitoring.html)

Load monitoring network

Funded with appropriations from Minnesota's Clean Water Legacy Fund, the Major Watershed Load Monitoring Program (MWLMP) is a long-term program designed to measure and compare regional differences and long-term trends in water quality among Minnesota's major rivers, including the Red, Rainy, St. Croix, Mississippi, Minnesota, and the outlets of major tributaries (8 digit HUC scale) draining to these rivers. Since the program's inception in 2007 the MWLMP has adopted a multi-agency monitoring design that combines site specific stream flow data from United States Geological Survey (USGS) and Minnesota Department of Natural Resources (DNR) flow gaging stations with water quality data collected by the Metropolitan Council Environmental Services (MCES), local monitoring organizations, and MWLMP staff to compute annual pollutant loads at 79 river monitoring sites across Minnesota. Data will also be used to assist with: "Total Maximum Daily Load" (TMDL) studies and implementation plans; watershed modeling efforts; and watershed research projects.

Figure 1. Major watersheds within Minnesota (8-Digit HUC)

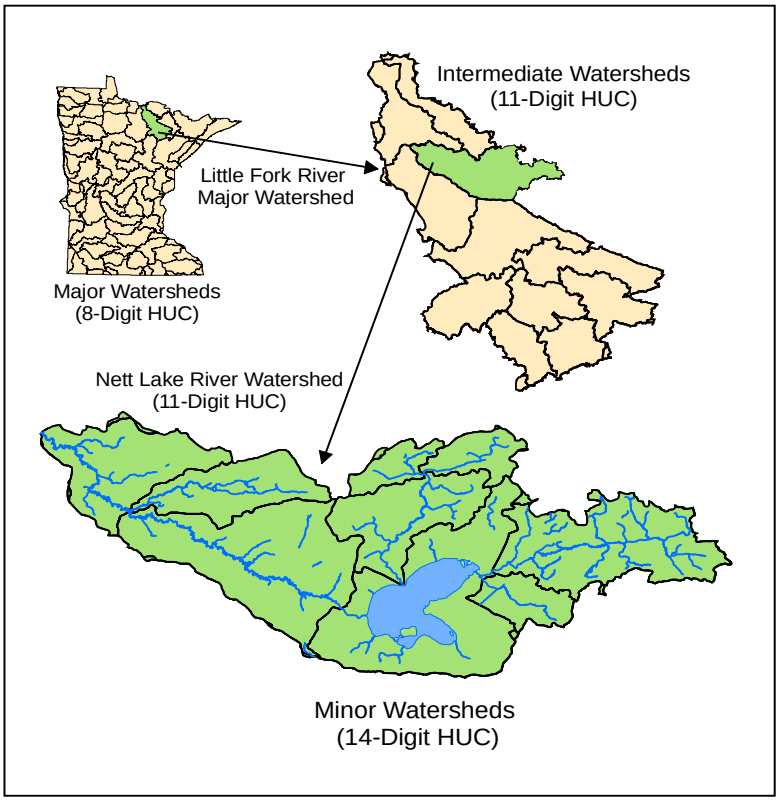


Pollutant sources affecting rivers are often diverse and can be quite variable from one watershed to the next depending on land use, climate, soils, slopes, and other factors. However, as a general rule, elevated levels of total suspended solids (TSS) and nitrate plus nitrite-nitrogen (nitrate-N) are generally regarded as "non-point" source derived pollutants originating from many diffuse sources such as urban or agricultural runoff. Excess total phosphorus (TP) and dissolved orthophosphate (DOP) can be attributed to both "non-point" as well as "point" and end of pipe sources such as industrial or waste water treatment plants. Major non-point sources of phosphorus include dissolved phosphorus from fertilizers and phosphorus adsorbed to and transported with sediment during runoff.

Intensive watershed monitoring

The intensive watershed monitoring strategy utilizes a nested watershed design allowing the aggregation of watersheds from a coarse to a fine scale. The foundation of this comprehensive approach is the 81 major watersheds within Minnesota. Sampling occurs in each major watershed once every 10 years. In this approach, intermediate-sized (approx. 11-digit HUC) and "minor" (14-digit HUC) watersheds are sampled along with the major watershed outlet to provide a complete assessment of water quality (Figure 2). Monitoring sites are selected at or near a road crossing closest to the outlet or "pour point" of each stream where possible. This approach provides an assessment of conditions of rivers and streams at multiple scales within each watershed without monitoring every single stream reach.

Figure 2. The intensive watershed monitoring design



The outlet of the major watershed (8-digit HUC) is sampled for biology, water chemistry, and fish contaminants to allow for the assessment of aquatic life, aquatic recreation, and aquatic consumption use-support. Each intermediate watershed (11-digit HUC) pour point is sampled for biology and water chemistry for the assessment of aquatic life and aquatic recreation use-support. Watersheds at this scale generally consist of major tributary streams with drainage areas ranging from 75 to 150 square miles. Lastly, most minor watersheds (typically 10-20 square miles) are sampled for biology to assess for aquatic life use-support. Chemistry monitoring is performed by MPCA staff and by local partners funded by Surface Water Assessment Grants (SWAGs). Biological monitoring is performed by MPCA staff.
The second step of the intensive watershed monitoring effort consists of follow-up monitoring at all intermediate watersheds determined to have impaired waters. This follow-up monitoring is designed to collect the information needed to initiate the stressor identification process in order to identify the source(s) and cause(s) of impairment needed for TMDL development and implementation.

Lake monitoring

The MPCA conducts and supports lake monitoring for a variety of objectives. Lake condition monitoring activities are focused on assessing the recreational use-support of lakes and identifying trends over time. The MPCA also assesses lakes for aquatic consumption use-support, based on fish-tissue and water-column concentrations of toxic pollutants. Lake monitoring was brought into the watershed monitoring framework in 2009. The MPCA conducts its own lake monitoring and also funds monitoring by local groups such as counties, SWCDs, watershed districts, nonprofits and educational institutions via SWAGs. Many SWAG grantees invite citizen participation in their monitoring projects. These local partners and citizens greatly expand MPCA's overall capacity to conduct lake monitoring.
Even when pooling MPCA and local resources, we are not able to monitor all lakes in Minnesota. The primary focus of MPCA monitoring is lakes ≥500 acres in size ("large lakes"). These resources typically have

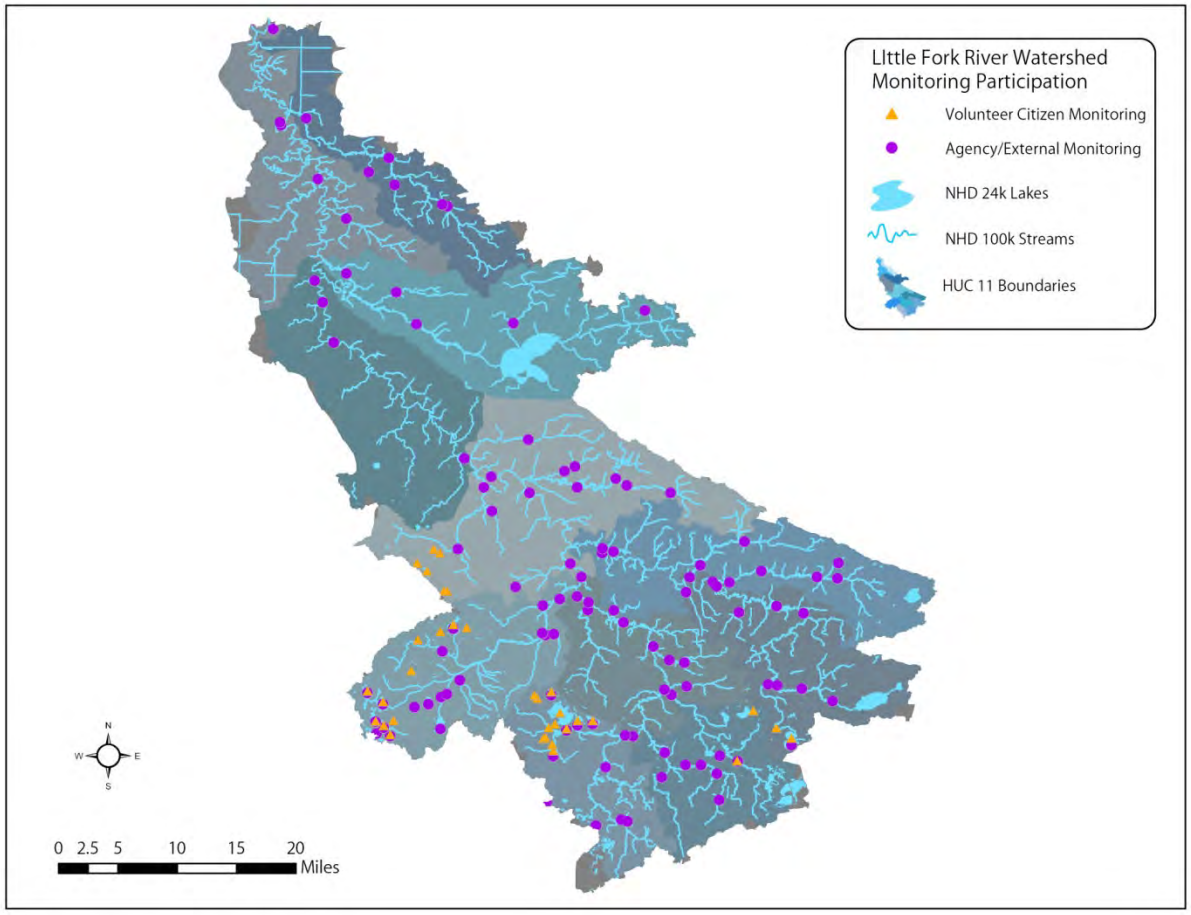
public access points, they generally provide the greatest aquatic recreational opportunity to Minnesota's citizens, and these lakes collectively represent 72 percent of the total lake area (greater than 10 acres) within Minnesota. Though our primary focus is on monitoring and assessing larger lakes, we are also committed to directly monitoring, or supporting the monitoring of small lakes between 100-499 acres for assessment purposes.

The annual SWAG Request for Proposals identifies the major watersheds that are scheduled for upcoming intensive monitoring and small lakes that have not been assessed. SWAG grantees conduct detailed sampling efforts following the same established monitoring protocols and quality assurance procedures used by the MPCA. All of the lake and stream monitoring data from SWAG projects are combined with the MPCA's monitoring data to assess the condition of Minnesota lakes and streams.

Citizen and local monitoring

Citizen monitoring is an important component of the watershed monitoring approach. The MPCA coordinates two programs aimed at encouraging citizen surface water monitoring: the Citizen Lake Monitoring Program (CLMP) and the Citizen Stream Monitoring Program (CSMP). Like the permanent load monitoring network that has been established at watershed pour points, sustained citizen monitoring can provide the long-term picture needed to help evaluate current status and trends. The advance identification of lake and stream sites that will be sampled by agency staff provides an opportunity to actively recruit volunteers to monitor those sites too, so that water quality data are available for the years before and after the intensive monitoring effort. This citizen-collected data helps agency staff interpret the results from the intensive monitoring effort, which only occurs once every ten years. It also allows interested parties to track any water quality changes that occur in the years between the intensive monitoring events. Coordinating with volunteers to focus monitoring efforts where it will be most effective for Clean Water Legacy planning and tracking purposes helps local citizens/governments see how their efforts are being used to inform water quality management decisions and affect change. Figure 3 provides an illustration of the locations where volunteer citizen and agency/external monitoring data are being used for assessment in the Little Fork River Watershed.

Figure 3. Monitoring locations of local groups, citizens, and the MPCA monitoring staff in the Little Fork River Watershed



III. Assessment Methodology

The Clean Water Act requires states to report, every two years, on the condition of the waters of the state. This biennial report to Congress contains an updated list of surface waters that are determined to be supporting or non-supporting of their designated uses. The assessment and listing process involves dozens of MPCA staff, other state agencies, and local partners in a review of water quality data to assess the condition of waterbodies. The goal of this effort is to use the best data and best science to assess the condition of Minnesota's water resources. For a thorough review of the assessment methodology see: Guidance Manual for Assessing the Quality of Minnesota Surface Waters for the Determination of Impairment 305(b) Report and 303(d) List (MPCA 2010) (http://www.pca.state.mn.us/index.php/download-document.html?gid=8601).

Water quality standards

Water quality standards are the fundamental benchmarks by which the quality of surface waters is measured. It is the water quality standards that are used to determine the impairment status (i.e. use attainment status) of a waterbody. Use attainment status is a term describing the degree to which environmental indicators are either above or below criteria specified by Minnesota Water Quality Standards (Minn. R. ch. 7050, 2008) (https://www.revisor.mn.gov/rules/?id=7050). These standards can be numeric or narrative in nature and define the concentrations or conditions of surface waters that allow them to meet their designated beneficial uses, such as for fishing (aquatic life), swimming (aquatic recreation), or human consumption (aquatic consumption). Waterbodies that are in attainment are said to be supporting their designated beneficial uses(s) whereas waterbodies out of attainment are considered non-supporting. All surface waters in Minnesota, including lakes, rivers, streams, and wetlands are protected for aquatic life and recreation where these uses are attainable. Protection of aquatic life means the maintenance of healthy, diverse, and successfully reproducing populations of aquatic organisms, including fish and macroinvertebrates. Protection of recreation means the maintenance of conditions suitable for swimming and other forms of water recreation. Protection of consumption means protecting citizens who eat fish from Minnesota waters or receive their drinking water from waterbodies are protected for this use.
Numeric water quality standards represent concentrations of specific pollutants in water that protect a specific designated use. Ideally, if the standard is not exceeded, the use will be protected. However, nature is very complex and variable, and the MPCA uses a variety of tools to fully assess designated uses. Assessment methodologies often differ by parameter and designated use, and consider multiple factors of the pollutants concentration; such as chronic value, maximum value, final acute value, magnitude, duration, and frequency.

Narrative standards are statements of conditions in and on the water, such as biological condition, that protect their designated uses. Interpretations of narrative criteria for aquatic life support in streams are based on multi-metric biological indices including the Fish Index of Biological Integrity (F-IBI), which evaluates the health of the fish community, and the Macroinvertebrate Index of Biological Integrity (M-IBI), which evaluates the health of the aquatic macroinvertebrate community. Biological monitoring is a direct means to assess aquatic life use support, as the aquatic community tends to integrate the effects of pollutants and stressors over time.

Assessment units

Assessments of use support in Minnesota are made for individual waterbodies. The waterbody unit used for river systems, lakes, and wetlands is called the "assessment unit". A stream or river assessment unit usually extends from one significant tributary stream to another or from the headwaters to the first tributary. A reach may be further divided into two or more assessment reaches when there is a change

in use classification (as defined in Minn. R., ch. 7050), or when there is a significant morphological feature such as a dam or lake within the reach. Therefore, a stream or river is often segmented into multiple assessment units that are variable in length. The MPCA is using the 1:24,000 scale High Resolution National Hydrologic Dataset (NHD) to define and index stream, lake, and wetland assessment units. Each river reach is identified by a unique waterbody identifier (known as its AUID), comprised of the USGS eight digit hydrologic unit code plus a three character code that is unique within each HUC. Lake and wetland identifiers are assigned by the MDNR.

It is for these specific stream reaches or lakes that the data are evaluated for potential use impairment. Therefore, any assessment of use support would be limited to the individual assessment unit. The major exception to this is the listing of rivers for contaminants in fish tissue (aquatic consumption). Over the course of time it takes fish, particularly game fish, to grow to "catchable" size and accumulate unacceptable levels of pollutants there is a good chance they have traveled a considerable distance. The impaired reach is defined by the location of significant barriers to fish movement such as dams upstream and downstream of the sampled reach and thus often includes several assessment units.

Determining use attainment status

Conceptually, the process for determining use attainment status of a waterbody is similar for each designated use: comparison of monitoring data to established water quality standards. However, the complexity of that process and the amount of information required to make accurate assessments varies between uses. In part, the level of complexity in the assessment process depends on the strength of the dose-response relationship; i.e., if chemical B exceeds water quality criterion X, how often is beneficial use Y truly not being attained. For beneficial uses related to human health, such as drinking water, the relationship is well understood and thus the assessment process is a relatively simple interpretation of numeric standards. In contrast, assessing whether a waterbody supports a healthy aquatic community is not as straightforward and often requires multiple lines of evidence to make use attainment decisions with a high degree of certainty. Incorporating a multiple lines of evidence approach into MPCA's assessment process has been evolving over the past few years. The current process used to assess the aquatic life use of rivers and streams in the Little Fork River Watershed is outlined below and in figure 4.

The first step in the aquatic life assessment process is a comparison of the monitoring data to standards. This is largely an automated process performed by logic programmed into a database application and the results are referred to as 'Pre-Assessments'. Pre-assessments are then reviewed by either a biologist or water quality professional, depending on whether the parameter is biological or chemical in nature. These "desktop assessments" are conducted using computer applications to analyze the data for potential temporal or spatial trends as well as gain a better understanding of any attenuating circumstances that should be considered (e.g., flow, time/date of data collection, habitat).

The next step in the process is a Comprehensive Watershed Assessment meeting where reviewers convene to discuss the results of their desktop assessments for each individual waterbody. Implementing a comprehensive approach to water quality assessment requires a means of organizing and evaluating information to formulate a conclusion utilizing multiple lines of evidence. Occasionally, the evidence stemming from individual parameters are not in agreement and would result in discrepant assessments if the parameters were evaluated independently. However, the overall assessment considers each piece of evidence to make a use attainment determination based on the preponderance of information available. See the Guidance Manual for Assessing the Quality of Minnesota Surface Waters for the Determination of Impairment 305(b) Report and 303(d) List (MPCA 2010) for the guidelines and factors to consider when making such determinations.

New impairments (i.e., waterbodies not attaining their beneficial uses), are reviewed using GIS to determine if greater than 50 percent of the assessment unit is channelized. With the exception of toxics and bacteria, the MPCA is deferring new impairments on channelized reaches until new aquatic life use standards have been developed as part of the tiered aquatic life use framework (http://www.pca.state.mn.us/index.php/water/water-monitoring-and-reporting/water-quality-and-pollutants/the-tiered-aquatic-life-use-talu-framework.html.) The last step in the assessment process is the Professional Judgement Group (PJG) meeting. At this meeting results are shared and discussed with entities outside of the MPCA that may have been involved in data collection or that might have a vested interest in the outcomes of the assessment process. Information obtained during this meeting may be used to revise previous use attainment decisions. The result of this meeting is a compilation of the assessed waters which will be included in the watershed assessment report. Waterbodies that do not meet standards and therefore do not attain one or more of their designated uses are considered impaired waters and are placed on the draft 303(d) Impaired Waters List.

Figure 4. Flowchart of aquatic life use assessment process.

Data management

It is MPCA policy to use all credible and relevant monitoring data to assess surface waters. The MPCA relies on data it collects along with data from other sources, such as sister agencies, local government, and volunteers. The data must meet rigorous quality-assurance protocols before being used. The MPCA stores surface monitoring data in U.S. Environmental Protection Agency's STORET system. All monitoring data required or paid for by MPCA is entered into STORET. STORET is currently being replaced by EQuIS. Projects funded by MPCA include CWA Section 319 projects, Clean Water Partnership (CWP) projects, SWAG projects, and more recently, TMDL projects. Many local projects not funded by MPCA choose to submit their data to the MPCA in STORET-ready format so that it may be utilized in the assessment process.

Period of record

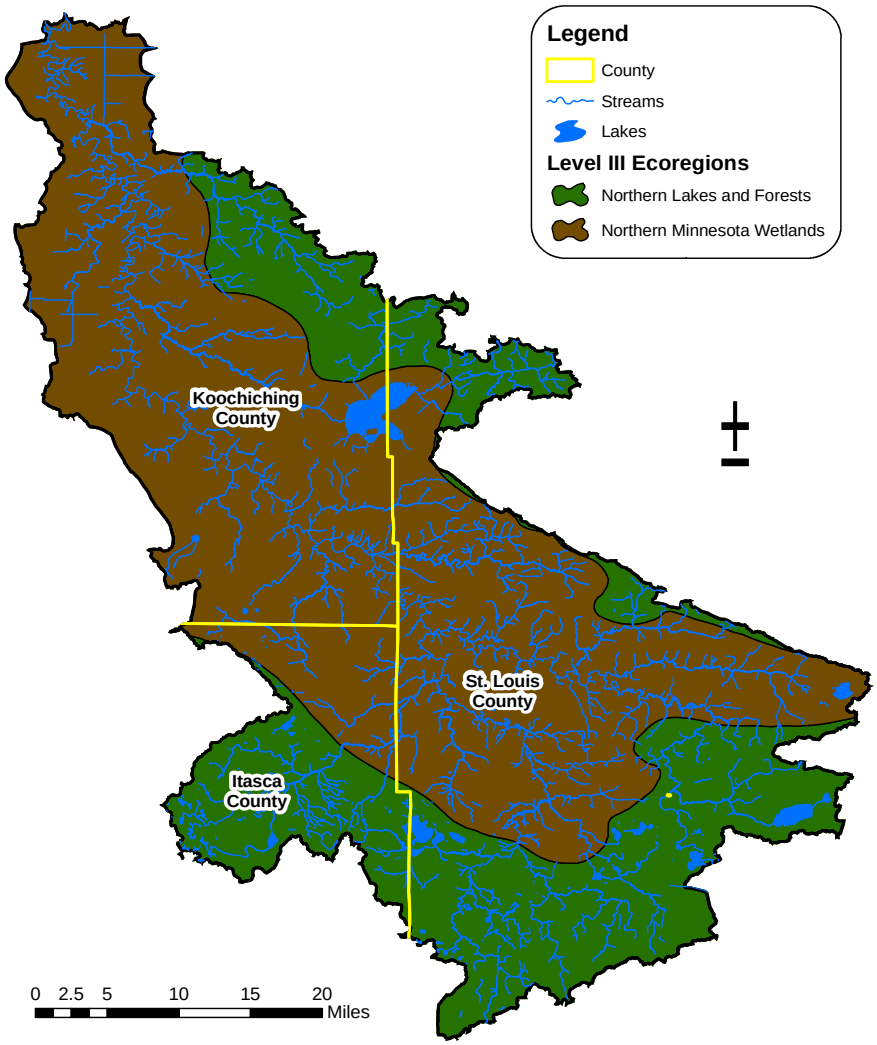
The MPCA use data collected over the most recent 10-year period for all water quality assessments. Generally, the most recent data from the 10-year assessment period is reviewed first when assessing toxic pollutants, eutrophication, fish contaminants. Also, the more recent data for all pollutant categories may be given more weight by members during the comprehensive watershed assessment or professional judgment group meetings. The goal is to use data from the 10-year period that best represents the current water quality conditions. Using data over 10-year period provides a reasonable assurance that data will have been collected over a range of weather and flow conditions and that all seasons will be adequately represented, however, data for the entire period are not required to make an assessment.

IV. Watershed Overview

Physical setting

The Little Fork River is a 160 mile long tributary of the Rainy River, draining a 1,843 square mile catchment in northeastern Minnesota. The Little Fork River watershed occupies areas of Koochiching, St. Louis, and Itasca Counties. The watershed lies primarily within the Ecological Classification System's Little Fork-Vermillion Uplands subsection with some Agassiz Lowlands in the western and northern reaches of the watershed. Minnesota level III ecoregions (Omernik and Gallant, 1988) included in the watershed are Northern Lakes and Forests and Northern Minnesota Wetlands (Figure 5). Soils types range from peat over clay to glacial till and ledge rock in the upper watershed to mostly silty clay with occasional upwellings of ledge rock and glacial outwash in the lower portion of the watershed (MPCA, 2001).

Figure 5. Level III ecoregions and county boundaries in the Little Fork River Watershed

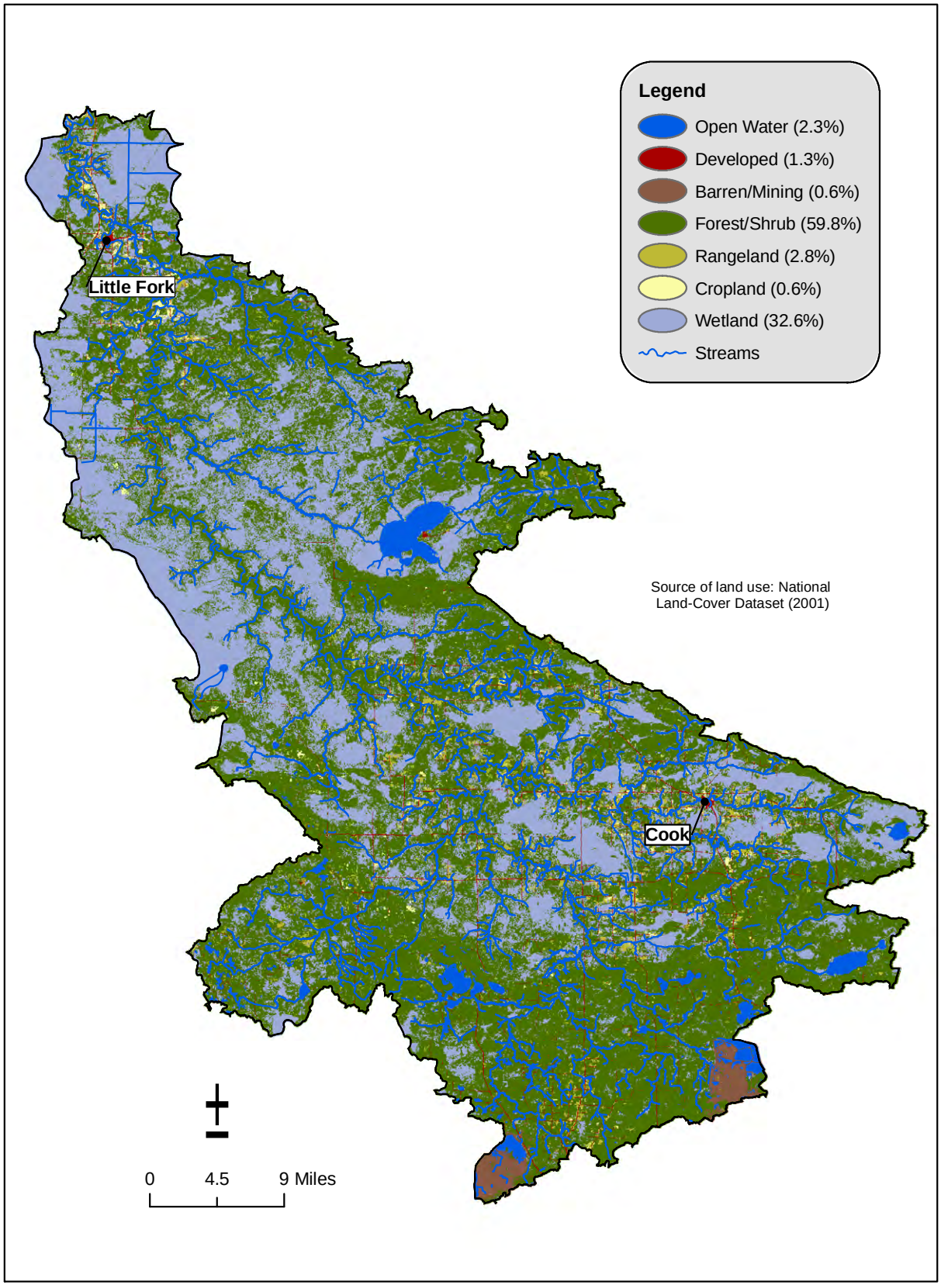


Land use summary

Besides the towns of Cook and Little Fork, the watershed is sparsely populated and is commonly referred to as remote and wild. Land cover percentages in the watershed are: forest/shrub (59.8 percent), wetland (32.6 percent), rangeland (2.8 percent), open water (2.3 percent), developed (1.3 percent), cropland (0.6 percent), and barren/mining (0.6 percent) (Figure 6). The upper portion of the watershed is dominated by forest cover with alders and willows in the lowlands, along with mostly black spruce and aspen established on the uplands (MPCA, 2001). From here, the Little Fork River makes its way downstream through a series of rapids and falls before entering the flat bed of glacial Lake Agassiz where wetlands become more prevalent. From the Highway 65 bridge near Silverdale, MN, the Little Fork River flows for more than 40 miles without a single road crossing until Highway 65 crosses once again to the north. This stretch of river is considered one of the most remote river reaches in the state of Minnesota. In this area, development all but diminishes and immense stands of mixed deciduous forest, interspersed with cedar and pine, make up the land cover. Farming activities reappear lower in the watershed as the river nears the town of Little Fork. Here, the river once again enters a series of rapids and pools before flattening out to its confluence with the Rainy River. The Little Fork River watershed was once densely covered with vast stands of mixed conifers and various hardwood species before intensive logging took place in the 1890's to 1937 (Anderson et. al, 2006). The river served as an important means of transporting the harvested timber downstream to the Rainy River. At times during these massive log drives, logs would often span the entire stream channel and large portions of the banks and floodplain, oftentimes creating log jams that would stretch for miles upstream (Anderson et. al, 2006). The primary economic activities in the watershed today are logging of second-growth timber and tourism. There is limited farming, mainly for the purpose of raising livestock, taking place primarily in the lower reaches of the watershed (MPCA, 2001).

Recreation opportunities in the Little Fork River watershed are numerous due to the fact that roughly 52 percent of the land in the watershed is open to the public. There are several state forests, along with the Superior National Forest, that provide tourists with ample access to hunting, fishing, and canoeing routes. Private property and corporate land holdings make up about 44 percent of the land in the watershed. Lastly, the Nett Lake Indian Reservation, located in the east-central portion of the watershed, occupies about four percent of the land in the watershed (NRCS, 2007).

Figure 6. Landuse in the Little Fork River Watershed



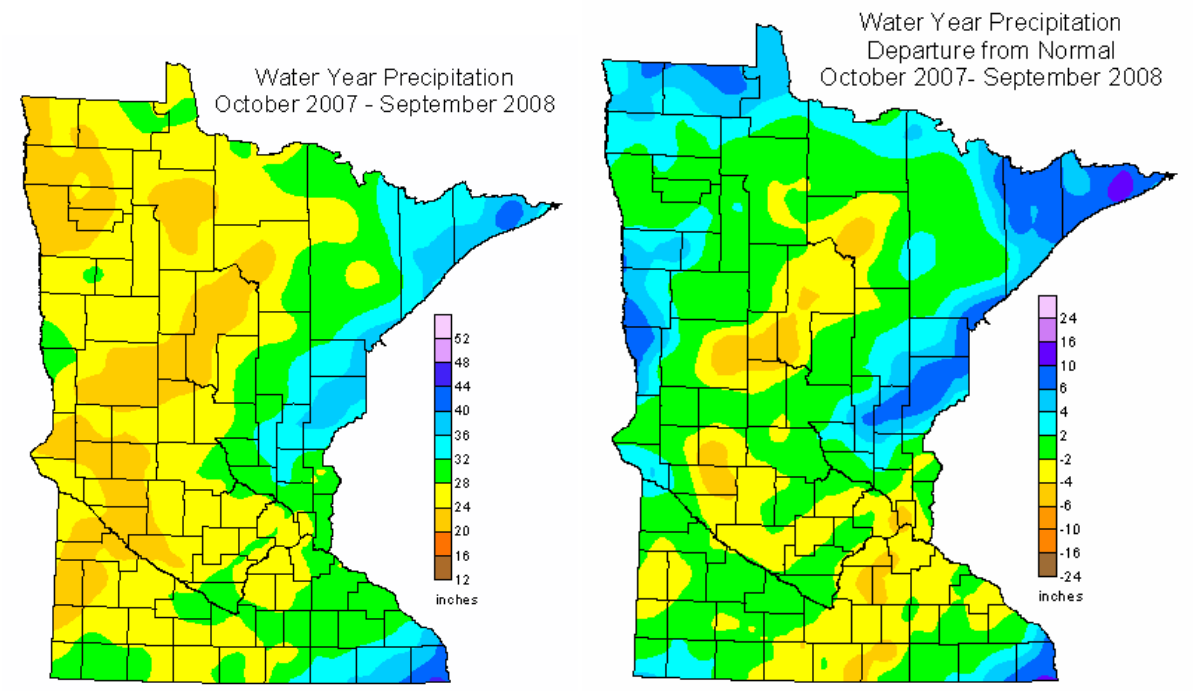
Surface water hydrology

The Little Fork River has its source in the lowlands near Lost Lake, south of Lake Vermillion. Flowing west past the town of Cook, MN, in St. Louis County, the river bends northwest through Koochiching County, eventually reaching its confluence with the Rainy River 11 miles west of International Falls, MN. From Lost Lake to the mouth, the river drops 300 feet with an overall mean gradient of two feet per mile. The mean annual discharge is around 1,000 cubic feet per second (cfs), although it has been known to reach levels of around 25,000 cfs (Waters, 1977). Principal tributaries include the Rice, Sturgeon, Willow, and Nett Lake Rivers; as well as Beaver Brook. The watershed has 108 minor watersheds (14 digit HUC) and 325 lakes, with the principal lakes being Big Rice, Nett, Sand, Sturgeon, and Lost.

Climate and precipitation

Annual precipitation levels in the watershed generally range from 23 to 29 inches (Minnesota State Climatologists Office, 2010). The October 2007-September 2008 water year, which encompasses the time span in which the majority of the data was collected in the watershed, the precipitation levels were near normal to slightly higher than normal (Figure 7). Precipitation totals for counties within the watershed were: Koochiching County 26.32 inches, St. Louis County 29.87 inches, and Itasca County 25.82 inches.

Figure 7. State-wide precipitation levels during the 2007 water year



V. Watershed Wide Data Collection Methodology

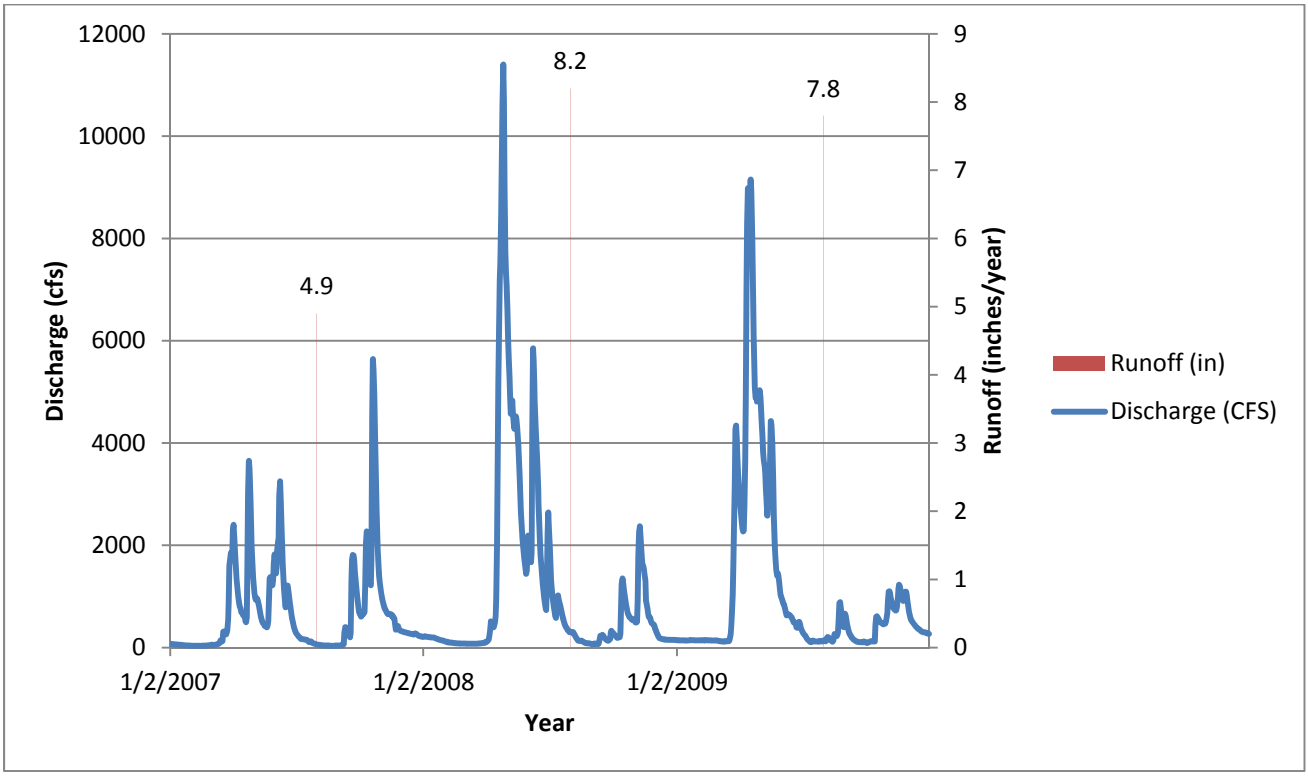
Load monitoring

The Little Fork River is monitored at USGS gage #05131500 in Littlefork, MN, approximately 10 miles upstream of the confluence with the Rainy River. Many years of water quality data from throughout Minnesota combined with previous analysis of Minnesota's ecoregion patterns, resulted in the development of three "River Nutrient Regions" (RNR) (MPCA 2010a), each with unique nutrient standards. Of the state's three RNR's (North, Central, South), the Little Fork River's load monitoring station is located within the North RNR. Annual flow weighted mean concentrations (FWMC's) were calculated for years 2007-2009 (Figures 21-24) and compared with RNR standards (only TP and TSS draft standards are available for the North RNR). It should be noted that while a FWMC exceeding given water quality standard is generally a good indicator the water body is out of compliance with the River Nutrient Region standard, the rule does not always hold true. Waters of the state are listed as impaired based on the percentage of individual samples exceeding the numeric standard, generally 10 percent and greater (MPCA 2010a), over the most recent ten year period and not based on comparisons with FWMC's. A river with a FWMC above a water quality standard, for example, would not be listed as impaired if less than 10 percent of the individual samples collected over the assessment period were above the standard.

Intensive water quality sampling occurs year round at all MWLM sites. Thirty to thirty-five mid-stream grab samples are collected per site per year with sampling frequency greatest during periods of moderate to high flow (Figure 8). Because correlations between concentration and flow exist for many of the monitored analytes, and because these relationships can shift between storms or with season, computation of accurate load estimates requires frequent sampling of all major runoff events. Low flow periods are also sampled and are well represented but sampling frequency tends to be less as concentrations are generally more stable when compared to periods of elevated flow. Despite discharge related differences in sample collection frequency, this staggered approach to sampling generally results in samples being well distributed over the entire range of flows.

Annual water quality and daily average discharge data are coupled in the "Flux32," pollutant load model, originally developed by Dr. Bill Walker and recently upgraded by the U.S. Army Corp of Engineers and MPCA, to create concentration/flow regression equations to estimate pollutant concentrations and loads on days when samples were not collected. Primary output includes annual and daily pollutant loads and flow weighted mean concentrations (pollutant load/total flow volume). Loads and flow weighted mean concentrations are calculated for total suspended solids (TSS), total phosphorus (TP), dissolved orthophosphate (DOP), nitrate plus nitrite nitrogen (nitrate-N) and total Kjeldahl nitrogen (TKN).

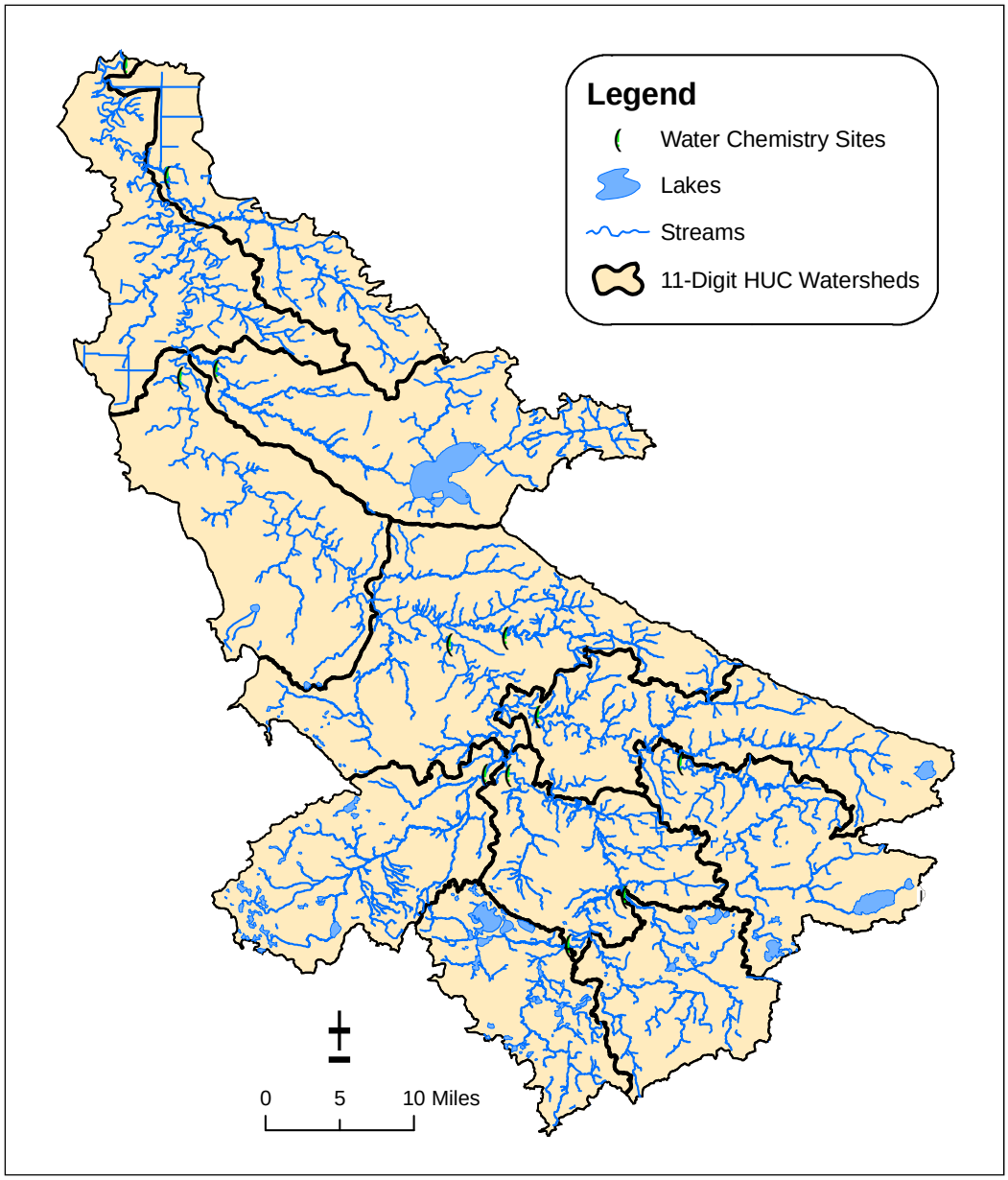
Figure 8. Hydrograph for the Little Fork River near Littlefork 2007-2009



Stream water sampling

A total of 12 water chemistry sites (Figure 9) were sampled in the summer of 2008 and 2009 throughout the Little Fork River watershed to provide data for water quality assessments. Monitoring took place cooperatively between staff from the MPCA, Minnesota Waters, Rainy River Community College, and trained citizen volunteers. These water chemistry sites were located near the pour points of intermediate (HUC-11) watersheds, per the MPCA's watershed monitoring approach. Due to the remote nature of much of the Little Fork watershed, historical data from upstream portions of the watersheds are sparse or lacking.

Figure 9. Intensive water chemistry monitoring stations in the Little Fork River Watershed



The HUC-11 pour point water chemistry data are summarized in Table Table 41, and include those parameters most closely related to the standards or expectations used for determining the assessments (i.e. supporting aquatic life and aquatic recreational use). Not all water chemistry parameters of interest have developed water quality standards. McCollor and Heiskary (1993) developed ecoregion expectations for a number of water quality parameters in streams that provide a good basis for evaluating water quality data and estimating attainable water quality for an ecoregion. The expectations were based on the 75th percentile from a long term dataset of least impacted streams.

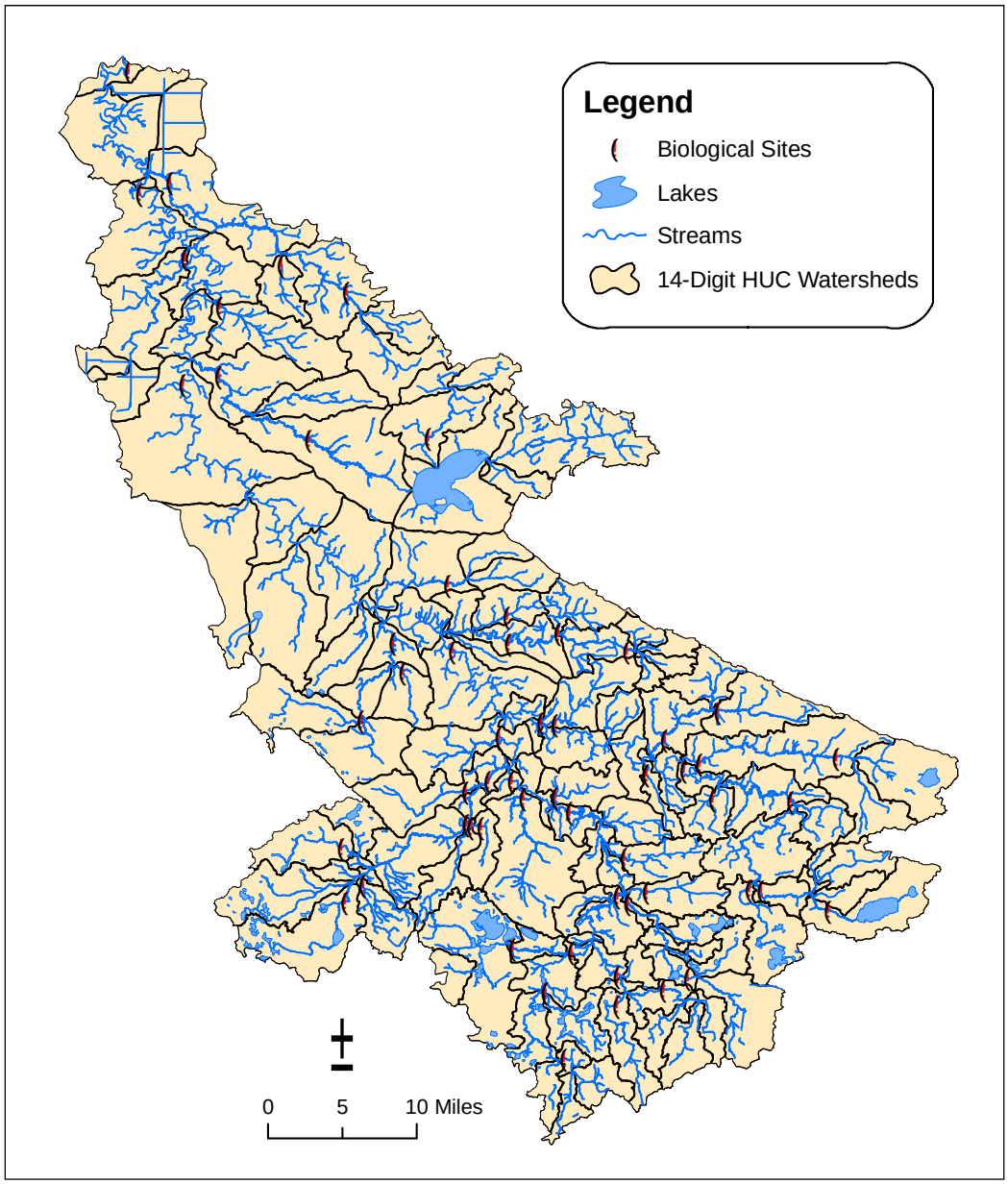
Stream biological sampling

A total of 54 biological sites (Figure 10) were established throughout the watershed and sampled during the summer months of 2008. These sites were located near the pour points of the 8 and 11 digit HUCs

watersheds and most minor HUC-14 watersheds. In addition, 28 existing biological monitoring stations within the watershed were revisited in 2008. The majority of these monitoring stations were initially established in 2005 as part of a statewide random stream survey while others were targeted to represent a particular area of interest. For these biological monitoring stations sampled in 2005, three were sampled for a second time in 2008. While data from the last ten years was used for assessment, the majority of data used for assessment was collected in 2008. A total of 55 AUIDs were sampled for biology in the Little Fork River watershed. Of these, 43 AUIDs were assessed for aquatic life use support and the remaining 12 AUIDs were not assessed. Certain AUIDs were not assessed due to the fact that biological criteria for channelized and coldwater streams were not developed at the time of the assessments. Five AUIDS in the Little Fork watershed were not assessed due to channelized conditions of the stream channel within the sampling reach and seven AUIDs were not assessed due to their classification as being a coldwater stream.

To measure the health of the biological communities at each assessable biological monitoring station, Indices of Biological Integrity (IBI) were used, specifically the Fish Index of Biological Integrity (F-IBI) and the Macroinvertebrate Index of Biological Integrity (M-IBI). The F-IBI and M-IBI partitions streams into seven distinct classes to account for natural, physical, and biological differences associated with different regions of the state, drainage area, gradient, and water temperature (Appendix 4). Fish and macroinvertebrate communities within each class are more similar to each other than those occurring in other classes. By partitioning, or accounting for the natural variation in streams, any changes in IBI scores within a class should reflect real change due to human-induced impacts. Each class specific IBI has a unique suite of metrics, scoring functions, impairment thresholds, and confidence intervals. IBI scores higher than the upper confidence limit reflect good biological condition, while scores below the lower confidence limit reflect poor biological condition. When IBI scores fall within the confidence interval, interpretation and assessment of waterbody condition involves consideration of potential stressors, and draws upon additional information regarding water chemistry, physical habitat, land use activities, etc. For individual biological monitoring station IBI scores, thresholds, and confidence intervals, refer to Appendix 4-6.

Figure 10. Biological monitoring stations in the Little Fork River Watershed



Fish contaminants

Mercury and polychlorinated biphenyls (PCBs) were analyzed in fish tissue samples collected from the Little Fork River in 1996, 2001, and 2008. Since 1991, mercury samples from fish were collected in 14 lakes within the Little Fork River watershed. PCBs were tested in the Little Fork River and in eight lakes within the watershed. Fish were collected in rivers by the MPCA Biological Monitoring Unit and in lakes by the Minnesota Department of Natural Resources (MDNR). Captured fish were wrapped in aluminum foil and frozen until they were thawed, scaled, filleted, and ground. The homogenized fillets were placed in 125 mL glass jars with Teflon™ lids and frozen until thawed for mercury or PCB analyses. The Minnesota Department of Agriculture Laboratory performed all mercury and PCB analyses of fish tissue.

Prior to 2006, mercury fish tissue concentrations were assessed for water quality impairment based on the Minnesota Department of Health's fish consumption advisory. An advisory more restrictive than a

meal per week was classified as impaired for mercury in fish tissue. Since 2006, a waterbody has been classified as impaired for mercury in fish tissue if ten percent of the fish samples (measured as the 90th percentile) exceed 0.2 mg/kg of mercury, which is one of Minnesota's water quality standards for mercury. At least five fish samples are required per species to make this assessment, and only the last 10 years of data are used for statistical analysis. MPCA's Impaired Waters Inventory includes waterways that were assessed as impaired prior to 2006 as well as more recently.

PCBs in fish have not been widely monitored as intensively as mercury in the last three decades, because, historically, concentrations of PCBs were high most typically downstream of large urban areas in large rivers, such as the Mississippi River, and in Lake Superior. Impairment assessment for PCBs in fish tissue is based on the fish consumption advisories prepared by the Minnesota Department of Health. If the consumption advice is to consume a particular fish species less than a meal per week because of PCBs, the MPCA considers the lake or river impaired. The threshold concentration for the more restrictive advice (one meal per month) is 0.22 mg/kg PCBs.

Lake water sampling

There are approximately 125 natural lakes greater than four hectares (10 acres) in the watershed. In general, lake water quality data are sparse in the watershed, with most lakes having little or no historical water quality data collected. Only 15 lakes have assessment level data (Table 42) and are located in the Bear River and Sturgeon Lake sub-watersheds. MPCA lake monitoring activities were not yet in sync with the watershed approach in 2008; the year MPCA intensively monitored streams in the Little Fork watershed to assess their condition. MPCA monitoring of large lakes within the Little Fork watershed will be conducted in 2010-2011.

VI. Individual HUC-11 Watershed Results

Assessment results are presented for each HUC-11 watershed unit within the Little Fork River Watershed, enabling the assessment of all surface waters at one time and the ability to develop comprehensive TMDL studies on a watershed wide basis rather than the reach by reach and parameter by parameter approach that has been typically employed historically. This scale provides a robust assessment of water quality condition in the 11-digit watershed unit and is a practical size for the development, management and implementation of effective TMDL's and protection strategies. The primary objective of this monitoring strategy is to portray all the impairments within a watershed resulting from the complex and multi-step assessment and listing process. The graphics presented for each of the HUC-11 watershed units contain the assessment results from the most recent 2011 Assessment Cycle as well as any impairment listings carried forward from previous assessment cycles. Discussion of assessment results will focus primarily on the 2008 intensive watershed monitoring effort but will also consider all available data from the last ten years.

Given all of the potential sources of data and differing assessment methodologies for assessing indicators and designated uses it is not feasible to provide results or summary tables for every monitoring station by parameter. However, in the proceeding pages an individual account of each 11 HUC sub-watershed is provided. Within each account, readers are given a brief description of the watershed along with a series of tables including a 1) Stream Assessment table where an overall assessment result is provided for each AUID by each assessable parameter and designated use (i.e. aquatic life and aquatic recreation), 2) non-assessable AUID table where a general indication of condition is provided for channelized streams (where applicable), 3) a Stream Habitat Results table, 4) a Pour Point Water Chemistry Results table, 5) a table describing Lake Water Chemistry (where applicable) and finally, a narrative that summarizes the unique components of the assessment and highlights noteworthy findings in the results.

Stream assessment

This table provides a summary of all assessable AUIDs by parameter within the watershed (where sufficient information was available to make an assessment). The tables denote the use support status of each individual water chemistry and biological parameter, as well as an overall use support assessment for aquatic life and aquatic recreation for each assessable AUID. The assessment for aquatic life is derived from analyzing biological data, DO, turbidity, chloride, pH and NH3 to determine use status, while the assessment for aquatic recreation in streams is solely based on E. coli concentrations. Immediately following the AUID-specific use support results, the location of any assessed biological monitoring sites are listed. Water chemistry station locations are not provided because information collected as specific locations within each AUID are combined for the purposes of conducting waterbody assessments. Some AUIDs within the sub-watershed do not have sufficient information for assessment and are not included in this table. Following the stream assessment table is a table describing a narrative biological condition of stations that could not be assessed due to their occurrence on channelized AUIDs, and is not an assessment for aquatic life for these systems. For more information regarding water chemistry parameters monitored in these studies refer to Appendix 1. A complete listing of all AUIDs within the watershed may be found in Appendix 3.

Stream habitat results

These tables convey the results of the Minnesota Stream Habitat Assessment (MSHA) surveys that are conducted during each fish sampling visit. The MSHA provides information on available fish habitat, land use and buffers along the immediate site reach, providing clues for impacts such as siltation or eutrophication which may lead to unhealthy fish and macroinvertebrate communities. The MSHA score is comprised of numerous scoring categories including land use, riparian zone, instream zone (substrate, embeddedness, cover types and amounts) and channel morphology (depth variability, sinuosity, stability, channel development, velocity) which are summed for a total possible score of 100 points. Total scores for each category and a summation of the total MSHA score are included. Where multiple visits occur at the same station, the relative scores from each visit have been averaged. The final row in each table displays average MSHA scores for each scoring category for that particular sub-watershed. A qualitative habitat rating was then assigned to each station: Good ≥ 66, Fair 45-65, or Poor ≤ 44.

Pour point water chemistry results

These summary tables display the water chemistry results for the intensive watershed station representing the pour point of the HUC-11 watershed. This data can provide valuable insight on water quality characteristics and potential parameters of concern within the watershed. While not all of the water chemistry parameters of interest have developed water quality standards, McCollor and Heiskary (1993) have developed ecoregion expectations for a number of water quality parameters in streams. These ecoregion expectations provide a good basis for evaluating water quality data and estimating attainable water quality for an ecoregion. The ecoregion expectations were based on the 75th percentile from a long term dataset of least impacted streams.

Lake water chemistry

This section provides a summary table including all lakes possessing sufficient data for aquatic recreation use assessments.

HUC-11 and HUC-8 Figures

The figures presented for each of the following HUC-11 watershed units contain the assessment results from the most recent assessment cycle as well as any impairment listings carried forward from previous assessment cycles. Following the results by HUC-11 watershed, are a series of figures that provide an overall summary of assessment results by designated use, impaired waters, and fully supporting waters within the entire Little Fork River major watershed (HUC-8).

Upper Little Fork River Watershed Unit HUC 0903000501

The Upper Little Fork River Watershed Unit, located in west-central St. Louis County, drains an area of 179.6 square miles. This watershed unit contains the headwaters of the Little Fork River, originating from Lost Lake, and a large surrounding wetland complex. The Little Fork River flows in a westerly direction through the town of Cook until reaching its confluence with the Sturgeon River. The watershed consists mostly of forest/shrub and wetland land cover with limited farming activities along the main-stem Little Fork River (Figure 10). Flint and Beaver Creek are the named tributaries within this watershed. The water chemistry monitoring for this watershed unit is represented by the pour point station 08RN005 on the Little Fork River at the County Road. 495 Bridge.

Stream assessments

Table 1. Aquatic life and recreation assessments on Assessed AUIDs in the Upper Little Fork River 11-HUC

AUID	Biological Station ID	Biological Station Location	F-IBI	M-IBI	DO	Turb	Cl	pH	NH_3	Aq. Life	Aq. Rec.
09030005-502 ***Little Fork River*** *Headwaters to Rice R*	08RN050 05RN189 05RN088 08RN015	Downstream of CR 420, 5 mi. E of Cook Upstream of CR 78, 5 mi. E of Cook Upstream of River Rd, In Cook Upstream of CR 914, 2 mi. SW of Cook	**FS**	**FS**	IF	**NS**	--	IF	--	**NS**	NA
09030005-504 **Little Fork River** *Beaver Cr to Sturgeon R*	05RN089 08RN005	Upstream of CR 495, 13 miles SW of Glendale Downstream of CR 495, 6 mi. SE of Greaney	**FS**	**FS**	--	**FS**	--	**FS**	**FS**	**FS**	**FS**
09030005-586 **Unnamed Creek** *Headwaters to Little Fork R*	05RN174	Upstream of CR 420, 6.5 mi E of Cook	**FS**	**FS**	--	--	--	--	--	**FS**	NA
09030005-518 **Beaver Creek** *Unnamed cr to T62 R20W S6, west line*	08RN017	Upstream of CR 139, 6.5 mi. SE of Greaney	**FS**	**FS**	--	--	--	--	--	**FS**	NA
09030005-613 **Flint Creek** *Unnamed Cr to Unnamed Cr*	08RN016	Upstream of CR 937, 6 mi. SE of Gheen	**FS**	IF	--	--	--	--	--	**FS**	NA
09030005-588 **Flint Creek** *Unnamed Cr to Unnamed Cr*	08RN051	Downstream of Hwy 1, 4 mi. W of Cook	**FS**	**FS**	--	--	--	**FS**	--	**FS**	NA
09030005-665 **Unnamed Creek** *Unnamed Cr to Sturgeon R*	08RN040	Upstream of CR 107, 4.5 mi. of Sturgeon	**FS**	**FS**	--	--	--	--	--	**FS**	NA

Abbreviations: **F-IBI** – Biological, Fish **M-IBI** – Biological, Macroinvertebrates **DO** – Dissolved Oxygen
Turb – Turbidity **Cl** – Chloride **NH3** – Unionized Ammonia
Aq. Life – Aquatic Life Use Assessment **Aq. Rec**. – Aquatic Recreation Assessment

FS – Full Support **NS** – Non-Support **IF** – Insufficient Information
NA – Not Assessed -- No Data

Table 2. Minnesota Stream Habitat Assessment (MSHA) for the Upper Little Fork River 11-HUC

Visits	Site ID	Stream Name	Land Use (0-5)	Riparian (0-15)	Substrate (0-27)	Fish Cover (0-17)	Channel Morph. (0-36)	MSHA Score (0-100)	MSHA Rating
1	08RN050	Little Fork River	5	14	15	13	29	76	Good
1	05RN189	Little Fork River	5	11	7	14	22	59	Fair
1	05RN088	Little Fork River	3	6	16	12	15	52	Fair
1	08RN015	Little Fork River	5	10	7	14	21	57	Fair
1	05RN089	Little Fork River	4	13	15	10	15	57	Fair
1	08RN005	Little Fork River	5	14	20	12	21	71	Good
1	08RN016	Flint Creek	5	11	4	10	14	44	Poor
2	08RN051	Flint Creek	5	11	7	9	17	49	Fair
1	08RN017	Beaver Creek	5	13	13	13	20	64	Fair
1	05RN174	Trib. to Little Fork River	5	13	3	16	23	60	Fair
1	08RN040	Trib. to Sturgeon River	5	13	9	12	18	57	Fair
Average Habitat Results: *Upper Little Fork River 11 HUC Watershed*			5	12	11	12	20	59	Fair

Qualitative habitat ratings:
Good: MSHA score above the median of the least-disturbed sites (≥66)
Fair: MSHA score between the median of the least-disturbed sites and the median of the most-disturbed sites (45-65)
Poor: MSHA score below the median of the most-disturbed sites (≤44)

Table 3. Pour point water chemistry results for the Upper Little Fork River 11-HUC

Station location:	Little Fork River at CR 495, 6 miles SE of Greaney
Storet ID:	S004-873
Station #:	08RN005

Parameter	TSS	Turb.[4]	T-tube	D.O.	TP[5]	TKN	Chloro-phyll-a[5]	E. coli	pH	Spec. cond.
Units	mg/l	NTU	cm	mg/l	mg/l	mg/l	ug/l	#/100ml	SU	uS/cm
# samples	9	6	18	18	9	9	4	14	17	17
Min	3.2	13	22	5.8	.033	0.77	1.1	6	6.7	51
Max	14	29	120	10.8	.078	1.3	3.0	53	7.8	188
Mean[1]	5.8	18	73	7.8	.063	1.1	1.8	21	7.3	110
Median	5.2	18	52	7.5	.068	1.1	1.6	18	7.3	112
WQ standard		25	20	5.0	0.055		10	126/ 1260	6.5-9.0	
# WQ exceedances[2]		1/6	0/18	0/18	7/9		0/4	0/14	0/17	
NMW 75th percentile[3]	20	12			0.09	0.18-0.73			8.0	230

1Geometric mean of all samples is provided for *E. coli* or fecal coliform.
2Represents exceedances of individual maximum standard for *E. coli* (1260/100ml) or fecal coliform (2000/100ml).
3Based on 1970-1992 summer data; see *Selected Water Quality Characteristics of Minimally Impacted Streams from Minnesota's Seven Ecoregions* (McCollor and Heiskary 1993). TKN range based on EPA Rivers and Streams in Nutrient Ecoregion VIII, NLF and NMW EPA 822 B-01-015. 2001
[4] Combined data from 3 turbidity methods, each with slightly different standard methods
[5] Proposed TP and Chlorophyll-a standards for the North region of Minnesota, see http://www.pca.state.mn.us/index.php/view-document.html?gid=14947

****Data found in the table above was compiled using the results from data collected in 2008 and 2009 at the pour point monitoring station. This site specific data does not necessarily reflect all data that was used to assess the AUID.**

Summary

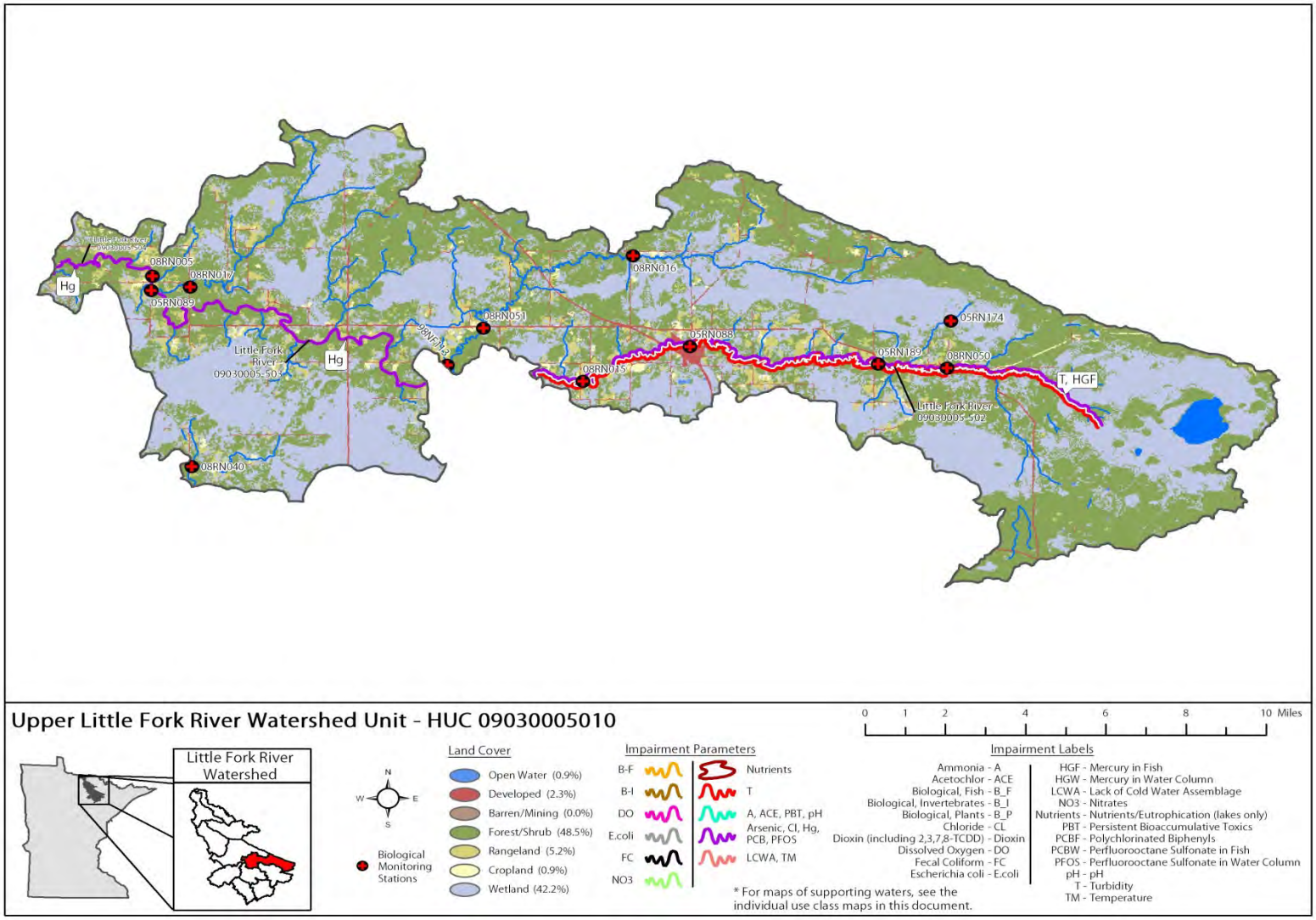
Fish community survey results in the Upper Little Fork River Watershed Unit all produced IBI scores above their respective thresholds. F-IBI scores along the headwaters of the Little Fork River (AUID 09030005-502) do approach threshold values at two stations, 05RN088 in the town of the Cook and 08RN015 approximately two miles downstream of Cook. The macroinvertebrate community sampled at 08RN015 produced a M-IBI score right at its respective threshold as well. This particular reach of the Little Fork River is extremely low gradient and has been observed as having stagnant flow conditions during mid-summer months which is not highly suitable for maintaining robust biological communities. Conditions do seem to improve at two stations further downstream on the Little Fork River (AUID 09030005-504) as both fish and macroinvertebrate communities yielded IBI scores well above threshold values, coinciding with an increase in stream gradient and more suitable habitat. Two macroinvertebrate samples, one from 05RN174 Unnamed Creek, and the other from 08RN016 on Flint Creek produced M-IBI scores that fell below thresholds but remained within the lower confidence interval. Given the lack of active disturbance in the upstream watershed of these sites and fish communities scoring well, they were deemed to be fully supporting for aquatic life.

Aquatic life indicators within this watershed unit are contradictory. Monitoring data collected prior to 2008 resulted in the headwaters of the Little Fork River (AUID 09030005-502) being placed on the impaired waters list for not supporting aquatic life due to violations of the turbidity standard. However, recent assessment results indicate that fish and macroinvertebrate communities are fully supported. Although both fish and macroinvertebrate communities do not appear to be detrimentally affected in the Little Fork River itself, these high turbidity levels are believed to negatively impact downstream waters such as the Rainy River and Lake of the Woods. For this reason, the turbidity impairment has been retained on the 2010 impaired waters list and a watershed wide turbidity TMDL study is scheduled to begin in 2012.

Stream water chemistry results taken from the pour point station indicate full support of both aquatic life and aquatic recreational uses. Nutrient, sediment, chlorophyll, and bacteria levels are low in this reach. Total Phosphorous (TP) concentrations averaged 0.063 mg/l, which is higher than most other watersheds. A total of seven samples exceeded the TP water quality standard of 0.055 mg/l, however all the samples remain below the Northern Minnesota Wetland (NMW) ecoregion expectation of 0.09 mg/l. With the preponderance of wetlands in this sub-watershed, it is likely that these higher concentrations are influenced by natural bog staining and wetland runoff. Flint Creek, the largest tributary within this watershed unit, is known to have high concentrations of suspended sediment and turbidity, although the numbers of samples collected are below those needed for a formal assessment. MPCA recommends additional water quality monitoring on Flint Creek to further define water quality conditions and supplement anecdotal evidence of high sedimentation.

There are only two lakes within the watershed, and they lack assessment level data. Lost Lake (69-0581) is being monitored by the MPCA in 2010 and 2011.

Figure 11. Currently listed impaired waters by parameter and landuse in the Upper Little Fork River Watershed Unit



South Branch Little Fork River Watershed Unit HUC 09030005020

The South Branch Little Fork River Watershed Unit, located in central St. Louis County, encompasses an area of 150.7 square miles. The watershed unit includes the 49 mile long Rice River drainage along with a portion of the main-stem Little Fork River from the confluence with the Rice River down to Co. Rd. 481. The Rice River originates in the Superior National Forest from Little Rice Lake and is a predominately low gradient system throughout its entire length. The watershed is largely undeveloped and consists predominantly of forest/shrub land cover and wetlands limit farming practices, particularly in the lower portion of the watershed (Figure 11). Named tributaries to the Little Fork River within this watershed unit include the Rice River and Johnson, Alango, Sassas, Maki, Puutio, Forsman, Walberg, and Angora creeks. The water chemistry monitoring for this watershed unit is the pour point station 08RN002 on the Rice River at the County Road 25 Bridge just southwest of the town of Cook. Although the monitoring station is further up in the watershed from where the pour point would normally be considered due to the scarcity of road crossings, this site adequately characterizes the water quality in the Rice River drainage which encompasses the majority of the watershed unit.

Stream assessments

Table 4. Aquatic life and recreation assessments on assessed AUIDs in the South Branch Little Fork River 11-HUC

AUID	Biological Station ID	Biological Station Location	F-IBI	M-IBI	DO	Turb	Cl	pH	NH_3	Aq. Life	Aq. Rec.
09030005-515	08RN039	Upstream of FR 256, 9 mi. N of Virginia									
Rice River	05RN068	Upstream of US Route 53, 10 mi. S of Cook	**FS**	**FS**	--	--	--	--	--	**FS**	NA
Headwaters to Johnson Cr	08RN012	Upstream of CR 652, 1.5 mi. S of Idington									
09030005-517	08RN036	Upstream of CR 87, 1.5 mi. E of Leander									
Rice River	05RN010	Upstream of State Route 1, 3 mi. SE of Cook	**NS**	**FS**	IF	**FS**	--	**FS**	**FS**	**NS**	**FS**
Johnson Cr to Little Fork R	08RN002	Downstream of CR 25, 3 mi. SW of Cook									
09030005-503	05RN018	Downstream of CR 194, 4 mi. SW of Cook									
Little Fork River			**FS**	**FS**	--	--	--	**FS**	--	**FS**	NA
Rice R to Beaver Cr											
09030005-530	08RN011*	Upstream of CR 652, 1.5 mi. SW of Idington									
Johnson Creek			NA*	NA*	--	--	--	--	--	NA*	--
Little Sand Lk to T60 R18W S6, north line											

Abbreviations: **F-IBI** – Biological, Fish **M-IBI** – Biological, Macroinvertebrates **DO** – Dissolved Oxygen **Turb** – Turbidity **Cl** – Chloride **NH3** – Unionized Ammonia
Aq. Life – Aquatic Life Use Assessment **Aq. Rec**. – Aquatic Recreation Assessment
FS – Full Support **NS** – Non-Support **IF** – Insufficient Information
NA – Not Assessed -- No Data

*** Aquatic Life assessment deferred during 2010 Assessments due to coldwater thermal regime and the lack of appropriate assessment tools for coldwater streams.**

Table 5. Non-assessed biological stations on channelized AUIDs in the South Branch Little Fork River 11-HUC

AUID	Biological Station ID	Biological Station Location	F-IBI Quality	M-IBI Quality
09030005-666 ***Unnamed Creek*** *Unnamed Cr to Rice R*	08RN013	Upstream of CR 923, 3 mi. SW of Cook	Good	Fair
09030005-667 ***Alango Creek*** *Unnamed ditch to Little Fork Cr*	08RN014	Upstream of CR 958, 5 mi. SW of Cook	Good	Poor

See Appendix 5 for clarification on the good/fair/poor thresholds and Appendix 4 for IBI results.

Table 6. Minnesota Stream Habitat Assessment (MSHA) for the South Branch Little Fork River 11-HUC

Visits	Site ID	Stream Name	Land Use (0-5)	Riparian (0-15)	Substrate (0-27)	Fish Cover (0-17)	Channel Morph. (0-36)	MSHA Score (0-100)	MSHA Rating
1	08RN039	Rice River	5	11	13	13	18	60	Fair
1	05RN068	Rice River	5	14	25	16	33	93	Good
2	08RN012	Rice River	5	11	14	13	26	69	Good
1	08RN036	Rice River	5	15	17	14	26	77	Good
1	05RN010	Rice River	5	10	8	11	17	51	Fair
1	08RN002	Rice River	5	11	7	12	17	52	Fair
1	05RN018	Little Fork River	5	11	19	12	34	81	Good
1	08RN011	Johnson Creek	5	10	10	13	17	55	Fair
1	08RN013*	Trib. to Rice River	5	12	9	10	17	53	Fair
1	08RN014*	Alango Creek	5	13	9	12	10	49	Fair
Average Habitat Results: *South Branch Little Fork River 11 HUC Watershed*			5	12	13	13	22	64	Fair

Qualitative habitat ratings:

Good: MSHA score above the median of the least-disturbed sites (≥66)

Fair: MSHA score between the median of the least-disturbed sites and the median of the most-disturbed sites (45-65)

Poor: MSHA score below the median of the most-disturbed sites (≤44)

***** Channelized reach Table 7. Pour point water chemistry results for the South Branch Little Fork River 11-HUC

Table 7. Pour point water chemistry results for the South Branch Little Fork River 11-HUC

Station location:	Rice River at CR 25, 3 miles SW of Cook
Storet ID:	S000-877
Station #:	08RN002

Parameter	TSS	Turb.[4]	T-tube	D.O.	TP[5]	TKN	Chloro-phyll-a[5]	E. coli	pH	Spec. cond.
Units	mg/l	NTU	cm	mg/l	mg/l	mg/l	ug/l	#/100ml	SU	uS/cm
# samples	10	6	18	17	10	10	4	13	16	16
Min	3.2	12	23	4.8	.03	0.67	1.1	10	6.3	46
Max	9.2	28	82	10.5	.07	1.25	5.5	83	7.6	172
Mean[1]	6.3	18	42	6.7	.05	0.95	3.6	26	7.0	93
Median	6.6	18	36	6.2	.05	0.95	3.9	18	7.1	83
WQ standard		25	20	5.0	0.055		10	126/ 1260	6.5-9.0	
# WQ exceedances[2]		1/6	0/18	1/17	6/10		0/4	0/13	0/16	
NLF 75th percentile[3]	5.6	4			0.05	0.18-0.73			7.9	260

1Geometric mean of all samples is provided for *E. coli* or fecal coliform.

2Represents exceedances of individual maximum standard for *E. coli* (1260/100ml) or fecal coliform (2000/100ml).

3Based on 1970-1992 summer data; see *Selected Water Quality Characteristics of Minimally Impacted Streams from Minnesota's Seven Ecoregions* (McCollor and Heiskary 1993). TKN range based on EPA Rivers and Streams in Nutrient Ecoregion VIII, NLF and NMW EPA 822 B-01-015. 2001

[4] Combined data from 3 turbidity methods, each with slightly different standard methods

[5] Proposed TP and Chlorophyll-a standards for the North region of Minnesota, see http://www.pca.state.mn.us/index.php/view-document.html?gid=14947

****Data found in the table above was compiled using the results from data collected in 2008 and 2009 at the pour point monitoring station. This site specific data does not necessarily reflect all data that was used to assess the AUID.**

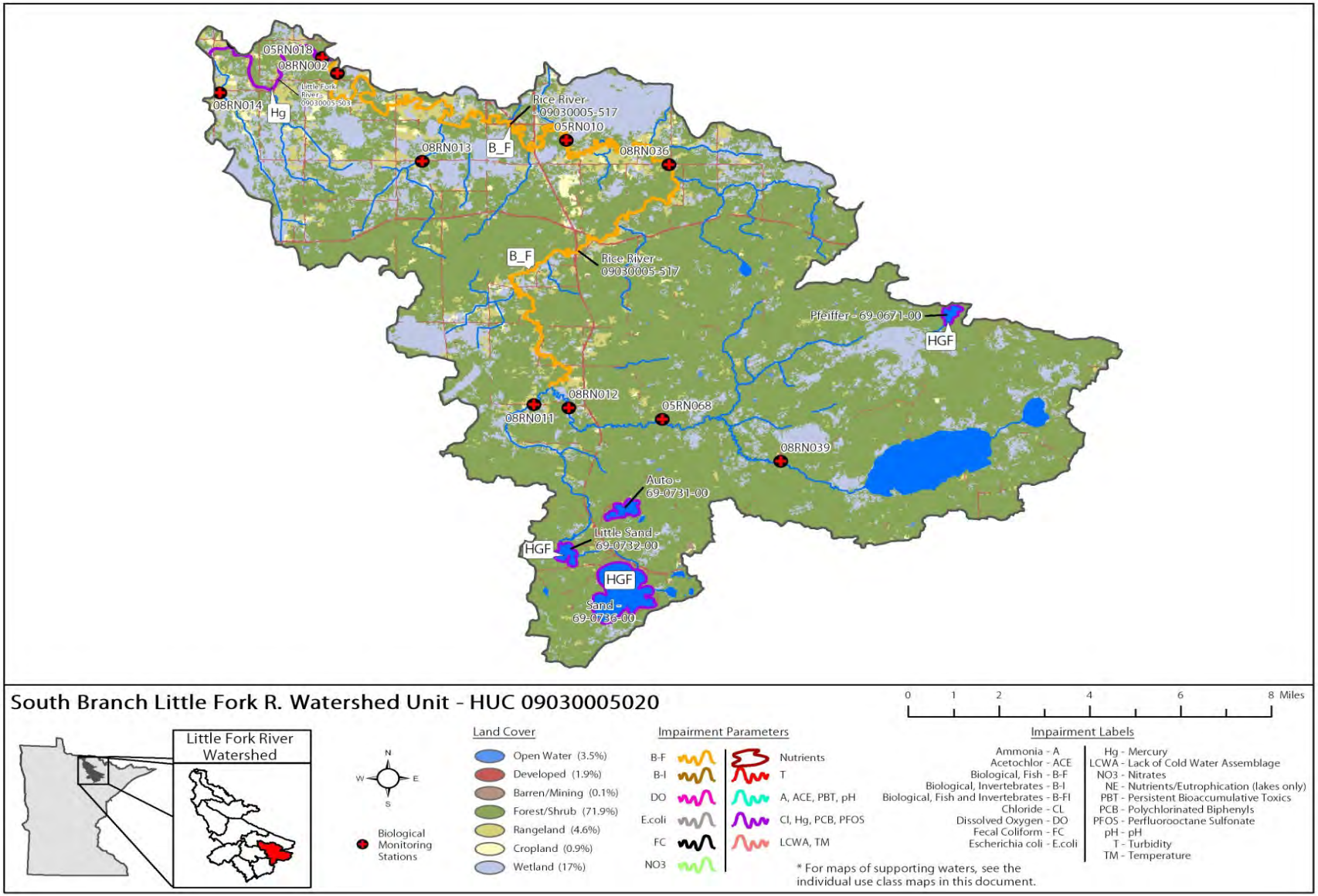
Summary

In general, fish and macroinvertebrate IBI scores along the Rice River are above thresholds, with the exception of station 05RN010. Sampled in 2005, 05RN010 yielded a F-IBI score seven points below the threshold for this stream type, resulting in AUID 09030005-517 being placed on the impaired waters list for aquatic life. The fish community sample taken from 05RN010 was dominated by tolerant species and possessed low numbers of sensitive species. The low fish IBI score could be attributed to localized land use practices upstream of the site, such as: feedlots, treatment ponds draining directly into the Rice River, and lack of an in-tact riparian due to cattle grazing. Stations that were sampled both upstream and downstream of 05RN010 on the Rice River in 2008 had IBI scores above the threshold, which further points to the potential that there are localized stressors affecting the fish community at 05RN010. Additional biological monitoring aimed at bracketing these land use practices near 05RN010 would be beneficial to better define the impairment. For the remainder of the watershed unit, biological communities appear to be healthy and are surpassing their respective thresholds, reflecting the abundance of forested acreage and wetland cover throughout the watershed unit. Habitat assessments taken at the biological monitoring stations reveal fair to good conditions throughout the watershed unit. Substrate conditions and channel morphology received the majority of the lower scores, most notably at the lowest two stations on the Rice River, which could be attributed to its low gradient nature.

E. coli bacteria levels were consistently very low, averaging 26 colonies / 100 mL. Although there were not the requisite 20 samples necessary for assessment, MPCA determined the river was meeting the recreational use standard. Total Suspended Solids (TSS) and turbidity levels were also low; only one sample exceeded the turbidity standard and the average TSS concentration was near the Northern Lakes and Forest (NLF) ecoregion expectation. TP data exceeded the water quality standard of 0.055 mg/l in 6 of 10 samples. The relatively high TP and Chl-a concentrations (3.6 µg/L) may be a function of the high percentage of wetlands in the watershed. Organic material originating from wetlands can yield elevated chl-a concentrations and increased algal (periphyton) growth, particularly during periods of summer drought in low gradient areas. Dissolved oxygen levels averaged 6.7 mg/L, and only one sample was below the 5 mg/L standard.

The watershed contains 11 lakes larger than 4 ha (10 acres). No lakes currently have assessment level data. Sand (69-0736) and Auto Lakes (69-0731) are being monitored by the MPCA in 2010 and 2011. Big Rice Lake (69-0669), covers 1,820 acres, and forms the headwaters of the Rice River. The lake was not monitored since it is a very shallow lake (max. depth = 4.5 feet), with limited recreational use (i.e. swimming).

Figure 12. Currently listed impaired waters by parameter and landuse in the South Branch Little Fork River Watershed Unit



Bear and Dark River Watershed Unit HUC 09030005030

The Bear and Dark River Watershed Unit encompasses an area of 114.7 square miles and is located in west central St. Louis County. The watershed unit includes two significant tributaries to the Sturgeon River; the East Branch Sturgeon and Dark Rivers. Both rivers originate within the Superior National Forest and flow northwest through an undeveloped and predominately forested landscape before emptying into the Sturgeon River. Some barren/mining land use practices take place in the southeastern portion of the watershed (Figure 12). Named tributaries within this watershed include Boriin, Lonesome Polecat, Slow, and McNiven creeks to the East Branch Sturgeon River and Leander and Knuckey creeks to the Dark River. The water chemistry monitoring for this watershed unit is represented by the pour point station 99NF120 on the Dark River at the County Road 668 Bridge. Although the watershed has two distinct pour points, it was decided to place the water monitoring station on the Dark River, instead of the East Branch Sturgeon River, to take advantage of existing data and to also obtain additional information as to the classification of the Dark River being a coldwater stream.

Stream assessments

Table 8. Aquatic life and recreation assessments on assessed AUIDs in the Bear and Dark River 11-HUC

AUID	Biological Station ID	Biological Station Location	F-IBI	M-IBI	DO	Turb	Cl	pH	NH_3	Aq. Life	Aq. Rec.
09030005-592 **Dark River** *Unnamed Cr to Unnamed Cr*	05RN079	Upstream of FR 668, 8 mi. NW of Mountain Iron	**FS**	**FS**	--	**FS**	--	--	--	**FS**	NA
09030005-591 **Dark River** *Unnamed Cr to Dark Lk*	08RN045	Upstream of CR 25, 8 mi. NW of Mountain Iron	**FS**	**FS**	--	--	--	--	--	**FS**	NA
09030005-525 **Dark River** *T60 R19W S30, east line to T60 R20W S10, north line*	99NF120*	At CR 688, 5 mi. S of Sturgeon	NA*	NA*	--	--	--	**FS**	**FS**	IF*	**FS**
09030005-596 **Sturgeon River, East Branch** *McNiven Cr to Slow Cr*	05RN034	Downstream of CR 25, 9 mi. NE of Chisholm	**FS**	**FS**	--	--	--	--	--	**FS**	NA
09030005-528 **Sturgeon River, East Branch** *Slow Cr to Sturgeon R*	08RN034 08RN033	Upstream of CR 445, 8 mi. NE of Chisholm Upstream of Hwy 73, 9 mi. N of Chisholm	**FS**	**FS**	--	--	--	--	--	**FS**	NA
09030005-597 **McNiven Creek** *Unnamed Cr to Unnamed Cr*	05RN061	Downstream of CR 66, 7 mi. NW of Mountain Iron	**FS**	**FS**	--	--	--	--	--	**FS**	NA
09030005-633 **Boriin Creek** *Headwaters to E Br Sturgeon R*	08RN010	Upstream of Hwy 73, 7 mi. N of Chisholm	**FS**	**FS**	--	--	--	--	--	**FS**	NA

Abbreviations: **F-IBI** – Biological, Fish **M-IBI** – Biological, Macroinvertebrates **DO** – Dissolved Oxygen
Turb – Turbidity **Cl** – Chloride **NH3** – Unionized Ammonia
Aq. Life – Aquatic Life Use Assessment **Aq. Rec**. – Aquatic Recreation Assessment
FS – Full Support **IF** – Insufficient Information
NA – Not Assessed **--** No Data

*** Aquatic Life assessment deferred during 2010 Assessments due to coldwater thermal regime and the lack of appropriate assessment tools for coldwater streams.**

Table 9. Minnesota Stream Habitat Assessment (MSHA) for the Bear and Dark River 11-HUC

Visits	Site ID	Stream Name	Land Use (0-5)	Riparian (0-15)	Substrate (0-27)	Fish Cover (0-17)	Channel Morph. (0-36)	MSHA Score (0-100)	MSHA Rating
2	05RN079	Dark River	5	13	13	16	29	76	Good
1	08RN045	Dark River	5	12	16	12	28	72	Good
3	99NF120	Dark River	5	12	20	12	25	74	Good
1	05RN034	Sturgeon River, East Branch	5	11	10	13	14	53	Fair
1	08RN034	Sturgeon River, East Branch	5	12	19	13	29	78	Good
1	08RN033	Sturgeon River, East Branch	5	15	23	16	31	90	Good
1	08RN010	Boriin Creek	5	12	18	12	25	72	Good
2	05RN061	McNiven Creek	5	12	14	15	27	73	Good
Average Habitat Results: *Bear & Dark River 11 HUC Watershed*			5	12	16	14	26	73	Good

Qualitative habitat ratings:
Good: MSHA score above the median of the least-disturbed sites (≥66)
Fair: MSHA score between the median of the least-disturbed sites and the median of the most-disturbed sites (45-65)
Poor: MSHA score below the median of the most-disturbed sites (≤44)

Table 10. Pour point water chemistry results for the Bear and Dark River 11-HUC

Station location:	Dark River at CR 688, 5 miles S. of Sturgeon, MN
Storet ID:	S004-874
Station #:	99NF120

Parameter	TSS	Turb.[4]	T-tube	D.O.	TP[5]	TKN	Chloro-phyll-a[5]	E. coli	pH	Spec. cond.
Units	mg/l	NTU	cm	mg/l	mg/l	mg/l	ug/l	#/100ml	SU	uS/cm
# samples	10	6	17	17	10	10	4	13	16	16
Min	1.2	2	52	6.7	.011	0.31	0.75	16	7.7	321
Max	7.2	14	100	10.8	.028	0.78	2.06	93	8.3	811
Mean[1]	3.4	4.9	85	9.2	.02	0.54	1.14	45	8.0	505
Median	2.4	3.3	100	9.4	.02	0.53	0.88	44	8.0	468
WQ standard		25	20	5.0	0.055		10	126/ 1260	6.5-9.0	
# WQ exceedances[2]		0/6	0/17	0/17	0/10		0/4	0/13	0/16	
NLF 75th percentile[3]	5.6	4			0.05	0.18-0.73			7.9	260

1Geometric mean of all samples is provided for *E. coli* or fecal coliform.
2Represents exceedances of individual maximum standard for *E. coli* (1260/100ml) or fecal coliform (2000/100ml).
3Based on 1970-1992 summer data; see *Selected Water Quality Characteristics of Minimally Impacted Streams from Minnesota's Seven Ecoregions* (McCollor and Heiskary 1993). TKN range based on EPA Rivers and Streams in Nutrient Ecoregion VIII, NLF and NMW EPA 822 B-01-015. 2001
[4] Combined data from 3 turbidity methods, each with slightly different standard methods
[5] Proposed TP and Chlorophyll-a standards for the North region of Minnesota, see http://www.pca.state.mn.us/index.php/view-document.html?gid=14947

****Data found in the table above was compiled using the results from data collected in 2008 and 2009 at the pour point monitoring station. This site specific data does not necessarily reflect all data that was used to assess the AUID.**

Summary

Biological communities within the Bear and Dark River Watershed Unit all produced IBI scores above their respective thresholds expect for one macroinvertebrate visit to 08RN034 on the Sturgeon River, East Branch. However, the low M-IBI score for 08RN034 was attributed to stagnant flow conditions due to beaver activity which can create unfavorable habitat for many macroinvertebrates resulting in lower than expected M-IBI scores. As a result, more weight was given to the downstream station, 08RN033, which had fast to moderate flow velocities and yielded an M-IBI score of 73, indicating full support. Habitat conditions in the Sturgeon River, East Branch improved longitudinally moving downstream, namely substrate conditions and channel morphology which coincided with an increase in stream gradient. However, fish IBI scores decreased slightly moving downstream but still remained above thresholds, with 05RN034 producing a remarkably high F-IBI score of 84.

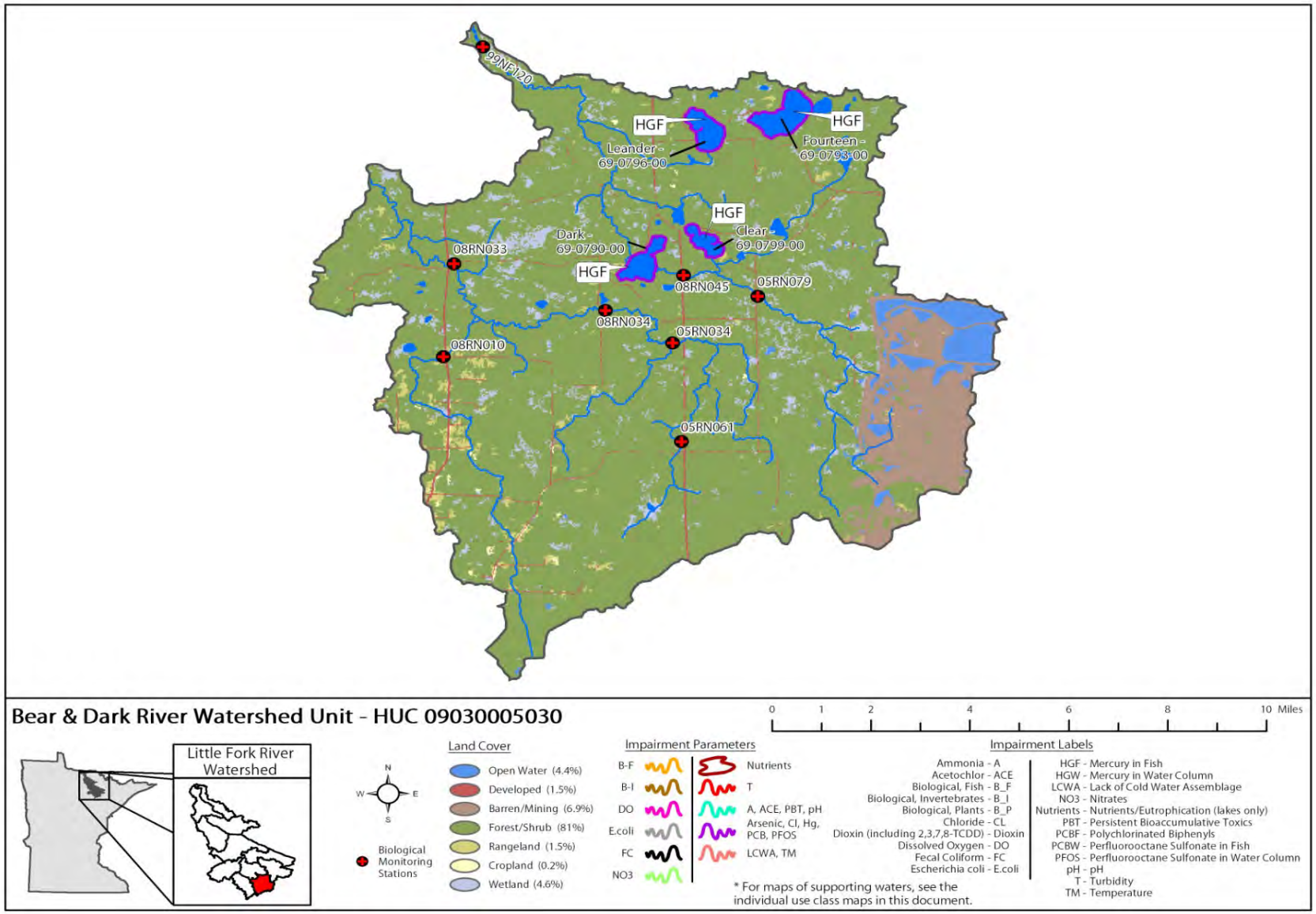
For the Dark River, the two stations upstream of Dark Lake produced passing IBI scores for both fish and macroinvertebrates which coincided with high habitat scores. Station 08RN045 yielded an excellent M-IBI score of 86. The furthest downstream station on the Dark River, 99NF120, is within a designated coldwater stream reach and thus was not assessed during the 2010 assessment cycle. The biological communities do look healthy, brook trout and high numbers of mottled sculpin were sampled during the earlier summer months, and will most likely show full support when assessment tools become available to assess coldwater streams.

McNiven and Boriin Creeks had excellent IBI scores for both fish and macroinvertebrates. Two F-IBI scores scored exceptionally well with an 83 for Boriin Creek and a 92 for McNiven Creek.

The stream water chemistry dataset for the pour point station on the Dark River indicate nutrient concentrations were very low and were meeting ecoregion expectations. E. coli concentrations were low, and were meeting aquatic recreational use standards. Sediment and turbidity levels were low (similar to other lake-dominated basins). Conductivity levels are considerably higher here than in other portions of the Little Fork River watershed and are attributed to the taconite tailings basin seepage in the headwaters of the Dark River. Overall, this watershed unit is supporting the aquatic life and aquatic recreational uses and is near the NLF ecoregion expectations. No follow up monitoring is recommended at this time.

This watershed contains 16 lakes larger than four ha (10 acres). No lakes currently have assessment level data. Dark (69-0790) and Clear (69-0799) lakes are being monitored by the MPCA in 2010 and 2011.

Figure 13. Currently listed impaired waters by parameter and landuse in the Bear and Dark River Watershed Unit



Sturgeon Lake Watershed Unit HUC 09030005040

The Sturgeon Lake Watershed Unit, located in western St. Louis and eastern Itasca Counties, drains an area of 114.5 square miles. The watershed unit contains the headwaters of the Sturgeon River and is the Little Fork's largest tributary. Originating from many small tributaries within the George Washington State Forest, the Sturgeon River begins at the outlet of Sturgeon Lake and flows in an easterly direction to its confluence with the Shannon River. Both the Sturgeon and Shannon rivers flow through predominately forested land cover with wetlands interspersed throughout (Figure 13). Other land uses in the watershed include barren/mining in the southwest portion and rangeland land use, although limited, in the southeast portion of the watershed. There are no named tributaries to the Sturgeon or Shannon Rivers in the watershed. The water chemistry monitoring for this watershed unit is represented by the pour point station 08RN001 on the Sturgeon River at the County Road 766 Bridge. Due to the lack of suitable road crossings, the monitoring station was placed outside the extent of the watershed unit as delineated (located in the next downstream watershed unit), however; the monitoring station adequately characterizes the upstream water quality in the Sturgeon Lake Watershed Unit.

Stream assessments

Table 11. Aquatic life and recreation assessments on assessed AUIDs in the Sturgeon Lake 11-HUC

AUID	Biological Station ID	Biological Station Location	F-IBI	M-IBI	DO	Turb	Cl	pH	NH_3	Aq. Life	Aq. Rec.
09030005-527 **Sturgeon River** *Headwaters to E Br Sturgeon R*	08RN001	Upstream of CR 766, 3 mi. E of Side Lake	**FS**	**FS**	IF	**FS**	--	**FS**	**FS**	**FS**	**FS**
09030005-603 **Shannon River** *Unnamed cr to Shannon Lk*	08RN044	Upstream of CR 484, 4 mi. SE of Side Lake	**FS**	**FS**	--	--	--	--	--	**FS**	NA

Abbreviations: **F-IBI** – Biological, Fish **M-IBI** – Biological, Macroinvertebrates **DO** – Dissolved Oxygen
Turb – Turbidity **Cl** – Chloride **NH3** – Unionized Ammonia
Aq. Life – Aquatic Life Use Assessment **Aq. Rec**. – Aquatic Recreation Assessment
FS – Full Support **IF** – Insufficient Information
NA – Not Assessed **--** No Data

Table 12. Non-assessed biological stations on channelized AUIDs in the Sturgeon Lake 11-HUC

AUID	Biological Station ID	Biological Station Location	F-IBI Quality	M-IBI Quality
09030005-599 Shannon River *Unnamed Cr to Unnamed Cr*	05RN091	Upstream of Olds Rd, 4 m NW of Chisholm	Good	Good
	08RN032	Upstream of CR 134, 4 mi. NW of Chisholm	Good	Good

See Appendix 5 for clarification on the good/fair/poor thresholds and Appendix 4 for IBI result

Table 13. Minnesota Stream Habitat Assessment (MSHA) for the Sturgeon Lake 11-HUC

Visits	Site ID	Stream Name	Land Use (0-5)	Riparian (0-15)	Substrate (0-27)	Fish Cover (0-17)	Channel Morph. (0-36)	MSHA Score (0-100)	MSHA Rating
1	08RN001	Sturgeon River	5	13	23	15	25	81	Good
1	05RN091*	Shannon River	2	6	9	6	11	34	Poor
3	08RN032*	Shannon River	5	11	18	13	27	74	Good
1	08RN044	Shannon River	5	12	9	12	24	62	Fair
Average Habitat Results: *Sturgeon Lake 11 HUC Watershed*			4	11	15	12	22	63	Fair

Qualitative habitat ratings:
Good: MSHA score above the median of the least-disturbed sites (≥66)
Fair: MSHA score between the median of the least-disturbed sites and the median of the most-disturbed sites (45-65)
Poor: MSHA score below the median of the most-disturbed sites (≤44)
***Channelized reach**

Table 14. Pour point water chemistry results for the Sturgeon Lake 11-HUC

Station location:	Sturgeon River at CR 766, 3 mi. E of Side Lake, MN
Storet ID:	S004-870
Station #:	08RN001

Parameter	TSS	Turb.[4]	T-tube	D.O.	TP [5]	TKN	Chloro-phyll-a [5]	E. coli	pH	Spec. cond.
Units	mg/l	NTU	cm	mg/l	mg/l	mg/l	ug/l	#/100ml	SU	uS/cm
# samples	10	6	18	18	10	10	4	14	17	17
Min	1.2	1.6	16	5.2	.016	0.57	0.9	9	6.6	68
Max	3.2	16	100	10.5	.046	0.87	2.4	93	7.8	227
Mean[1]	2.2	4.6	70	7.2	.023	0.71	1.4	39	7.2	125
Median	2.0	2.6	94	7.1	.02	0.71	1.1	31	7.2	122
WQ standard		25	20	5.0	0.055		10	126/ 1260	6.5-9.0	
# WQ exceedances[2]		0/6	2/18	0/18	0/10		0/4	0/14	0/17	
NLF 75th percentile[3]	5.6	4			0.05	0.18-0.73			7.9	260

1Geometric mean of all samples is provided for *E. coli* or fecal coliform.
2Represents exceedances of individual maximum standard for *E. coli* (1260/100ml) or fecal coliform (2000/100ml).
3Based on 1970-1992 summer data; see *Selected Water Quality Characteristics of Minimally Impacted Streams from Minnesota's Seven Ecoregions* (McCollor and Heiskary 1993). TKN range based on EPA Rivers and Streams in Nutrient Ecoregion VIII, NLF and NMW EPA 822 B-01-015. 2001
[4] Combined data from 3 turbidity methods, each with slightly different standard methods
[5] Proposed TP and Chlorophyll-a standards for the North region of Minnesota, see http://www.pca.state.mn.us/index.php/view-document.html?gid=14947

****Data found in the table above was compiled using the results from data collected in 2008 and 2009 at the pour point monitoring station. This site specific data does not necessarily reflect all data that was used to assess the AUID.**

Table 15. Aquatic recreation assessments for lakes in the Sturgeon Lake 11-HUC

Lake Name/ID	TP (ug/L)	Chl-a (ug/L)	Secchi (meters)
Beatrice Lake (31-0158)	8.8	3.4	3.6
Sturgeon Lake (69-0939-01)	9	2.6	4.1
West Sturgeon Lake (69-0939-03)	15.7	5.4	1.6
Little Sturgeon Lake (69-1290)	23.8	5.4	1.5
South Sturgeon Lake (31-0003)	14.6	4.3	1.3
Side Lake (69-0933)	11	3.4	3.3
Perch Lake (69-0932	12.4	4	3.3
Hobson Lake (69-0923)	12	3.9	2.9
NLF - Aquatic Rec. Use (Class 2B)	**<30**	**<9**	**>2.0**

Results shown for Total Phosphorous, Chlorophyll-a, and Secchi disk are averages.

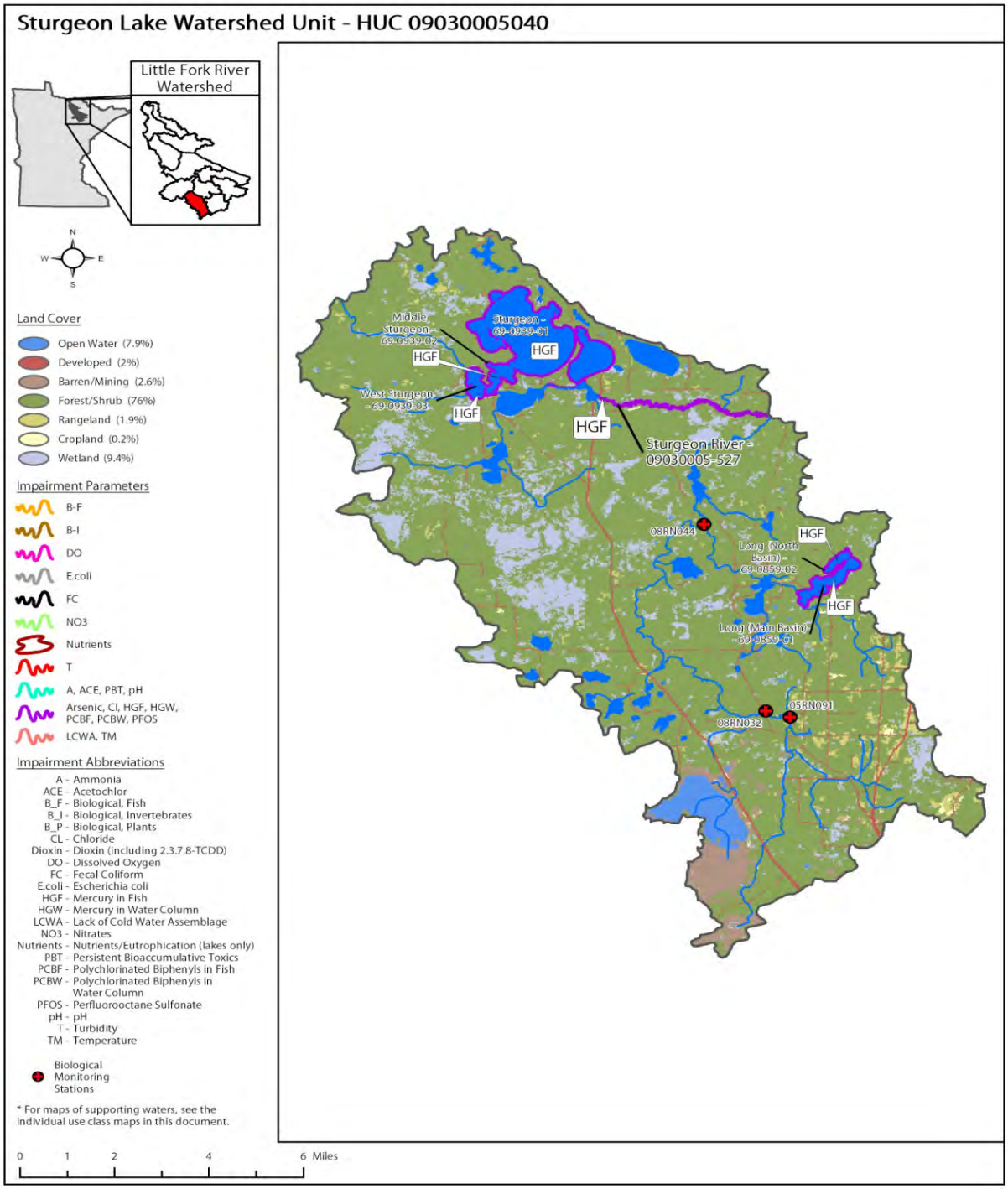
Summary

Both the fish and the macroinvertebrate communities that were sampled in this watershed unit yielded favorable IBI scores. The macroinvertebrate communities were not as strong as the fish communities but remained close to their respective thresholds and the preponderance of evidence indicates that the stream reaches sampled show full support. Excellent habitat characteristics were observed at station 08RN001 on the Sturgeon River. Two stations on the Shannon River were not assessed due to channelized conditions within the sampling reach. Despite having altered habitat conditions, the IBI scores for both fish and macroinvertebrates scored very well and could be a sign that this system has stabilized and is recovering nicely from the channel modifications performed in the past.

This watershed unit has 30 lakes greater than 10 acres, and forms the headwaters of the Sturgeon River. The Sturgeon Chain of Lakes are likely the most developed lakes in the Little Fork Watershed. Local property owners have worked with Minnesota Department of Natural Resources (DNR) Fisheries and Itasca County to model shore land development sensitivity and proper citing of septic systems. As part of this effort, volunteers and the DNR worked cooperatively to collect water quality samples in 2007 and 2008. As a result, eight lakes have assessment level data, and all are meeting eutrophication criteria (Table 15). These recent data indicate that lakes within the Sturgeon chain have excellent water quality. Headwater and seepage lakes, such as Beatrice and Side, have lower TP and chl-a concentrations (and higher SD transparencies) because watershed sources of nutrients are low. Flowage lakes, such as Little Sturgeon, with much larger drainage areas, have higher TP and chl-a concentrations (and lower transparencies) but results are within NLF criteria and reflective of natural watershed characteristics. Long (69-0859) and Dewey (69-0912) lakes are being monitored by the MPCA in 2010 and 2011.

The watershed unit drains the upper portion of the Sturgeon River which is a lake-dominated area. As such, nutrient, sediment, and chlorophyll-a levels sampled at the pour point station 08RN001 are low. This reach of the Sturgeon River has excellent water quality and is supporting the aquatic life and aquatic recreation uses, and meeting NLF ecoregion expectations. No follow up monitoring is recommended at this time.

Figure 14. Currently listed impaired waters by parameter and landuse in the Sturgeon Lake Watershed Unit



Sturgeon River Watershed Unit HUC 09030005050

The Sturgeon River Watershed Unit, immediately downstream of the Sturgeon Lake watershed unit, is located in western St. Louis County and drains an area of 129.8 square miles. The Sturgeon River is the largest tributary to the Little Fork River. Within this watershed unit, the Sturgeon River flows in a general northeast direction until its confluence with the Dark River, where it then turns and flows northwest to its confluence with the Bear River. The Sturgeon River, along with its tributaries', flow through an undeveloped forest and wetland dominated landscape with scattered agricultural practices in the eastern portion of the watershed (Figure 14). The named tributaries to the Sturgeon River in this watershed unit are Sand, Gilmore, Paavola, and Murray creeks. The water chemistry monitoring for this watershed unit is represented by the pour point station 08RN003 on the Sturgeon River at the County Road 107 Bridge, upstream of the confluence with the Bear River.

Stream Assessments

Table 16. Aquatic life and recreation assessments on assessed AUIDs in the Sturgeon River 11-HUC

AUID	Biological Station ID	Biological Station Location	F-IBI	M-IBI	DO	Turb	Cl	pH	NH_3	Aq. Life	Aq. Rec.
09030005-527 **Sturgeon River** *Headwaters to E Br Sturgeon R*	05RN020	Downstream of CR 766, 11 mi. NW of Chisholm	**FS**	**FS**	IF	**FS**	--	**FS**	**FS**	**FS**	**FS**
09030005-523 **Sturgeon River** *E Br Sturgeon R to Dark R*	08RN048	Downstream of Hwy 73, 4.5 mi. S of Sturgeon	**FS**	**FS**	--	--	--	**FS**	--	**FS**	NA
09030005-524 **Sturgeon River** *Dark R to Bear R*	05RN059 08RN035 05RN066 08RN003	Upstream of CR 492, ~1.5 mi. SW of Sturgeon Downstream of CR 931, 3 mi. NW of Sturgeon Upstream of CR 107, 15 mi. W of Cook Downstream of CR 107, 4 mi. NE of Bear River	**FS**	**FS**	IF	**FS**	--	**FS**	**FS**	**FS**	**FS**
09030005-627 **Paavola Creek** *Unnamed cr to Sturgeon R*	08RN029	Upstream of CR 481, 4 mi. SE of Sturgeon	**FS**	**FS**	--	--	--	--	--	**FS**	NA
09030005-550 **Sand Creek** *Headwaters to Sturgeon R*	08RN030*	Downstream of CR 923, 4 mi. NE of Bear River	NA*	NA*	--	--	--	--	--	NA*	--

Abbreviations: **F-IBI** – Biological, Fish **M-IBI** – Biological, Macroinvertebrates **DO** – Dissolved Oxygen **Turb** – Turbidity **Cl** – Chloride **NH3** – Unionized Ammonia
Aq. Life – Aquatic Life Use Assessment **Aq. Rec**. – Aquatic Recreation Assessment

FS – Full Support **IF** – Insufficient Information
NA – Not Assessed -- No Data

*** Aquatic Life assessment deferred during 2010 Assessments due to coldwater thermal regime and the lack of appropriate assessment tools for coldwater streams.**

Table 17. Non-assessed biological stations on channelized AUIDs in the Sturgeon River 11-HUC

AUID	Biological Station ID	Biological Station Location	F-IBI Quality	M-IBI Quality
09030005-593 **Gilmore Creek** *Unnamed Cr to Unnamed Cr*	05RN087	Downstream of CR 481, 10 mi. SW of Cook	Good	Fair
09030005-594 **Gilmore Creek** *Unnamed Cr to Unnamed Cr*	08RN031	Upstream of CR 82, 2 mi. S of Sturgeon	Good	Fair

See Appendix 5 for clarification on the good/fair/poor thresholds and Appendix 4 for IBI results.

Table 18. Minnesota Stream Habitat Assessment (MSHA) for the Sturgeon River 11-HUC

Visits	Site ID	Stream Name	Land Use (0-5)	Riparian (0-15)	Substrate (0-27)	Fish Cover (0-17)	Channel Morph. (0-36)	MSHA Score (0-100)	MSHA Rating
1	05RN020	Sturgeon River	5	13	22	16	33	89	Good
1	08RN048	Sturgeon River	5	10	16	7	20	58	Fair
1	05RN059	Sturgeon River	4	8	18	11	19	60	Fair
1	08RN035	Sturgeon River	5	13	15	8	21	62	Fair
2	05RN066	Sturgeon River	5	12	12	11	16	56	Fair
2	08RN003	Sturgeon River	5	12	16	12	21	66	Good
1	05RN087*****	Gilmore Creek	3	6	17	7	13	46	Fair
1	08RN031*****	Gilmore Creek	5	12	8	14	21	59	Fair
1	08RN029	Paavola Creek	5	11	15	10	27	68	Good
1	08RN030	Sand Creek	5	13	18	12	24	72	Good
Average Habitat Results: *Sturgeon River 11 HUC Watershed*			5	11	16	11	22	64	Fair

Qualitative habitat ratings:
Good: MSHA score above the median of the least-disturbed sites (≥66)
Fair: MSHA score between the median of the least-disturbed sites and the median of the most-disturbed sites (45-65)
Poor: MSHA score below the median of the most-disturbed sites (≤44)
*****Channelized reach

Table 19. Pour point water chemistry results for the Sturgeon River 11-HUC

Station location:	Sturgeon River at CR 107, 4 miles NE of Bear River, MN
Storet ID:	S004-871
Station #:	08RN003

Parameter	TSS	Turb.[4]	T-tube	D.O.	TP[5]	TKN	Chloro-phyll-a[5]	E. coli	pH	Spec. cond.
Units	mg/l	NTU	cm	mg/l	mg/l	mg/l	ug/l	#/100ml	SU	uS/cm
# samples	10	6	19	18	10	10	4	14	17	17
Min	4	1.6	31	7.4	.02	0.34	1.19	13	7.2	93
Max	18	16	88	11.7	.051	1.01	2.75	51	8.1	407
Mean[1]	8.9	12	56	8.6	.035	0.67	1.89	28	7.7	256
Median	6.8	2.6	56	8.2	.034	0.71	1.81	28	7.7	285
WQ standard		25	20	5.0	0.055		10	126/ 1260	6.5-9.0	
# WQ exceedances[2]		0/6	0/19	0/18	0/10		0/4	0/14	0/17	
NMW 75th percentile[3]	20	12			0.09	0.18-0.73			8.0	230

1Geometric mean of all samples is provided for *E. coli* or fecal coliform.
2Represents exceedances of individual maximum standard for *E. coli* (1260/100ml) or fecal coliform (2000/100ml).
3Based on 1970-1992 summer data; see *Selected Water Quality Characteristics of Minimally Impacted Streams from Minnesota's Seven Ecoregions* (McCollor and Heiskary 1993). TKN range based on EPA Rivers and Streams in Nutrient Ecoregion VIII, NLF and NMW EPA 822 B-01-015. 2001
[4] Combined data from 3 turbidity methods, each with slightly different standard methods
[5] Proposed TP and Chlorophyll-a standards for the North region of Minnesota, see http://www.pca.state.mn.us/index.php/view-document.html?gid=14947

****Data found in the table above was compiled using the results from data collected in 2008 and 2009 at the pour point monitoring station. This site specific data does not necessarily reflect all data that was used to assess the AUID.**

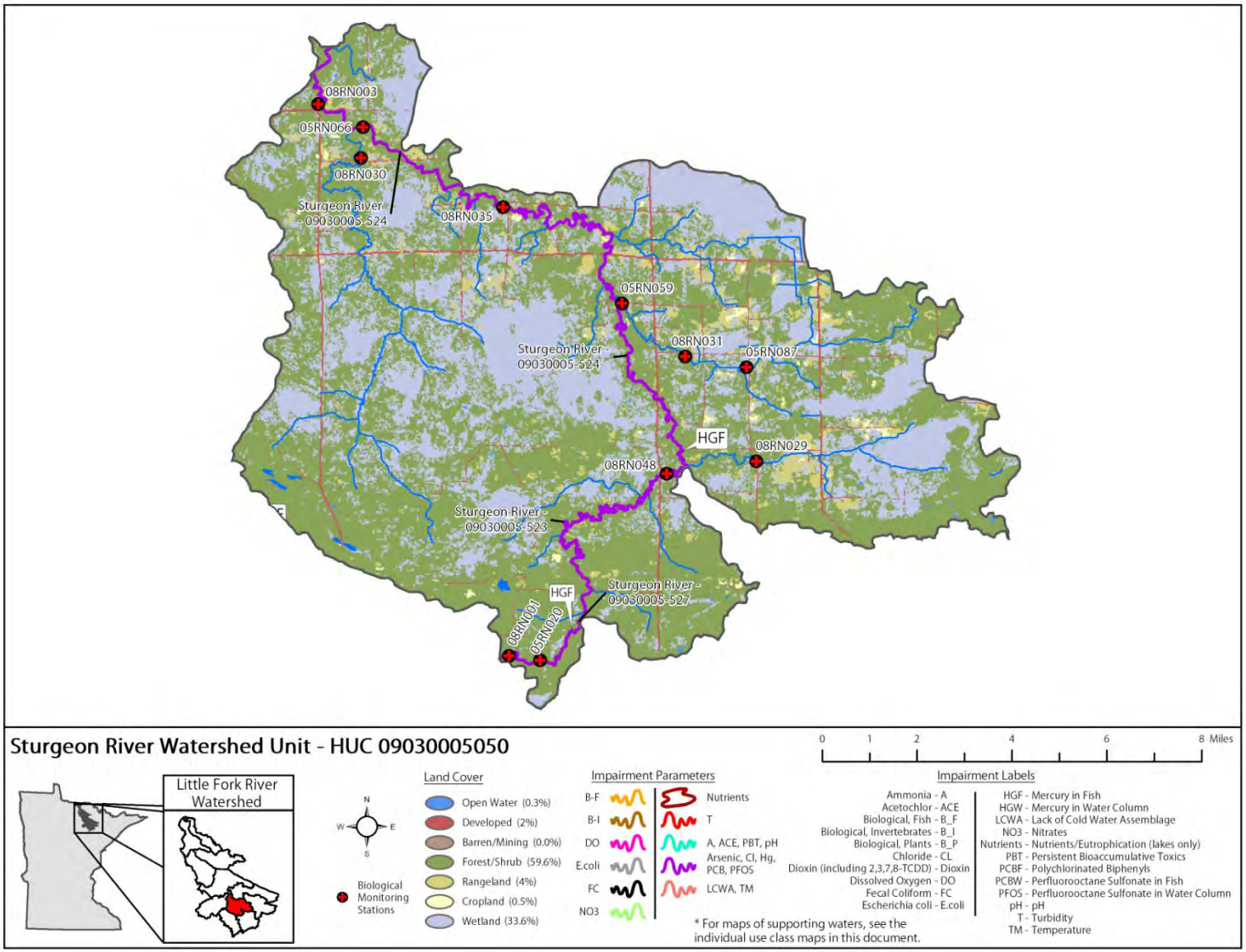
Summary

Biological communities within the Sturgeon River Watershed Unit all produced IBI scores above their respective thresholds expect for one macroinvertebrate visit to 08RN029 on Paavola Creek. However, the low M-IBI score for this station was attributed to stagnant flow conditions due to beaver activity and not to anthropogenic sources. This watershed unit is largely undeveloped as forests and wetlands make up over 90 percent of the land cover type. Several biological monitoring stations along the Sturgeon River in this watershed unit produced exceptionally high IBI scores for both fish and macroinvertebrates with scores ranging from 81 – 90 and are indicative of the excellent water quality found in the Sturgeon River.

Phosphorus concentrations were slightly higher than those from the upstream reach, but still meeting NMW ecoregion expectations. Chlorophyll-a concentrations were low (average = 1.9 µg/L); productivity was likely influenced by the area's riparian wetlands and natural bog-staining which reduced transparency. Data indicate full support for both aquatic life and aquatic recreational uses. No follow-up monitoring is recommended at this time.

This watershed contains only two lakes greater than 10 acres. Luna and Elbow lakes are small, shallow, and undeveloped. Both lakes lack water quality data for assessment.

Figure 15. Currently listed impaired waters by parameter and landuse in the Sturgeon River Watershed Unit



Bear River Watershed Unit HUC 09030005060

The Bear River Watershed Unit, located primarily in northeastern Itasca County, encompasses an area of 168.7 square miles. The Bear River originates in the George Washington State Forest and flows 40 miles in a northeast direction through an undeveloped forest/shrub and wetland matrix until reaching its confluence with the Sturgeon River (Figure 15). Named tributaries to the Bear River include Stony Brook, Bearskin River, and Venning and Bear River creeks. The water chemistry monitoring for this watershed unit is represented by the pour point station 08RN004 on the Bear River at the County Road 5 Bridge.

Stream assessments

Table 20. Aquatic life and recreation assessments on assessed AUIDs in the Bear River 11-HUC

AUID	Biological Station ID	Biological Station Location	F-IBI	M-IBI	DO	Turb	Cl	pH	NH_3	Aq. Life	Aq. Rec.
09030005-513 **Bear River** *Headwaters to Sturgeon R*	05RN094 08RN022 08RN046 08RN004	Upstream of CR 52, 10 mi. SW of Togo Downstream of CR 52, 9 mi. SW of Bear River Upstream of CR 527, In Bear River Upstream of CR 5, 3 mi. NE of Bear River	**FS**	**FS**	IF	**FS**	--	**FS**	**FS**	**FS**	**FS**
09030005-662 **Unnamed Creek** *Unnamed Cr to Unnamed Cr*	08RN023	Unnamed Rd off of Hwy 1, 8 mi. W of Bear River	**FS**	**FS**	--	--	--	--	--	**FS**	NA
09030005-663 **Bearskin River** *Unnamed Cr to Bear R*	08RN024	Downstream of CR 916, 2.5 mi. N of Bear River	**FS**	**FS**	--	--	--	--	--	**FS**	NA
09030005-664 **Bear River Creek** *Headwaters to Stony Bk*	08RN043	Downstream of CR 962, 0.5 mi. E of Bear River	**FS**	**FS**	--	--	--	--	--	**FS**	NA
09030005-568 **Venning Creek** *T61 R23W S35, east line to Bear R*	08RN021*	Downstream of CR 552, 7 mi. SW of Bear River	NA*	NA*	--	--	--	--	--	NA*	--
09030005-558 **Stony Brook** *T60 R22W S4, south line to Bear River Cr*	08RN042*	Upstream of CR 22, In Bear River	NA*	NA*	--	--	--	--	--	NA*	--

Abbreviations: **F-IBI** – Biological, Fish **M-IBI** – Biological, Macroinvertebrates **DO** – Dissolved Oxygen
Turb – Turbidity **Cl** – Chloride **NH3** – Unionized Ammonia
Aq. Life – Aquatic Life Use Assessment **Aq. Rec**. – Aquatic Recreation Assessment
FS – Full Support **IF** – Insufficient Information
NA – Not Assessed -- No Data

* Aquatic Life assessment deferred during 2010 Assessments due to coldwater thermal regime and the lack of appropriate assessment tools for coldwater streams.

Table 21. Minnesota Stream Habitat Assessment (MSHA) for the Bear River 11-HUC

Visits	Site ID	Stream Name	Land Use (0-5)	Riparian (0-15)	Substrate (0-27)	Fish Cover (0-17)	Channel Morph. (0-36)	MSHA Score (0-100)	MSHA Rating
1	05RN094	Bear River	5	12	9	12	17	55	Fair
1	08RN022	Bear River	5	15	22	12	33	87	Good
1	08RN046	Bear River	5	12	14	12	25	68	Good
2	08RN004	Bear River	5	14	15	12	24	70	Good
1	08RN021	Venning Creek	5	14	12	14	25	70	Good
1	08RN023	Trib. to Bear River	5	11	20	8	29	73	Good
2	08RN024	Bearskin River	5	12	17	15	24	73	Good
2	08RN042	Stony Brook	5	10	14	9	25	63	Fair
2	08RN043	Bear River Creek	5	11	10	14	25	65	Fair
Average Habitat Results: *Bear River 11 HUC Watershed*			5	12	15	12	25	69	Good

Qualitative habitat ratings:

Good: MSHA score above the median of the least-disturbed sites (≥66)

Fair: MSHA score between the median of the least-disturbed sites and the median of the most-disturbed sites (45-65)

Poor: MSHA score below the median of the most-disturbed sites (≤44)

Table 22. Pour point water chemistry results for the Bear River 11-HUC

Station location:	Bear River at CR 5, 3 miles NE of Bear River, MN
Storet ID:	S004-872
Station #:	08RN004

Parameter	TSS	Turb.[4]	T-tube	D.O.	TP[5]	TKN	Chloro-phyll-a[5]	E. coli	pH	Spec. cond.
Units	mg/l	NTU	cm	mg/l	mg/l	mg/l	ug/l	#/100ml	SU	uS/cm
# samples	10	6	18	18	10	10	4	14	17	17
Min	2	4.5	26	7.4	.019	0.22	0.74	8	7.1	73
Max	19	19	100	11.2	.051	1.1	11.8	145	8.7	269
Mean[1]	7.1	8.3	58	8.6	.034	0.6	3.9	56	7.8	181
Median	4.2	6.4	50	8.3	.033	0.6	1.5	40	7.8	195
WQ standard		25	20	5.0	0.055		10	126/ 1260	6.5-9.0	
# WQ exceedances[2]		0/6	0/18	0/18	0/10		1/4	0/14	0/17	
NLF 75th percentile[3]	5.6	4			0.05	0.18-0.73			7.9	260

1Geometric mean of all samples is provided for *E. coli* or fecal coliform.

2Represents exceedances of individual maximum standard for *E. coli* (1260/100ml) or fecal coliform (2000/100ml).

3Based on 1970-1992 summer data; see *Selected Water Quality Characteristics of Minimally Impacted Streams from Minnesota's Seven Ecoregions* (McCollor and Heiskary 1993). TKN range based on EPA Rivers and Streams in Nutrient Ecoregion VIII, NLF and NMW EPA 822 B-01-015. 2001

[4] Combined data from 3 turbidity methods, each with slightly different standard methods

[5] Proposed TP and Chlorophyll-a standards for the North region of Minnesota, see http://www.pca.state.mn.us/index.php/view-document.html?gid=14947

****Data found in the table above was compiled using the results from data collected in 2008 and 2009 at the pour point monitoring station. This site specific data does not necessarily reflect all data that was used to assess the AUID.**

Table 23. Aquatic recreation assessments for lakes in the Bear River 11-HUC

Lake Name/ID	TP (ug/L)	Chl-a (ug/L)	Secchi (meters)
Horsehead Lake (31-0155)	14	1.7	3
Little Bear Lake (31-0156)	11	4.6	2.8
Bear Lake (31-0157)	27	10.2	1.1
Raddison (31-0284)	9	1.8	4.3
Napoleon (31-0290)	11	2.2	4.6
Walters Lake (31-0298)	17	3.9	2.3
Kelly Lake (31-0299)	11	2.6	2.6
NLF - Aquatic Rec. Use (Class 2B)	**<30**	**<9**	**>2.0**

Results shown for Total Phosphorous, Chlorophyll-a, and Secchi disk are averages.

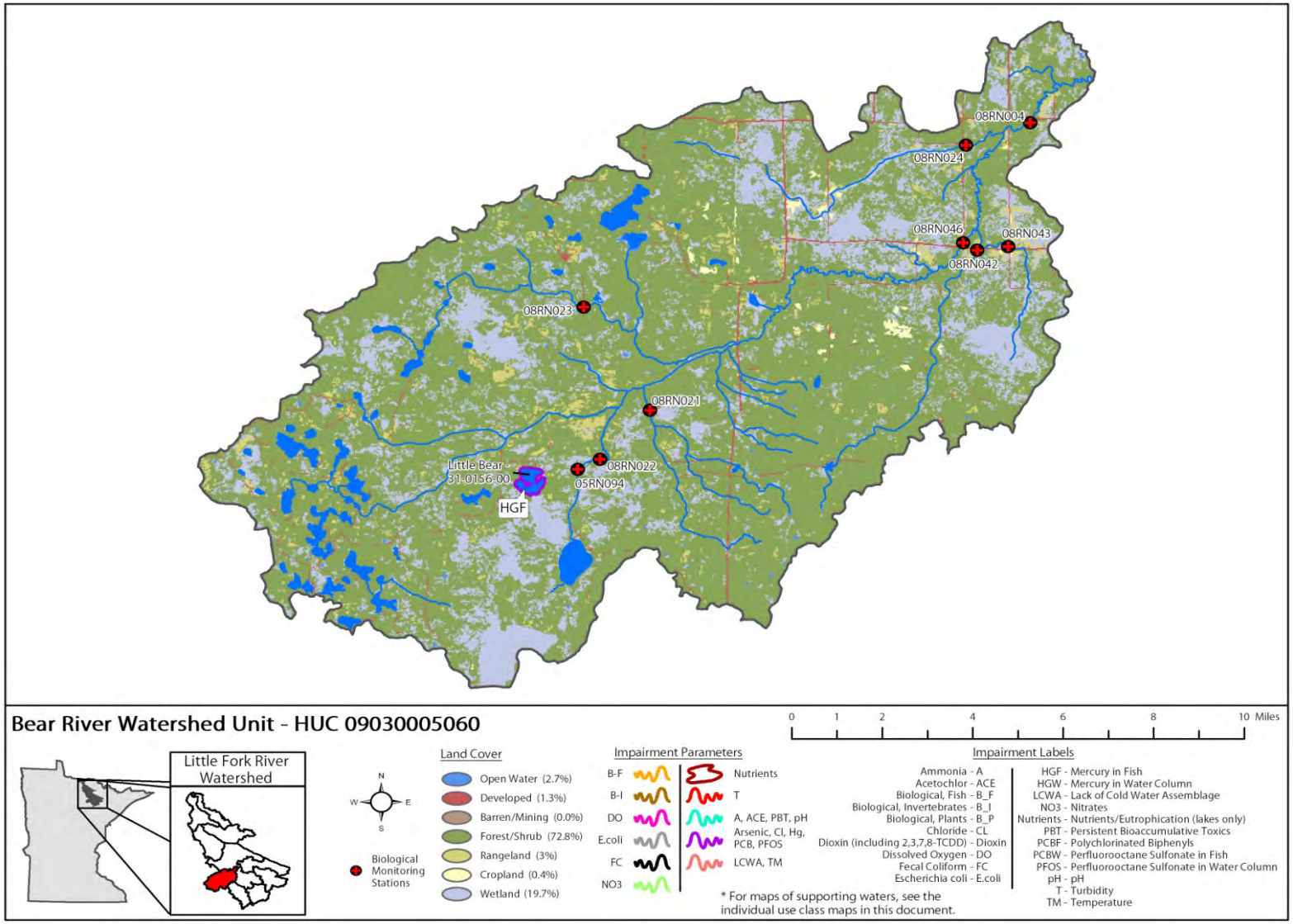
Summary

Biological communities within the Sturgeon River Watershed Unit all produced IBI scores above their respective thresholds. The excellent biological integrity found in this watershed unit can be attributed to the quality of habitat noted from the MSHA scores and the fact that over 90 percent of the watershed is occupied by forests and wetlands. The macroinvertebrate communities generally improve moving downstream along the Bear River. Tributary streams to the Bear River revealed excellent IBI scores, scoring well above thresholds. Stations on Venning Creek and Stony Brook were not assessed as they are designated coldwater streams.

This watershed unit has 26 lakes greater than 10 acres. A total of seven of these lakes have assessment level data, and were sampled by Itasca County Community College via a Surface Water Assessment Grant (SWAG) from the MPCA. These lakes include Horsehead, Little Bear, Bear, Raddison, Napoleon, Walters, and Kelly. Several of these lakes have very small watersheds with small stream or sub-surface outlets. All lakes are meeting eutrophication criteria and recreational use standards. Secchi disk transparencies are lowest, and TP and Chl-a concentrations highest, in Bear Lake. This is due to the bog stained water from the wetland and forest dominated watershed.

The headwaters drain a lake-dominated area and flows through a large wetland complex, resulting in nutrient and chlorophyll-concentrations slightly higher than those of the Sturgeon River, but still meeting standards and ecoregion expectations. This watershed is supporting the aquatic life and aquatic recreational uses and meeting NLF ecoregion expectations. No follow up monitoring is recommended at this time.

Figure 16. Currently listed impaired waters by parameter and landuse in the Bear River Watershed Unit



Middle Little Fork River Watershed Unit HUC 09030005070

The Middle Little Fork River Watershed Unit, located in St. Louis, Koochiching, and Itasca Counties, drains an area of 270.0 square miles. The watershed unit includes the reach from the Sturgeon River downstream to where Prairie Creek enters approximately four miles west of Silverdale. Landuse within the watershed unit is predominately forest/shrub and wetland with a small percentage taken up by rangeland (Figure 16). Named tributaries in the watershed are Willow and Valley rivers and Prairie and Squaw creeks.

Due to the lack of suitable road crossings near the pour point, two monitoring stations were placed further upstream in the watershed. One of the water chemistry monitoring stations is 08RN006, located on the Little Fork River at the County Road 75 Bridge upstream of the Willow River confluence. The second water chemistry monitoring station in this watershed unit, 08RN054, was placed on the Willow River, a major tributary to the Little Fork River, at the Co. Rd. 75 Bridge near Greaney. The Willow River originates in a large wetland complex southeast of Orr. The watershed is remote and dominated by forest and wetlands.

Stream Assessments

Table 24. Aquatic life and recreation assessments on assessed AUIDs in the Middle Little Fork River 11-HUC

AUID	Biological Station ID	Biological Station Location	F-IBI	M-IBI	DO	Turb	Cl	pH	NH_3	Aq. Life	Aq. Rec.
09030005-505 **Little Fork River** *Sturgeon R to Willow R*	08RN006	Downstream of CR 75, 2 mi. SE of Rauch	**FS**	**FS**	IF	**FS**	--	**FS**	**FS**	**FS**	**FS**
09030005-506 **Little Fork River** *Willow R to Valley R*	05RN052	1 mi. N of CR 57, 3 mi. SW of Silverdale	**FS**	**FS**	--	**NS**	--	**FS**	--	**NS**	NA
09030005-514 **Sturgeon River** *Bear R to Little Fork R*	08RN052	Upstream of Hwy 1, 1 mi. E of Celina	**FS**	**FS**	--	--	--	--	--	**FS**	NA
09030005-519 **Willow River** *Headwaters to Little Fork R*	08RN018 05RN045 08RN054	Downstream of CR 769, 2 mi. SW of Gheen 0.5 mi. S of CR 74, 4 mi. W of Gheen Corner Upstream of CR 75, 0.75 mi. S of Greaney	**FS**	**FS**	IF	IF	--	**FS**	**FS**	**FS**	**FS**
09030005-587 **Unnamed Creek** *Unnamed Cr to Willow R*	08RN055 05RN180	Downstream of CR 497, 1 mi. N of Greaney Downstream of Hwy 74, 12 miles SW of Orr	**FS**	**FS**	--	--	--	--	--	**FS**	NA
09030005-668 **Unnamed Creek** *Unnamed Cr to Willow R*	08RN019	Upstream of CR 74, 3.5 mi. E of Greaney	**FS**	**FS**	--	--	--	--	--	**FS**	NA
09030005-520 **Prairie Creek** *Headwaters to Little Fork R*	08RN047	Upstream of Hwy 65, 2 mi. N of Silverdale	**FS**	**FS**	--	--	--	--	--	**FS**	NA
09030005-512 **Valley River** *T62 R23W S4, north line to Little Fork R*	08RN020* 08RN037*	Upstream of CR 57, 2 mi. W of Rauch Upstream of Holstrum Spur Rd, 4 mi. SW of Bramble	NA*	NA*	--	--	--	--	--	NA*	--
09030005-562 **Trib. to Valley River** *T63 R22W S28, south line to Unnamed Cr*	08RN041*	Upstream of CR 66, 1.5 mi. NW of Bramble	NA*	NA*	--	--	--	--	--	NA*	--

Abbreviations: **F-IBI** – Biological, Fish **M-IBI** – Biological, Macroinvertebrates **DO** – Dissolved Oxygen **Turb** – Turbidity **Cl** – Chloride
NH3 – Unionized Ammonia
Aq. Life – Aquatic Life Use Assessment **Aq. Rec**. – Aquatic Recreation Assessment
FS – Full Support **NS** – Non-Support **IF** – Insufficient Information
NA – Not Assessed -- No Data

*** Aquatic Life assessment deferred during 2010 Assessments due to coldwater thermal regime and the lack of appropriate assessment tools for coldwater streams.**

Table 25. Minnesota Stream Habitat Assessment (MSHA) for the Middle Little Fork River 11-HUC

Visits	Site ID	Stream Name	Land Use (0-5)	Riparian (0-15)	Substrate (0-27)	Fish Cover (0-17)	Channel Morph. (0-36)	MSHA Score (0-100)	MSHA Rating
1	08RN018	Willow River	5	11	3	15	19	53	Fair
1	05RN045	Willow River	5	11	8	11	23	58	Fair
1	08RN054	Willow River	5	13	19	12	21	70	Good
1	08RN006	Little Fork River	5	11	21	12	26	75	Good
1	05RN052	Little Fork River	5	10	12	5	11	43	Poor
1	08RN019	Trib. to Willow River	5	14	12	14	23	68	Good
1	08RN055	Trib. to Willow River	5	11	20	15	27	78	Good
1	05RN180	Trib. to Willow River	5	14	14	16	25	73	Good
1	08RN037	Valley River	5	11	16	13	27	72	Good
1	08RN020	Valley River	5	15	20	13	30	83	Good
2	08RN041	Trib. to Vallley River	5	11	18	13	23	70	Good
1	08RN047	Prairie Creek	5	12	3	15	22	57	Fair
1	08RN052	Sturgeon River	5	14	20	12	22	73	Good
Average Habitat Results: *Middle Little Fork River 11 HUC Watershed*			5	12	14	13	23	67	Good

Qualitative habitat ratings:

Good: MSHA score above the median of the least-disturbed sites (≥66)

Fair: MSHA score between the median of the least-disturbed sites and the median of the most-disturbed sites (45-65)

Poor: MSHA score below the median of the most-disturbed sites (≤44)

Table 26. Pour point water chemistry results (Little Fork River) for the Middle Little Fork River 11-HUC

Station location:	Little Fork River at CR 75, 2 miles SE of Rauch, MN
Storet ID:	S004-920
Station #:	08RN006

Parameter	TSS	Turb.[4]	T-tube	D.O.	TP[5]	TKN	Chloro-phyll-a[5]	E. coli	pH	Spec. cond.
Units	mg/l	NTU	cm	mg/l	mg/l	mg/l	ug/l	#/100ml	SU	uS/cm
# samples	10	6	18	18	10	10	4	14	17	17
Min	1.6	6	26	5.9	.019	0.4	0.5	4	7.1	75
Max	20	26	120	10.8	.061	1.2	2.7	33	8.4	297
Mean[1]	6.9	12	82	8.2	.04	0.82	1.5	17	7.8	196
Median	4.4	10	85	8.1	.04	0.91	1.5	17	7.8	196
WQ standard		25	20	5.0	0.055		10	126/ 1260	6.5-9.0	
# WQ exceedances[2]		1/6	0/18	0/18	1/10		0/4	0/14	0/17	
NMW 75th percentile[3]	20	12			0.09	0.18-0.73			8.0	230

1Geometric mean of all samples is provided for *E. coli* or fecal coliform.

2Represents exceedances of individual maximum standard for *E. coli* (1260/100ml) or fecal coliform (2000/100ml).

3Based on 1970-1992 summer data; see *Selected Water Quality Characteristics of Minimally Impacted Streams from Minnesota's Seven Ecoregions* (McCollor and Heiskary 1993). TKN range based on EPA Rivers and Streams in Nutrient Ecoregion VIII, NLF and NMW EPA 822 B-01-015. 2001

[4] Combined data from 3 turbidity methods, each with slightly different standard methods

[5] Proposed TP and Chlorophyll-a standards for the North region of Minnesota, see http://www.pca.state.mn.us/index.php/view-document.html?gid=14947

****Data found in the table above was compiled using the results from data collected in 2008 and 2009 at the pour point monitoring station. This site specific data does not necessarily reflect all data that was used to assess the AUID.**

Table 27. Pour point water chemistry results (Willow River) for the Middle Little Fork River 11-HUC

Station location:	Willow River at CR 75, 0.75 miles S. of Greaney
Storet ID:	S004-814
Station #:	08RN054

Parameter	TSS	Turb.[4]	T-tube	D.O.	TP[5]	TKN	Chloro-phyll-a[5]	E. coli	pH	Spec. cond.
Units	mg/l	NTU	cm	mg/l	mg/l	mg/l	ug/l	#/100ml	SU	uS/cm
# samples	10	6	18	18	10	10	4	14	17	17
Min	6.4	19	18	4.3	.037	0.93	1.0	5	6.8	57
Max	15	42	50	9.8	.106	1.56	8.9	107	7.5	194
Mean[1]	10.6	26	29	6.4	.072	1.29	4.8	30	7.2	117
Median	9.4	25	28	5.8	.077	1.36	4.7	25	7.2	109
WQ standard		25	20	5.0	0.055		10	126/ 1260	6.5-9.0	
# WQ exceedances[2]		3/6	1/18	2/18	6/10		0/4	0/14	0/17	
NMW 75th percentile[3]	20	12			0.09	0.18-0.73			8.0	230

1Geometric mean of all samples is provided for *E. coli* or fecal coliform.
2Represents exceedances of individual maximum standard for *E. coli* (1260/100ml) or fecal coliform (2000/100ml).
3Based on 1970-1992 summer data; see *Selected Water Quality Characteristics of Minimally Impacted Streams from Minnesota's Seven Ecoregions* (McCollor and Heiskary 1993). TKN range based on EPA Rivers and Streams in Nutrient Ecoregion VIII, NLF and NMW EPA 822 B-01-015. 2001
[4] Combined data from 3 turbidity methods, each with slightly different standard methods
[5] Proposed TP and Chlorophyll-a standards for the North region of Minnesota, see http://www.pca.state.mn.us/index.php/view-document.html?gid=14947

****Data found in the table above was compiled using the results from data collected in 2008 and 2009 at the pour point monitoring station. This site specific data does not necessarily reflect all data that was used to assess the AUID.**

Summary

As a whole, the biological communities in this watershed unit are meeting their respective thresholds. Fish communities seem to be doing especially well, as the lowest IBI score in the watershed was 64. The macroinvertebrate communities produced a wider range in scores, with some stations scoring at or near thresholds. One station in particular, 08RN018 near the headwaters of the Willow River, produced a M-IBI considerably lower than most other stations, however it was later decided that the low score be attributed to stagnant flow conditions due to beaver activity. Habitat scores for stations along the Willow River increase moving downstream, especially substrate conditions, most likely due to an increase in gradient. Given the lack of disturbance in the watershed, over 90 percent of its land cover is a combination of forests and wetlands, full support was given to all biotic indicators. Stations along the Valley River and Trib. to Valley River were not assessed at this time as they are both designated coldwater streams.

Biological and chemical aquatic life indicators within this watershed unit are contradictory. Monitoring data collected prior to 2008 resulted in the Little Fork River (AUID 09030005-506) being placed on the impaired waters list for aquatic life due to violations of the turbidity standard. However, recent assessment results indicate that fish and macroinvertebrate communities are fully supporting for aquatic life. Although both fish and macroninverterate communities do not appear to be detrimentally affected in the Little Fork River itself, these high turbidity levels are believed to negatively impact downstream waters such as the Rainy River and Lake of the Woods. For this reason, the turbidity impairment has been retained on the 2010 impaired waters list and a watershed wide turbidity TMDL study is scheduled to begin in 2012.

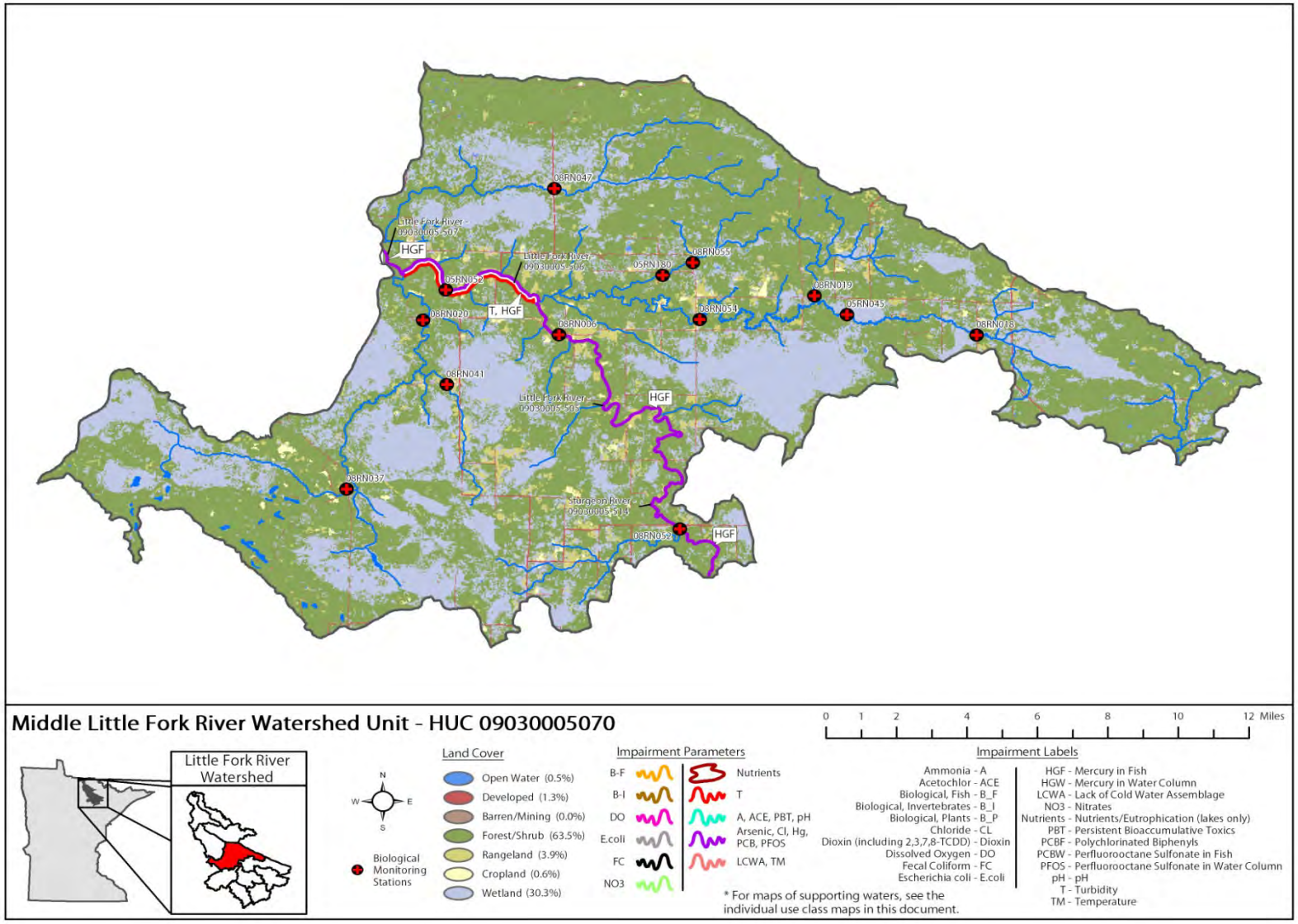
Little Fork River pour point water chemistry station 08RN006 (Note that this water chemistry station is on the next upstream AUID from the impaired reach mentioned above):

Similar to other reaches upstream, sediment, turbidity, nutrient, and bacteria levels are low. Water quality in this reach is meeting aquatic life and aquatic recreational uses. Research (K. Gran, 2008) has indentified that this reach of the Little Fork has the potential for excessive streambank erosion, because the channel is the most entrenched and often in contact with its valley's walls. Continued monitoring in this reach is important to track changes in channel geomorphology and sedimentation.

Willow River pour point water chemistry station 08RN054:
The water quality data indicate full support for aquatic life and recreational use. Nutrient, sediment, and turbidity values are higher compared to upstream sub-watersheds, likely due to the wetland influence. Dissolved oxygen concentrations were occasionally (4 of 19 samples) slightly below the 5 mg/L standard; this was attributed to natural conditions from the wetland-dominated landscape. Chlorophyll-a and TP concentrations were highest in this reach; likely naturally elevated from organic material (i.e. decaying wetland vegetation) reaching the stream from the surrounding landscape. This can be most pronounced during periods of summer drought, where flow is often imperceptible.

The watershed has few lakes, only eight greater than 10 acres. All are small, isolated seepage lakes in the southwest portion of the watershed. No lakes have assessment level data.

Figure 17. Currently listed impaired waters by parameter and landuse in the Middle Little Fork River Watershed Unit



Lower Middle Little Fork River Watershed Unit HUC 09030005080

The Lower Middle Little Fork River Watershed Unit, located in southeast Koochiching County, drains an area of 212.5 square miles. The watershed unit encompasses the Little Fork River main-stem from the Prairie Creek confluence downstream to the Nett Lake River confluence and is located within parts of the Koochiching State Forest and the southwest portion of the Bois Forte (Nett Lake) Indian Reservation. This is a very remote stretch of the river with limited human disturbance. The Little Fork River flows northwest for 40 miles without a single road crossing through extensive wetland and forest/shrub land cover, making up 98 percent of the land use (Figure 17). Named tributaries in the watershed include the Rapid River and Gardner Brook. The water chemistry monitoring for this watershed unit is represented by the pour point station 08RN007 on the Little Fork River at the Highway 65 Bridge 13 miles south of Littlefork.

Stream assessments

Table 28. Aquatic life and recreation assessments on assessed AUIDs in the Lower Middle Little Fork River 11-HUC.

AUID	Biological Station ID	Biological Station Location	F-IBI	M-IBI	DO	Turb	Cl	pH	NH_3	Aq. Life	Aq. Rec.
09030005-508	05RN001	Downstream of State Route 65, 9 mi. SE of Nett Lake	**FS**	**FS**	IF	**NS**	--	**FS**	**FS**	**NS**	**FS**
Little Fork River	05RN031	1.5 mi. S of Hwy 65, 18 mi. SE of Littlefork									
Prairie Cr to Nett Lake R	05RN044	0.5 mi. W of State Route 65, 15 mi. SSE of Littlefork									
	08RN007	Upstream of Hwy 65, 13 mi. SE of Littlefork									

Abbreviations: **F-IBI** – Biological, Fish **M-IBI** – Biological, Macroinvertebrates **DO** – Dissolved Oxygen
Turb – Turbidity **Cl** – Chloride **NH3** – Unionized Ammonia
Aq. Life – Aquatic Life Use Assessment **Aq. Rec**. – Aquatic Recreation Assessment
FS – Full Support **NS** – Non-Support **IF** – Insufficient Information
-- No Data

Table 29. Minnesota Stream Habitat Assessment (MSHA) for the Lower Middle Little Fork River 11-HUC

Visits	Site ID	Stream Name	Land Use (0-5)	Riparian (0-15)	Substrate (0-27)	Fish Cover (0-17)	Channel Morph. (0-36)	MSHA Score (0-100)	MSHA Rating
1	05RN001	Little Fork River	5	11	18	7	19	60	Fair
1	05RN031	Little Fork River	5	11	22	8	15	61	Fair
1	05RN044	Little Fork River	5	12	22	8	18	65	Fair
1	08RN007	Little Fork River	5	13	21	12	26	76	Good
Average Habitat Results: *Lower Middle Little Fork River 11 HUC Watershed*			5	12	21	9	20	66	Good

Qualitative habitat ratings:

Good: MSHA score above the median of the least-disturbed sites (≥66)

Fair: MSHA score between the median of the least-disturbed sites and the median of the most-disturbed sites (45-65)

Poor: MSHA score below the median of the most-disturbed sites (≤44)

Table 30. Pour point water chemistry results for the Lower Middle Little Fork River 11-HUC

Station location:	Little Fork River at Hwy 65, 13 miles SE of Littlefork
Storet ID:	S002-552
Station #:	08RN007

Parameter	TSS	Turb.[4]	T-tube	D.O.	TP[5]	TKN	Chloro-phyll-a[5]	E. coli	pH	Spec. cond.
Units	mg/l	NTU	cm	mg/l	mg/l	mg/l	ug/l	#/100ml	SU	uS/cm
# samples	10	6	18	18	10	10	4	14	17	17
Min	2	7	17	6	.02	0.55	0.5	1	7.3	79
Max	42	22	98	10.3	.07	1.1	1.7	47	8.3	271
Mean[1]	11	12	41	8.1	.04	0.94	1.2	21	7.9	187
Median	5	12	38	7.6	.04	0.98	1.3	21	7.9	202
WQ standard		25	20	5.0	0.055		10	126/ 1260	6.5-9.0	
# WQ exceedances[2]		0/6	1/18	0/18	2/10		0/4	0/14	0/17	
NMW 75th percentile[3]	20	12			0.09	0.18-0.73			8.0	230

[1] Geometric mean of all samples is provided for *E. coli* or fecal coliform.

[2] Represents exceedances of individual maximum standard for *E. coli* (1260/100ml) or fecal coliform (2000/100ml).

[3] Based on 1970-1992 summer data; see *Selected Water Quality Characteristics of Minimally Impacted Streams from Minnesota's Seven Ecoregions* (McCollor and Heiskary 1993). TKN range based on EPA Rivers and Streams in Nutrient Ecoregion VIII, NLF and NMW EPA 822 B-01-015. 2001

[4] Combined data from 3 turbidity methods, each with slightly different standard methods

[5] Proposed TP and Chlorophyll-a standards for the North region of Minnesota, see http://www.pca.state.mn.us/index.php/view-document.html?gid=14947

****Data found in the table above was compiled using the results from data collected in 2008 and 2009 at the pour point monitoring station. This site specific data does not necessarily reflect all data that was used to assess the AUID.**

Summary

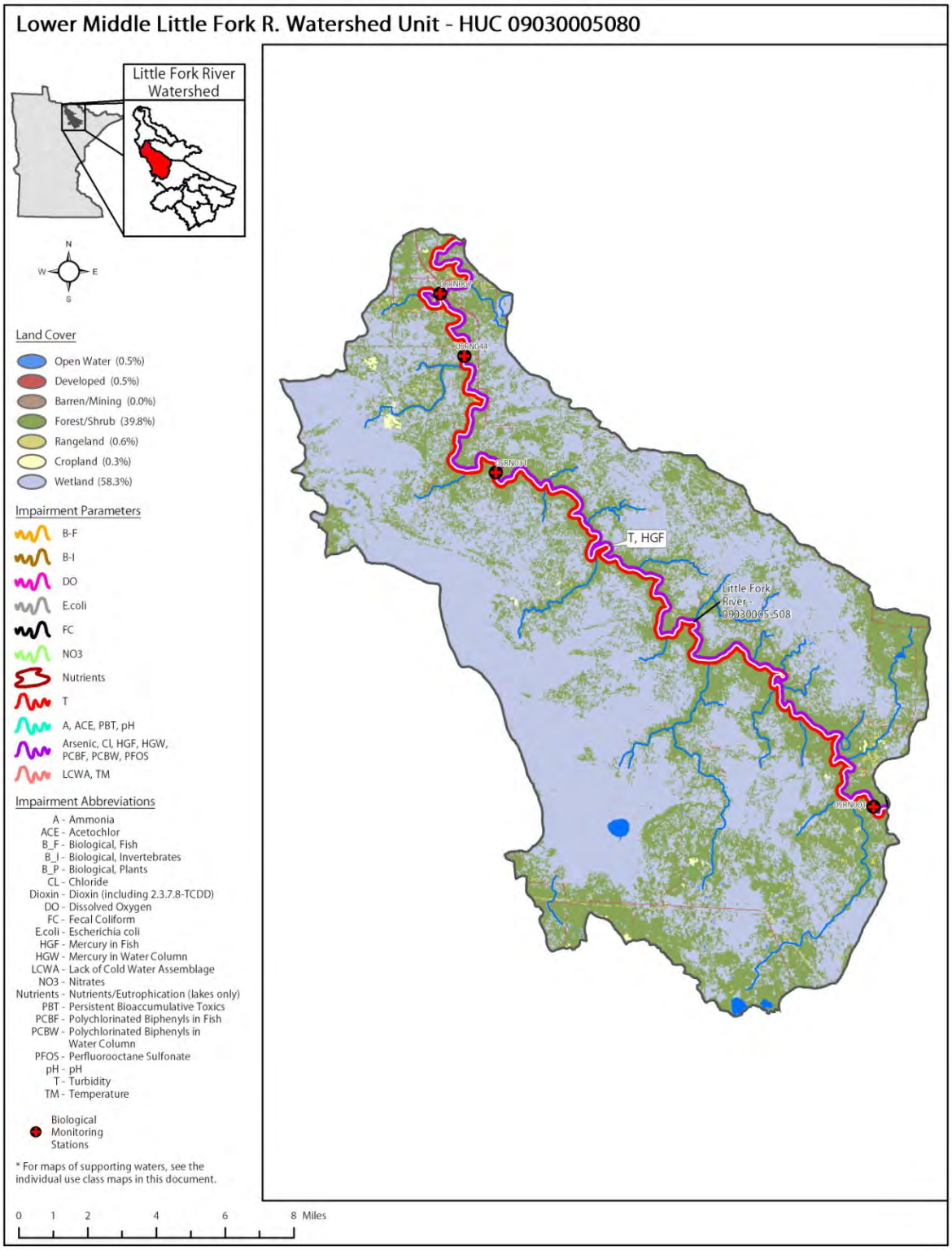
Four discrete biological monitoring stations spread along the 40 mile long reach of the Little Fork River in this watershed unit were sampled for both fish and macroinvertebrates and their resulting IBI scores were all above their respective thresholds. Three of the four stations were sampled in 2005 as part of the MPCA's statewide random stream survey effort. The pour point station in this watershed unit, 08RN007, produced the highest IBI scores for fish and macroinvertebrates, scoring an 84 and 89 respectively, coinciding with the highest MSHA rating as well. No tributary streams were sampled as part of the Intensive Watershed Monitoring process as road access throughout this watershed unit was limited.

This reach of the Little Fork River was assessed as fully supporting for aquatic recreation, based on very low bacteria levels (average of 21 counts / 100 mL) but non-supporting for aquatic life. The non-supporting aquative life conclusion was based on exceedances of the turbidity standard and TSS ecoregion expectation both historically and during the recent 10X monitoring (particularly at higher flows) and anecdotal evidence of stream channel instability (excessive streambank erosion, perched culverts, gullies, slumping, and road slides) in the vicinity. The causes of the channel instability are difficult to determine, and are likely related to a combination of natural and human-caused factors related to historical logging operations. Further study and monitoring is recommended to better define the source(s) and cause(s) of the impairment.

Biological and chemistry aquatic life indicators within this watershed unit are contradictory. Monitoring data collected prior to 2008 resulted in the Little Fork River being placed on the impaired waters list for aquatic life due to violations of the turbidity standard. However, recent assessment results indicate that fish and macroinvertebrate communities are fully supporting for aquatic life. Although both fish and macroinvertebrate communities do not appear to be detrimentally affected in the Little Fork River itself, these high turbidity levels are believed to negatively impact downstream waters such as the Rainy River and Lake of the Woods. For this reason, the turbidity impairment has been retained on the 2010 impaired waters list and a watershed wide turbidity TMDL study is scheduled to begin in 2012.

This watershed has very few lakes, with only three greater than 10 acres (Myrtle, Frankin, and Pocquette). They are isolated seepage lakes surrounded by large wetland areas. No lakes have assessment level data.

Figure 18. Currently listed impaired waters by parameter and landuse in the Lower Middle Little Fork River Watershed Unit



Nett Lake Watershed Unit HUC 09030005090

The Nett Lake Watershed Unit, located in Koochiching and St. Louis Counties, encompasses an area of 212.3 square miles. The watershed unit includes the headwaters of the Nett Lake River to its confluence with the Little Fork River. The headwaters of the Nett Lake River originate in the Kabetogama State Forest and flow into Nett Lake – a large, shallow wild-rice lake. From the outlet of Nett Lake, the Nett Lake River flows nearly 40 miles in a northwest direction through most of the Bois Forte (Nett Lake) Indian Reservation and a portion of the Koochiching State Forest. The Nett Lake River is the least impacted sub-watershed in the basin. Forest/shrub and wetlands comprise 93 percent of the watersheds surface area (Figure 18). Named tributaries within the watershed unit include the Lost River and Portage Creek. The water chemistry monitoring for this watershed unit is represented by the pour point station 08RN008 on the Nett Lake River at the County Highway 8 Bridge.

Stream

Table 31. Aquatic life and recreation assessments on assessed AUIDs in the Nett Lake 11-HUC

AUID	Biological Station ID	Biological Station Location	F-IBI	M-IBI	DO	Turb	Cl	pH	NH_3	Aq. Life	Aq. Rec.
09030005-671 **Trib. to Nett Lake** *Unnamed Cr to Unnamed Cr*	08RN025	Upstream of BIA-5, 3.5 mi. NW of Nett Lake	**FS**	**FS**	--	--	--	--	--	**FS**	NA
09030005-673 **Nett Lake River** *Headwaters to Unnamed Cr*	05RN107	Downstream of BIA-8, 10 mi. NW of Nett Lake	**FS**	**FS**	--	--	--	--	--	**FS**	NA
09030005-672 **Nett Lake River** *Unnamed Cr to Little Fork R*	08RN008	Upstream of CR 8, 13 mi. SE of Littlefork	**FS**	**FS**	IF	IF	--	**FS**	**FS**	**FS**	**FS**

Abbreviations: **F-IBI** – Biological, Fish **M-IBI** – Biological, Macroinvertebrates **DO** – Dissolved Oxygen
Turb – Turbidity **Cl** – Chloride **NH3** – Unionized Ammonia
Aq. Life – Aquatic Life Use Assessment **Aq. Rec**. – Aquatic Recreation Assessment
FS – Full Support **IF** – Insufficient Information
NA – Not Assessed **--** No Data

Table 32. Minnesota Stream Habitat Assessment (MSHA) for the Nett Lake 11-HUC

Visits	Site ID	Stream Name	Land Use (0-5)	Riparian (0-15)	Substrate (0-27)	Fish Cover (0-17)	Channel Morph. (0-36)	MSHA Score (0-100)	MSHA Rating
2	05RN107	Nett Lake River	5	14	17	9	21	66	Good
1	08RN008	Nett Lake River	5	15	20	12	32	84	Good
1	08RN025	Trib. to Nett Lake	5	14	7	15	18	59	Fair
Average Habitat Results: *Nett Lake 11 HUC Watershed*			5	14	15	12	24	69	Good

Qualitative habitat ratings:
Good: MSHA score above the median of the least-disturbed sites (≥66)
Fair: MSHA score between the median of the least-disturbed sites and the median of the most-disturbed sites (45-65)
Poor: MSHA score below the median of the most-disturbed sites (≤44)

Table 33. Pour point water chemistry results for the Nett Lake 11-HUC

Station location:	Nett Lake River at CR 8, 13 miles SE of Littlefork
Storet ID:	S003-998
Station #:	08RN008

Parameter	TSS	Turb.[4]	T-tube	D.O.	TP[5]	TKN	Chloro-phyll-a[5]	E. coli	pH	Spec. cond.
Units	mg/l	NTU	cm	mg/l	mg/l	mg/l	ug/l	#/100ml	SU	uS/cm
# samples	10	6	18	18	10	10	4	14	17	17
Min	3.8	11	26	6.4	.031	0.8	1.1	5	6.9	103
Max	44	27	88	10.6	.049	1.3	2.7	147	8.2	269
Mean[1]	16.1	17	48	8.3	.040	1.0	1.9	54	7.8	148
Median	12	15	43	8.1	.040	1.0	1.8	49	7.8	143
WQ standard		25	20	5.0	0.055		10	126/ 1260	6.5-9.0	
# WQ exceedances[2]		1/6	0/18	0/18	0/10		0/4	0/14	0/17	
NMW 75th percentile[3]	20	12			0.09	0.18-0.73			8.0	230

1Geometric mean of all samples is provided for *E. coli* or fecal coliform.
2Represents exceedances of individual maximum standard for *E. coli* (1260/100ml) or fecal coliform (2000/100ml).
3Based on 1970-1992 summer data; see *Selected Water Quality Characteristics of Minimally Impacted Streams from Minnesota's Seven Ecoregions* (McCollor and Heiskary 1993). TKN range based on EPA Rivers and Streams in Nutrient Ecoregion VIII, NLF and NMW EPA 822 B-01-015. 2001
[4] Combined data from 3 turbidity methods, each with slightly different standard methods
[5] Proposed TP and Chlorophyll-a standards for the North region of Minnesota, see http://www.pca.state.mn.us/index.php/view-document.html?gid=14947

****Data found in the table above was compiled using the results from data collected in 2008 and 2009 at the pour point monitoring station. This site specific data does not necessarily reflect all data that was used to assess the AUID.**

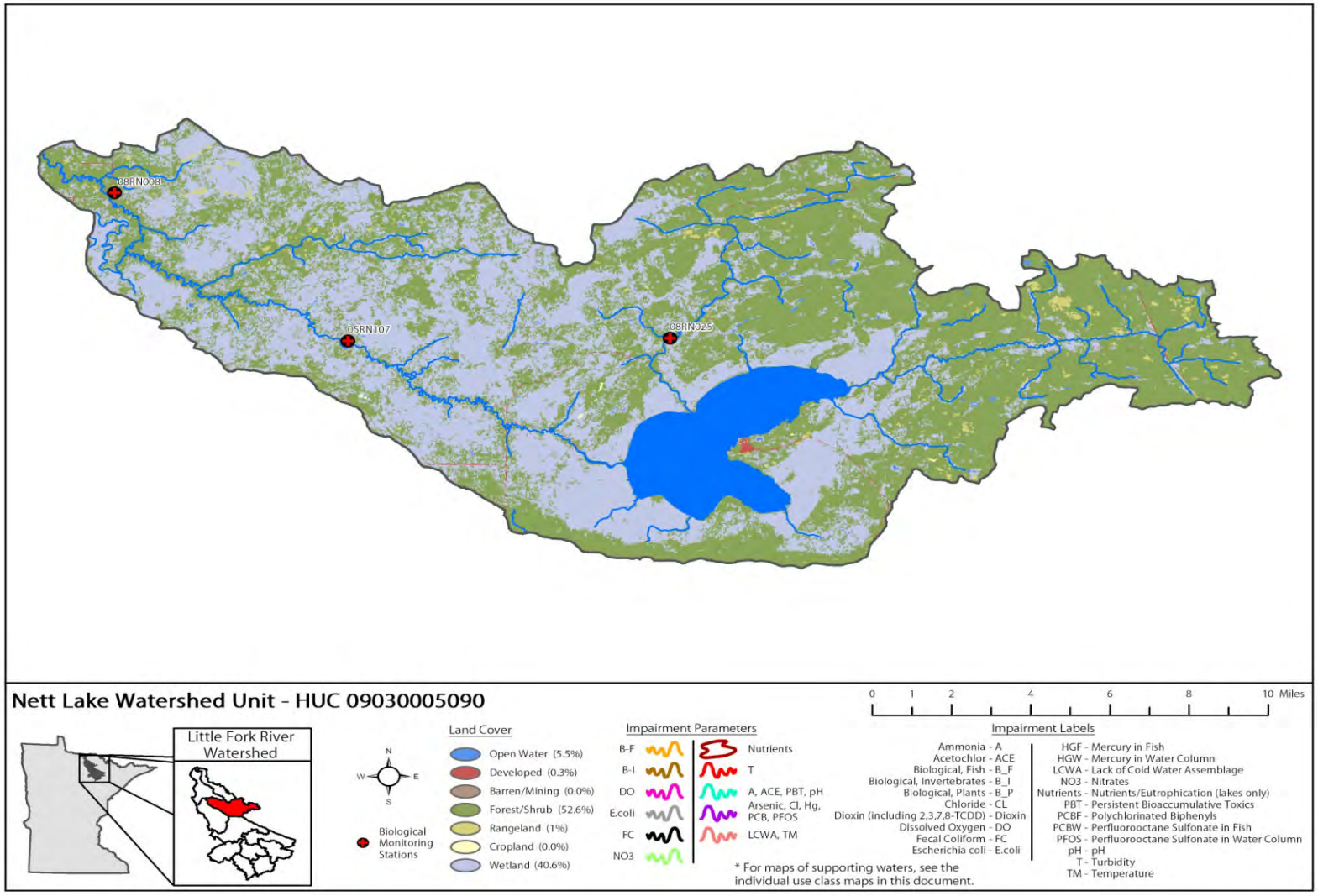
Summary

The biology sampled in the Nett Lake Watershed Unit appears to be adequate and supporting for aquatic life. The furthest upstream station on the Nett Lake River, 05RN107, was sampled twice for both fish and macroinvertebrates, once in 2005 and once in 2008, and their resulting IBI scores were relatively close to thresholds. The M-IBI score resulting from the 2008 visit fell approximately ten points below the threshold but remained within the lower confidence interval. Because three of the four macroinvertebrate samples yielded IBI scores above threshold limits and there was a lack of disturbance in the watershed, full support was given to this reach.

Based on the pour point water chemistry results, the lower reach was assessed as fully supporting for both aquatic life and aquatic recreation. Sediment, nutrient, turbidity, and bacteria concentrations are low and meeting standards or ecoregion expectations. No additional monitoring is recommended at this time.

Nett is the only lake within the watershed, covering over 7,200 acres. The lake is un-assessed, and is entirely within the Nett Lake Indian Reservation.

Figure 19. Currently listed impaired waters by parameter and landuse in the Nett Lake Watershed Unit



Beaver Brook Watershed Unit HUC 0903005100

The Beaver Brook Watershed Unit, located in northeastern Koochiching County, drains an area of 123.1 square miles. Beaver Brook flows in a northwest direction over its course for nearly 46 miles until its confluence with the Little Fork River one mile downstream of the town of Littlefork. Located primarily within the Koochiching State Forest, the watershed's land use is predominantly forest/shrub and wetlands with scattered areas of rangeland in the lower portion of the watershed (Figure 19). There are no named tributaries to Beaver Brook in the watershed. The water chemistry monitoring for this watershed unit is represented by the pour point station 05RN037 on Beaver Brook at the Highway 217 Bridge east of Littlefork.

Stream assessments

Table 34. Aquatic life and recreation assessments on assessed AUIDs in the Beaver Brook 11-HUC

AUID	Biological Station ID	Biological Station Location	F-IBI	M-IBI	DO	Turb	Cl	pH	NH_3	Aq. Life	Aq. Rec.
09030005-522 **Beaver Brook** *Headwaters to Little Fork R*	08RN038 05RN171 05RN026 05RN037	Upstream of Haney Rd, 14 mi. SE of Littlefork Downstream of CR 29, 10 miles SW of Ray Upstream of Hwy 217, 9 mi. SE of Littlefork Downstream of Hwy 217, 1.5 miles E of Littlefork	**FS**	**FS**	IF	**FS**	--	**FS**	**FS**	**FS**	**FS**
09030005-669 **Unnamed Creek** *Unnamed Cr to Beaver Bk*	08RN026	Off of Old Galvin Ln, 10 mi. SE of Littlefork	**FS**	IF	--	--	--	--	--	**FS**	NA

Abbreviations: **F-IBI** – Biological, Fish **M-IBI** – Biological, Macroinvertebrates **DO** – Dissolved Oxygen
Turb – Turbidity **Cl** – Chloride **NH3** – Unionized Ammonia
Aq. Life – Aquatic Life Use Assessment **Aq. Rec**. – Aquatic Recreation Assessment
FS – Full Support **IF** – Insufficient Information
NA – Not Assessed **--** No Data

Table 35. Minnesota Stream Habitat Assessment (MSHA) for the Beaver Brook 11-HUC

Visits	Site ID	Stream Name	Land Use (0-5)	Riparian (0-15)	Substrate (0-27)	Fish Cover (0-17)	Channel Morph. (0-36)	MSHA Score (0-100)	MSHA Rating
1	08RN038	Beaver Brook	5	11	17	9	27	69	Good
1	05RN171	Beaver Brook	5	12	13	12	24	66	Good
1	05RN026	Beaver Brook	5	11	12	11	21	60	Fair
2	05RN037	Beaver Brook	5	12	19	12	26	74	Good
1	08RN026	Trib. to Beaver Brook	5	12	9	12	24	62	Fair
Average Habitat Results: *Beaver Brook 11 HUC Watershed*			5	12	14	11	24	66	Good

Qualitative habitat ratings:
Good: MSHA score above the median of the least-disturbed sites (≥66)
Fair: MSHA score between the median of the least-disturbed sites and the median of the most-disturbed sites (45-65)
Poor: MSHA score below the median of the most-disturbed sites (≤44)

Table 36. Pour point water chemistry results for the Beaver Brook 11-HUC

Station location:	Beaver Brook at of Hwy 217, 1.5 miles E of Littlefork
Storet ID:	S003-999
Station #:	05RN037

Parameter	TSS	Turb.[4]	T-tube	D.O.	TP[5]	TKN	Chloro-phyll-a[5]	E. coli	pH	Spec. cond.
Units	mg/l	NTU	cm	mg/l	mg/l	mg/l	ug/l	#/100ml	SU	uS/cm
# samples	10	6	19	18	10	10	4	14	17	17
Min	2.8	12	22	6.4	.036	1.0	0.7	4	7.5	114
Max	23	33	75	10.5	.094	1.3	1.6	6448	8.3	291
Mean[1]	6.4	17	48	8.2	.066	1.1	1.1	108	7.9	190
Median	3.8	15	51	8.1	.068	1.1	0.9	65	7.9	193
WQ standard		25	20	5.0	0.055		10	126/ 1260	6.5-9.0	
# WQ exceedances[2]		1/6	0/19	0/18	7/10		0/4	0/14	0/17	
NLF 75th percentile[3]	5.6	4			0.05	0.18-0.73			7.9	260

1Geometric mean of all samples is provided for *E. coli* or fecal coliform.
2Represents exceedances of individual maximum standard for *E. coli* (1260/100ml) or fecal coliform (2000/100ml).
3Based on 1970-1992 summer data; see *Selected Water Quality Characteristics of Minimally Impacted Streams from Minnesota's Seven Ecoregions* (McCollor and Heiskary 1993). TKN range based on EPA Rivers and Streams in Nutrient Ecoregion VIII, NLF and NMW EPA 822 B-01-015. 2001
[4] Combined data from 3 turbidity methods, each with slightly different standard methods
[5] Proposed TP and Chlorophyll-a standards for the North region of Minnesota, see http://www.pca.state.mn.us/index.php/view-document.html?gid=14947

****Data found in the table above was compiled using the results from data collected in 2008 and 2009 at the pour point monitoring station. This site specific data does not necessarily reflect all data that was used to assess the AUID.**

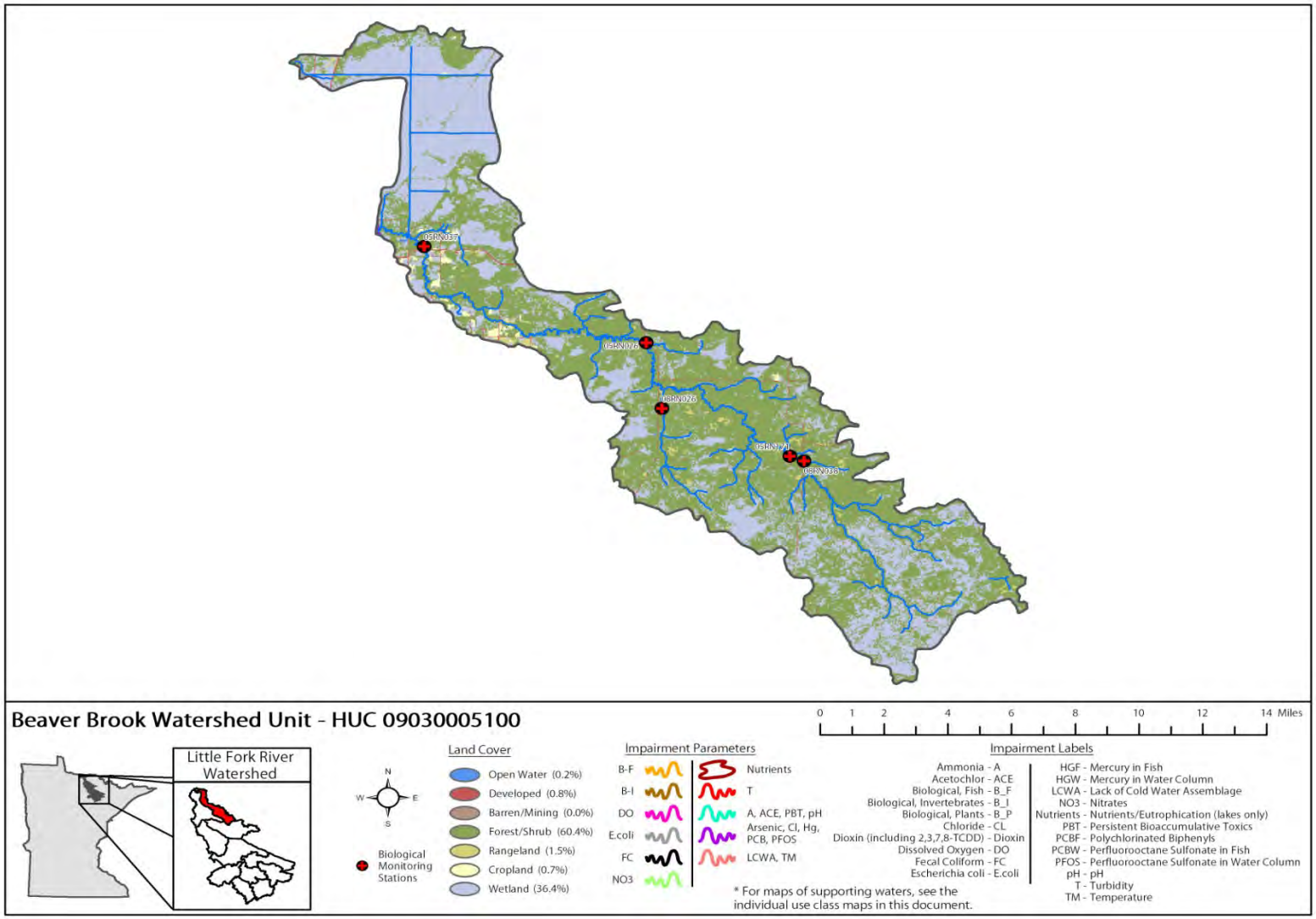
Summary

The biology sampled in the Beaver Brook Watershed Unit appears to be adequate and supporting for aquatic life. All samples taken along Beaver Brook produced IBI scores above their respective thresholds except for one macroinvertebrate sample taken from station 05RN026 which received a score of 38. A second sample from this station was taken a day later which produced a score of 62. Taking into account the quality of habitat, and the undisturbed surrounding land use, more weight was given to the second sample as it better represents the condition of the upstream watershed. Unnamed Creek, a tributary to Beaver Brook, produced discrepant results between the fish and macroinvertebrate communities at station 08RN026. The fish community fared exceptionally well with a F-IBI score of 87, while the macroinvertebrates had an M-IBI score of 36. As with other low M-IBI scores found within the Little Fork River Watershed, the low score was attributed to natural flow disruptions due to beaver activity resulting in stagnant flow conditions.

The watershed is relatively un-impacted; it does receive treated wastewater effluent from Littlefork near the watershed outlet. Sediment, nutrient, turbidity, and bacteria concentrations are low and meeting standards or ecoregion expectations. Phosphorus concentrations were higher than most other sub-watersheds, but within excepted ranges given the wetland dominated landscape. Bacteria concentrations were meeting standards and designated uses; one sample with high counts was collected after a significant rainfall event. The excellent water quality reflects watershed land cover that is near 97 percent forest and wetland. No additional monitoring is recommended at this time.

The Beaver Brook Watershed Unit does not contain any lakes.

Figure 20. Currently listed impaired waters by parameter and landuse in the Beaver Brook Watershed Unit



Lower Little Fork River Watershed Unit HUC 09030005110

The Lower Little Fork River Watershed Unit, located in northern Koochiching County, drains an area of 168.4 square miles. The watershed unit includes the Little Fork River main-stem from the Nett Lake River input, downstream through the town of Littlefork, to its confluence with the Rainy River. Land use in the watershed is predominantly forest/shrub and wetlands with scattered areas of rangeland and row crop agriculture along the main-stem of the Little Fork River and the town of Littlefork (Figure 20). Significant tributaries to the Little Fork River in the watershed are the Cross River and Ester Brook. The water chemistry monitoring for this watershed unit is represented by the pour point station S000-179 on the Little Fork River at the Highway 11 Bridge at Pelland, 0.4 miles from the confluence with the Rainy River.

Stream assessment

Table 37. Aquatic life and recreation assessments on assessed AUIDs in the Lower Little Fork River 11-HUC

AUID	Biological Station ID	Biological Station Location	F-IBI	M-IBI	DO	Turb	Cl	pH	NH_3	Aq. Life	Aq. Rec.
09030005-510 **Little Fork River** *Cross R to Beaver Bk*	08RN049 05RN086	Downstream of Hwy 217, 0.25 mi. SW of Littlefork Downstream of Hwy 217, 0.5 mi. NW of Littlefork	FS	FS	IF	NS	FS	FS	FS	NS	NA
09030005-501 **Little Fork River** *Beaver Bk to Rainy R*	08RN053	Upstream of Hwy 11, 1 mi. S of Pelland	FS	FS	FS	NS	FS	FS	FS	NS	FS
09030005-511 **Cross River** *Headwaters to Little Fork R*	08RN028	Downstream of CR 73, 5 mi. SE of Littlefork	FS	FS	--	--	--	--	--	FS	NA
09030005-609 **Ester Brook** *Unnamed Cr to Little Fork R*	08RN027	Upstream of CR 8, 9 mi. SE of Littlefork	FS	FS	--	--	--	--	--	FS	NA

Abbreviations: **F-IBI** – Biological, Fish **M-IBI** – Biological, Macroinvertebrates **DO** – Dissolved Oxygen
Turb – Turbidity **Cl** – Chloride **NH3** – Unionized Ammonia
Aq. Life – Aquatic Life Use Assessment **Aq. Rec**. – Aquatic Recreation Assessment
FS – Full Support **NS** – Non-Support **IF** – Insufficient Information
NA – Not Assessed -- No Data

Table 38. Minnesota Stream Habitat Assessment (MSHA) for the Lower Little Fork River 11-HUC

Visits	Site ID	Stream Name	Land Use (0-5)	Riparian (0-15)	Substrate (0-27)	Fish Cover (0-17)	Channel Morph. (0-36)	MSHA Score (0-100)	MSHA Rating
1	08RN049	Little Fork River	1	10	21	11	29	72	Good
1	05RN086	Little Fork River	1	5	14	8	22	50	Fair
1	08RN053	Little Fork River	5	11	16	6	19	57	Fair
2	08RN027	Ester Brook	5	15	20	13	30	83	Good
1	08RN028	Cross River	5	14	18	14	33	84	Good
Average Habitat Results: *Lower Little Fork River 11 HUC*			3	11	18	10	27	69	Good

Qualitative habitat ratings:
Good: MSHA score above the median of the least-disturbed sites (≥66)
Fair: MSHA score between the median of the least-disturbed sites and the median of the most-disturbed sites (45-65)
Poor: MSHA score below the median of the most-disturbed sites (≤44)

Table 39. Pour point water chemistry results for the Lower Little Fork River 11-HUC

Station location:	Little Fork River at Highway 11, 0.5 miles W. of Pelland
Storet ID:	S000-179
Station #:	

Parameter	TSS	Turb.[4]	T-tube	D.O.	TP[5]	TKN	Chloro-phyll-a[5]	E. coli	pH	Spec. cond.
Units	mg/l	NTU	cm	mg/l	mg/l	mg/l	ug/l	#/100ml	SU	uS/cm
# samples	9	6	19	19	10	9	4	14	18	18
Min	4	14	14	5.1	.035	0.68	2.1	2	6.8	91
Max	48	33	120	12.2	.083	1.25	4.0	85	8.2	297
Mean[1]	19	27	52	7.9	.05	0.99	2.7	16	7.7	182
Median	14	28	38	7.2	.046	1.05	2.4	9	7.7	186
WQ standard		25	20	5.0	0.055		10	126/1260	6.5-9.0	
# WQ exceedances[2]		5/6	2/19	0/19	3/10		0/4	0/14	0/18	
NMW 75th percentile[3]	20	12			0.09	0.18-0.73			8.0	230

1Geometric mean of all samples is provided for *E. coli* or fecal coliform.
2Represents exceedances of individual maximum standard for *E. coli* (1260/100ml) or fecal coliform (2000/100ml).
3Based on 1970-1992 summer data; see *Selected Water Quality Characteristics of Minimally Impacted Streams from Minnesota's Seven Ecoregions* (McCollor and Heiskary 1993). TKN range based on EPA Rivers and Streams in Nutrient Ecoregion VIII, NLF and NMW EPA 822 B-01-015. 2001
[4] Combined data from 3 turbidity methods, each with slightly different standard methods
[5] Proposed TP and Chlorophyll-a standards for the North region of Minnesota, see http://www.pca.state.mn.us/index.php/view-document.html?gid=14947

****Data found in the table above was compiled using the results from data collected in 2008 and 2009 at the pour point monitoring station. This site specific data does not necessarily reflect all data that was used to assess the AUID.**

Summary

Five distinct stations were sampled for both fish and macroinvertebrates in this watershed unit and indicated full support for aquatic life. All IBI scores were above their respective thresholds except for one macroinvertebrate visit to 08RN049 on the Little Fork River. This particular sample yielded a M-IBI score of 43, which is approximately eight points below the threshold but within the lower confidence interval. In close proximity is station 05RN086, and here the M-IBI score was roughly nine points above the threshold. Given that all three F-IBI scores and two out of the three M-IBI scores were above thresholds on this reach of the Little Fork River, the weight of evidence approach suggests the biology is fully supporting. F-IBI scores improve moving downstream along the Little Fork River in this watershed unit. The pour point station, 08RN053, produced an F-IBI score of 88 and is the highest F-IBI score given to a Little Fork River main-stem station in the entire watershed. Stations on Ester Brook and the Cross River, both tributaries to the Little Fork River, provided passing IBI scores for both fish and macroinvertebrates and reflects the high quality habitat observed at these two stations.

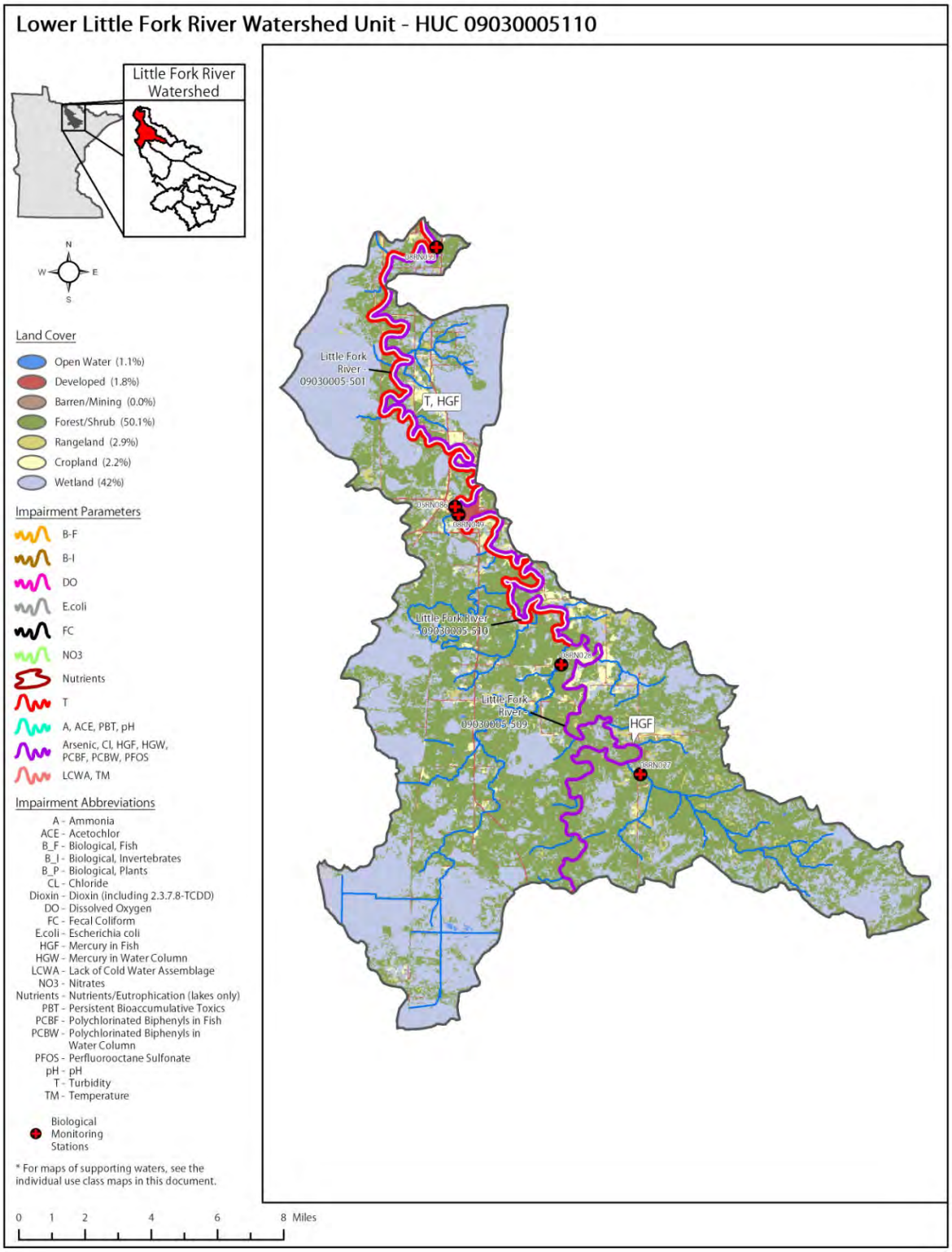
Biological and chemical aquatic life indicators within this watershed unit are contradictory. Monitoring data collected prior to 2008 resulted in the Little Fork River (AUID 09030005-501 & 09030005-510) being placed on the impaired waters list for aquatic life due to violations of the turbidity standard. However, recent assessment results indicate that fish and macroinvertebrate communities are fully supporting for aquatic life. Although both fish and macroinvertebrate communities do not appear to be detrimentally affected in the Little Fork River itself, these high turbidity levels are believed to negatively impact downstream waters such as the Rainy River and Lake of the Woods. For this reason, the turbidity impairment has been retained on the 2010 impaired waters list and a watershed wide turbidity TMDL study is scheduled to begin in 2012.

The mouth of the Little Fork River, AUID 09030005-501, is designated as impaired for exceedances of the turbidity standard. A compilation of data from the long-term MPCA Milestone monitoring at Pelland, other MPCA monitoring, and the most recent 10X data show the turbidity standard was exceeded nearly 50 percent of the time within the assessment cycle (31 of 58 samples). A portion of these exceedances may be due to backwater effects from the Rainy River, which under certain flows can cause stagnant conditions at the Pelland Bridge. Bacteria levels are low and meeting the aquatic recreation standard.

The adjacent, upstream reach of the Little Fork River, AUID 09030005-510, is also impaired for aquatic life due to exceedances of the turbidity standard. This particular AUID possesses the most robust water chemistry dataset resulting from the Major Watershed Load Monitoring Station being located here. Consistently high levels of turbidity and phosphorus have been observed here and the potential impacts on downstream water bodies are a concern. (Refer to the Load Monitoring Results section for further information in this particular AUID)

There are no lake water aquatic recreation assessments as this watershed unit does not contain any lakes.

Figure 21. Currently listed impaired waters by parameter and landuse in the Lower Little Fork River Watershed Unit



VII. Watershed Wide Results and Discussion

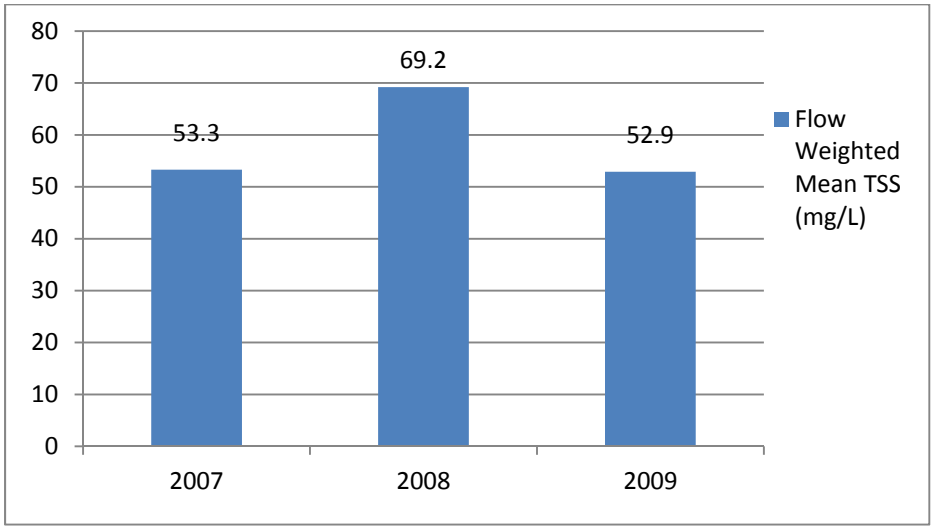
Assessment results and data summaries are included below for the entire HUC-8 watershed unit of the Little Fork River, grouped by sampling type. Summaries are provided for aquatic life and recreation uses in streams and lakes throughout the watershed, for aquatic consumption results and load monitoring data results near the mouth of the river. Following the results are a series of graphics that provide an overall summary of assessment results by designated use, impaired waters and fully supporting waters within the entire Little Fork River Watershed.

Load monitoring

Total Suspended Solids

Currently, the State of Minnesota's TSS standards are moving from the "development phase" into the "approval phase" and must be considered to be draft standards until the process is complete. Within the North RNR, the TSS draft standard is 15 mg/L (MPCA 2010c); TSS concentrations in the Little Fork River watershed at or above 15 mg/L are considered to impair aquatic life. When greater than 10 percent of the individual samples exceed the draft standard, the river is out of compliance. Calculations from 2007 through 2009 show 52, 58 and 48 percent of the individual samples exceeded the 15 mg/L draft standard, respectively. In addition, the computed FWMC's for the three sample years all drastically exceeded the 15 mg/L draft standard, 53.3, 69.2 and 52.9 mg/L respectively. Because of the strong correlation that often exists between pollutant loads and annual discharge volume, annual variability in pollutant loads can often be attributed to differences in annual runoff (Figure 21).

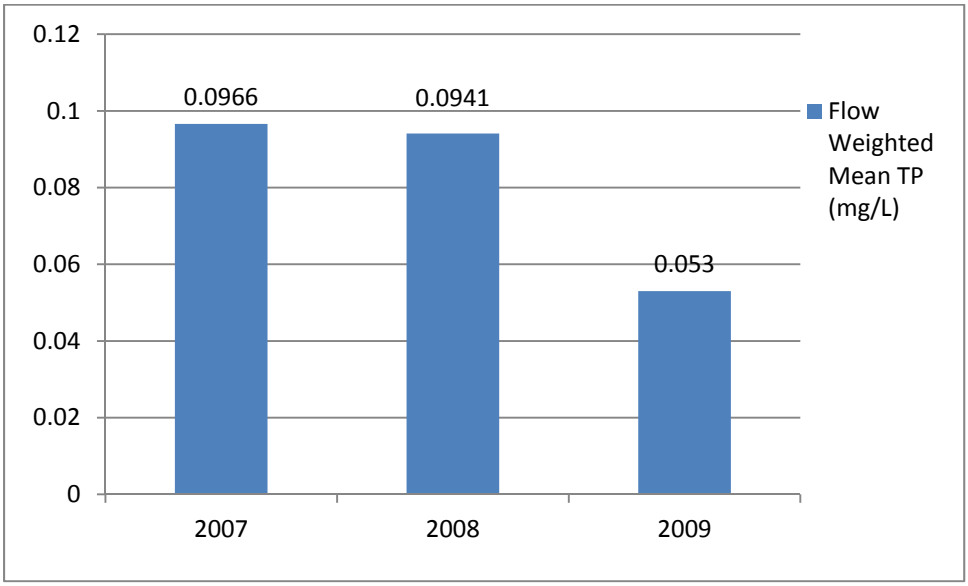
Figure 22. Total Suspended Solids (TSS) Flow Weighted Mean Concentrations for the Little Fork River at Littlefork Minnesota, 2007-2009



Total Phosphorus

Total Phosphorus standards for Minnesota's rivers are also in the final approval phase and must be considered draft standards until final approval. Within the North RNR, the TP draft standard is 55 ug/L as a summer average. Summer average violations of one or more "response" variables (pH, biological oxygen demand (BOD), dissolved oxygen flux, chlorophyll-a) must also occur along with the TP numeric violation for the water to be listed. Concentrations from 2007 through 2009 show that 35, 45, and 68 percent of the individual TP samples exceeded the 55ug/L draft standard, respectively. Observations of Observations of Figure 22 show that all the FWMC's from 2007 and 2008 are considerably higher than the draft standard at 96.6 and 94.1 ug/L respectively , while the 2009 FWMC is just below the draft standard at 53 ug/L.

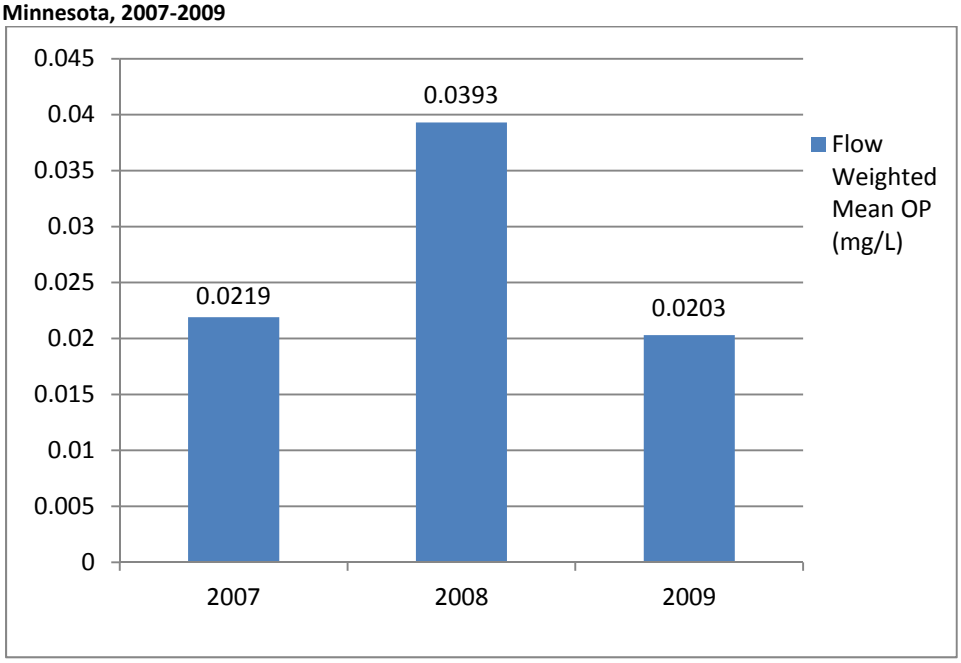
Figure 23. Total Phosphorus (TP) Flow Weighted Mean Concentrations for the Little Fork River in Littlefork Minnesota, 2007-2009



Dissolved Orthophosphate

The 2007 through 2009 FWMC ratio of DOP to TP shows 23 to 42 percent of TP is in the orthophosphate form. Over the three year monitoring period, there is not a significant trend.

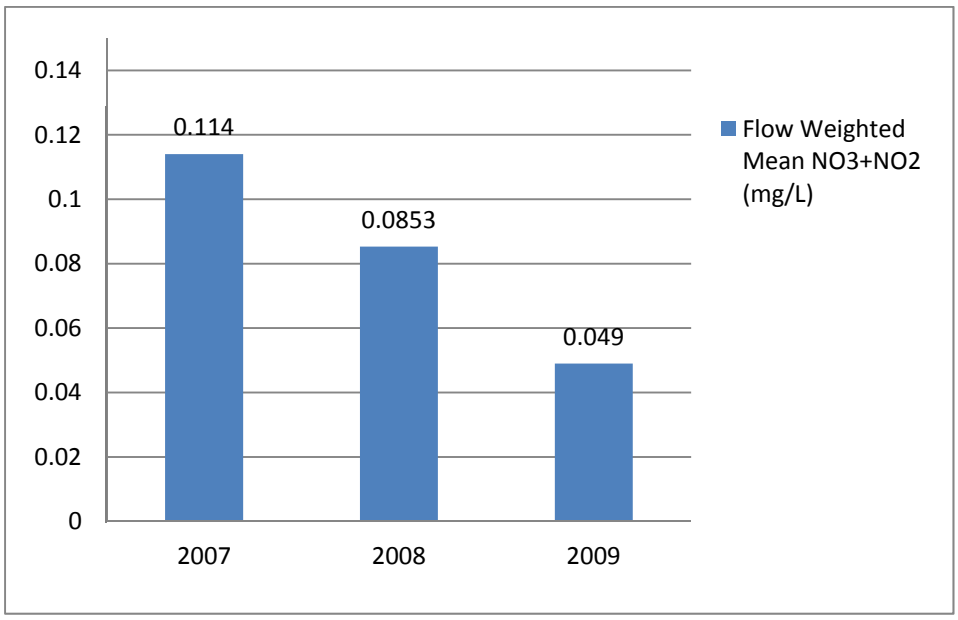
Figure 24. Dissolved Orthophosphate (DOP) Flow Weighted Mean Concentrations for the Little Fork River at Littlefork Minnesota, 2007-2009



Nitrate plus Nitrite - Nitrogen

Currently nitrate-N standards are absent for Minnesota Rivers, but are in the MPCA's "development phase," with a scheduled adoption deadline of September 2012. The draft acute nitrate-N value (maximum standard) is 41 mg/L for a one-day duration, and the draft chronic value is 4.9 mg/L nitrate-N for a 4-day duration. In addition, a draft chronic value of 3.1 mg/L nitrate- N (4-day duration) was determined for protection of class 2A surface waters. FWMC's of nitrate-nitrogen within the Little Fork River are well below the acute and chronic nitrate-N standards (Figure 24).

Figure 25. Nitrate + Nitrite Nitrogen (Nitrate-N) Weighted Mean Concentrations for the Little Fork River at Littlefork Minnesota, 2007-2009



Long-term monitoring of major watersheds on a statewide level show elevated levels of nitrate-N in Minnesota's western and southern basins, more specifically, watersheds of the Minnesota River Basin have some of the highest measured nitrate-N FWMC's in the state (Figure 25).

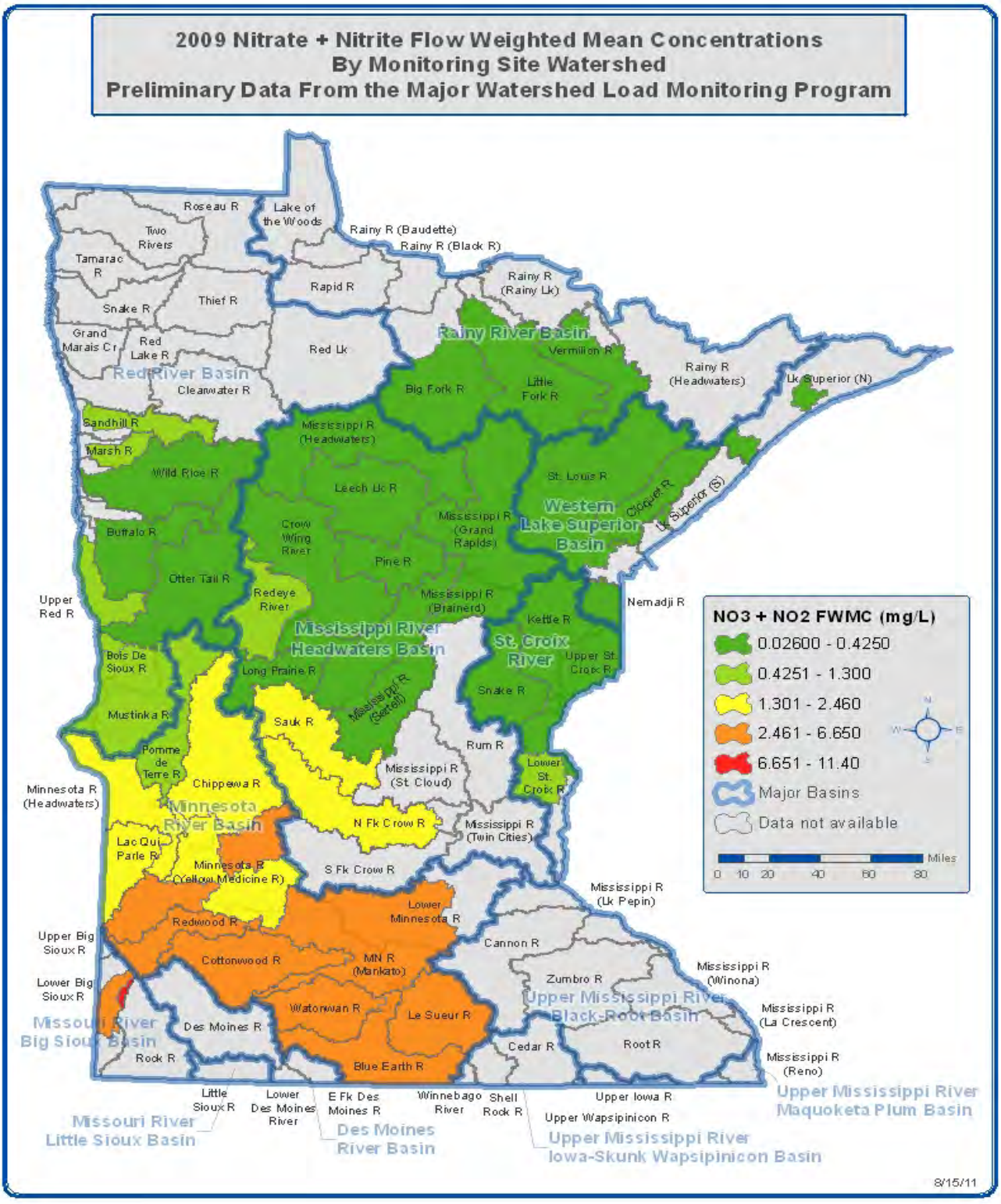


Figure 26. Statewide comparison of Nitrate + Nitrite Nitrogen Flow Weighted Mean Concentrations by Watershed-2009

Table 40. Annual pollutant loads by parameter calculated for the Little Fork River at Littlefork Minnesota, 2007-2009

Parameter	2007		2008		2009	
	Mass (kg)	FWM (mg/L)	Mass (kg)	FWM (mg/L)	Mass (kg)	FWM (mg/L)
Total Suspended Solids	31,862,116	53.3	68,714,980	69.2	50,048,125	52.9
Total Phosphorus	57,723	0.0966	93,264	0.0941	71,211	0.053
Othro Phorphorus	13,162	0.022	39,105	0.0393	19,152	0.0203
Nitrate + Nitrite Nitrogen	68,313	0.114	84,706	0.0853	46,359	0.049

Stream water quality

Overall, water quality conditions are good, and reflect the forests and wetlands that dominate land-cover within the Little Fork watershed. TSS and turbidity levels are elevated in some tributaries and Little Fork reaches, including those that were previously designated as impaired for turbidity. Sources of the sediment and turbidity are numerous, and are a function of the watershed's geologic setting, the river's geomorphology, and current and historical landuse. Nutrient (total phosphorus and total Kjeldahl nitrogen) concentrations are generally meeting NLF ecoregion expectations; and yield low chlorophyll-a concentrations (typically < 3 µg/L). Ammonia and nitrate-nitrite nitrogen levels were consistently below standards and ecoregion expectations. E. coli levels were also low, and all sites are meeting the recreational use standard. Only rarely did individual samples exceed the criterion, often during or after significant rain events. Dissolved oxygen concentrations were meeting standards at all sites. Occasionally, individual samples were slightly below the five mg/L standard; typically during periods of low flow in watersheds where oxygen naturally sags in wetland dominated regions.

Table 41. Average, minimum and maximum values from 2008-2009 Little Fork Watershed intensive water chemistry stream monitoring stations (water quality standards or NLF ecoregion expectation values in bold and within parentheses)

Site Name & Station ID	Total Suspended Solids- mg/L **(6)**			Field Turbidity – FNU **(25)**			Dissolved Oxygen – mg/L **(5)**			Total Phosphorus ug/L **(50)**			Total Kjeldahl Nitrogen (mg/L)			Chlorophyll-a – ug/L **(< 10)** [1]			E. Coli - # / 100mL **(126)**		
	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.
Rice River @ Co. Rd. 25 (08RN002)	6	3	8	18	12	28	6.7	4.8	10.5	52	30	70	0.9	0.7	1.2	3.6	1.2	5.5	26	10	83
Little Fork River @ Co. Rd. 495 (08RN005)	6	3	14	19	13	29	7.8	5.8	10.8	63	33	78	1.1	0.8	1.3	1.8	1.1	3.1	21	6	53
Sturgeon River @ Co. Rd. 766 (08RN001)	2	1	3	5	2	16	7.1	5.2	10.5	23	16	46	0.7	0.6	0.9	1.4	0.9	2.4	39	9	93
Bear River @ Co. Rd. 5 (08RN004)	7	2	19	8	5	19	8.6	7.4	11.2	34	19	51	0.6	0.2	1.1	3.9	0.7	11.8	56	8	145
Dark River @ Co. Rd. 688 (99NF120)	3	1	7	5	2	14	9.2	6.7	10.8	20	11	28	0.5	0.3	0.8	1.1	0.7	2.1	45	16	93
Sturgeon River @ Co. Rd. 107 (08RN003)	9	4	18	12	8	24	8.6	7.4	11.7	35	20	51	0.7	0.3	1.1	1.9	1.2	2.7	29	13	51
Little Fork River @ Co. Rd. 75 (08RN006)	7	2	20	12	6	26	8.2	5.9	10.8	40	19	61	0.8	0.4	1.3	1.5	0.5	2.7	17	4	33
Willow River @ Co. Rd. 75 (08RN054)	11	6	15	26	19	42	6.4	4.3	9.8	72	37	106	1.3	0.9	1.6	4.9	1.1	8.9	31	5	107
Little Fork River @ MN Hwy 65 (08RN007)	12	2	42	13	8	23	8.1	6.1	10.3	43	20	75	0.9	0.5	1.1	1.2	0.5	1.7	21	1	48
Nett Lake River @ Co. Rd. 8 (08RN008)	16	4	44	17	11	27	8.3	6.4	10.6	40	31	49	1.1	0.8	1.3	1.9	1.1	2.8	54	5	147
Beaver Brook @ MN Hwy 217 (05RN037)	6	3	23	17	12	33	8.2	6.4	10.5	66	36	94	1.2	1.1	1.3	1.1	0.7	1.7	108	4	648
Little Fork River @ MN Hwy 11 (S000-179)	19	4	48	27	14	33	7.9	5.1	12.2	50	35	83	0.9	0.7	1.2	2.7	2.1	4.1	16	2	85

[1] **Proposed Chlorophyll-a standard for the North region of Minnesota, see http://www.pca.state.mn.us/index.php/view-document.html?gid=149**

Lake water quality

Little Fork watershed lakes were assessed relative to the NLF Class 2B ecoregion standards-those waters that support a cool and warm water fishery (Table 42). Based on recent monitoring, all assessed lakes are meeting eutrophication criteria. The assessment cycle mean TP concentration for all lakes is below the standard (30 µg/L). Likewise, chl-a is below the standard for all lakes except Bear. The Secchi standard in four lakes (Bear, Little Sturgeon, West Sturgeon, and South Sturgeon) is not being met, but this is due to natural bog staining, and is not in response to elevated chlorophyll-a concentrations.

Table 42. Assessment summary for lake water chemistry in the Little Fork River Watershed

	Lake Name/ID	TP (ug/L)	Chl-a (ug/L)	Secchi (meters)
Bear River HUC-11	Horsehead Lake (31-0155)	14	1.7	3
	Little Bear Lake (31-0156)	11	4.6	2.8
	Bear Lake (31-0157)	27	10.2	1.1
	Raddison (31-0284)	9	1.8	4.3
	Napoleon (31-0290)	11	2.2	4.6
	Walters Lake (31-0298)	17	3.9	2.3
	Kelly Lake (31-0299)	11	2.6	2.6
Sturgeon Lake HUC-11	Beatrice Lake (31-0158)	8.8	3.4	3.6
	Sturgeon Lake (69-0939-01)	9	2.6	4.1
	West Sturgeon Lake (69-0939-03)	15.7	5.4	1.6
	Little Sturgeon Lake (69-1290)	23.8	5.4	1.5
	South Sturgeon Lake (31-0003)	14.6	4.3	1.3
	Side Lake (69-0933)	11	3.4	3.3
	Perch Lake (69-0932	12.4	4	3.3
	Hobson Lake (69-0923)	12	3.9	2.9
NLF Ecoregion - Aquatic Rec. Use (Class 2B)		**<30**	**<9**	**>2.0**

Results shown for Total Phosphorous, Chlorophyll-a, and Secchi disk are averages.

Fish contaminants

Mercury

Descriptive statistics for fish total length and mercury concentrations are summarized by waterway and species in (Table 43). Mercury data were available for 14 fish species in the Little Fork River watershed. Median mercury concentrations in the river fish ranged from 0.15 to 0.52 mg/kg; in lakes, the medians ranged from 0.03 to 1.00 mg/kg. As is typically seen in Minnesota lakes, walleye and northern pike had the highest mercury concentrations. The highest mercury concentration, 1.68 mg/kg, was in a 40 inch northern pike from Dark Lake in 1999. As a benchmark for the mercury concentrations, summary statistics are shown for years 2000 to 2008 from the Minnesota Fish Contaminant Program database (Table 44). Walleye and northern pike have very similar ranges of mercury concentrations, with the statewide mean mercury concentrations of 0.34 mg/kg and 0.36 mg/kg, respectively. Most of the high mercury concentrations in sport fish were from northern Minnesota lakes, because of the watershed and water chemistry characteristics of the northern waters.

The 2010 Impaired Water Inventory includes 12 of the 14 lakes in the watershed with mercury tissue data. The two lakes not on the inventory list, however, should be added to the 2012 inventory as impaired for mercury in fish tissue. Thistledew Lake (31-0158) had a 90th percentile for northern pike of

0.5 mg/kg and Perch Lake (69-0932) had a 90th percentile for walleye of 0.66 mg/kg. Perch Lake, Little Sand Lake (69-0732) and Dark Lake (69-0790) had 90th percentiles that exceeded 0.57 mg/kg; therefore, they require TMDLs and cannot be included in the statewide mercury TMDL. The other 11 lakes qualified for inclusion in the Minnesota Statewide Mercury TMDL (http://www.pca.state.mn.us/water/tmdl/tmdl-mercuryplan.html). In the Little Fork River, five of the seven fish species analyzed for mercury had 90th percentiles that exceeded the 0.2 mg/kg impairment threshold, but only northern pike and sauger had adequate sample size to meet the assessment criteria. The 90th percentiles for northern pike and sauger did not exceed 0.57 mg/kg and, therefore, the Little Fork River is included in the statewide mercury TMDL.

The goal for the statewide mercury TMDL is for the 90th percentile of mercury concentrations in top predator species to be less than 0.2 mg/kg. Implementation of the mercury TMDL is focused primarily on reducing mercury emissions to the atmosphere, because wastewater point source discharges are less than one percent of the total mercury load to the state.

Table 43. Descriptive statistics of mercury concentrations by waterway and species

				Length (in)			Hg (mg/kg)				
Waterway	**Lake ID**	**Species**	N	Min	Max	Mean	Min	Max	Mean	Median	90th Pctl
Little Fork River		Northern pike	8	15.3	25.2	20.4	0.185	0.474	0.286	0.256	0.433
		Quillback	1	20.5	20.5	20.5	0.377	0.377	0.377	0.377	NA
		Redhorse, unknown sp.	1	19.0	19.0	19.0	0.220	0.220	0.220	0.220	NA
		Sauger	5	11.6	12.4	12.1	0.221	0.359	0.303	0.334	0.359
		Shorthead redhorse	2	17.5	17.8	17.7	0.410	0.634	0.522	0.522	0.634
		Silver redhorse	3	18.3	23.5	20.7	0.249	0.482	0.335	0.274	0.482
		Walleye	3	12.9	15.8	14.1	0.316	0.459	0.393	0.403	0.459
		White sucker	1	18.1	18.1	18.1	0.146	0.146	0.146	0.146	NA
Little Bear	31-0156-00	Bluegill sunfish	1	5.6	5.6	5.6	0.069	0.069	0.069	0.069	NA
		Northern pike	2	19.1	21.5	20.3	0.250	0.300	0.275	0.275	0.300
		Walleye	2	19.2	23.4	21.3	0.240	0.330	0.285	0.285	0.330
Thistledew	31-0158-00	Bluegill sunfish	1	6.7	6.7	6.7	0.061	0.061	0.061	0.061	NA
		Northern pike	6	20.7	29.8	25.4	0.181	0.542	0.340	0.308	0.534
		White sucker	1	17.5	17.5	17.5	0.052	0.052	0.052	0.052	NA
Pfeiffer	69-0671-00	Bluegill sunfish	1	6.5	6.5	6.5	0.140	0.140	0.140	0.140	NA
		Largemouth bass	4	9.5	13.3	12.1	0.290	0.410	0.368	0.385	0.410
		Walleye	10	14.2	18.7	15.5	0.210	0.400	0.256	0.240	0.340
		White sucker	1	17.9	17.9	17.9	0.130	0.130	0.130	0.130	NA
Auto	69-0731-00	Bluegill sunfish	1	6.9	6.9	6.9	0.180	0.180	0.180	0.180	NA
		Northern pike	10	17.7	25.0	21.5	0.150	0.460	0.274	0.275	0.410
		Walleye	10	15.1	20.9	18.5	0.200	0.880	0.448	0.370	0.845
Little Sand	69-0732-00	Bluegill sunfish	1	8.3	8.3	8.3	0.360	0.360	0.360	0.360	NA
		Northern pike	4	18.6	32.2	24.6	0.460	0.960	0.695	0.680	0.960
		Walleye	2	12.0	18.4	15.2	0.220	0.490	0.355	0.355	0.490
Sand	69-0736-00	Bluegill sunfish	1	6.2	6.2	6.2	0.050	0.050	0.050	0.050	NA
		Northern pike	10	17.3	30.2	24.5	0.080	0.260	0.157	0.140	0.245
		Walleye	10	12.3	24.5	18.2	0.070	0.420	0.188	0.165	0.340
		White sucker	1	19.6	19.6	19.6	0.080	0.080	0.080	0.080	NA

Waterway	Lake ID	Species	N	Length (in) Min	Max	Mean	Hg (mg/kg) Min	Max	Mean	Median	90th Pctl
Dark	69-0790-00	Bluegill sunfish	2	6.1	6.6	6.4	0.111	0.120	0.116	0.116	0.120
		Northern pike	14	17.7	39.7	23.6	0.210	1.680	0.634	0.473	1.365
		White sucker	1	17.8	17.8	17.8	0.280	0.280	0.280	0.280	NA
Fourteen	69-0793-00	Bluegill sunfish	1	6.5	6.5	6.5	0.067	0.067	0.067	0.067	NA
		Black crappie	1	7.7	7.7	7.7	0.028	0.028	0.028	0.028	NA
		Northern pike	10	21.7	30.8	25.1	0.086	0.370	0.225	0.230	0.335
Leander	69-0796-00	Bluegill sunfish	1	6.6	6.6	6.6	0.046	0.046	0.046	0.046	NA
		Cisco	1	8.1	8.1	8.1	0.043	0.043	0.043	0.043	NA
		Largemouth bass	1	13.3	13.3	13.3	0.230	0.230	0.230	0.230	NA
		Northern pike	3	18.4	27.2	22.6	0.140	0.310	0.230	0.240	0.310
		Walleye	2	22.6	25.5	24.1	0.450	1.100	0.775	0.775	1.100
Clear	69-0799-00	Bluegill sunfish	1	6.2	6.2	6.2	0.066	0.066	0.066	0.066	NA
		Northern pike	3	12.6	20.9	17.1	0.110	0.240	0.187	0.210	0.240
		White sucker	2	17.0	20.3	18.7	0.084	0.110	0.097	0.097	0.110
Long	69-0859-00	Bluegill sunfish	1	7.2	7.2	7.2	0.160	0.160	0.160	0.160	NA
		Cisco	1	18.1	18.1	18.1	0.280	0.280	0.280	0.280	NA
		Northern pike	2	18.5	21.5	20.0	0.340	0.540	0.440	0.440	0.540
		Walleye	1	18.5	18.5	18.5	1.000	1.000	1.000	1.000	NA
Perch	69-0932-00	Black crappie	2	8.1	11.0	9.6	0.056	0.202	0.129	0.129	0.202
		Northern pike	7	21.2	27.0	24.4	0.266	0.611	0.359	0.324	0.564
		Smallmouth bass	5	14.1	17.5	16.5	0.189	0.524	0.412	0.454	0.524
		Walleye	6	15.4	21.2	18.5	0.161	0.696	0.339	0.309	0.658
Side	69-0933-00	Largemouth bass	7	10.3	15.2	12.7	0.109	0.288	0.186	0.174	0.287
Sturgeon	69-0939-00	Bluegill sunfish	1	7.3	7.3	7.3	0.096	0.096	0.096	0.096	NA
		Lake whitefish	1	17.7	17.7	17.7	0.075	0.075	0.075	0.075	NA
		Northern pike	6	13.0	28.5	20.7	0.140	0.320	0.252	0.275	0.318

Table 44. Mercury concentrations of 10 most abundant species in the Minnesota fish contaminant database from 2000-2008, sorted from highest to lowest mercury concentration

Species		Mercury Concentration (mg/kg - ww)					Total Fish Length (in)		
Common Name	Scientific Name	N	90th pctl	Min	Max	Mean	Min	Max	Mean
Walleye	*Sander vitreus*	2525	0.72	0.02	2.63	0.34	6.8	29.7	17.1
Northern Pike	*Esox lucius*	5293	0.71	0.01	2.95	0.36	7.5	45.5	22.2
Channel Catfish	*Ictalurus punctatus*	325	0.53	0.01	1.19	0.22	10	36	19.9
Smallmouth Bass	*Micropterus dolomieu*	528	0.46	0.02	1.24	0.25	1.2	20.3	12.9
Largemouth Bass	*Micropterus salmoides*	518	0.41	0.01	1.39	0.22	5.3	18.9	12.9
Common Carp	*Cyprinus carpio carpio*	359	0.31	0.01	0.70	0.16	4.5	35.9	21.8
Black Crappie	*Pomoxis nigromaculatus*	278	0.26	0.01	0.62	0.12	4.0	16.1	8.7
White Sucker	*Catostomus commersonii*	161	0.26	0.01	0.53	0.12	4.4	21.1	16.0
Yellow Perch	*Perca flavescens*	596	0.20	0.01	0.84	0.10	1.5	12.6	7.0
Bluegill Sunfish	*Lepomis macrochirus*	353	0.17	0.01	0.40	0.09	2.6	9.6	6.9

Polychlorinated Biphenyls (PCBs)

Fish were tested for PCBs in the Little Fork River from 1995 to 2008 (Table 45). PCBs concentrations were below or near the reporting limits in the five species tested. Consequently, the Little Fork River is not impaired for PCBs in fish tissue. Eight lakes in the Little Fork River watershed were tested for PCBs between 1991 and 1995 (Table 45). All of the lakes had concentrations of PCBs below or near the reporting limit. Therefore, no lakes are impaired for PCBs in fish tissue.

Table 45. Summary of total PCBs concentrations by waterway and species

Waterway	Lake ID	Species	Year	N	PCBs (mg/kg)
Little Fork River		Northern pike	2008	2	< 0.025
		Quillback	2001	1	0.06
		Redhorse sucker	1996	1	0.01
		Silver redhorse	2008	2	0.08
		White sucker	2001	1	0.01
Little Bear	31-0156-00	Walleye	1995	1	< 0.01
Pfeiffer	69-0671-00	Largemouth bass	1997	1	< 0.01
		Walleye	1997	1	0.01
		White sucker	1997	1	0.01
Little Sand	69-0732-00	Northern pike	1995	1	< 0.01
Dark	69-0790-00	Northern pike	1999	2	0.013
Leander	69-0796-00	Cisco	1991	1	< 0.01
		Largemouth bass	1991	1	< 0.01
		Northern pike	1991	2	< 0.01
		Walleye	1991	2	< 0.01
Clear	69-0799-00	Northern pike	1992	1	< 0.01
		White sucker	1992	1	< 0.01
Long	69-0859-00	Cisco	1993	1	0.014
		Northern pike	1993	1	< 0.01
Sturgeon	69-0939-00	Lake whitefish	1995	1	< 0.01
		Northern pike	1995	1	< 0.01

Trends

Water Chemistry data were analyzed for trends for the long term period of record (1971-present) and near term period of record (1995-2009). There were significant decreases in BOD and total phosphorus and significant increases in chloride during the long-term period of record. No trends were observed during the short term period of record. Citizen volunteer monitoring data of stream and lakes shows mixed results for water clarity trends.

Table 46. Pollutant trends for the Little Fork River from the long-term Milestone Site at Pelland Minnesota

HUC 09030005 Period of Record: 1971 - present Site: S000-179 (LF-0.5)	**Total Suspended Solids**	**Biochemical Oxygen Demand**	**Total Phosphorus**	**Nitrite/ Nitrate**	**Unionized Ammonia**	**Chloride**	**pH**
overall trend	**no trend**	**decrease**	**decrease**	**no trend**	**no trend**	**increase**	**no trend**
avg. annual change		**-1.1%**	**-1.3%**			**2.0%**	
(range: lower limit		(-1.7%)	(-1.8%)			(0.9%)	
upper limit)		(-0.3%)	(-0.7%)			(3.5%)	
total change		**-37%**	**-40%**			**123%**	
(range: lower limit		(-49%)	(-51%)			(45%)	
upper limit)		(-10%)	(-24%)			(296%)	
(p-value)		0.01	0.00			0.01	
1995 - 2009 trend	**no trend**	**no trend**	**no trend**	**no trend**	**no trend**	**no trend**	**decrease**
avg. annual change							**-0.04**
(range: lower limit							(-0.06)
upper limit)							(-0.02)
total change							**-0.63**
(range: lower limit							(-0.90)
upper limit)							(-0.30)
(p-value)							0.00

(A designation of "no trend" means that a statistically significant trend has not been found; this may simply be the result of insufficient data.)
(Ranges for annual and total changes are 90% confidence intervals.)

Water clarity trends at Citizen Monitoring sites

Little Fork HUC 09030005	Streams	Lakes
number of sites w/ increasing trend	0	4
number of sites w/ decreasing trend	0	3
number of sites w/ no trend	1	6

Figure 27. Aquatic life use support in the Little Fork River Watershed

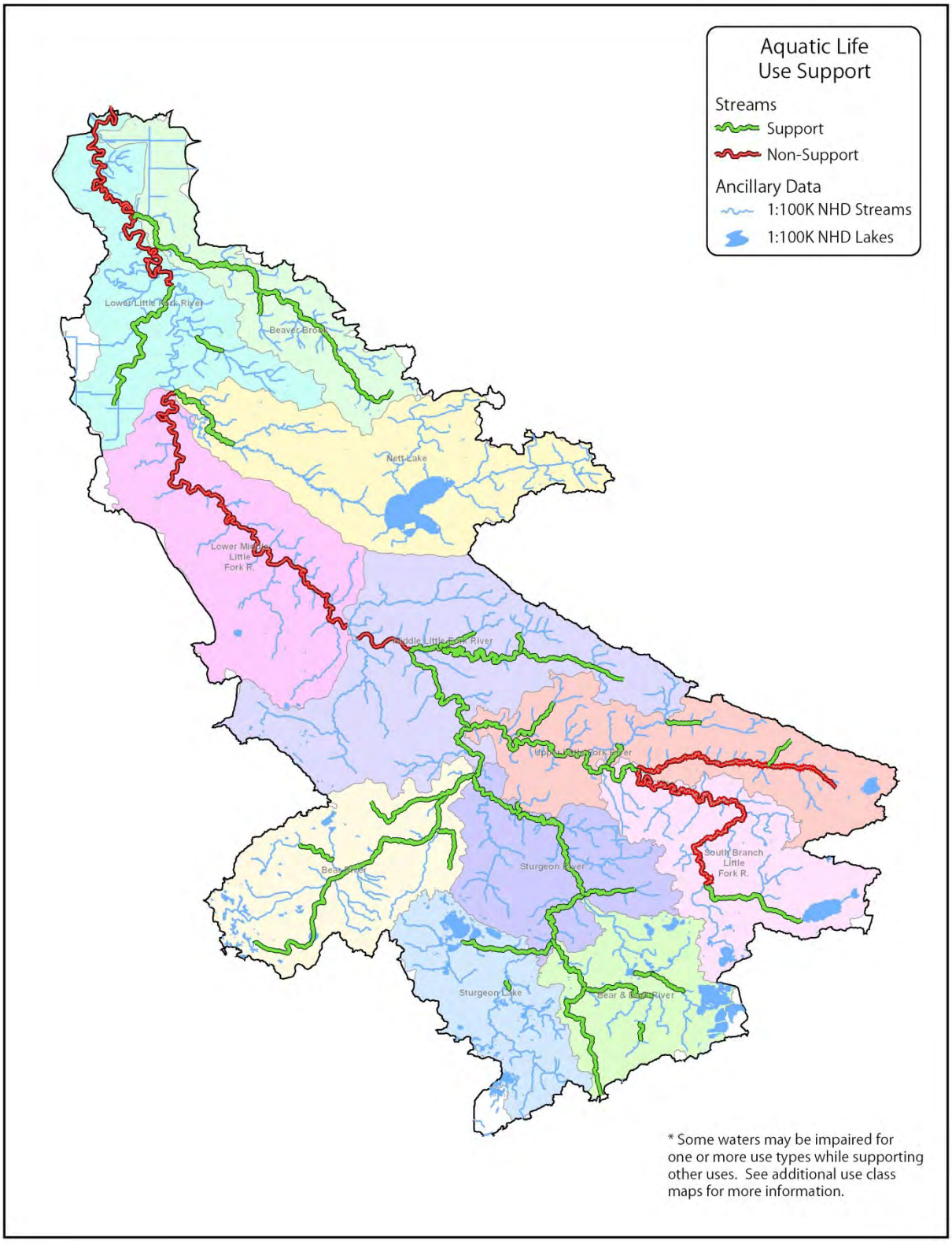


Figure 28. Aquatic recreation use support in the Little Fork River Watershed

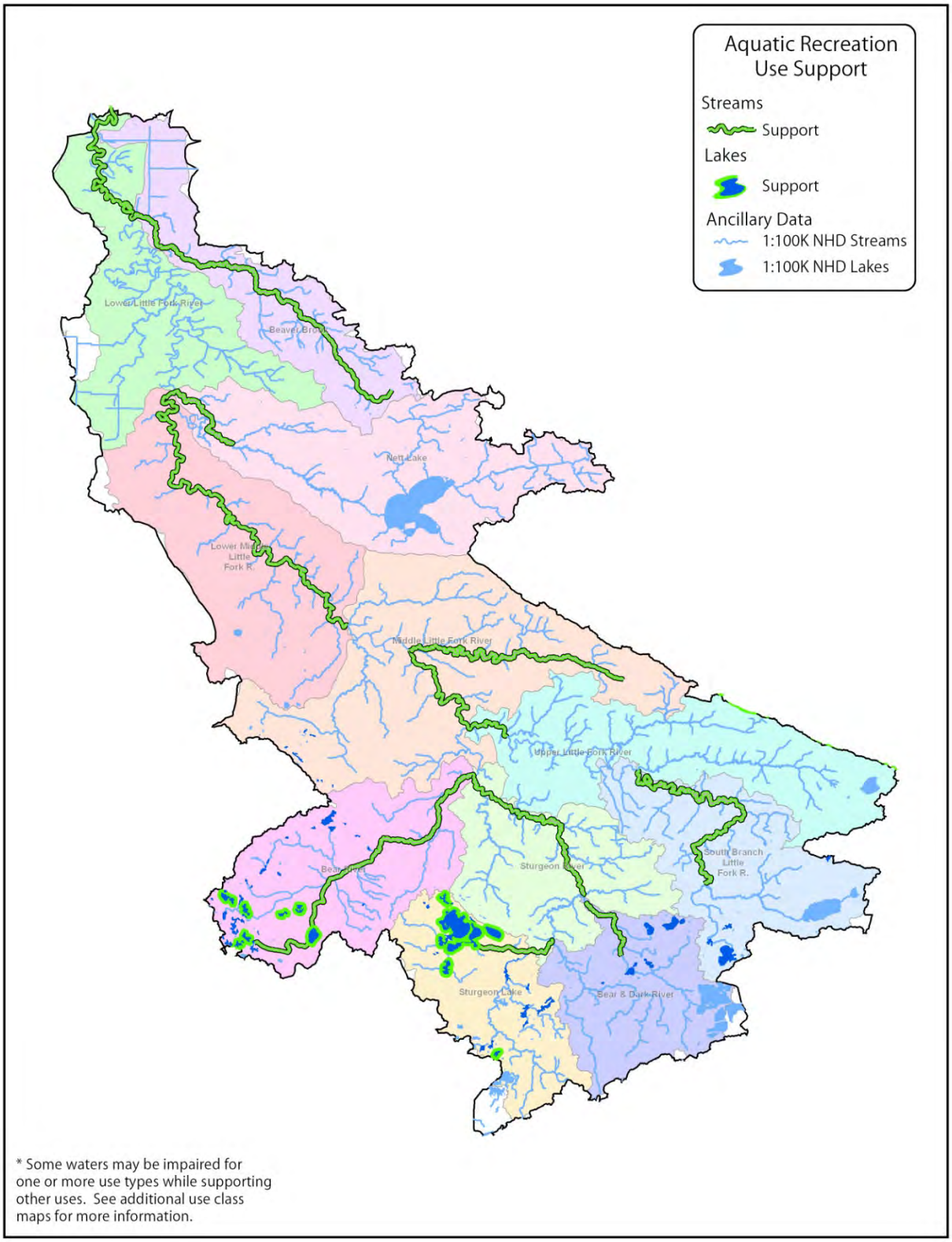


Figure 29. Aquatic consumption use support in the Little Fork River Watershed

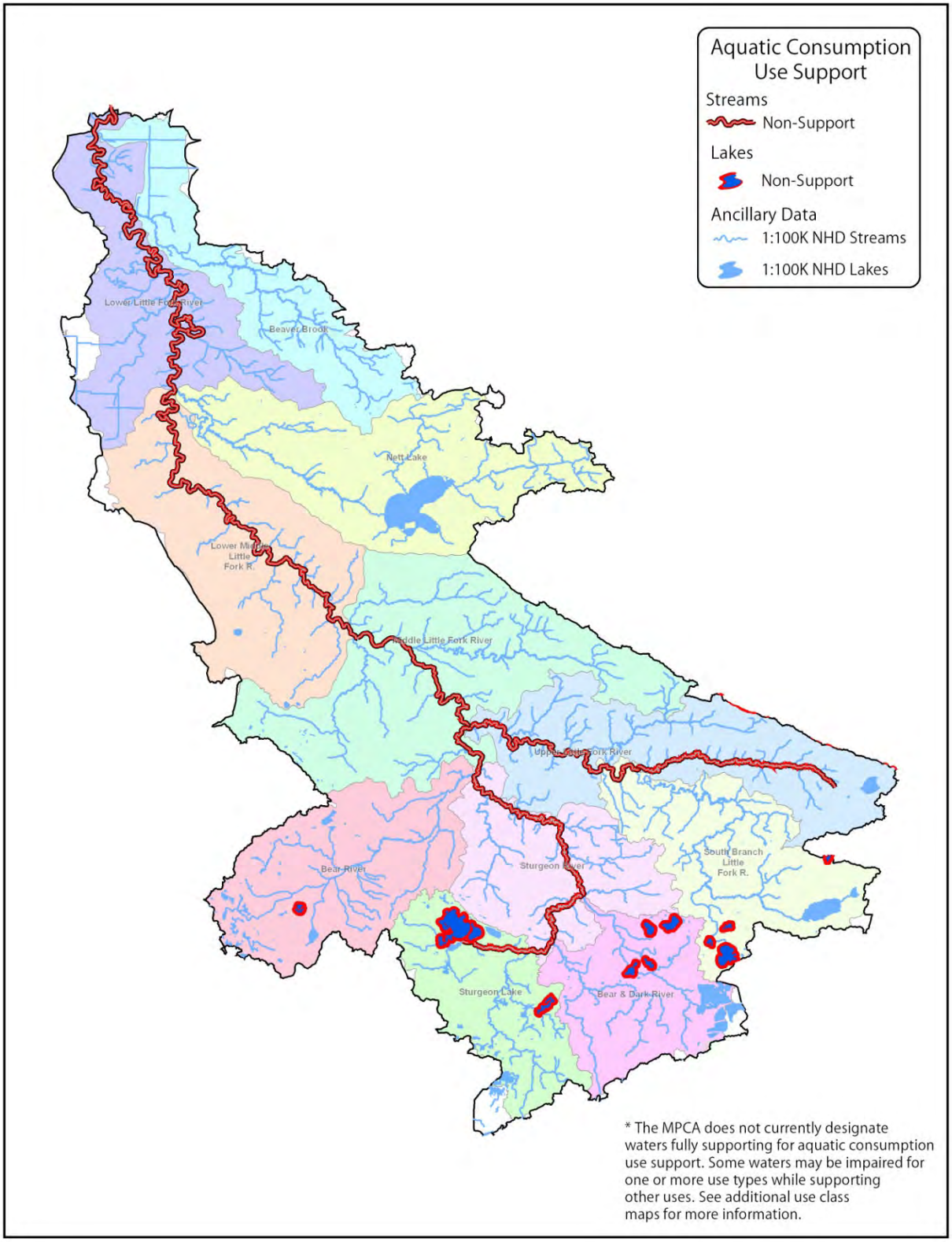


Figure 30. Impaired waters by designated use in the Little Fork River Watershed

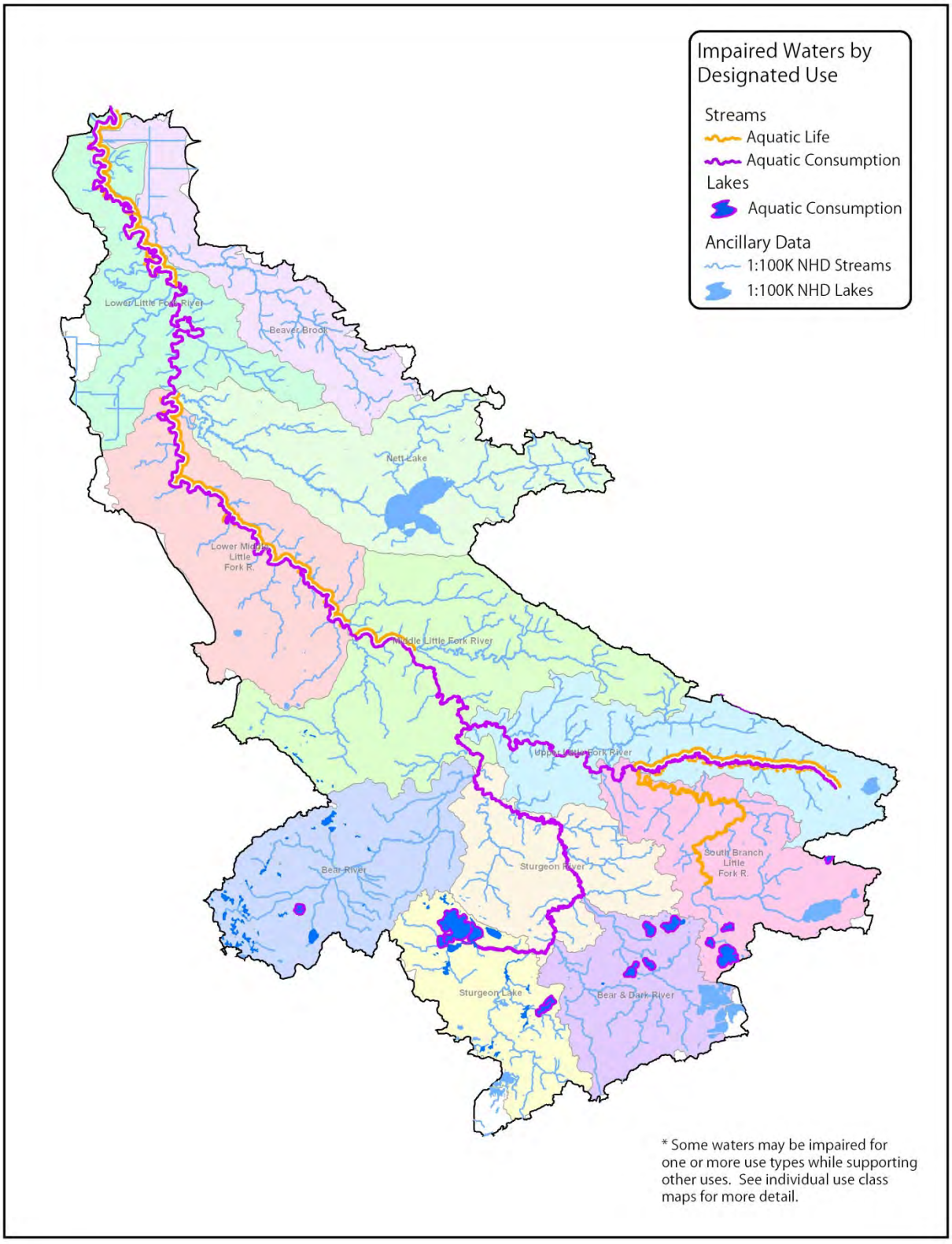
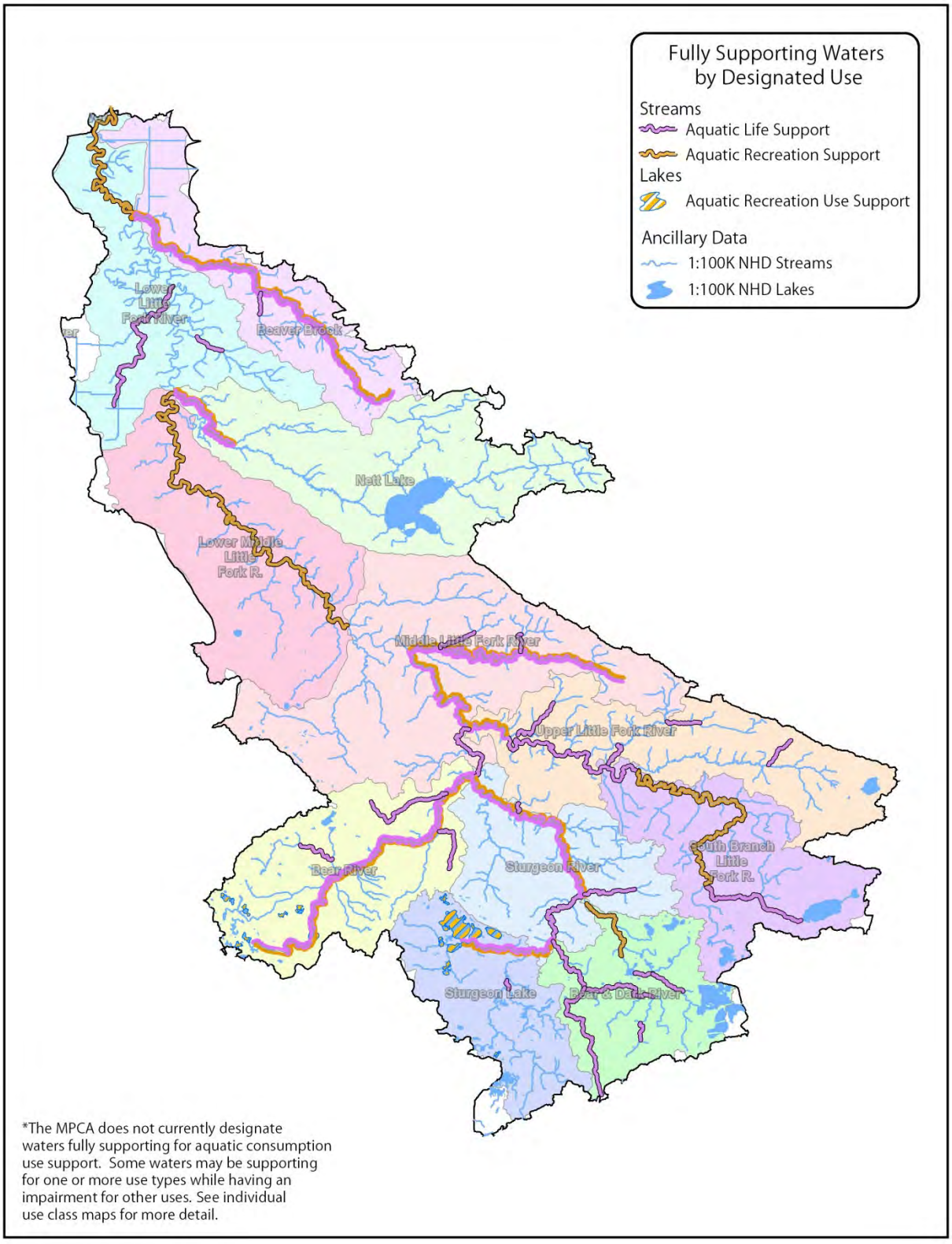


Figure 31. Fully supporting waters by designated use in the Little Fork River Watershed



VIII. Summaries and Recommendations

While the Little Fork River Watershed is looked at as one of Minnesota's most highly valued watersheds, many miles of the Little Fork River are not meeting the state's turbidity standard. The high volumes of suspended sediment and nutrients found in the Little Fork River negatively impact its aesthetic and recreational value as well as that of the adjoining downstream waters. The high sediment loads may also affect the aquatic life in the downstream waters although the fish and invertebrate indicators strongly suggest that these aquatic communities in the Little Fork Watershed are generally in very good condition. In order to bring turbidity values back into compliance, considerable measures must be taken on a watershed wide scale to better define critical areas contributing to the impairment.

A watershed wide TMDL is scheduled to begin in 2012 aimed at addressing the turbidity impairment. Since nearly all sources of suspended sediment is from non-point source pollution, the TMDL will encompass the entire river and select tributaries. Several segments of the Little Fork River have already been identified as having unstable or incised stream banks, with restricted access to the floodplain. Certain tributaries have also been noted to possess unstable banks and destabilized stream beds. Flint Creek is a tributary of particular concern as high levels of turbidity have been observed year round. Summaries and analyses of the Little Fork River's geomorphology, hydrology, channel stability, including hypotheses on potential impacts and recovery from historical logging can be found in Anderson, et. al., 2006, and Gran, et. al., 2007.

The aquatic life indicators used for assessment in the Little Fork River Watershed show that all assessed streams support healthy and diverse aquatic communities, with the exception of the Rice River. Protection strategies need to be developed and implemented in order to maintain these areas of high biological integrity. Although the fish and macroinvertebrate communities sampled in the Little Fork River have shown to be quite resilient to the excess levels of turbidity, there are concerns that high turbidity may have a detrimental effect on aquatic life in downstream receiving waters. The TMDL should also incorporate additional monitoring along the Rainy River, downstream of its confluence with the Little Fork River, to explain potential downstream effects.

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Appendix 1. Water Chemistry Parameter Definitions

Dissolved oxygen (DO) - Oxygen dissolved in water required by aquatic life for metabolism. Dissolved oxygen enters into water from the atmosphere by diffusion and from algae and aquatic plants when they photosynthesize. Dissolved oxygen is removed from the water when organisms metabolize or breathe. Low DO often occurs when organic matter or nutrient inputs are high, and light inputs are low.

Escherichia coli (E. coli) - A type of fecal coliform bacteria that comes from human and animal waste. E. coli levels aid in the determination of whether or not fresh water is safe for recreation. Disease-causing bacteria, viruses and protozoans may be present in water that has elevated levels of E. coli.

Nitrate plus Nitrite – Nitrogen - Nitrate and nitrite-nitrogen are inorganic forms of nitrogen present within the environment that are formed through the oxidation of ammonia-nitrogen by nitrifying bacteria (nitrification). Ammonia-nitrogen is found in fertilizers, septic systems and animal waste. Once converted from ammonia-nitrogen to nitrate and nitrite-nitrogen, these species can stimulate excessive levels of algae in streams. Because nitrate and nitrite-nitrogen are water soluble, transport to surface waters is enhanced through agricultural drainage. The ability of nitrite-nitrogen to be readily converted to nitrate-nitrogen is the basis for the combined laboratory analysis of nitrate plus nitrite-nitrogen (nitrate-N), with nitrite-nitrogen typically making up a small proportion of the combined total concentration. These and other forms of nitrogen exist naturally in aquatic environments; however concentrations can vary drastically depending on season, biological activity, and anthropogenic inputs.

Dissolved Orthophosphate - Dissolved Orthophosphate (DOP) is a water soluble form of phosphorus that is readily available to algae (bio-available) (MPCA and MSUM 2009). While orthophosphates occur naturally in the environment, river and stream concentrations may become elevated with additional inputs from waste water treatment plants, noncompliant septic systems, and fertilizers in urban and agricultural runoff.

pH - A measure of the level of acidity in water. Rainfall is naturally acidic, but fossil fuel combustion has made rain more acid. The acidity of rainfall is often reduced by other elements in the soil. As such, water running into streams is often neutralized to a level acceptable for most aquatic life. Only when neutralizing elements in soils are depleted, or if rain enters streams directly, does stream acidity increase.

Specific Conductance - The amount of ionic material dissolved in water. Specific conductance is influenced by the conductivity of rainwater, evaporation and by road salt and fertilizer application.

Temperature - Water temperature in streams varies over the course of the day similar to diurnal air temperature variation. Daily maximum temperature is typically several hours after noon, and the minimum is near sunrise. Water temperature also varies by season as doe's air temperature.

Total Kjehldahl nitrogen (TKN) - The combination of organically bound nitrogen and ammonia in wastewater. TKN is usually much higher in untreated waste samples then in effluent samples.

Total Phosphorus (TP) - Nitrogen (N), phosphorus (P), and potassium (K) are essential macronutrients and are required for growth by all animals and plants. Lack of sufficient nutrient levels in surface water often restricts the growth of aquatic plant species (University of Missouri Extension 1999). In freshwaters such as lakes and streams, phosphorus is typically the nutrient limiting growth; increasing the amount of phosphorus entering a stream or lake will increase the growth of aquatic plants and other organisms. Although phosphorus is a necessary nutrient, excessive levels over-stimulate aquatic growth in lakes and streams resulting in reduced water quality. The progressive deterioration of water quality from overstimulation of nutrients is called eutrophication where, as nutrient concentrations increase,

the surface water quality is degraded (University of Missouri Extension 1999). Elevated levels of phosphorus in rivers and streams can result in: increased algae growth, reduced water clarity, reduced oxygen in the water, fish kills, altered fisheries, and toxins from cyanobacteria (blue green algae) which can affect human and animal health (University of Missouri Extension 1999). In “non-point” source dominated watersheds, total phosphorus (TP) concentrations are strongly correlated with stream flow. During years of above average precipitation, TP loads are generally highest.

Total Suspended Solids (TSS) – Water clarity refers to the transparency or clearness of water. Turbidity is a measure of the lack of transparency or "cloudiness" of water due to the presence of suspended and colloidal materials such as clay, silt, finely divided organic and inorganic matter, and plankton or other microscopic organisms. By definition, turbidity is caused primarily by suspension of particles that are smaller than one micron in diameter in the water column.

Analysis has shown a strong correlation to exist between the measures of TSS and turbidity. The greater the level of TSS, the murkier the water appears and the higher the measured turbidity. High turbidity results in reduced light penetration that harms beneficial aquatic species and favors undesirable algae species. An overabundance of algae can lead to increases in turbidity, further compounding the problem. Periods of high turbidity often occur when heavy rains fall on unprotected soils. Upon impact, raindrops dislodge soil particles and overland flow transports fine particles of silt and clay into rivers and streams (MPCA and MSUM 2009).

Total Suspended Volatile Soilds (TSVS) - Volatile solids are solids lost during ignition (heating to 500 degrees C.) They provide an approximation of the amount of organic matter that was present in the water sample. ‘‘Fixed solids’’ is the term applied to the residue of total, suspended, or dissolved solids after heating to dryness for a specified time at a specified temperature. The weight loss on ignition is called ‘‘volatile solids.’’

Unnionized Ammonia (NH3) - Ammonia is present in aquatic systems mainly as the dissociated ion $NH4^{+}$, which is rapidly taken up by phytoplankton and other aquatic plants for growth. Ammonia is an excretory product of aquatic animals. As it comes in contact with water, ammonia dissociates into $NH4^{+}$ ions and ^{-}OH ions (ammonium hydroxide). If pH levels increase, the ammonium hydroxide becomes toxic to both plants and animals.

Appendix 2. Intensive Water Chemistry Monitoring Stations in the Little Fork River Watershed

Biological Station ID	STORET ID	Waterbody Name	Location	11-digit HUC
08RN005	S004-873	Little Fork River	At CR 495, 6 mi. SE of Greaney	9030005010
08RN002	S000-877	Rice River	At CR 25, 3 mi. SW of Cook	9030005020
99NF120	S004-874	Dark River	At CR 688, 5 mi. S of Sturgeon	9030005030
08RN001	S004-870	Sturgeon River	At CR 766, 3 mi. E of Side Lake	9030005040
08RN003	S004-871	Sturgeon River	At CR 107, 4 mi. NE of Bear River	9030005050
08RN004	S004-872	Bear River	At CR 5, 3 mi. NE of Bear River	9030005060
08RN006	S004-920	Little Fork River	At CR 75, 2 mi. SE of Rauch	9030005070
08RN054	S004-814	Willow River	At CR 75, 0.75 mi. S of Greaney	9030005070
08RN007	S002-552	Little Fork River	At Hwy 65, 13 mi. SE of Littlefork	9030005080
08RN008	S003-998	Nett Lake River	At CR 8, 13 mi. SE of Littlefork	9030005090
05RN037	S003-999	Beaver Brook	At Hwy 217, 1.5 mi. E of Littlefork	9030005100
None	S000-179	Little Fork River	At Hwy 11, 0.5 mi. W of Pelland	9030005110

Appendix 3. AUID Table of Results by Parameter and Beneficial Use

					USES			BIOLOGICAL CRITERIA		WATER QUALITY STANDARDS												ECOREGION EXPECTATIONS		
National Hydrography Dataset (NHD) Assessment Segment AUID	Stream Segment Name	Segment Description	NHD Length (Miles)	Use Class	Aquatic Life	Aquatic Recreation	Aquatic Consumption	Fish	Macroinvertebrates	Arsenic	Cadmium	Copper	Lead	Nickel	Zinc	Chloride	Escherichia coli	pH	Turbidity	Un-ionzed ammonia	Dissolved Oxygen	Oxygen Demand (BOD)	Nitrite/Nitrate	Total Phosphorous
HUC 11: 09030005010 (Upper Little Fork River)																								
09030005-613	Flint Creek	Unnamed cr to Unnamed cr	4.14	2B	FS	NA	NA	+	IF															
09030005-588	Flint Creek	Unnamed cr to Unnamed cr	3.38	2B	FS	NA	NA	+	+									+						
09030005-518	Beaver Creek	Unnamed cr to T62 R20W S6	5.07	2C	FS	NA	NA	+	+															
09030005-586	Unnamed creek	Headwaters to Little Fork R	2.7	2B	FS	NA	NA	+	+															
09030005-665	Unnamed creek	Unnamed cr to Sturgeon R	0.93	2B	FS	NA	NA	+	+															
09030005-502	Little Fork River	Headwaters to Rice R	25.67	2B	NS	NA	NS	+	+									IF	-		IF			-
09030005-504	Little Fork River	Beaver Cr to Sturgeon R	4.79	2B	FS	FS	NS	+	+								+	+	+	+				-
HUC 11: 09030005020 (South Branch Little Fork River)																								
09030005-666	Unnamed creek	Unnamed cr to Rice R	1.91	2B	NA	NA	NA	NA	NA															
09030005-667	Alango Creek	Unnamed ditch to Little Fork Cr	4.84	2B	NA	NA	NA	NA	NA															
09030005-530	Johnson Creek	Little Sand Lk to T60 R18W S6	6.77	2A	NA	NA	NA	NA	NA															
09030005-515	Rice River	Headwaters to Johnson Cr	13.62	2B	FS	NA	NA	+	+															
09030005-517	Rice River	Johnson Cr to Little Fork R	35.04	2B	NS	FS	NA	-	+								+	+	+	+	IF		+	-
09030005-503	Little Fork River	Rice R to Beaver Cr	17.5	2B	FS	NA	NS	+	+									+						
HUC 11: 09030005030 (Bear & Dark River)																								
09030005-597	McNiven Creek	Unnamed cr to Unnamed cr	1.68	2B	FS	NA	NA	+	+															
09030005-633	Boriin Creek	Headwaters to E Br Sturgeon R	11.91	2B	FS	NA	NA	+	+															
09030005-596	Sturgeon River, East Branch	McNiven Cr to Slow Cr	1.45	2B	FS	NA	NA	+	+															
09030005-528	Sturgeon River, East Branch	Slow Cr to Sturgeon R	13.33	2B	FS	NA	NA	+	+															
09030005-591	Dark River	Unnamed cr to Dark Lk	1.86	2B	FS	NA	NA	+	+															
09030005-592	Dark River	Unnamed cr to Unnamed cr	3.6	2B	FS	NA	NA	+	+										+					
09030005-525	Dark River	T60 R19W S30 to T60 R20W S10	7.91	2A	IF	FS	NA	NA	NA															

					USES			BIOLOGICAL CRITERIA		WATER QUALITY STANDARDS													ECOREGION EXPECTATIONS		
National Hydrography Dataset (NHD) Assessment Segment AUID	Stream Segment Name	Segment Description	NHD Length (Miles)	Use Class	Aquatic Life	Aquatic Recreation	Aquatic Consumption	Fish	Macroinvertebrates	Arsenic	Cadmium	Copper	Lead	Nickel	Zinc	Chloride	Escherichia coli	pH	Turbidity	Un-ionzed ammonia	Dissolved Oxygen	Oxygen Demand (BOD)	Nitrite/Nitrate	Total Phosphorous
HUC 11: 09030005040 (Sturgeon Lake)																								
09030005-599	Shannon River	Unnamed cr to Unnamed cr	16	2B	NA	NA	NA	NA	NA															
09030005-603	Shannon River	Unnamed cr to Shannon Lk	1.07	2B	FS	NA	NA	+	+															
09030005-527	Sturgeon River	Headwaters to E Br Sturgeon R	11.99	2B	FS	FS	NS	+	+								+	+	+	+	IF		+	+
HUC 11: 09030005050 (Sturgeon River)																								
09030005-550	Sand Creek	Headwaters to Sturgeon R	18.81	2A	NA	NA	NA	NA	NA															
09030005-593	Gilmore Creek	Unnamed cr to Unnamed cr	0.62	2B	NA	NA	NA	NA	NA															
09030005-594	Gilmore Creek	Unnamed cr to Unnamed cr	3.66	2B	NA	NA	NA	NA	NA															
09030005-627	Paavola Creek	Unnamed cr to Sturgeon R	5.02	2B	FS	NA	NA	+	+															
09030005-523	Sturgeon River	E Br Sturgeon R to Dark R	9.88	2B	FS	NA	NS	+	+									+						
09030005-524	Sturgeon River	Dark R to Bear R	22.02	2B	FS	FS	NS	+	+								+	+	+	+	IF		+	+
HUC 11: 09030005060 (Bear River)																								
09030005-568	Venning Creek	T61R23W S35, east line to Bear R	0.79	2A	NA	NA	NA	NA	NA															
09030005-558	Stony Brook	T60 R22W S4 to Bear River Cr	8.32	2A	NA	NA	NA	NA	NA															
09030005-662	Unnamed creek	Unnamed cr to Unnamed cr	3.68	2B	FS	NA	NA	+	+															
09030005-663	Unnamed creek	Unnamed cr to Bear R	9.31	2B	FS	NA	NA	+	+															
09030005-664	Bear River Creek	Headwaters to Stony Bk	4.34	2B	FS	NA	NA	+	+															
09030005-513	Bear River	Headwaters to Sturgeon R	39.67	2B	FS	FS	NA	+	+								+	+	+	+	IF		+	+

					USES			BIOLOGICAL CRITERIA		WATER QUALITY STANDARDS													ECOREGION EXPECTATIONS		
National Hydrography Dataset (NHD) Assessment Segment AUID	Stream Segment Name	Segment Description	NHD Length (Miles)	Use Class	Aquatic Life	Aquatic Recreation	Aquatic Consumption	Fish	Macroinvertebrates	Arsenic	Cadmium	Copper	Lead	Nickel	Zinc	Chloride	Escherichia coli	pH	Turbidity	Un-ionzed ammonia	Dissolved Oxygen	Oxygen Demand (BOD)	Nitrite/Nitrate	Total Phosphorous
HUC 11: 09030005070 (Middle Little Fork River)																								
09030005-520	Prairie Creek	Headwaters to Little Fork R	19.1	2B	FS	NA	NA	+	+															
09030005-562	Trib. to Valley River	T63 R22W S28 to Unnamed Cr	3.15	2A	NA	NA	NA	NA	NA															
09030005-512	Valley River	T62 R23W S4 to Little Fork R	19.54	2A	NA	NA	NA	NA	NA															
09030005-587	Unnamed creek	Unnamed cr to Willow R	3.42	2B	FS	NA	NA	+	+															
09030005-668	Unnamed creek	Unnamed cr to Willow R	1.89	2B	FS	NA	NA	+	+															
09030005-514	Sturgeon River	Bear R to Little Fork R	6.25	2B	FS	NA	NS	+	+															
09030005-519	Willow River	Headwaters to Little Fork R	33.22	2B	FS	FS	NA	+	+								+	+	IF	+	IF		+	+
09030005-505	Little Fork River	Sturgeon R to Willow R	11.86	2B	FS	FS	NS	+	+								+	+		+	IF		+	-
09030005-506	Little Fork River	Willow R to Valley R	5.15	2B	NS	NA	NS	+	+									+	-					-
HUC 11: 09030005080 (Lower Middle Little Fork River)																								
09030005-508	Little Fork River	Prairie Cr to Nett Lake R	40.29	2B	NS	FS	NS	+	+								+	+	-	+	IF		+	+
HUC 11: 09030005090 (Nett Lake)																								
09030005-671	Unnamed creek	Unnamed cr to Unnamed cr	4.02	2B	FS	NA	NA	+	+															
09030005-673	Nett Lake River	Headwaters to Unnamed cr	25.81	2B	FS	NA	NA	+	+															
09030005-672	Nett Lake River	Unnamed cr to Little Fork R	14.17	2B	FS	FS	NA	+	+								IF	+	-	+	IF		+	+
HUC 11: 09030005100 (Beaver Brook)																								
09030005-669	Unnamed creek	Unnamed cr to Beaver Bk	1.7	2B	FS	NA	NA	+	IF															
09030005-522	Beaver Brook	Headwaters to Little Fork R	44.61	2B	FS	FS	NA	+	+								+	+	+	+	IF		+	-
HUC 11: 09030005110 (Lower Little Fork River)																								
09030005-511	Cross River	Headwaters to Little Fork R	20.04	2B	FS	NA	NA	+	+															
09030005-609	Ester Brook	Unnamed cr to Little Fork R	3.6	2B	FS	NA	NA	+	+															
09030005-510	Little Fork River	Cross R to Beaver Bk	14.31	2B	NS	NA	NS	+	+							+		+	-	+	IF		-	-
09030005-501	Little Fork River	Beaver Bk to Rainy R	19.15	2B	NS	FS	NS	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	-	-

Appendix 4. Minnesota Statewide IBI Thresholds and Confidence Limits

Class#	Class Name	Threshold	Confidence Limit	Upper	Lower
Fish					
1	Southern Rivers	39	±11	50	28
2	Southern Streams	45	±9	54	36
3	Southern Headwaters	51	±7	58	44
4	Northern Rivers	35	±9	44	26
5	Northern Streams	50	±9	59	41
6	Northern Headwaters	40	±16	56	24
7	Low Gradient	40	±10	50	30
Macroinvertebrates					
1	Northern Forest Rivers	51.3	±10.8	62.1	40.5
2	Prairie Forest Rivers	30.7	±10.8	41.5	19.9
3	Northern Forest Streams RR	50.3	±12.6	62.9	37.7
4	Northern Forest Streams GP	52.4	±13.6	66	38.8
5	Southern Streams RR	35.9	±12.6	48.5	23.3
6	Southern Forest Streams GP	46.8	±13.6	60.4	33.2
7	Prairie Streams GP	38.3	±13.6	51.9	24.7

Appendix 5. Biological Monitoring Results – Fish IBI Scores

National Hydrography Dataset (NHD) Assessment Segment AUID	Biological Station ID	Stream Segment Name	Drainage Area Mi²	Fish Class	Threshold	F-IBI	Visit Date
HUC-11: 09030005010 (Upper Little Fork River)							
09030005-502	08RN050	Little Fork River	41.64	7	40	70	25-Jun-08
09030005-518	08RN017	Beaver Creek	15.69	6	40	47	18-Jun-08
09030005-588	08RN051	Flint Creek	46.90	6	40	57	25-Jun-08
09030005-588	08RN051	Flint Creek	46.90	6	40	67	06-Aug-08
09030005-574	98NF113	Flint Creek	47.99	7	40	55	07-Jul-98
09030005-504	05RN089	Little Fork River	322.53	5	50	72	09-Sep-05
09030005-504	08RN005	Little Fork River	325.72	5	50	71	21-Aug-08
09030005-586	05RN174	Unnamed creek	4.44	7	40	64	21-Jun-05
09030005-502	05RN189	Little Fork River	52.87	5	50	56	01-Aug-06
09030005-613	08RN016	Flint Creek	18.87	7	40	63	17-Jun-08
09030005-502	08RN015	Little Fork River	69.45	5	50	51	26-Aug-08
09030005-665	08RN040	Unnamed creek	11.58	6	40	61	07-Jul-08
09030005-502	05RN088	Little Fork River	62.45	5	50	54	06-Jul-05
HUC-11: 09030005020 (South Branch Little Fork River)							
09030005-517	05RN010	Rice River	120.23	5	50	43	16-Aug-05
09030005-517	08RN002	Rice River	142.88	5	50	55	26-Aug-08
09030005-515	08RN012	Rice River	52.14	5	50	57	24-Jun-08
09030005-515	08RN012	Rice River	52.14	5	50	53	07-Aug-08
09030005-515	08RN039	Rice River	22.26	7	40	79	24-Jun-08
09030005-515	05RN068	Rice River	48.69	6	40	90	28-Jun-05
09030005-517	08RN036	Rice River	107.56	5	50	73	25-Aug-08
09030005-503	05RN018	Little Fork River	215.53	5	50	64	30-Aug-05

HUC-11: 09030005030 (Bear & Dark River)							
09030005-596	05RN034	Sturgeon River, East Branch	18.53	7	40	84	14-Jul-05
09030005-528	08RN034	Sturgeon River, East Branch	28.98	7	40	81	23-Jun-08
09030005-528	08RN033	Sturgeon River, East Branch	54.74	5	50	60	16-Jun-08
09030005-591	08RN045	Dark River	35.60	6	40	63	30-Jun-08
09030005-592	05RN079	Dark River	23.51	7	40	45	22-Aug-05
09030005-597	05RN061	McNiven Creek	6.95	6	40	75	20-Jun-05
09030005-597	05RN061	McNiven Creek	6.95	6	40	92	13-Jul-05
09030005-633	08RN010	Boriin Creek	14.21	6	40	83	07-Jul-08
09030005-592	05RN079	Dark River	23.51	7	40	47	29-Jun-05
HUC-11: 09030005040 (Sturgeon Lake)							
09030005-527	08RN001	Sturgeon River	121.15	5	50	60	18-Aug-08
09030005-603	08RN044	Shannon River	56.52	5	50	71	19-Jun-08
HUC-11: 09030005050 (Sturgeon River)							
09030005-524	08RN003	Sturgeon River	376.89	5	50	88	20-Aug-08
09030005-524	08RN035	Sturgeon River	319.02	5	50	65	31-Jul-08
09030005-627	08RN029	Paavola Creek	13.56	7	40	79	18-Jun-08
09030005-524	05RN066	Sturgeon River	337.24	5	50	86	22-Aug-05
09030005-524	05RN066	Sturgeon River	337.24	5	50	81	27-Sep-05
09030005-524	05RN059	Sturgeon River	298.45	5	50	74	09-Aug-05
09030005-527	05RN020	Sturgeon River	121.77	5	50	74	13-Jul-05
09030005-523	08RN048	Sturgeon River	205.00	5	50	65	28-Jul-08

HUC-11: 09030005060 (Bear River)							
09030005-513	08RN046	Bear River	119.94	5	50	69	16-Jun-08
09030005-513	08RN004	Bear River	165.01	5	50	68	06-Aug-08
09030005-513	05RN094	Bear River	24.98	7	40	45	12-Jul-05
09030005-513	08RN022	Bear River	27.91	6	40	89	18-Jun-08
09030005-513	08RN004	Bear River	165.01	5	50	64	25-Jun-08
09030005-664	08RN043	Bear River Creek	8.27	6	40	74	19-Jun-08
09030005-664	08RN043	Bear River Creek	8.27	6	40	92	09-Jul-08
09030005-662	08RN023	Unnamed creek	13.48	6	40	90	18-Jun-08
09030005-663	08RN024	Unnamed creek	18.11	7	40	79	09-Jul-08
HUC-11: 09030005070 (Middle Little Fork River)							
09030005-520	08RN047	Prairie Creek	24.15	7	40	65	06-Aug-08
09030005-587	08RN055	Unnamed creek	7.04	6	40	87	08-Jul-08
09030005-519	05RN045	Willow River	24.26	7	40	78	07-Jul-05
09030005-519	08RN054	Willow River	49.31	6	40	70	19-Aug-08
09030005-519	08RN018	Willow River	15.30	7	40	64	27-Aug-08
09030005-668	08RN019	Unnamed creek	12.77	6	40	72	18-Jun-08
09030005-514	08RN052	Sturgeon River	572.35	4	35	79	20-Aug-08
09030005-587	05RN180	Unnamed creek	7.61	6	40	80	15-Aug-05
09030005-505	08RN006	Little Fork River	932.15	4	35	83	29-Jul-08
09030005-506	05RN052	Little Fork River	1016.86	4	35	77	23-Aug-05
HUC-11: 09030005080 (Lower Middle Little Fork River)							
09030005-508	08RN007	Little Fork River	1351.79	4	35	84	19-Aug-08
09030005-508	05RN031	Little Fork River	1300.43	4	35	66	31-Aug-05
09030005-508	05RN001	Little Fork River	1138.97	4	35	68	23-Aug-05
09030005-508	05RN044	Little Fork River	1337.38	4	35	63	31-Aug-05

HUC-11: 09030005090 (Nett Lake)							
09030005-671	08RN025	Unnamed creek	28.06	7	40	76	05-Aug-08
09030005-673	05RN107	Nett Lake River	162.80	5	50	55	05-Jul-05
09030005-673	05RN107	Nett Lake River	162.80	5	50	51	08-Sep-08
09030005-672	08RN008	Nett Lake River	206.22	5	50	66	05-Aug-08
HUC-11: 09030005100 (Beaver Brook)							
09030005-522	05RN037	Beaver Brook	95.81	5	50	75	01-Aug-05
09030005-522	05RN037	Beaver Brook	95.81	5	50	59	30-Jul-08
09030005-522	05RN026	Beaver Brook	74.52	5	50	51	02-Aug-05
09030005-522	08RN038	Beaver Brook	41.22	6	40	81	26-Jun-08
09030005-669	08RN026	Unnamed creek	9.41	7	40	87	08-Jul-08
09030005-522	05RN171	Beaver Brook	41.59	6	40	65	03-Aug-05
HUC-11: 09030005110 (Lower Little Fork River)							
09030005-510	05RN086	Little Fork River	1707.67	4	35	82	30-Aug-05
09030005-510	08RN049	Little Fork River	1704.10	4	35	71	30-Jul-08
09030005-511	08RN028	Cross River	44.60	6	40	70	26-Jun-08
09030005-501	08RN053	Little Fork River	1872.76	4	35	88	16-Sep-08
09030005-609	08RN027	Ester Brook	27.67	6	40	89	05-Aug-08

Appendix 6. Biological Monitoring Results–Macroinvertebrate IBI Scores

National Hydrography Dataset (NHD) Assessment Segment (AUID)	Biological Station ID	Stream Segment Name	Drainage Area ($Mi.^2$)	Invert Class	Threshold	M-IBI	Visit Date
HUC - 11: 09030005010 (Upper Little Fork River)							
09030005-502	05RN088	Little Fork River	62.5	4	52.4	62.7	09-Aug-05
09030005-502	05RN189	Little Fork River	52.9	4	52.4	76.4	16-Aug-06
09030005-502	08RN015	Little Fork River	69.4	4	52.4	52.5	30-Sep-08
09030005-502	08RN050	Little Fork River	41.6	4	52.4	82.1	06-Aug-08
09030005-504	05RN089	Little Fork River	322.5	4	52.4	81.9	10-Aug-05
09030005-504	08RN005	Little Fork River	325.7	4	52.4	62.7	30-Sep-08
09030005-504	08RN005	Little Fork River	325.7	4	52.4	71.9	30-Sep-08
09030005-518	08RN017	Beaver Creek	15.7	4	52.4	71.0	04-Aug-08
09030005-588	08RN051	Flint Creek	46.9	4	52.4	62.4	25-Aug-08
09030005-613	08RN016	Flint Creek	18.9	4	52.4	41.6	07-Aug-08
09030005-665	08RN040	Trib. to Sturgeon River	11.6	4	52.4	54.0	05-Aug-08
HUC-11: 09030005020 (South Branch Little Fork River)							
09030005-503	05RN018	Little Fork River	215.5	3	50.3	65.0	16-Aug-05
09030005-515	05RN068	Rice River	48.7	3	50.3	72.8	15-Aug-05
09030005-515	08RN012	Rice River	52.1	4	52.4	89.4	26-Aug-08
09030005-515	08RN039	Rice River	22.3	4	52.4	59.5	07-Aug-08
09030005-515	08RN039	Rice River	22.3	4	52.4	49.7	07-Aug-08
09030005-517	05RN010	Rice River	120.2	4	52.4	83.0	09-Aug-05
09030005-517	05RN010	Rice River	120.2	4	52.4	82.1	18-Sep-12
09030005-517	08RN002	Rice River	142.9	4	52.4	52.9	30-Sep-08
09030005-517	08RN036	Rice River	107.6	4	52.4	65.3	03-Sep-08
HUC-11: 09030005030 (Bear & Dark River)							
09030005-525	99NF120	Dark River	57.7	11	37	38.4	06-Aug-08
09030005-525	99NF120	Dark River	57.7	8	26	38.4	06-Aug-08
09030005-528	08RN033	Sturgeon River, East Branch	54.7	3	50.3	73.1	05-Aug-08
09030005-528	08RN034	Sturgeon River, East Branch	29.0	4	52.4	42.1	02-Sep-08
09030005-591	08RN045	Dark River	35.6	4	52.4	85.7	05-Aug-08
09030005-592	05RN079	Dark River	23.5	4	52.4	74.3	08-Aug-05
09030005-596	05RN034	Sturgeon River, East Branch	18.5	4	52.4	61.9	08-Aug-05

National Hydrography Dataset (NHD) Assessment Segment (AUID)	Biological Station ID	Stream Segment Name	Drainage Area ($Mi.^2$)	Invert Class	Threshold	M-IBI	Visit Date
09030005-597	05RN061	McNiven Creek	7.0	4	52.4	69.4	08-Aug-05
09030005-633	08RN010	Boriin Creek	14.2	4	52.4	74.5	06-Aug-08
HUC-11: 09030005040 (Sturgeon Lake)							
09030005-603	08RN044	Shannon River	56.5	4	52.4	53.0	02-Sep-08
09030005-603	08RN044	Shannon River	56.5	4	52.4	43.1	02-Sep-08
09030005-603	08RN044	Shannon River	56.5	4	52.4	61.2	06-Aug-08
HUC-11: 09030005050 (Sturgeon River)							
09030005-523	08RN048	Sturgeon River	205.0	4	52.4	87.4	26-Aug-08
09030005-524	05RN059	Sturgeon River	298.5	4	52.4	90.1	23-Aug-05
09030005-524	05RN059	Sturgeon River	298.5	4	52.4	89.7	10-Aug-05
09030005-524	05RN066	Sturgeon River	337.2	4	52.4	75.5	09-Aug-05
09030005-524	08RN003	Sturgeon River	376.9	4	52.4	89.2	03-Sep-08
09030005-524	08RN035	Sturgeon River	319.0	4	52.4	83.9	03-Sep-08
09030005-527	05RN020	Sturgeon River	121.8	3	50.3	86.1	09-Aug-05
09030005-527	08RN001	Sturgeon River	121.2	4	52.4	51.7	02-Sep-08
09030005-550	08RN030	Sand Creek	38.4	11	37	17.5	03-Sep-08
09030005-550	08RN030	Sand Creek	38.4	8	26	17.5	03-Sep-08
09030005-550	08RN030	Sand Creek	38.4	11	37	36.8	03-Sep-08
09030005-550	08RN030	Sand Creek	38.4	8	26	36.8	03-Sep-08
09030005-627	08RN029	Paavola Creek	13.6	4	52.4	46.8	05-Aug-08
HUC-11: 09030005060 (Bear River)							
09030005-513	05RN094	Bear River	25.0	4	52.4	61.8	24-Aug-05
09030005-513	08RN004	Bear River	165.0	4	52.4	84.2	03-Sep-08
09030005-513	08RN022	Bear River	27.9	3	50.3	59.9	07-Aug-08
09030005-513	08RN046	Bear River	119.9	4	52.4	77.8	05-Aug-08
09030005-558	08RN042	Stony Brook	12.0	11	37	25.0	05-Aug-08
09030005-558	08RN042	Stony Brook	12.0	8	26	25.0	05-Aug-08
09030005-568	08RN021	Venning Creek	12.8	11	37	34.8	05-Aug-08
09030005-568	08RN021	Venning Creek	12.8	8	26	34.8	05-Aug-08
09030005-662	08RN023	Trib. to Bear River	13.5	4	52.4	76.0	29-Aug-08
09030005-663	08RN024	Bearskin River	18.1	4	52.4	55.8	05-Aug-08
09030005-664	08RN043	Bear River Creek	8.3	4	52.4	71.0	05-Aug-08

National Hydrography Dataset (NHD) Assessment Segment (AUID)	Biological Station ID	Stream Segment Name	Drainage Area ($Mi.^2$)	Invert Class	Threshold	M-IBI	Visit Date
HUC-11: 09030005070 (Middle Little Fork River)							
09030005-505	08RN006	Little Fork River	932.2	1	43	86.6	28-Aug-08
09030005-506	05RN052	Little Fork River	1016.9	1	43	80.3	16-Aug-05
09030005-512	08RN020	Valley River	68.5	11	37	39.8	28-Aug-08
09030005-512	08RN020	Valley River	68.5	8	26	39.8	28-Aug-08
09030005-512	08RN037	Valley River	20.3	11	37	32.7	05-Aug-08
09030005-512	08RN037	Valley River	20.3	8	26	32.7	05-Aug-08
09030005-514	08RN052	Sturgeon River	572.4	1	43	75.1	03-Sep-08
09030005-519	05RN045	Willow River	24.3	4	52.4	61.0	23-Aug-05
09030005-519	08RN018	Willow River	15.3	4	52.4	33.2	30-Sep-08
09030005-519	08RN054	Willow River	49.3	4	52.4	52.3	30-Sep-08
09030005-520	08RN047	Prairie Creek	24.2	4	52.4	50.9	28-Aug-08
09030005-562	08RN041	Trib. to Vallley River	10.3	11	37	21.2	28-Aug-08
09030005-562	08RN041	Trib. to Vallley River	10.3	8	26	21.2	28-Aug-08
09030005-587	05RN180	Trib. to Willow River	7.6	4	52.4	62.3	23-Aug-05
09030005-587	08RN055	Trib. to Willow River	7.0	4	52.4	56.1	04-Aug-08
09030005-668	08RN019	Trib. to Willow River	12.8	4	52.4	53.5	04-Aug-08
HUC-11: 09030005080 (Lower Middle Little Fork River)							
09030005-508	05RN001	Little Fork River	1139.0	1	43	63.9	18-Aug-05
09030005-508	05RN031	Little Fork River	1300.4	1	43	82.2	30-Aug-05
09030005-508	05RN044	Little Fork River	1337.4	1	43	70.9	17-Aug-05
09030005-508	08RN007	Little Fork River	1351.8	1	43	89.3	04-Sep-08
09030005-508	10EM073	Little Fork River	1316.1	1	43	72.1	23-Sep-10
HUC-11: 09030005090 (Nett Lake)							
09030005-671	08RN025	Trib. to Nett Lake	28.1	4	52.4	61.2	06-Aug-08
09030005-672	08RN008	Nett Lake River	206.2	3	50.3	51.2	06-Aug-08
09030005-673	05RN107	Nett Lake River	162.8	4	52.4	59.2	10-Aug-05
09030005-673	05RN107	Nett Lake River	162.8	4	52.4	41.7	04-Sep-08
09030005-677	10EM153	Unnamed creek	2.1	4	52.4	56.1	16-Sep-10
HUC-11: 09030005100 (Beaver Brook)							
09030005-522	05RN026	Beaver Brook	74.5	4	52.4	37.4	10-Aug-05
09030005-522	05RN026	Beaver Brook	74.5	4	52.4	62.2	11-Aug-05

National Hydrography Dataset (NHD) Assessment Segment (AUID)	Biological Station ID	Stream Segment Name	Drainage Area ($Mi.^2$)	Invert Class	Threshold	M-IBI	Visit Date
09030005-522	05RN037	Beaver Brook	95.8	3	50.3	52.3	10-Aug-05
09030005-522	05RN037	Beaver Brook	95.8	3	50.3	63.9	28-Sep-08
09030005-522	05RN171	Beaver Brook	41.6	4	52.4	82.4	17-Aug-05
09030005-522	08RN038	Beaver Brook	41.2	4	52.4	65.3	06-Aug-08
09030005-669	08RN026	Trib. to Beaver Brook	9.4	4	52.4	35.9	04-Aug-08
HUC-11: 09030005110 (Lower Little Fork River)							
09030005-501	08RN053	Little Fork River	1872.8	1	43	59.7	29-Sep-08
09030005-510	05RN086	Little Fork River	1707.7	1	43	59.8	10-Aug-05
09030005-510	08RN049	Little Fork River	1704.1	1	43	42.6	27-Aug-08
09030005-511	08RN028	Cross River	44.6	3	50.3	58.9	06-Aug-08
09030005-609	08RN027	Ester Brook	27.7	4	52.4	74.3	06-Aug-08

Appendix 7. Good/Fair/Poor Thresholds for Biological Stations on Non-Assessed Channelized AUIDs

Ratings of **Good** for channelized streams are based on Minnesota's general use threshold for aquatic life (Table 1). Stations with IBIs that score above this general use threshold would be given a rating of **Good**. The **Fair** rating is calculated as a 15 point drop from the general use threshold (Table 1). Stations with IBI scores below the general use threshold, but above the **Fair** threshold would be given a rating of **Fair**. Stations scoring below the Fair threshold would be considered **Poor** (Table 1).

Class #	Class Name	Good	Fair	Poor
Fish				
1	Southern Rivers	>38	38-24	<24
2	Southern Streams	>44	44-30	<30
3	Southern Headwaters	>50	50-36	<36
4	Northern Rivers	>34	34-20	<20
5	Northern Streams	>49	49-35	<35
6	Northern Headwaters	>39	39-25	<25
7	Low Gradient Streams	>39	39-25	<25
Invertebrates				
1	Northern Forest Rivers	>51	52-36	<36
2	Prairie Forest Rivers	>31	31-16	<16
3	Northern Forest Streams RR	>50	50-35	<35
4	Northern Forest Streams GP	>52	52-37	<37
5	Southern Streams RR	>36	36-21	<21
6	Southern Forest Streams GP	>47	47-32	<32
7	Prairie Streams GP	>38	38-23	<23

Appendix 8. Biological Monitoring Results for Non-Assessed Channelized AUIDs-Fish IBI Scores

National Hydrography Dataset (NHD) Assessment Segment AUID	Biological Station ID	Stream Segment Name	Drainage Area Mi²	Fish Class	Good	Fair	Poor	F-IBI	Visit Date
HUC-11: 09030005020 (South Branch Little Fork River)									
09030005-667	08RN014	Alango Creek	5.15	6	100 - 40	39 - 25	24 - 0	62	20-Aug-08
09030005-666	08RN013	Unnamed creek	7.00	6	100 - 40	39 - 25	24 - 0	63	18-Jun-08
HUC-11: 09030005040 (Sturgeon Lake)									
09030005-599	05RN091	Shannon River	15.27	6	100 - 40	39 - 25	24 - 0	75	27-Jun-05
09030005-599	08RN032	Shannon River	16.77	6	100 - 40	39 - 25	24 - 0	61	4-Aug-08
HUC-11: 09030005050 (Sturgeon River)									
09030005-593	05RN087	Gilmore Creek	8.30	7	100 - 40	39 - 25	24 - 0	84	13-Jul-05
09030005-594	08RN031	Gilmore Creek	13.24	6	100 - 40	39 - 25	24 - 0	69	18-Jun-08

Appendix 9. Biological Monitoring Results for Non-Assessed Channelized AUIDs-Macroinvertebrate IBI Scores

Assessment Segment AUID	Biological Station ID	Stream Segment Name	Drainage Area Mi²	Invert Class	Good	Fair	Poor	M-IBI	Visit Date
HUC-11: 09030005020 (South Branch Little Fork River)									
09030005-667	08RN014	Alango Creek	5.15	4	100 - 53	52 - 37	36 - 0	32	03-Sep-08
09030005-666	08RN013	Unnamed creek	7.00	4	100 - 53	52 - 37	36 - 0	40	06-Aug-08
HUC-11: 09030005040 (Sturgeon Lake)									
09030005-599	05RN091	Shannon River	15.27	4	100 - 53	52 - 37	36 - 0	75	09-Aug-05
09030005-599	08RN032	Shannon River	16.77	4	100 - 53	52 - 37	36 - 0	73	07-Aug-08
HUC-11: 09030005050 (Sturgeon River)									
09030005-593	05RN087	Gilmore Creek	8.30	4	100 - 53	52 - 37	36 - 0	52	09-Aug-05
09030005-594	08RN031	Gilmore Creek	13.24	4	100 - 53	52 - 37	36 - 0	44	05-Aug-08