Rainy River-Headwaters Watershed Monitoring and Assessment Report

Minnesota Pollution Control Agency

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List of acronyms

AUID Assessment Unit Identification Determination

BWCAW Boundary Waters Canoe Area Wilderness

Chl-a Chlorophyll-a

CI Confidence Interval

CLMP Citizen Lake Monitoring Program

CR County Road

CSAH County State Aid Highway

CSMP Citizen Stream Monitoring Program

CWA Clean Water Act

DNR Minnesota Department of Natural Resources

DO Dissolved oxygen

DOP Dissolved Orthophosphate

EMAP Environmental Monitoring and Assessment Program

EQuIS Environmental Quality Information System

EX Exceeds Criteria (Bacteria)

EXP Exceeds Criteria, Potential Impairment

EXS Exceeds Criteria, Potential Severe Impairment

F-IBI Fish Index of Biological Integrity

FWMC Flow Weighted Mean Concentration

HUC Hydrologic Unit Code

IWM Intensive Watershed Monitoring

K Potassium

LRVW Limited Resource Value Water

MCL Maximum Contaminant Level

MDA Minnesota Department of Agriculture

MDH Minnesota Department of Health

M-IBI Macroinvertebrate Index of Biological Integrity

MPCA Minnesota Pollution Control Agency

MSHA Minnesota Stream Habitat Assessment

N Nitrogen

Nitrate-N Nitrate Plus Nitrite Nitrogen

NA Not Assessed

NHD National Hydrologic Dataset

NH3 Ammonia

NLF Northern Lakes and Forest

NMW Northern Minnesota Wetlands

OP Orthophosphate

P Phosphorous

PCB Poly Chlorinated Biphenyls

PFCs perfluorochemicals

PFOS perfluorooctane sulfonate

SWAG Surface Water Assessment Grant

SWUD State Water Use Database

TALU Tiered Aquatic Life Uses

TKN Total Kjeldahl Nitrogen

TMDL Total Maximum Daily Load

TP Total Phosphorous

TSS Total Suspended Solids

UAA Use Attainability Analysis

USDA United States Department of Agriculture

USFS United State Forest Service

USGS United States Geological Survey

VNP Voyageurs National Park

WPLMN Water Pollutant Load Monitoring Network

Executive summary

The Rainy River-Headwaters Watershed (09030001) lies in northeastern Minnesota and covers approximately 2,954 mi^2 or 1,890,689 acres. A total of 1,273 lakes (>10 acres) and 408 stream reaches reside within this watershed. Streams are generally small to moderate in channel size, short, and vary in gradient; many are direct tributaries to the many lakes in the watershed. Both drinking water quality and the recreational value of lakes and streams are important to the health and wealth of local economies throughout this watershed. The waterbodies also provide habitat for aquatic life, riparian corridors for wildlife. The immaculate waters found within this watershed not only produce some of the highest quality fisheries in the state but also offer visitors many scenic and natural views. The most visited wilderness area (Boundary Waters Canoe Area) in the United States is located within this watershed, with water as a major focal point. Today over 99% of the Rainy River-Headwaters Watershed is undeveloped and utilized for timber production, hunting, fishing, hiking, and other recreational opportunities. Large tracts of public land exist within this watershed, including county land, national and state forests, wildlife management areas, scientific and natural areas, state parks, and a national park.

In 2014, the Minnesota Pollution Control Agency (MPCA) undertook an intensive watershed monitoring (IWM) effort of surface waters within the Rainy River-Headwaters Watershed. Sixty-two stream stations were sampled for biology at the outlets of variable sized subwatersheds. These locations included the mouth of the Ash, Bear Island, Black Duck, Cross, Dumbbell, Dunka, Island, Little Indian Sioux, Little Isabella, Shagawa, South Kawishiwi, and Stony rivers, as well as the upstream outlets of major tributaries, and the headwater outlets of smaller streams. Cook and Lake County Soil and Water Conservation Districts (SWCD) and Vermilion Community College completed stream water chemistry sampling at the outlets of 13 streams. In addition, the MPCA, Lake County SWCD, Natural Resources Research Institute, National Park Service, and local volunteers completed lake monitoring on 60 lakes. In 2016, a holistic approach was taken to assess all surface waterbodies within the Rainy River-Headwaters Watershed for support of aquatic life, recreation, and consumption (where sufficient data was available). Additional data from other state and federal agencies, local units of government, lake associations, and/or individuals were used in the assessment of these designated beneficial uses. Sixty-four stream segments and 245 lakes were assessed in this effort.

Of the assessed streams, 97% fully supported aquatic life and 92% fully supported aquatic recreation. There were impairments for total suspended solids (TSS), Escherichia coli (bacteria), and mercury in fish. All but one lake assessed met eutrophication standards for lake trout, cold, and warm-water lakes in the Northern Lakes and Forest ecoregion, and had good water quality that indicated oligotrophic to mesotrophic conditions. A number of lakes deep within the Boundary Waters Canoe Area Wilderness (BWCAW) fully supported aquatic recreation based on satellite estimated Secchi transparency. One-hundred and eighty-eight lakes had existing aquatic consumption impairments due to an exceedance of standards for mercury in fish tissue. The Minnesota Department of Health (MDH) has issued numerous fish consumption advisories for specific lakes throughout this watershed.

Overall, water quality conditions are good to excellent and can be attributed to the forest and wetlands that dominate land cover within the Rainy River-Headwaters Watershed. A limited number of impairments do occur and persist throughout the watershed. They are typically limited to the lower reaches where stressors from land use practices may accumulate. Impairments found within this watershed are likely a function of both natural and anthropogenic stressors. Historical and recent forest cover changes, along with urban/industrial development, and draining of wetlands are likely stressors affecting biological communities within the watershed. The majority of the waterbodies within this watershed had exceptional biological, chemical, and physical characteristics that are worthy of additional protection.

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) which requires 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 their surface waters and develop a list of waterbodies that do not meet established standards. Such waters are referred to as "impaired waters" and the state must make appropriate plans to restore these waters, including the development of Total Maximum Daily Loads (TMDLs). A TMDL is a comprehensive study determining the assimilative capacity of a waterbody, identifying all pollution sources causing or contributing to impairment, and an estimation of the reductions needed to restore a waterbody so that it can once again support its designated use.

The MPCA currently conducts a variety of surface water monitoring activities that support our overall mission of helping Minnesotans protect the environment. To successfully prevent and address problems, decision makers need good information regarding the status of the resources, potential and actual threats, options for addressing the threats and data on the effectiveness of management actions. 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 in 2006 provided a policy framework and the initial resources for state and local governments to accelerate efforts to monitor, assess, restore, and protect surface waters. This work is implemented on an on-going basis with funding from the Clean Water Fund created by the passage of the Clean Water Land, and Legacy Amendment to the state constitution. To facilitate the best use of agency and local resources, the MPCA has developed a watershed monitoring strategy which uses an effective and efficient integration of agency and local water monitoring programs to assess the condition of Minnesota's surface waters, and to allow for coordinated development and implementation of water quality restoration and improvement projects.

The strategy behind the watershed monitoring approach is to intensively monitor streams and lakes within a major watershed to determine the overall health of water resources, identify impaired waters, and to identify waters in need of additional protection. The benefit of the approach is the opportunity to begin to address most, if not all, impairments through a coordinated TMDL process at the watershed scale, rather than the reach-by-reach and parameter-by-parameter approach often historically employed. The watershed approach will more effectively address multiple impairments resulting from the cumulative effects of point and non-point sources of pollution and further the CWA goal of protecting and restoring the quality of Minnesota's water resources.

This watershed-wide monitoring approach was implemented in the Rainy River-Headwaters Watershed beginning in the summer of 2014. This report provides a summary of all water quality assessment results in the Rainy River-Headwaters Watershed and incorporates all data available for the assessment process including watershed monitoring, volunteer monitoring and monitoring conducted by local government units.

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 80 major watersheds. 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, project planning, effectiveness monitoring and protection strategies. The following paragraphs provide details on each of the four principal monitoring components of the watershed approach. For additional information see: Watershed Approach to Condition Monitoring and Assessment (MPCA 2008) (http://www.pca.state.mn.us/publications/wq-s1-27.pdf).

Intensive watershed monitoring

The IWM strategy utilizes a nested watershed design allowing the sampling of streams within watersheds from a coarse to a fine scale (Figure 1). Each watershed scale is defined by a hydrologic unit code (HUC). These HUCs define watershed boundaries for waterbodies within a similar geographic and hydrologic extent. The foundation of this approach is the 80 major watersheds (8-HUC) within Minnesota. Using this approach, many of the smaller headwaters and tributaries to the main stem river are sampled in a systematic way so that a more holistic assessment of the watershed can be conducted and problem areas identified without monitoring every stream reach. Each major watershed is the focus of attention for at least one year within the 10-year cycle.

River/stream stations are selected near the outlet of each of three watershed scales, 8-HUC, aggregated 12-HUC and 14-HUC (Figure 1). Within each scale, different water uses are assessed based on the opportunity for that use (i.e., fishing, swimming, supporting aquatic life such as fish and insects). The major river watershed is represented by the 8-HUC scale. The outlet of the major 8-HUC watershed (purple dot in Figure 2) is sampled for biology (fish and macroinvertebrates), water chemistry and fish contaminants to allow for the assessment of aquatic life, aquatic recreation, and aquatic consumption use support. The aggregated 12-HUC is the next smaller subwatershed scale which generally consists of major tributary streams with drainage areas ranging from 75 to 150 mi^2. Each aggregated 12-HUC outlet (green dots in Figure 2) is sampled for biology and water chemistry for the assessment of aquatic life and aquatic recreation use support. Within each aggregated 12-HUC, smaller watersheds (14 HUCs, typically 10-20 mi^2), are sampled at each outlet that flows into the major aggregated 12-HUC tributaries. Each of these minor subwatershed outlets is sampled for biology to assess aquatic life use support (red dots in Figure 2).

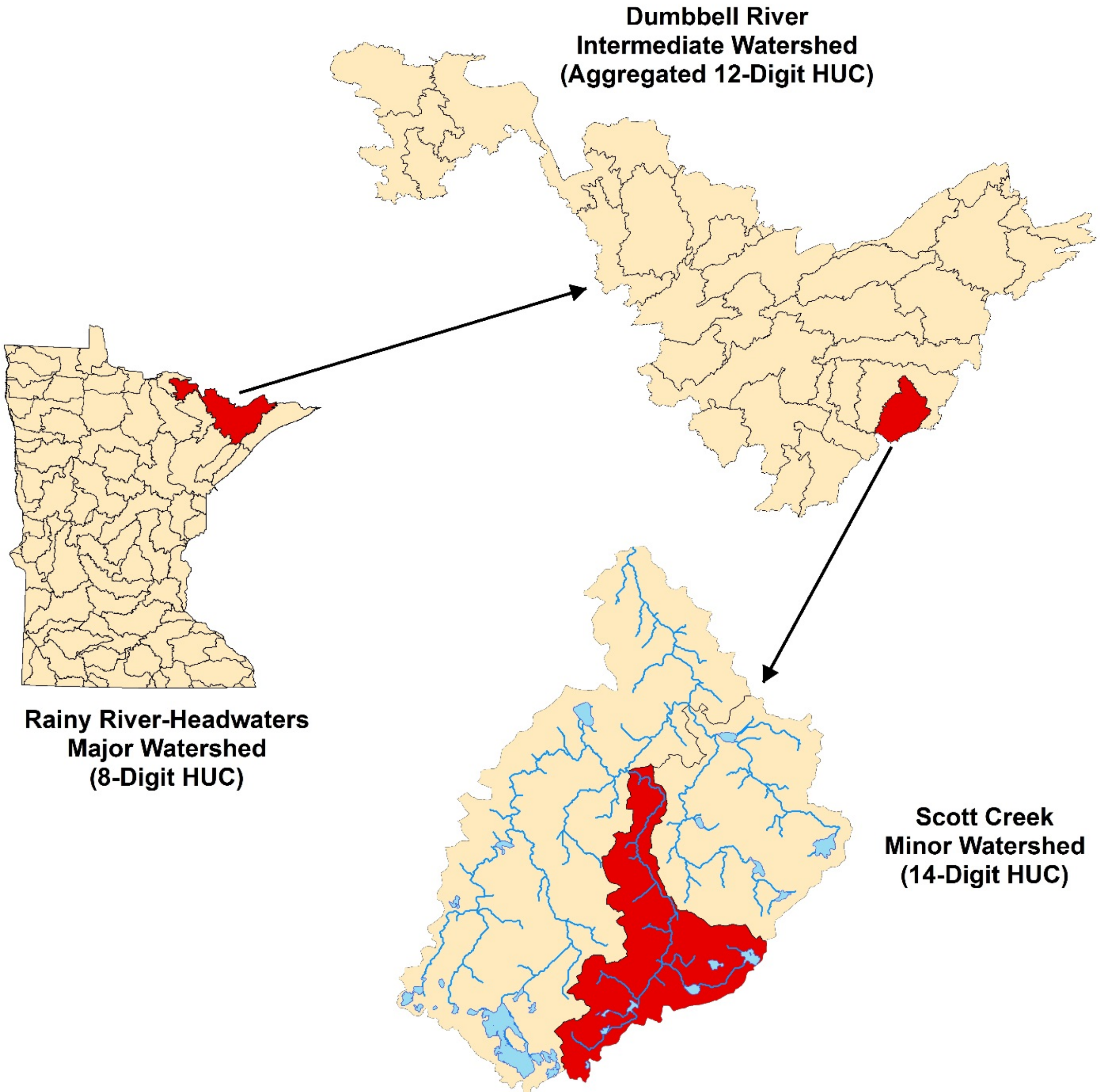


Figure 1. The intensive watershed monitoring design.

Lakes most heavily used for recreation (all those greater than 500 acres and at least 25% of lakes 100-499 acres) are monitored for water chemistry to determine if recreational uses, such as swimming and wading, are being supported and where applicable, where fish community health can be determined. Lakes are prioritized by size, accessibility (can the public access the lakes), and presence of recreational use.

Specific locations for stations sampled as part of the intensive monitoring effort in the Rainy River-Headwaters Watershed are shown in Figure 2 and are listed in Appendix 2.1 and 2.2.

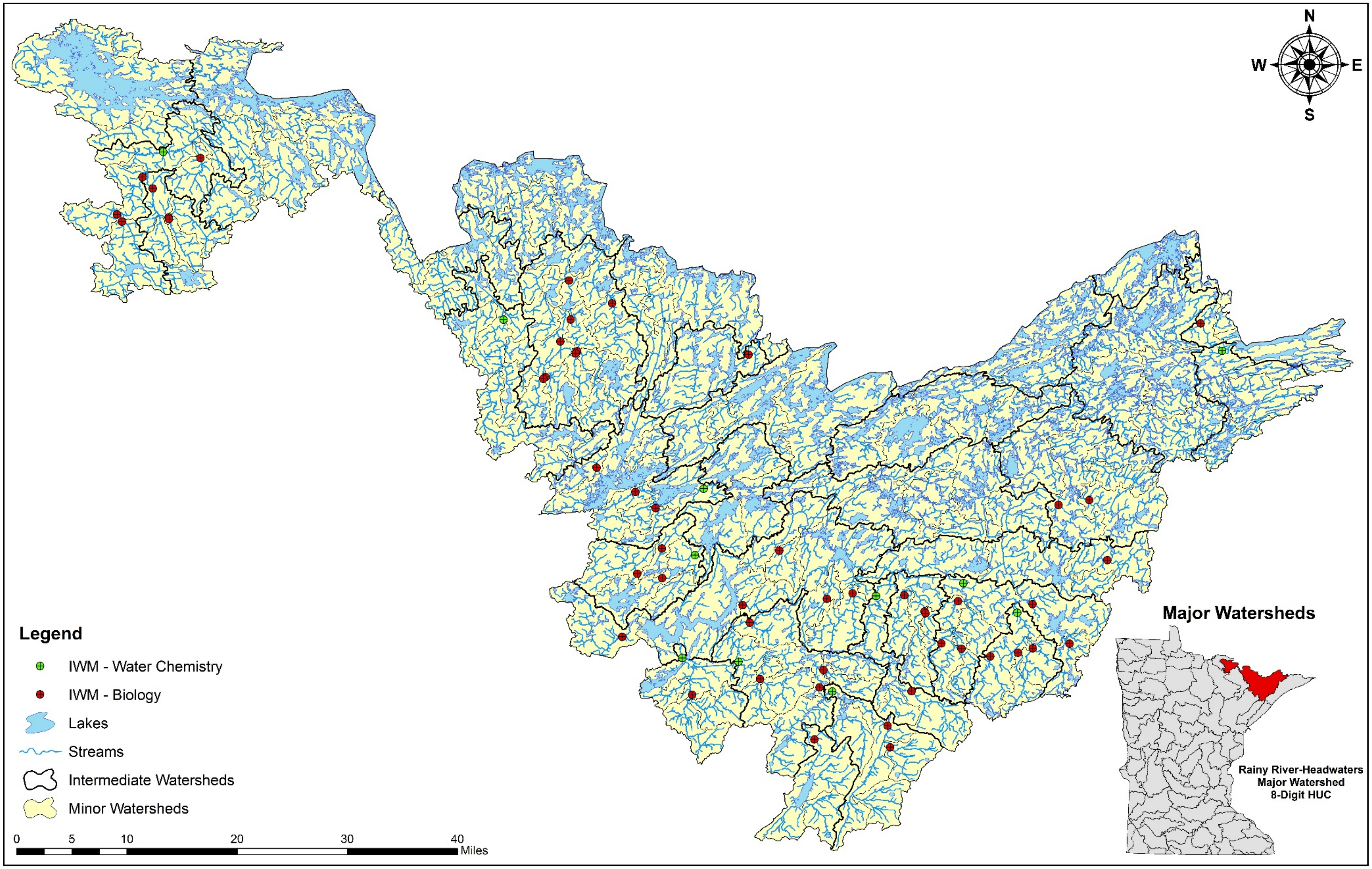


Figure 2. Intensive watershed monitoring stations for streams in the Rainy River-Headwaters Watershed.

Citizen and local monitoring

Citizen and local monitoring is an important component of the watershed approach. The MPCA and its local partners jointly select the stream stations and lakes to be included in the IWM process. Funding passes from MPCA through Surface Water Assessment Grants (SWAGs) to local groups such as counties, SWCDs, watershed districts, nonprofits, and educational institutions to support lake and stream water chemistry monitoring. Local partners use the same monitoring protocols as the MPCA, and all monitoring data from SWAG projects are combined with the MPCA's to assess the condition of Minnesota lakes and streams. Preplanning and coordination of sampling with local citizens and governments helps focus monitoring where it will be most effective for assessment and observing long-term trends. This allows citizens/governments the ability to see how their efforts are used to inform water quality decisions and track how management efforts affect change. Many SWAG grantees invite citizen participation in their monitoring projects and their combined participation greatly expand our overall capacity to conduct sampling.

The MPCA also coordinates two programs aimed at encouraging long term citizen surface water monitoring: the Citizen Lake Monitoring Program (CLMP) and the Citizen Stream Monitoring Program (CSMP). Like the permanent load monitoring network, having citizen volunteers monitor a given lake or stream station monthly and from year to year can provide the long-term picture needed to help evaluate current status and trends. Citizen monitoring is especially effective at helping to track water quality changes that occur in the years between intensive monitoring years. Figure 3 provides an illustration of the locations where citizen monitoring data were used for assessment in the Rainy River-Headwaters Watershed.

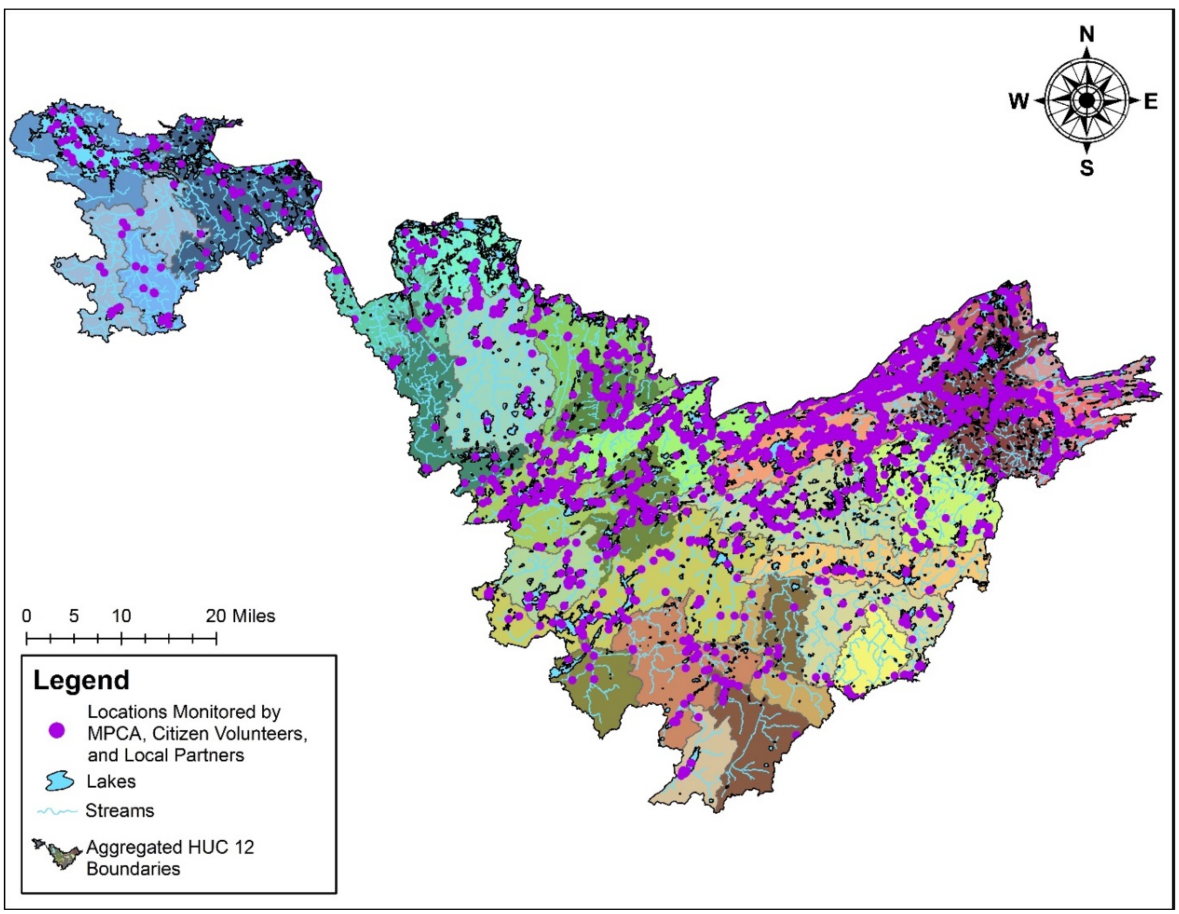


Figure 3. Monitoring locations of local groups, citizens and the MPCA lake monitoring staff in the Rainy River-Headwaters Watershed.

Assessment methodology

The CWA requires states to report on the condition of the waters of the state every two years. 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 as evaluated by the comparison of monitoring data to criteria specified by Minnesota Water Quality Standards (Minn. R. ch. 7050 2008; https://www.revisor.leg.state.mn.us/rules/?id=7050). The assessment and listing process involves dozens of MPCA staff, other state agencies, and local partners. The goal of this effort is to use the best data and best science available to assess the condition of Minnesota's water resources. For a thorough review of the assessment methodologies see: *Guidance Manual for Assessing the Quality of Minnesota Surface Waters for the Determination of Impairment 305(b) Report and 303(d) List* (MPCA, December 2016; https://www.pca.state.mn.us/sites/default/files/wq-iw1-04i.pdf).

Water quality standards

Water quality standards are the fundamental benchmarks by which the quality of surface waters are measured and used to determine impairment. 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). All surface waters in Minnesota, including lakes, rivers, streams, and wetlands are protected for aquatic life and recreation where these uses are attainable. Numeric water quality standards represent concentrations of specific pollutants in water that protect a specific designated use. Narrative standards are statements of conditions in and on the water, such as biological condition, that protect their designated uses.

Protection of aquatic recreation means the maintenance of conditions safe and suitable for swimming and other forms of water recreation. In streams, aquatic recreation is assessed by measuring the concentration of *E. coli* bacteria in the water. To determine if a lake supports aquatic recreational activities its trophic status is evaluated, using total phosphorus, Secchi depth, and chlorophyll-a (Chl-a) as indicators. Lakes that are enriched with nutrients and have abundant algal growth are eutrophic and do not support aquatic recreation.

Protection of consumption means protecting citizens who eat fish from Minnesota waters or receive their drinking water from waterbodies protected for this beneficial use. The concentrations of mercury and polychlorinated biphenyls (PCBs) in fish tissue are used to evaluate whether or not fish are safe to eat in a lake or stream and to issue recommendations regarding the frequency that fish from a particular waterbody can be safely consumed. For lakes, rivers, and streams that are protected as a source of drinking water, the MPCA primarily measures the concentration of nitrate in the water column to assess this designated use.

Protection of aquatic life means the maintenance of a healthy aquatic community, including fish, invertebrates, and plants. Biological monitoring, the sampling of aquatic organisms, is a direct means to assess aquatic life use support, as the aquatic community tends to integrate the effects of all pollutants and stressors over time. To effectively use biological indicators, the MPCA employs the Index of Biotic Integrity (IBI). This index is a scientifically validated combination of measurements of the biological community (called metrics). An IBI is comprised of multiple metrics that measure different aspects of aquatic communities (e.g., dominance by pollution tolerant species, loss of habitat specialists). Metric scores are summed together and the resulting index score characterizes the biological integrity or "health" of a station. The MPCA has developed stream IBIs for (fish and macroinvertebrates) since these communities can respond differently to various types of pollution (MPCA, June 2014 & July 2014). The MPCA also uses a lake fish IBI developed by the Minnesota Department of Natural Resources (DNR) to determine if lakes are meeting aquatic life use. Because the lakes, rivers, and streams in Minnesota are physically, chemically, and biologically diverse, IBIs are developed separately for different stream classes and lake class groups to account for this natural variation. Further interpretation of biological community data is provided by an assessment threshold or biocriteria against which an IBI score can be compared within a given stream class. In general, an IBI score above this threshold is indicative of aquatic life use support, while a score below this threshold is indicative of non-support. Additionally, chemical parameters are measured and assessed against numeric standards developed to be protective of aquatic life. For streams these include pH, dissolved oxygen (DO), un-ionized ammonia nitrogen, chloride, TSS, pesticides, and river eutrophication. For lakes, pesticides and chlorides contribute to the overall aquatic life use assessment.

Protection for aquatic life uses in streams and rivers are divided into three tiers: Exceptional, General, and Modified. Exceptional Use waters support fish and macroinvertebrate communities that have minimal changes in structure and function from the natural condition. General Use waters harbor "good" assemblages of fish and macroinvertebrates that can be characterized as having an overall balanced distribution of the assemblages and with the ecosystem functions largely maintained through redundant attributes. Modified Use waters have been extensively altered through legal physical modifications which limit the ability of the biological communities to attain the General Use. Currently the Modified Use is only applied to streams with channels that have been directly altered by humans (e.g., maintained for drainage, riprapped). These tiered uses are determined before assessment based on the attainment of the applicable biological criteria and/or an assessment of the habitat. For additional information, see: https://www.pca.state.mn.us/water/tiered-aquatic-life-uses-talu-framework.

Table 1. Table of proposed Tiered Aquatic Life Use Standards.

Proposed Tiered Aquatic Life Use	Acronym	Proposed Use Class Code	Description
Warm-water General	WWg	2Bg	Warm-water Stream protected for aquatic life and recreation, capable of supporting and maintaining a balanced, integrated, adaptive community of warm or cool-water aquatic organisms that meet or exceed the General Use biological criteria.
Warm-water Modified	WWm	2Bm	Warm-water Stream protected for aquatic life and recreation, physically altered watercourses (e.g., channelized streams) capable of supporting and maintaining a balanced, integrated, adaptive community of warm or cool-water aquatic organisms that meet or exceed the Modified Use biological criteria, but are incapable of meeting the General Use biological criteria as determined by a Use Attainability Analysis
Warm-water Exceptional	WWe	2Be	Warm-water Stream protected for aquatic life and recreation, capable of supporting and maintaining an exceptional and balanced, integrated, adaptive community of warm or cool-water aquatic organisms that meet or exceed the Exceptional Use biological criteria.
Coldwater General	CWg	2Ag	Cold-water Stream protected for aquatic life and recreation, capable of supporting and maintaining a balanced, integrated, adaptive community of cold-water aquatic organisms that meet or exceed the General Use biological criteria.
Coldwater Exceptional	CWe	2Ae	Cold-water Stream protected for aquatic life and recreation, capable of supporting and maintaining an exceptional and balanced, integrated, adaptive community of cold-water aquatic organisms that meet or exceed the Exceptional Use biological criteria.

A small percentage of stream miles in the state (~1% of 92,000 miles) have been individually evaluated and re-classified as a Class 7 Limited Resource Value Water (LRVW). These streams have previously demonstrated that the existing and potential aquatic community is severely limited and cannot achieve aquatic life standards either by: a) natural conditions as exhibited by poor water quality characteristics, lack of habitat or lack of water; b) the quality of the resource has been significantly altered by human activity and the effect is essentially irreversible; or c) there are limited recreational opportunities (such as fishing, swimming, wading or boating) in and on the water resource. While not being protective of aquatic life, LRVWs are still protected for industrial, agricultural, navigation, and other uses. Class 7 waters are also protected for aesthetic qualities (e.g., odor), secondary body contact, and groundwater for use as a potable water supply. To protect these uses, Class 7 waters have standards for bacteria, pH, dissolved oxygen and toxic pollutants.

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 stream "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 or stream reach is identified by a unique waterbody identifier (known as its AUID), comprised of the United States Geological Survey (USGS) eight-digit hydrologic unit code (8-HUC) plus a three-character code that is unique within each HUC. Lake and wetland identifiers are assigned by the DNR. The Protected Waters Inventory provides the identification numbers for lake, reservoirs and wetlands. These identification numbers serve as the AUID and are composed of an eight-digit number indicating county, lake and bay for each basin.

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

For beneficial uses related to human health, such as drinking water or aquatic recreation, the relationship is well understood and thus the assessment process is a relatively simple comparison of monitoring data to 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 is outlined below and in Figure 4.

The first step in the aquatic life assessment process is largely an automated process performed by logic programmed into a database application where all data from the 10 year assessment window is gathered; the results are referred to as 'Pre-Assessments'. Data filtered into the "Pre-Assessment" process is then reviewed to insure that data is valid and appropriate for assessment purposes. Tiered use designations are determined before data is assessed based on the attainment of the applicable biological criteria and/or an assessment of the habitat. Stream reaches are assigned the highest aquatic life use attained by both biological assemblages on or after November 28, 1975. Streams that do not attain the Exceptional or General Use for both assemblages undergo a Use Attainability Analysis (UAA) to determine if a lower use is appropriate. A Modified Use can be proposed if the UAA demonstrates that the General Use is not attainable as a result of legal human activities (e.g., drainage maintenance, channel stabilization) which are limiting the biological assemblages through altered habitat. Decisions to propose a new use are made through UAA workgroups which include watershed project managers and biology leads. The final approval to change a designated use is through formal rulemaking.

The next step in the aquatic life assessment process is a comparison of the monitoring data to water quality standards. 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 reviews are conducted at the workstation of each reviewer (i.e., desktop) using computer applications to analyze the data for potential temporal or spatial trends as well as gain a better understanding of any extenuating circumstances that should be considered (e.g., flow, time/date of data collection, or habitat).

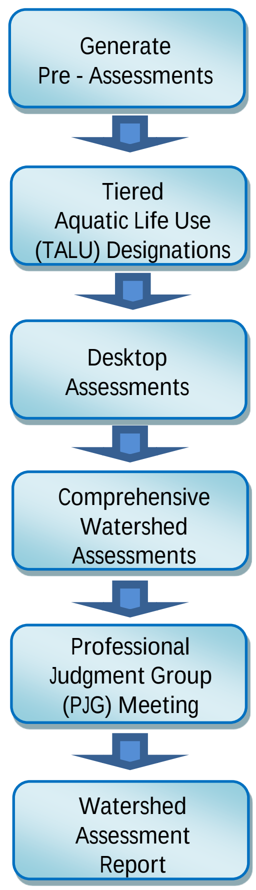


Figure 4. Flowchart of aquatic life use assessment process.

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, December 2016; https://www.pca.state.mn.us/sites/default/files/wq-iw1-04i.pdf) for guidelines and factors considered when making such determinations.

The last step in the assessment process is the Professional Judgment Group 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 be responsible for local watershed reports and project planning. Information obtained during this meeting may be used to revise previous use attainment decisions (e.g., sampling events that may have been uncharacteristic due to annual climate or flow variation, local factors such as impoundments that do not represent the majority of conditions on the AUID). 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. Assessment results are also included in watershed monitoring and assessment reports.

Watershed overview

The Rainy River-Headwaters Watershed (0903001) occupies a cumulative total of 2,954 mi^2 or 1,890,689 acres of land within Minnesota. This watershed consists of a "V" shaped strip extending along the Canadian border. A large proportion of this watershed lies within Ontario, Canada; statistics from that portion are not included in this report (unless further mentioned). Elevations within this watershed range from a high of 2,199 feet above sea level to its lowest point 1,104 feet. The largest portion of this watershed is within Lake County (45.67%), with a slightly smaller proportion in St. Louis (42.77%), Cook (11.01%) and Koochiching counties (0.55%).

The Rainy River-Headwaters Watershed lies in the northeastern portion of the Northern Lakes and Forest (NLF) Ecoregion (Figure 5). The NLF is dominated by relatively nutrient-poor glacial soils which support the growth of coniferous and northern hardwood forest (Omernik, 1988). This heavily forested ecoregion is made up of many steep, rolling hills, broad lacustrine basins, and extensive sandy outwash plains. Soils within this ecoregion lack the arability of soils in the adjacent ecoregions to the south. Lakes are numerous in numbers throughout the NLF ecoregions and are clearer and less productive than those that are located to the south. Throughout the NLF many Precambrian granitic bedrock outcropping exist between shallow-to-deep moraine deposits left by the last glacier retreat that dates back to 12,000 years ago (Omernik, 1988).

The United States Department of Agriculture (USDA) Major Land Resource Areas (MLRA) for the Rainy River-Headwaters includes two classifications (Figure 6). The majority (99.91%) of the watershed is classified as Superior Stony and Rocky Loamy Plains and Hills, Western Part, while a small portion in the far northwestern corner is classified as Northern Minnesota Glacial Lake Basin. The Superior Stoney and Rocky Loamy Plains and Hills, Western Part is very diverse in soil types and can be a very shallow to deep dense loamy till, coarse glacial drift and outwash, silty glaciolacustrine sediment, local loess, alluvium, and organic material (USDA/NRCS, 2006). Bedrock outcrops are common in many places and the topography is gently sloping to very steep in locations. Bogs and large wetland complexes are common in the headwaters of many subwatersheds. Given the geologic history of the valley, some natural springs can be found throughout this watershed. The Northern Minnesota Glacial Lake Basin has very deep sandy to clayey soils and are dominantly poorly drained. An extensive amount of organic soils occur in this MLRA, with a higher concentration of it in the Agassiz Basin (USDA/NRCS, 2006). The glacial deposits are underlined by crystalline metamorphic rocks, with some lake-modified glacial till present. Ditches have been used in portions of this MLRA to improve drainage of wet areas. The Rainy River-Headwaters Watershed lacks much of this modified drainage due to a large proportion being Superior Stony and Rocky Loamy Plains and Hills, Western Part.

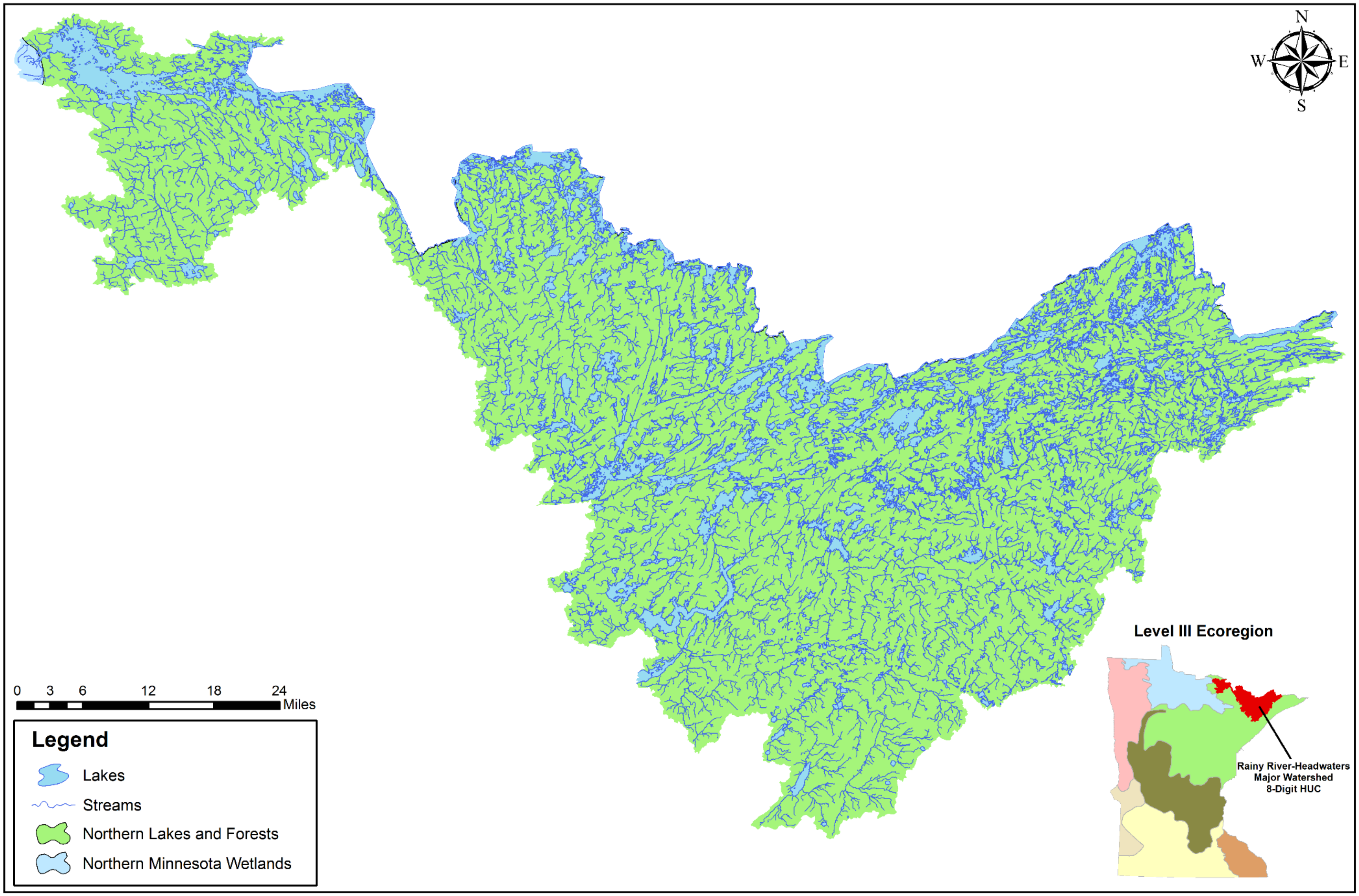


Figure 5. The Rainy River-Headwaters Watershed within the NLF and NMW ecoregion of northeastern Minnesota.

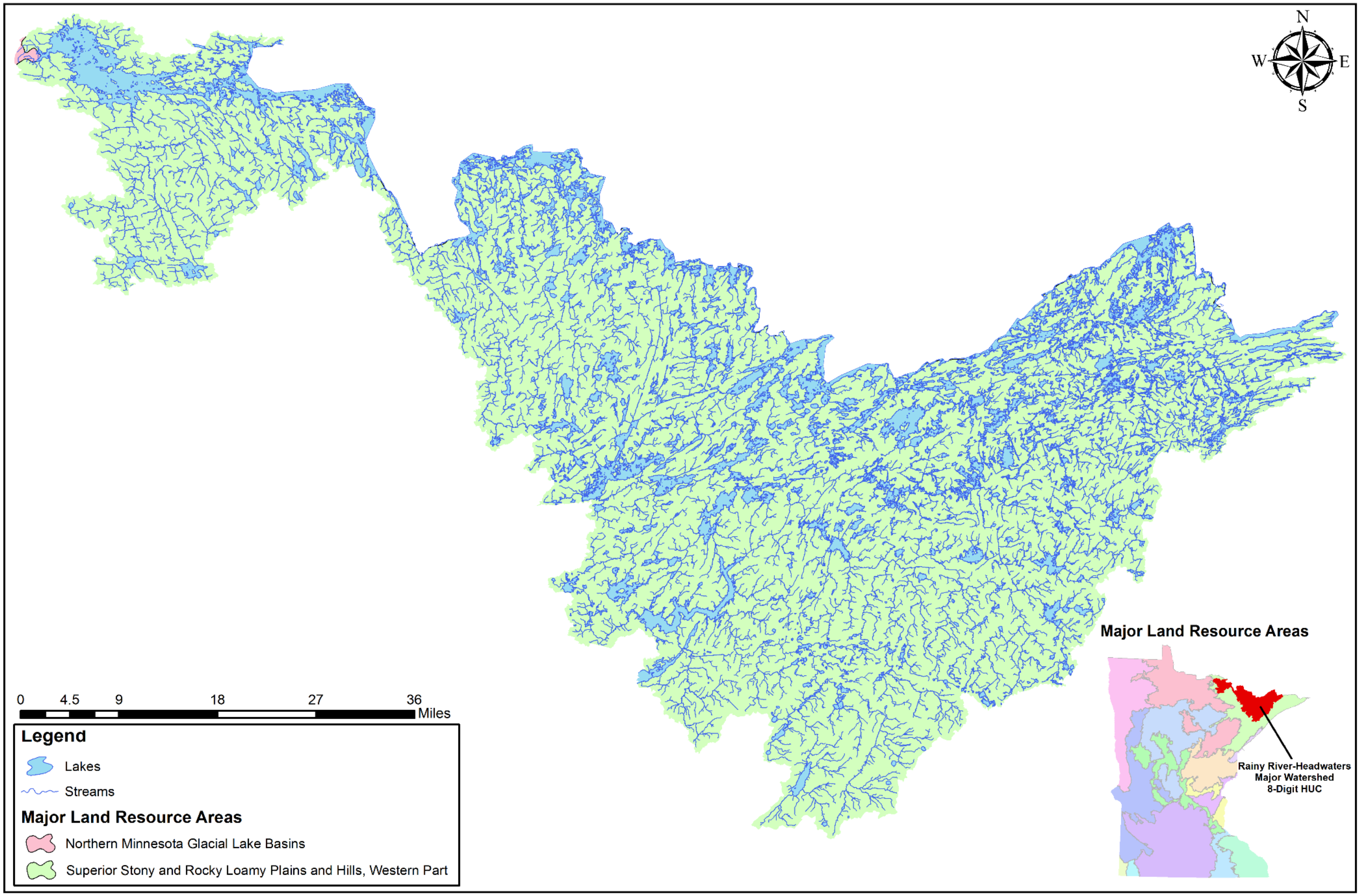


Figure 6. Major Land Resource Areas and springs in the Rainy River-Headwaters Watershed.

Land use summary

Historically, land cover in the Rainy River-Headwaters Watershed was largely forest with a mixture of brushland, wetlands, and open water. Pre-settlement vegetation was dominated by old growth forest of White Pine, Red Pine, Quaking Aspen, Paper Birch, and Black Spruce (Waters, 1977). The forest was dependent on infrequent low lying fires that cleared out thick brush and alders to regenerate saplings (Larson, 2007). Stream corridors were heavily forested and provided ample shade to tributary streams. The corridors consisted of small patches of thick alder, marsh, and sedge meadows in the river's meanders and abandoned oxbows (Waters, 1977).

Although a large portion of the current land use within the Rainy River-Headwaters Watershed is still forest, the discovery of western Lake Superior in the late 1600s has changed this area in many ways. This area was well used by Native Americans who developed numerous canoe trails and portages throughout the region. After centuries of using these trails, the Native Americans found new tracks and shorter routes by different lakes. By the time explorers discovered the route in the late 1600s, or were shown it, the trails were virtually in their present day form (Waters, 1977). The extent of this route (Grand Portage) began to be recorded in 1731 when the La Verendrye's company landed at Grand Portage Bay and passed over into the string of lakes to build an outpost on Rainy Lake. Other routes (Kaministikwia River) were first used by the French to access this area (Lac La Croix) for 30-years before discovering this shorter and less grueling route.

This entire watershed and the surrounding area was known as the Voyageur's Highway and was a life-line to the North American fur trade. This magnificent route, with its dark virgin forests, blue lakes, and whitewater cascades was a major trail for the French-Canadian canoeman (Waters, 1977). Canoemen were typically recruited from the lands along the north shore of the St. Lawrence River, with many individuals originating from Normandy. These voyageurs traveled the vast expansions of the great lakes before reaching Grand Portage and the Pigeon River. Portages that were developed between these numerous waterbodies connected the Pigeon River to Rainy Lake and further downstream to Lake of the Woods. At Grand Portage, company agents negotiated and bartered for fur and other goods. Through this process two separate groups were developed, that included the "Northmen" who traveled the Quetico-Superior and the Montreal canoemen who traveled the Great Lakes portion of the route. The Northmen used a smaller and more easily portaged canoe called the "North Canoe" or *canot du nord*. Voyageur's that were experienced on this trail and had spent the winter in the north woods trading with the Native Americans received the title of *hommes du nord*, or "winterers".

In 1770, several companies combined to create the famed North West Company, which plied along the fur trade routes into North American interior for nearly 50 years (Water, 1977). The North West Company ended its use of this route in 1803 with the fear of duties attached by the assertion of territorial rights by the newly established United States. This company re-established the original route into the Quetico-Superior through the Kamainistikwia River until 1821. The Grand Portage route continued to be used by the John Jacob Astor's American Fur Company, along with its working force of voyageurs, until 1842 (Waters, 1977). As the use of this route for fur trade dwindled, it gave way to other endeavors that were to bring civilization to the Rainy River country. By the 1860s, the trade of this entire area was serviced by land transportation through St. Paul and the upper Red River Valley, which was primarily faster and cheaper. Although the fur trade opened the northern wilderness to the Europeans, other industries such as logging quickly became an important economic driver. This region was settled following the fur trade and not the logger's ax like other areas of the state. The economic stimulus from this trade, coupled by the daring of the voyageurs, and the exploration of the Voyageur's Highway had settled this area.

The rivers of the Rainy River-Headwaters Watershed did not play a major role in the timber harvest of the border lake country due to their shortness and ruggedness. A few sawmills were established throughout the Rainy River Basin, including one in Winton, Minnesota. Timber was transported to these mills by floating timber or rafting them across lakes but most were moved by small logging railroad. The harvest of this timber began in 1893 and lasted until about 1930 when the great depression and other factors brought operations to a halt (waters, 1977). Logging first began on the Canadian side of the border, along with settlement, agriculture, railroads, and industry. The White and Red Pine were particularly high quality on the Minnesota side of the border and was intensively harvested during this period. Shortly after logging began, there was a recognition of the importance of this area for its recreational potential and an interest in protecting the virgin timberland for its aesthetic value. Many supporters campaigned for protection of the remaining virgin forestland within the state and in 1902 a half-million acres of forest were set aside in Cook and Lake County. This land, along with another half-million were later incorporated in the Superior National Forest when President Theodore Roosevelt signed a proclamation in 1909. In that same year, the Canadian government established the Quetico Forest Reserve north of the border.

This area was largely roadless, with much of the land within the same condition as when the voyageurs first paddled through it. The border lake country was first recognized for its special recreational value over two centuries ago when the first explorers visited the area. Although their lifestyle was deadly serious, they did note the beauty of the wild environment, with its sweeping lakes, brood forests, rock outcroppings, and the roaring cascades (Waters, 1977). Additions were made to the Superior National Forest until it reached its present size of three million acres. Numerous campgrounds and recreational areas were established throughout, which provided better access to public hunting, fishing, and other recreational opportunities throughout the forest. A sharp increase in recreational use of the forest occurred after World War I, with the main driving factor being a unique opportunity to canoe pristine forestland. Development pressures soon followed, with a push to develop roads and hydropower dams throughout the region. Many recognized the value of the area and pressured legislation to protect the area, resulting in the creation of a designated primitive area in 1926 (Waters, 1977). Additional protections were established with the Shipstead-Nolan Act of 1930, which prevented the alteration of existing water levels and logging along natural shoreline. In 1938, the Superior Roadless Primitive Area was established, setting aside about one million acres of Superior National Forest. There was another sharp increase in use after World War II, with fly-in resorts being the primary focus. This diminished the wilderness value of the area and with great concern, President Harry S Truman issued an executive order in 1949 to prohibit recreational use of aircraft into the area by 1951. This area received its present day name, the Boundary Waters Canoe Area Wilderness (BWCAW), in 1958 and was one of the first to be incorporated in the National Wilderness Preservation System in 1964 (Waters, 1977). The BWCAW now consist of 1,090,000 acres between two basins (Rainy River and Lake Superior) and three counties (St. Louis, Lake, and Cook). Pressures to develop this area continue to this date, with dams, pollution, mining, motorized recreational use, and logging being major conflicts. Many citizen groups are active throughout this watershed to protect its intrinsic value. The chain of lakes and forest trails that connected Grand Portage to Rainy Lake eventually became the Voyageur's Highway. This route eventually was incorporated into the present-day BWCAW and Voyageurs National Park (VNP) (Figure 7).

A national park designation for this region was debated for decades in northern Minnesota. At the beginning of the logging era in 1891, the Minnesota State Legislature petitioned the United States government to establish a park along the border. The Park Service made its initial recommendations to establish a National Park in this area in 1964 and later established VNP in 1975. This park now incorporates over 160,000 acres, including over 60,000 acres of water. The main waterbodies within this park include Kabetogama, Namakan, and Rainy Lake. Numerous state forests are located within the boundary of this watershed including Lake Jeanette, Burntside, Insula Lake, Lake Isabella, Bear Island, and Kabetogama. A portion of Bear Head State Park is located along the southwestern border of this watershed.

Currently, about 75.4% of the land within this watershed is owned by the federal government, with the second largest ownership being the state of Minnesota (12.9%) (Figure 7; NRCS, 2007). Forest is the most extensive land use, with numerous lakes and rivers interlaced throughout this watershed. Today, land cover within the Minnesota portion of the Rainy River-Headwaters Watershed is distributed as follows: 80.08% forest/shrub, 13.64% open water, 5.52% wetlands, 0.37% developed, 0.19% rangeland, 0.18% barren/mining, and 0.01% row-crop agriculture (Figure 8; NRCS, 2011). Over 99% of the Rainy River-Headwaters is undeveloped and utilized for timber production, hunting, fishing, canoeing, hiking, and other recreational opportunities. Timber production occurs on both private and public land throughout this watershed at varying degrees of intensity. Large tracts of public land exist within this watershed, including county land, national and state forests, wildlife management areas, scientific and natural areas, state and national parks. Portions of the Vermilion, Mesabi, and Gunflint Iron Range lie within this drainage, with several inactive and active mines present. The population of this watershed is estimated to be near 8,000 people, equating to roughly about three people per square mile (NRCS, 2007). A large proportion of the population in the Rainy River-Headwaters Watershed lies within the city of Ely, Minnesota, with an estimated population of 3,408 (USCB, 2015). There are many smaller towns found throughout the Rainy River-Headwaters Watershed including Winton and Isabella.

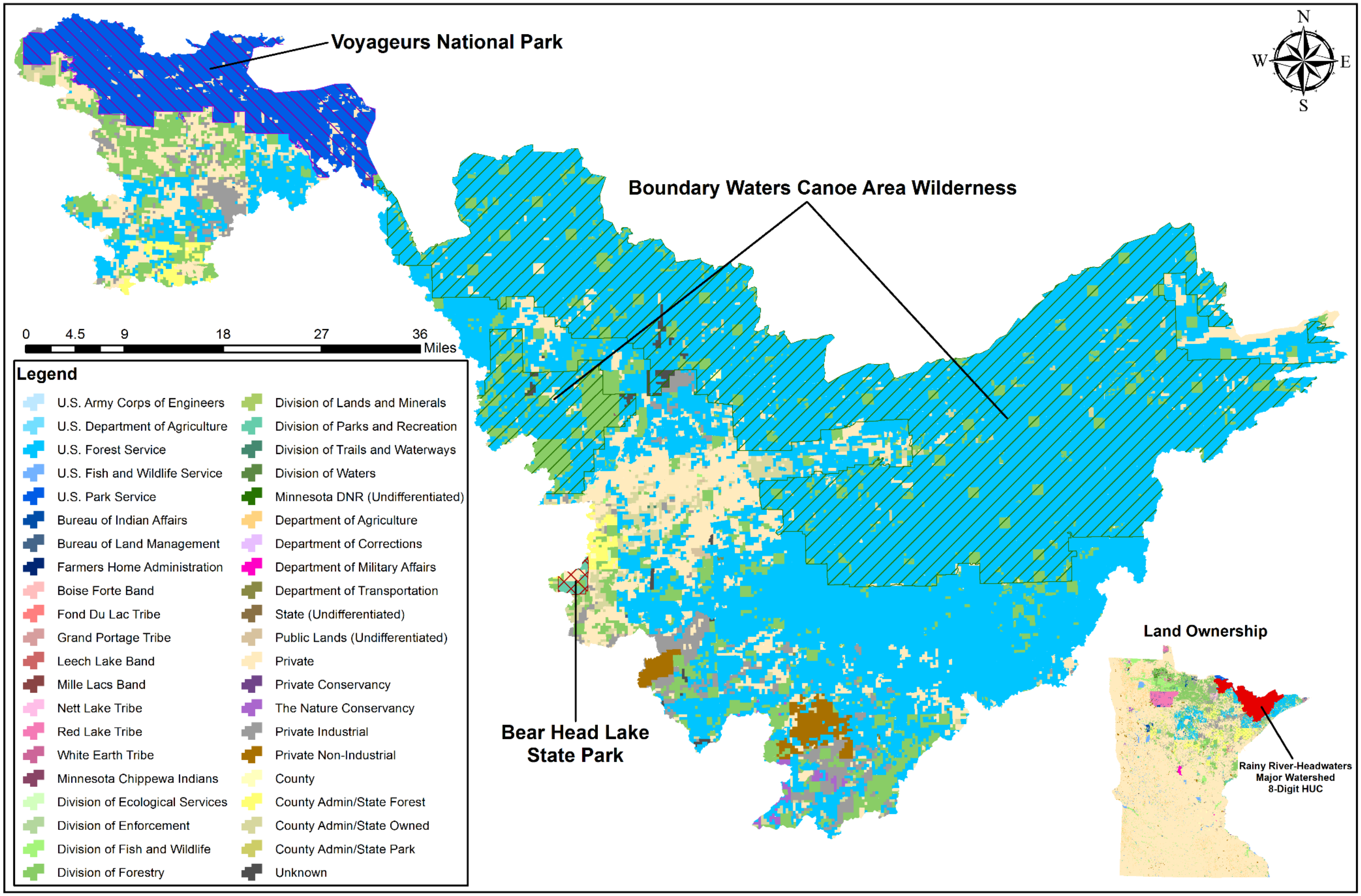


Figure 7. Land ownership in the Rainy River-Headwaters Watershed.

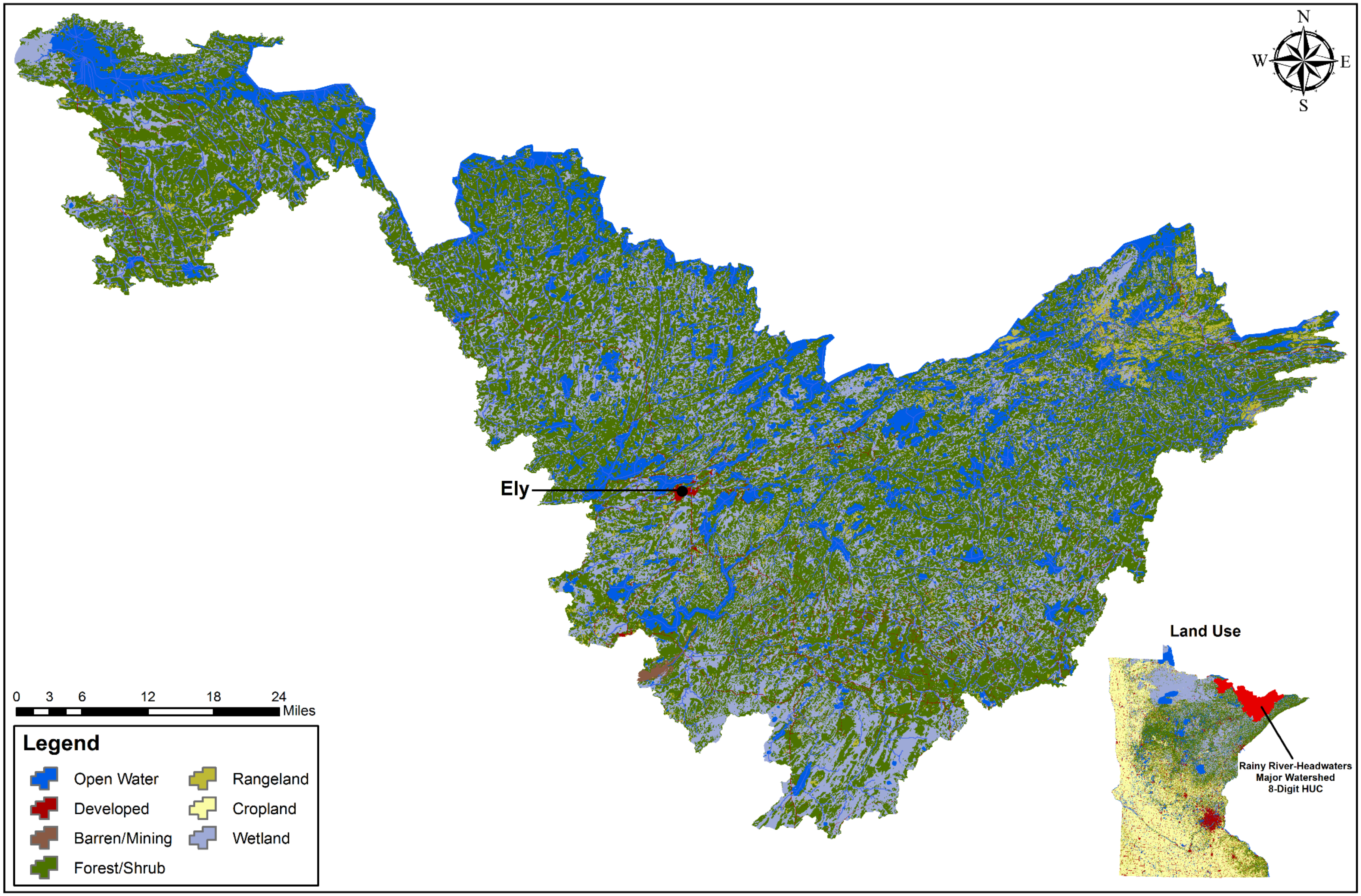


Figure 8. Land use in the Rainy River-Headwaters Watershed.

Surface water hydrology

The Rainy River-Headwaters Watershed contains 32 intermediate watersheds (12-digit Aggregated HUC) and 136 minor watersheds (14-digit HUC). Major rivers include the Ash, Bear Island, Black Duck, Burntside, Cross, Dumbbell, Dunka, Greenwood, Horse, Isabella, Island, Kawishiwi, Little Indian Sioux, Little Isabella, Mitawan, Moose, Nina Moose, Sea Gull, Shagawa, and Stony rivers. In addition, many smaller tributaries flow directly into lakes and into other major tributaries. This entire watershed is comprised of the Canadian Shield, which is a broad plain of eroded ancient rock covering much of central Canada and portions of northern Minnesota. Most of this bedrock is extremely hard, with the exception of some weak spots where glaciers have scared the landscape. The majority of this excavation is westward trending and now holds the lakes of the region and many of the streams that connect those lakes (Waters, 1977). This pattern is evident throughout the border lakes region of Minnesota and Ontario. The Canadian Shield, although locally rugged, is a vast area that is regionally flat. This regional attribute produces a great maze of navigable waterways that permitted relatively easy access by Native Americans, Voyageurs, and present day recreational use.

The Kawishiwi River is the largest river system in the Rainy River-Headwaters Watershed and begins it journey downstream from Kawishiwi Lake. It continues to flow to the north through Square, Kawasachong, Polly, Koma, and Malberg Lake before turning to the west. The Kawishiwi River passes through a lake-dominated landscape, with Alice, Insula, Hudson, Four, Three, Two and Lake One connecting directly to the river. After flowing 46.9 miles from its headwater, the South Kawishiwi River splits off to the southwest towards Birch Lake. On its path, it receives additional water from the Isabella River, which connects to the South Kawishiwi through Little Gabbro, Gabbro, and Bald Eagle Lake. The Isabella River is a stream-dominated system, with many cold-water stream resources that produce a vibrant brook trout population. Several other stream systems contribute their waters to Birch Lake directly before the South Kawishiwi River exits along its northern shoreline. The South Kawishiwi River rejoins the mainstem in Farm Lake after flowing through White Iron Lake. Waters of the Kawishiwi River continues to flow north from Farm Lake through another series of lakes and rapids before contributing its waters to Pipestone Bay of Basswood Lake. The Kawishiwi Falls, between Garden and Fall Lake, is a 60-foot waterfall that attracts numerous tourist each year. The river drops approximately 340 feet from its headwaters to its mouth at Basswood Lake. Most of this change in elevation occurs at the occasional rapids and falls between lakes, resulting in a less than five feet of elevation change per river mile. Major tributaries within this drainage are the Isabella, Dunka, Stony, Bear Island, and Dumbbell River. The majority of this drainage is within the BWCAW. This catchment contain 45.7% (863,998 acres) of the entire land mass of the Rainy River-Headwaters and has an average discharge near Ely of 1,000 cubic feet per second.

Many of the large lakes (Gunflint, Saganaga, Basswood, Crooked, Lac la Croix) that are located along the border are treasured by canoeists, campers, and fishermen as nearly pristine remnants of the “North Woods”. A few short rivers along the international border exist, including the 12-mile long Granite River between Gunflint and Saganaga Lake. This river consists of small-interconnected lakes that are shallow in depth and can have some rough rapids with sufficient water. The majority of the water exiting Saganaga Lake flows to the north into Canada along the voyageurs’ Kaministikwia route (Waters, 1977). This water later rejoins the United States portion of this watershed through the Maligne River that contributes its flow to Lac la Croix. A small tributary stream also connects Saganaga to Swamp Lake, where it continues to the west through Ottertrack, Little Knife, Knife, Birch, Basswood, & many more lakes and small connector streams. The land mass between these two major flowages is better known as Hunter’s Island. This island is solely contained in Ontario, Canada, with the majority of it within the Quetico Provincial Park. The Basswood River starts at the outlet of Basswood Lake and flows 5.3 miles before connecting with Crooked Lake. The Horse River contributes its flow to the Basswood River between the Upper and Lower Basswood Falls. Crooked Lake extends 20 miles along the international border before contributing its waters to Iron Lake through Curtain Falls. Water from Iron Lake continues through Bottle, Lac la Croix, and Loon Lake, before contributing its waters to the Loon River. Numerous tributary streams enter along this route including Little Indian Sioux, Boulder, and numerous other tributary streams from both Canada and the United States. The Loon River untimately enters Little Vermilion Lake before continuing on to Sand Point Lake. The Vermilion River Watershed enters the Rainy River-Headwaters through Crane Lake before contributing its waters to Namakan Lake. Namakan Lake connects to both Kabetogama and Rainy Lake, with the majority of the flow being contributed to Rainy Lake through Namakan Lake.

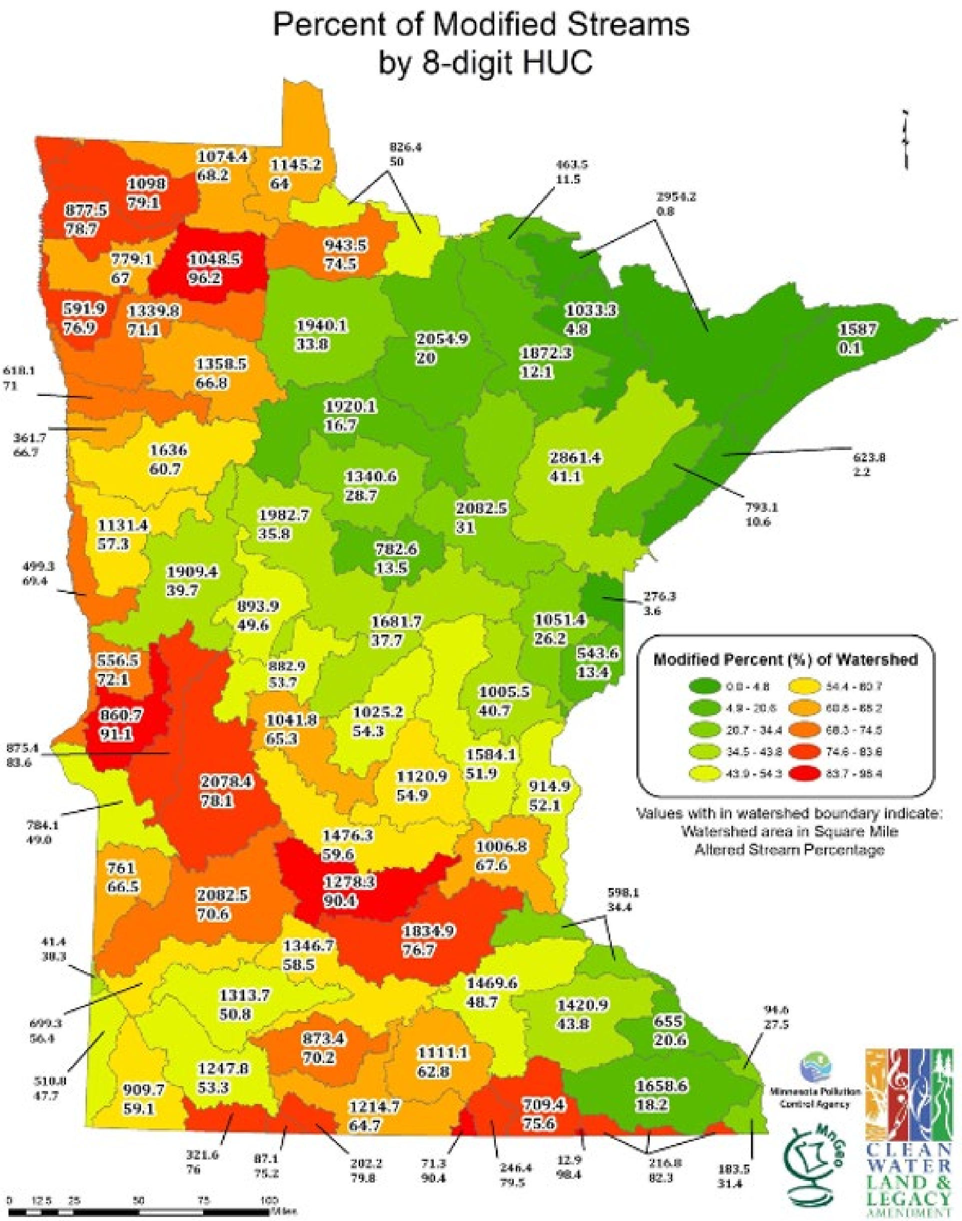


Figure 9. Map of percent modified streams by major watershed (8-HUC).

Streams within this watershed are generally short and connect the many lakes that are present throughout. Magnificent rapids and waterfalls can usually be found at the outlet of lakes where rock rims have dammed up the water. A large proportion of the streams are naturally meandering with little to no channelized sections (Figure 9). This watershed, although named after the Rainy River, has no portion of this stream within its boundaries. Waters from this area eventually enter the Rainy River before flowing 85.1 miles to Lake of the Woods, where it continues down the Winnipeg River to Lake Winnipeg, and finally, by way of Canada's Nelson River, to Hudson Bay.

Select drainages within this watershed provide excellent brook trout habitat near the middle and upper reaches but usually lack them near the pour point where habitat is limiting (thermal, substrate, and gradient). Tributary streams to the Island River are generally cooler, with brook trout as the principal game fish. Four-hundred and eight stream reaches totaling 894.26 stream miles exist throughout this major watershed, of which 373.11 stream miles are designated as cold-water (CW) in 227 stream reaches. Some of the streams that are designated cold-water include Arrowhead, Ash, Black Duck, Dunka, Dumbell, Inga, Little Isabella, Kinmount, Mitawan, and Snake River/Creek.

There are 12 dams located on various sized tributaries and outlets of major lakes, including the Kawishiwi, South Kawishiwi, and Stony River (USACE, 2013). Most of these dams were originally created for hydroelectric production or to control water levels. A limited amount of stream channels have been altered, with many natural meandering streams present throughout this watershed (Figure 10). The majority of the streams within this watershed are colored to some degree, with low alkalinity (10-50 parts per million as a result of igneous rock and bogs (Waters, 1977). There is five long-term and continuous USGS stream flow monitoring station located in this watershed near the mouth of the Gold Portage, Kawishiwi, South Kawishiwi (2), and Basswood River. Stream discharge in this watershed is relatively stable due to the moderating effect that the abundant lakes and wetlands have on stream flows.

A total of 1,273 lakes greater than 10 acres and 401,146 acres of wetlands exist within this watershed. The majority of the lakes and wetlands are found along the international border and function as water storage for continued stream flow throughout the seasons. Carved from hard igneous rock by the glaciers, these lakes are typically cold, deep, rocky, clear, and well-oxygenated (Waters, 1977). Many of these lakes are narrow, long and straight, oriented in the way glaciers proceeded through the landscape. This topography is a canoeist paradise, with many islands and rocky points. Many of these lakes are interconnected by water routes and short streams, with relatively easy portages between waters that are not navigable.

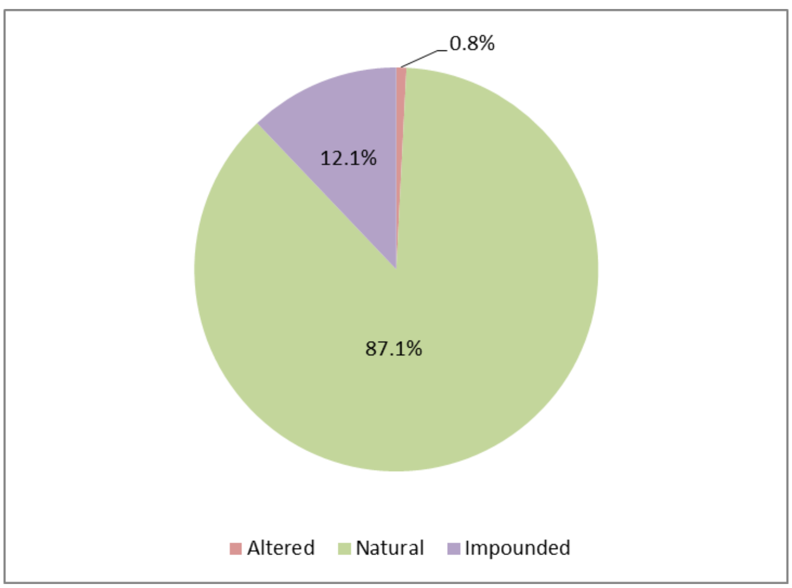


Figure 10. Comparison of natural to altered streams in the Rainy River-Headwaters Watershed.

Climate and precipitation

Minnesota has a continental climate, marked by warm summers and cold winters. The mean annual temperature for Minnesota is 40.1˚F. The mean summer (June-August) temperature for northeast Minnesota and the Rainy River-Headwaters Watershed is 61.7˚F and the mean winter (December-February) temperature is 7.5˚ F (NOAA, 2017).

Precipitation is an important source of water input to a watershed. Figure 11 shows two representations of precipitation for the water year 2014-2015. Total precipitation is displayed on the left, while the departure from normal is displayed on the right. Precipitation in the Rainy River-Headwaters Watershed ranged from just below 28 to nearly 36 inches in water year 2014 which was normal or slightly above normal. In water year 2015, total precipitation ranged from 24-28 inches, which was about 2-4 inches less than normal (DNR, 2016a).

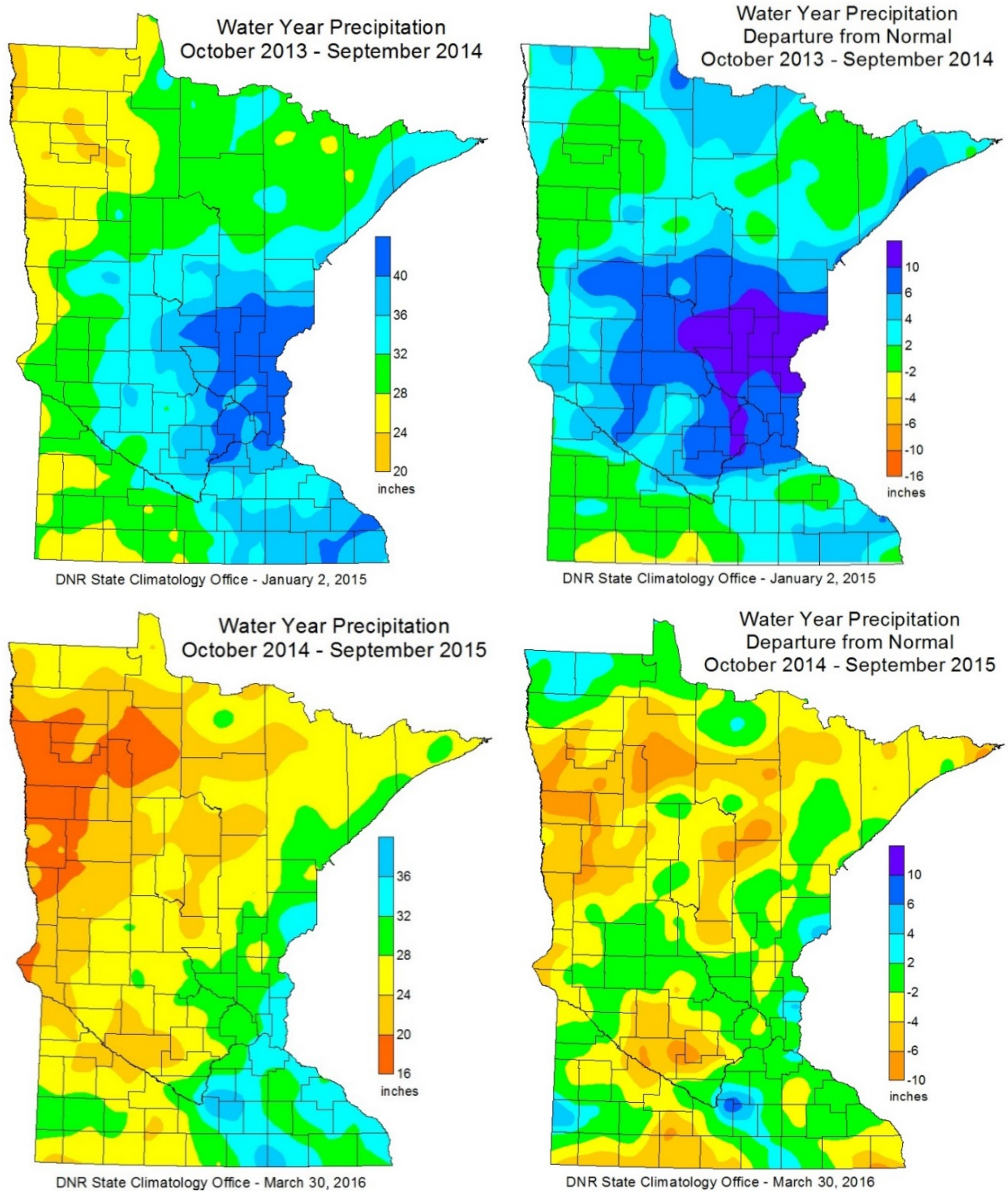
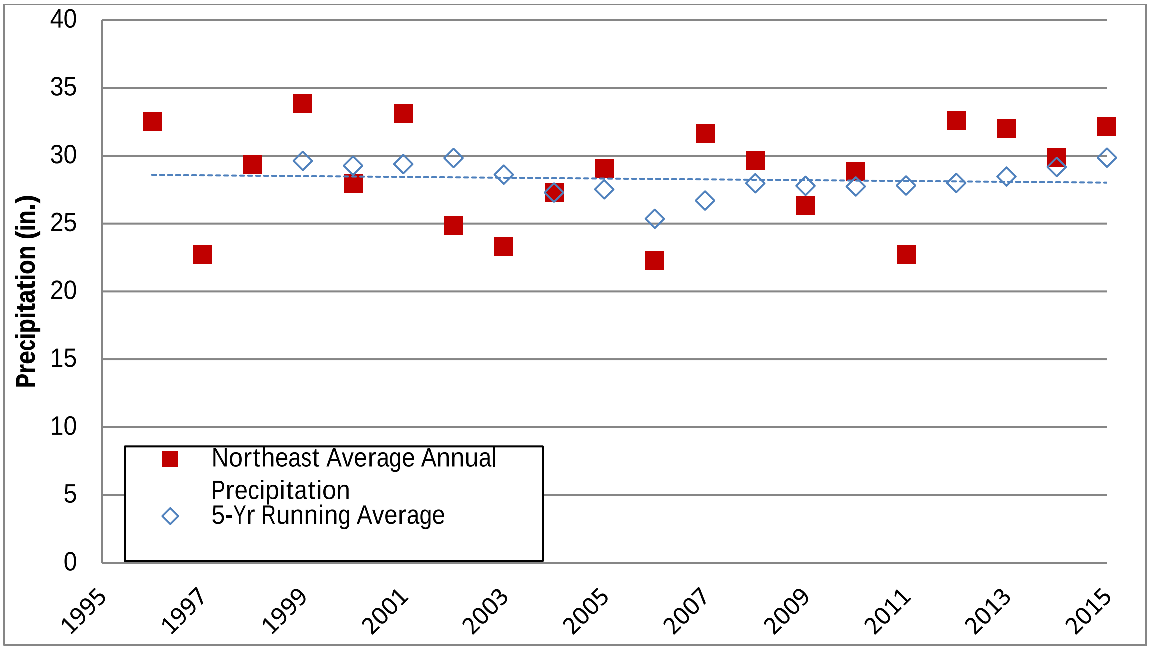


Figure 11. Statewide precipitation levels during the 2014-2015 water year.

Figure 12 displays the areal average representation of precipitation in northeast Minnesota for 20 and 100 years, respectively. An areal average is a spatial average of all the precipitation data collected within a certain area presented as a single dataset. Though rainfall can vary in intensity and time of year, rainfall totals in the Northeast region display no significant trend over the last 20 years. However, precipitation in northeast Minnesota exhibits a significant rising trend over the past 100 years (p=0.001). This is a strong trend and matches similar trends throughout Minnesota (WRCC 2016).



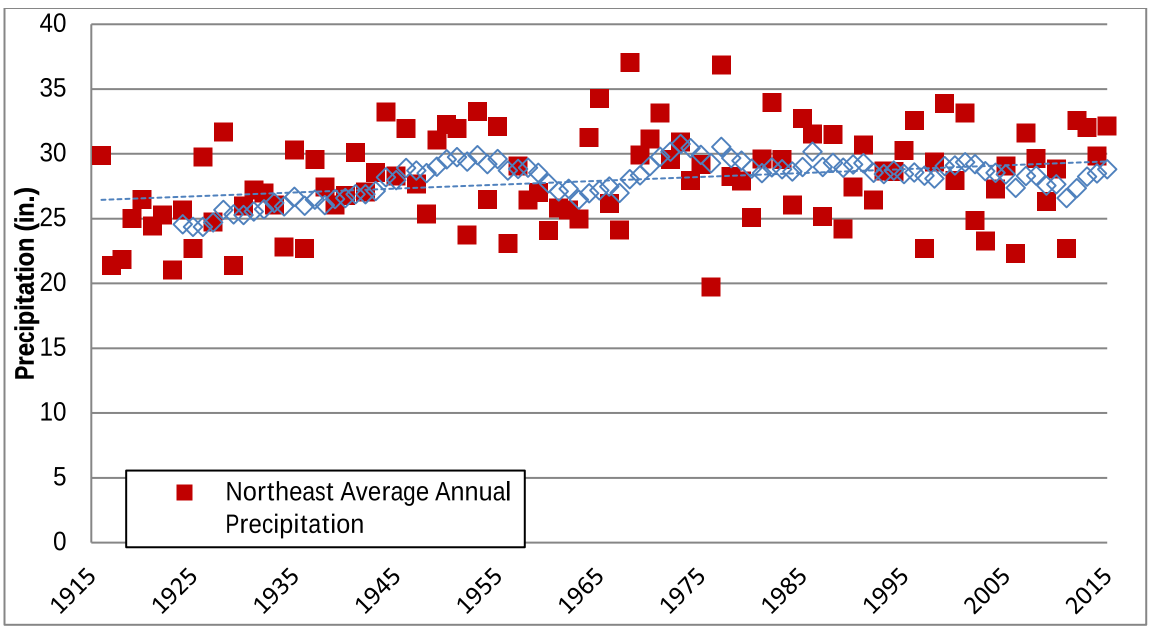


Figure 12. Average annual precipitation in northeast Minnesota (Above: 1996-2015 with 5 year running average; Below: 1916-2015 with10-year running average)

Hydrogeology and groundwater quality

The Rainy River-Headwaters Watershed is underlain by Precambrian bedrock which forms an impermeable layer for water moving through surficial materials. This water may accumulate and move along the bedrock interface and move through faults and fractures. Wells in this bedrock layer primarily act as storage for water moving through the fractures. Shallow surficial and buried drift aquifers above the bedrock are comprised of well-sorted sand and gravel and are sufficient for domestic withdrawals but are of limited supply for high-capacity use. An area in the southern portion of the watershed has thicker sandy and clayey glacial drift above the bedrock and slightly better groundwater availability. Across the watershed, the limited depth of surficial aquifers keeps them susceptible to contamination from human activity. (MPCA, 1999; DNR, 2001)

There are no DNR observation wells within the Rainy River-Headwaters Watershed. Water level measurements taken from MPCA monitoring wells in the shallow surficial aquifers tend to mirror recent precipitation trends. This supports the USGS description, stating recharge of these aquifers is limited to areas located at topographic highs, those with surficial sand and gravel deposits, and those along the bedrock/surficial deposit interface. In the Rainy River-Headwaters Watershed, the average annual recharge rate to surficial materials can range from 8-12 inches per year (Figure 13).

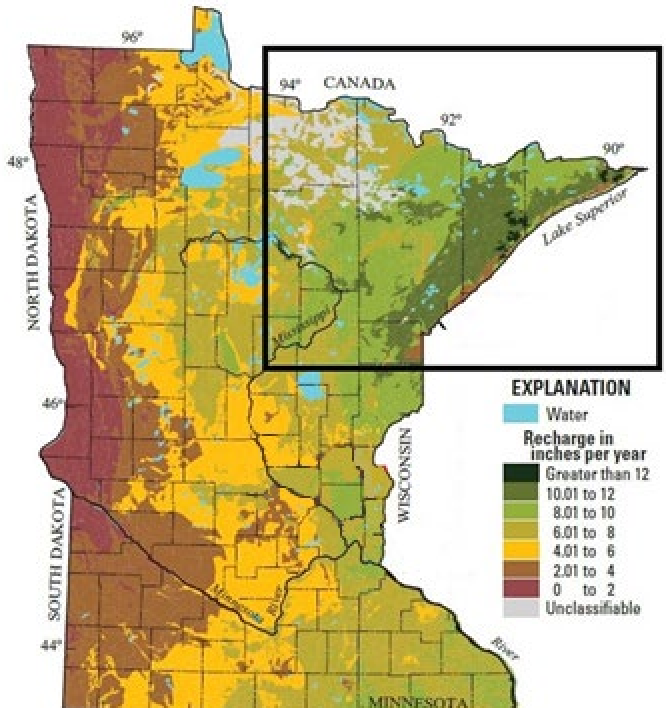


Figure 13. Average annual recharge rate to surficial materials in Minnesota (1971-2000) (USGS, 2007).

Wetlands

Excluding open water portions of lakes, ponds, and rivers, the Rainy River-Headwaters Watershed has approximately 401,146 acres of wetlands, which is equivalent to 21.2% of the watershed area. Forested wetlands are the most common wetland class in this watershed, by a factor of over 2 to 1, comprising 12.1% of the total wetland area (Figure 14). Scrub-shrub wetlands are the second most common wetland class comprising (5.4%). Emergent and shallow water habitat wetlands summed, total 3.8% of the wetland in the Rainy River-Headwaters Watershed. Peatlands comprise 34% of the wetland extent in the Rainy River-Headwaters Watershed. Often called "bogs", peatlands are wetlands with substrates of partially decomposed plant material that accumulates as peat. Peatlands can be forested, shrub dominated or occur as open herbaceous emergent wetland communities. These estimates and distribution observations are derived from the updated Minnesota National Wetland Inventory (NWI) based primarily on 2009 spring leaf-off imagery http://www.dnr.state.mn.us/eco/wetlands/nwi_proj.html.

The Rainy River-Headwaters Watershed makes up most of the BWCAW. Rainy River-Headwaters Watershed surface geology is characterized by outcropped bedrock, interspersed with glacial moraine till from the Rainy ground moraine complex in the north and east of the watershed and the Erskine moraine complex to the west and south region. The extensive ground moraine derived till with frequent depressions resulting from blocks of ice breaking from the most recent glacial ice sheet and shallow to exposed bedrock in this region is conducive to formation of wetlands. The entire Rainy River-Headwaters Watershed occurs within the Mixed Wood Shield Ecoregion.

Upper and Lower Stony River, Bear Island River and Greenwood River 12HUC subwatersheds support the highest percentage of wetland among all the 12-HUC subwatersheds in the Rainy River-Headwaters Watershed ranging in area from 32.1 to 50.2%. These estimates and distribution observations are derived from the updated Minnesota NWI based primarily on 2009 spring leaf-off imagery http://www.dnr.state.mn.us/eco/wetlands/nwi_proj.html. This updated inventory revealed slightly less wetland area (21.2%) compared to the original wetland inventory (22.9%). Given the lack of development within the Rainy River-Headwaters Watershed, the slight difference in wetland percent is likely due to improved data and advanced geographic data analysis methods currently available.

Special wetland features

To protect and maintain existing high water quality uses, all waters, including all wetlands, within the BWCAW and those within Voyagers National Park are prohibited from receiving net increases in pollutant loading or other causes of degradation in accordance with Minn. R. ch. 7050 parts 0265 and 0270. The southern region of the watershed, which is outside the BWCAW, includes nine 12-HUC watersheds where more than 25% of the area is wetland. In all nine of these subwatersheds forested wetlands are the dominant wetland type. There are six subwatersheds that support less than 15% wetlands, the lowest being Lac La Croix with 8.7% wetland. In most of these subwatersheds, deep-water habitats (i.e. lakes and large rivers) comprise at least 20% of the area with the balance being upland. The Sea Gull River subwatershed is the exception to this characterization as it supports less than 17% deep-water habitat, 15% wetland with the balance being upland.

Another special feature present throughout the wetlands in this watershed is the presence of wild rice. Analysis of a recent compilation of waters known to support wild rice finds 170 locations where wild rice grows in the Rainy River-Headwaters Watershed, the majority of these locations are lakes, however 18 locations are emergent or shallow water wetlands.

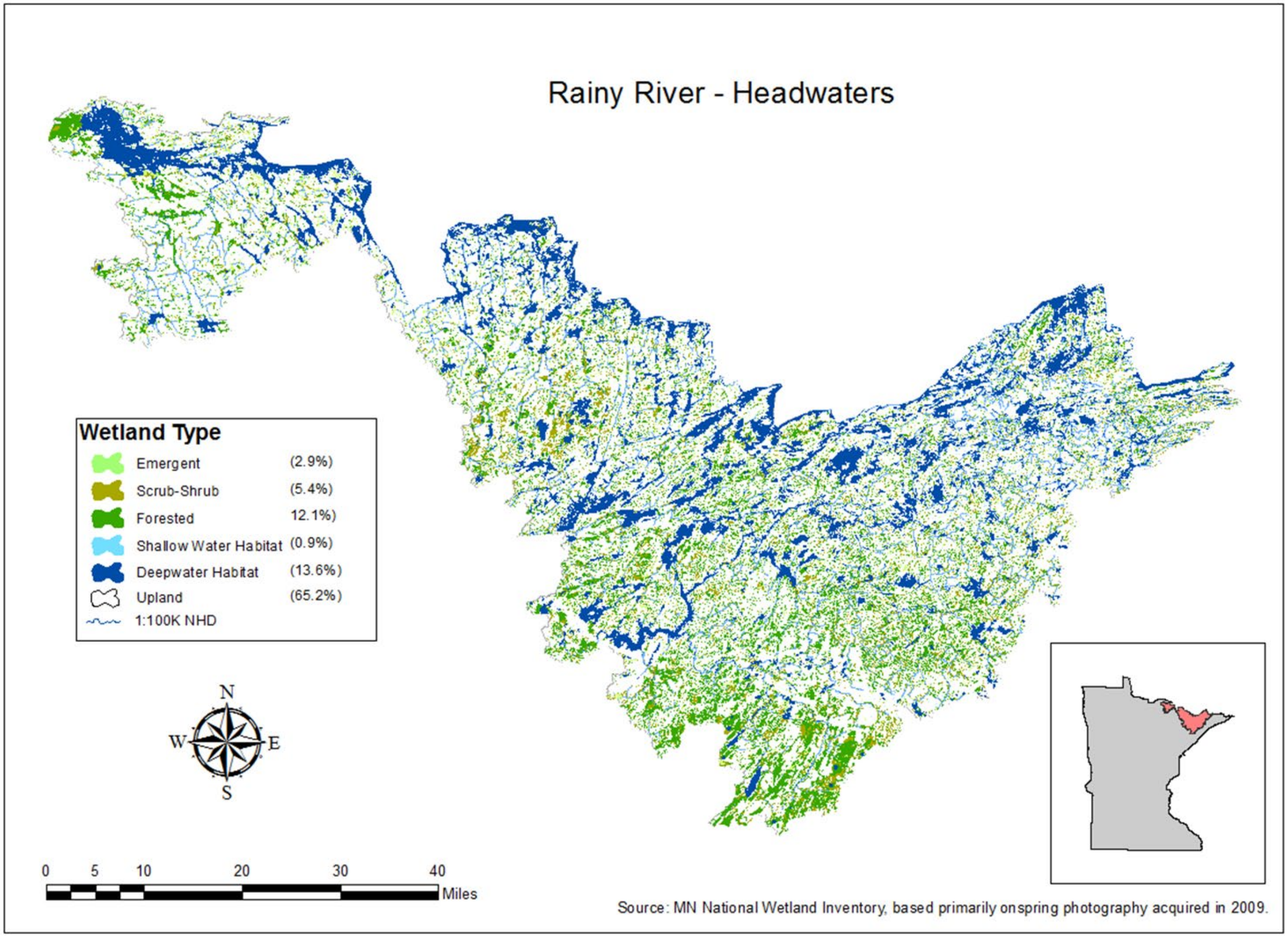


Figure 14. Wetlands and surface water in the Rainy River-Headwaters Watershed.

Watershed-wide data collection methodology

Lake water sampling

MPCA staff sampled many lakes in this watershed from 2012-2016. Specifically, MPCA staff sampled over 20 large and popular recreation lakes in the watershed, such as Burntside, Snowbank, Saganaga, Loon, Big, Dumbbell, Silver Island, Windy, Cedar, Tofte, Fenske, Ensign, Jeanette, Black Duck and Ash. Additionally, a Surface Water Assessment Grant was provided to local partners at Lake County Soil and Water Conservation District and University of Minnesota Duluth's Natural Resources Research Institute to monitor several other lakes such as Johnson, Spring, Sand, Little Long, Nils, South Farm, and North McDougal. Other large lakes in this watershed were routinely monitored by citizen volunteers, such as the White Iron Chain, by White Iron Chain of Lakes Association. Lastly, citizen volunteers collected Secchi transparency data on dozens of lakes via the MPCA's; (see Figure 3). Many BWCAW lakes were also monitored as part of CLMP, especially from the Boy Scouts of America, at the Northern Tier High Adventure Base east of Ely. Sampling methods are similar among monitoring groups and are described in the document entitled "MPCA Standard Operating Procedure for Lake Water Quality" found at http://www.pca.state.mn.us/publications/wq-s1-16.pdf (MPCA, March 2015). The lake water quality assessment standard requires eight observations/samples within a 10-year period (June to September) for phosphorus, Chl-a, and Secchi depth.

Stream water sampling

Thirteen water chemistry stations were sampled from May thru September in 2014, and again June thru August of 2015, to provide sufficient water chemistry data to assess all components of the aquatic life and recreation use standards. Following the IWM design, water chemistry stations were placed at the outlet of each aggregated 12-HUC subwatershed that was >40 square miles in area (purple circles and green circles/triangles in (Figure 2). SWAGs were awarded to Lake and Cook County SWCDs and the Vermilion Community College in Ely, to conduct the sampling. (See Appendix 2.1 for locations of stream water chemistry monitoring stations. See Appendix 1 for definitions of stream chemistry analytes monitored in this study).

Stream flow methodology

MPCA and the DNR joint stream water quantity and quality monitoring data for dozens of stations across the state on major rivers, at the mouths of most of the state's major watersheds, and at the mouths of some aggregated 12-HUC subwatersheds are available at the DNR/MPCA Cooperative Stream Gaging webpage at: http://www.dnr.state.mn.us/waters/csg/index.html (DNR, 2016b).

Stream biological sampling

The biological monitoring component of the IWM in the Rainy River-Headwaters Watershed was completed during the summer of 2014-2015. A total of 59 stations were newly established across the watershed and sampled as a result of the IWM design. These stations were located near the outlets of most minor HUC-14 watersheds. In addition, three existing biological monitoring stations within the watershed were revisited in 2014. These monitoring stations were initially established as part of an Environmental Monitoring and Assessment Program (EMAP) study of 2005, or for the development of biocriteria, or they were historical DNR stations. Six other stations were newly established in 2015 to supplement monitoring conducted in 2014 and provided further insight into the condition of streams within this watershed. An additional 19 stations were established and monitored by the MPCA from 1998 to 2015 for various reasons, including EMAP, stressor identification, biocriteria, etc. Of these stations, three (Dumbbell River; 14RN010, Moose River; 05RN076, and Mitawan Creek 05RN073) are long-term biological monitoring stations that are sampled by the MPCA biennially. The United States Forest Service (Superior National Forest) also provided biological data for 25 stations (including four stations sampled by the MPCA). Five other stations were sampled by the DNR and available as supporting information in this assessment. Two of these stations were co-located with stations monitored by the MPCA and provided further insight into the assessment of aquatic life.

While data from the last 10 years contributed to the watershed assessments, the majority of data utilized for the 2016 assessment was collected in 2014. A total of 94 stations were sampled within the 10 year assessment window (≥2006), while 17 other stations had data that were expired (<2006) and were only used in a supporting role for this assessment (Appendix 2.2 and 2.3). A total of 75 stream segments were sampled for biology in the Rainy River-Headwaters Watershed. Waterbody assessments to determine aquatic life use support were conducted for 64 stream segments. Biological information that was not used in the assessment process will be crucial to the stressor identification process and will also be used as a basis for long term trend results in subsequent reporting cycles.

To measure the health of aquatic life at each biological monitoring station, IBIs, specifically Fish and Invert IBIs, were calculated based on monitoring data collected for each of these communities. A fish and macroinvertebrate classification framework was developed to account for natural variation in community structure which is attributed to geographic region, watershed drainage area, water temperature and stream gradient. As a result, Minnesota's streams and rivers were divided into seven distinct warm-water classes and two cold-water classes, with each class having its own unique Fish IBI and Invert IBI. Each IBI class uses a unique suite of metrics, scoring functions, impairment thresholds, and confidence intervals (CIs) (For IBI classes, thresholds and CIs, see Appendix 3.1). IBI scores higher than the impairment threshold and upper CI indicate that the stream reach supports aquatic life. Contrarily, scores below the impairment threshold and lower CI indicate that the stream reach does not support aquatic life. When an IBI score falls within the upper and lower confidence limits additional information may be considered when making the impairment decision such as the consideration of potential local and watershed stressors and additional monitoring information (e.g., water chemistry, physical habitat, observations of local land use activities). For IBI results for each individual biological monitoring station, see Appendix 4.1 and 4.2.

Fish contaminants

The DNR fisheries staff collect most of the fish for the Fish Contaminant Monitoring Program (MPCA, July 2008). In addition, MPCA's biomonitoring staff collect up to five piscivorous (top predator) fish and five forage fish as part of the IWM. All fish collected by the MPCA are analyzed for mercury and the two largest individual fish of each species are analyzed for polychlorinated biphenyls (PCBs).

Captured fish were wrapped in aluminum foil and frozen until they were thawed, scaled (or skinned), filleted, and ground to a homogenized tissue sample. Homogenized fillets were placed in 60 mL glass jars with Teflon™ lids and frozen until thawed for lab analysis. The Minnesota Department of Agriculture Laboratory analyzed the samples for mercury and PCBs. If fish were tested for perfluorochemicals (PFCs), whole fish were shipped to AXYS Analytical Laboratory, which analyzed the homogenized fish fillets for 13 PFCs. Of the measured PFCs, only perfluorooctane sulfonate (PFOS) is reported because it bioaccumulates in fish to levels that are potentially toxic and a reference dose has been developed.

From the fish contaminant analyses, MPCA determines which waters exceed impairment thresholds. The Impaired Waters List is prepared by the MPCA and submitted every even year to the U.S. Environmental Protection Agency (EPA). MPCA has included waters impaired for contaminants in fish on the Impaired Waters List since 1998. Impairment assessment for PCBs (and PFOS when tested) in fish tissue is based on the fish consumption advisories prepared by the MDH. If the consumption advice is to restrict consumption of a particular fish species to less than a meal per week the MPCA considers the lake or river impaired. The threshold concentration for impairment (consumption advice of one meal per month) is an average fillet concentration of 0.22 mg/kg for PCBs (and 0.200 mg/kg for PFOS).

Monitoring of fish contaminants in the 1970s and 1980s showed high concentrations of PCBs were primarily a concern downstream of large urban areas in large rivers, such as the Mississippi River, and in Lake Superior. Therefore, PCBs are now tested where high concentrations in fish were measured in the past and the major watersheds are screened for PCBs in the watershed monitoring collections.

Before 2006, mercury in fish tissue was assessed for water quality impairment based on MDH's fish consumption advisory, the same as PCBs. With the adoption of a water quality standard for mercury in edible fish tissue, a waterbody has been classified as impaired for mercury in fish tissue if 10% of the fish samples (measured as the 90^{th} percentile) exceed 0.2 mg/kg of mercury. At least five fish samples of the same species are required to make this assessment and only the last 10 years of data are used for the assessment. MPCA's Impaired Waters List includes waterways that were assessed as impaired prior to 2006 as well as more recent impairments.

Load monitoring

The Watershed Pollutant Load Monitoring Network (WPLMN) 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, and Minnesota; at the outlets of the major tributaries (8 digit HUC scale) draining to these rivers; and for subwatersheds of the major watersheds. Intensive water quality sampling occurs at all WPLMN stations. Thirty-five samples per year are allocated for basin and major watershed stations and 25 samples per season (ice out through October 31) for subwatershed stations. Water sample results and daily average flow data are coupled in the FLUX32 pollutant load model to estimate the transport (load) of nutrients and other water quality constituents past a sampling station over a given period of time. Loads and flow weighted mean concentrations (FWMCs) are calculated for total suspended solids (TSS), total phosphorus (TP), dissolved orthophosphate (DOP), nitrate plus nitrite nitrogen (NO_3+NO_2-N), and total Kjeldahl nitrogen (TKN).

More information can be found at the WPLMN website (MPCA, 2016b).

Groundwater monitoring

Groundwater quantity

Monitoring wells from the DNR Observation Well Network track the elevation of groundwater across the state. The elevation of groundwater is measured as depth to water in feet and reflects the fluctuation of the water table as it rises and falls with seasonal variations and anthropogenic influences. Data from these wells and others are available at the Groundwater Level Data website (DNR, December 2016).

Groundwater quality

The MPCA's Ambient Groundwater Monitoring Program monitors trends in statewide groundwater quality by sampling for a comprehensive suite of chemicals including nutrients, metals, and volatile organic compounds. These ambient wells represent a mix of deeper domestic wells and shallow monitoring wells. The shallow wells interact with surface waters and exhibit impacts from human activities more rapidly. Available data from federal, state and local partners are used to supplement reviews of groundwater quality in the region.

Groundwater/surface water withdrawals

The DNR permits all high capacity water withdrawals where the pumped volume exceeds 10,000 gallons/day or 1 million gallons/year. Permit holders are required to track water use and report back to the DNR yearly. Information on the program and the program database are found at the Minnesota Water Use Data website (DNR, 2016c).

Stream flow

MPCA and the DNR jointly monitor stream water quantity and quality at dozens of stations across the state on major rivers, at the mouths of most of the state's major watersheds, and at the mouths of some aggregated 12-HUC subwatersheds. Information and data on these stations are available at the MDNR/MPCA Cooperative Stream Gaging website (DNR, 2016b).

Wetland monitoring

The MPCA is actively developing methods and building capacity to conduct wetland quality monitoring and assessment. Our primary approach is biological monitoring—where changes in biological communities may be indicating a response to human-caused impacts. The MPCA has developed IBIs to monitor the macroinvertebrate condition of depressional wetlands with open water and the Floristic Quality Assessment to assess vegetation condition in all of Minnesota's wetland types. For more information about the wetland monitoring (including technical background reports and sampling procedures), please visit the MPCA Wetland monitoring and assessment webpage (MPCA, 2016a).

The MPCA currently does not monitor wetlands systematically by watershed. Rather, the MPCA is using probabilistic monitoring to assess status and trends of wetland quality in the state and by major ecoregion. Probabilistic monitoring refers to the process of randomly selecting stations to monitor; from which, an unbiased estimate of the resource can be made. Regional probabilistic survey results can provide a reasonable approximation of the current wetland quality in the watershed.

Individual Aggregated 12-HUC subwatershed results

Aggregated 12-HUC subwatersheds

Assessment results for aquatic life and recreation use are presented for each aggregated 12-HUC subwatershed within the Rainy River-Headwaters Watershed. The primary objective is to portray all the full support and impairment listings within an aggregated 12-HUC subwatershed resulting from the complex and multi-step assessment and listing process. This scale provides a robust assessment of water quality condition at a practical size for the development, management, and implementation of effective TMDLs and protection strategies. The graphics presented for each of the aggregated 12-HUC subwatersheds contain the assessment results from the 2016 Assessment Cycle as well as any impairment listings from previous assessment cycles. Discussion of assessment results focuses primarily on the 2014 IWM effort, but also considers available data from the last 10 years.

The proceeding pages provide an account of each aggregated 12-HUC subwatershed. Each account includes a brief description of the aggregated 12-HUC subwatershed, and summary tables of the results for each of the following: a) stream aquatic life and aquatic recreation assessments, and b) lake aquatic life and recreation assessments. Following the tables is a narrative summary of the assessment results and pertinent water quality projects completed or planned for the aggregated 12-HUC subwatershed. A brief description of each of the summary tables is provided below. Individual watersheds that lie along the international border between the United States and Canada will only have watershed statistics and assessment results from the United States side of the border.

Stream assessments

A table is provided in each section summarizing aquatic life and aquatic recreation assessments of all assessable stream reaches within the aggregated 12-HUC subwatershed (i.e., where sufficient information was available to make an assessment). Primarily, these tables reflect the results of the 2012 assessment process 2014 EPA reporting cycle); however, impairments from previous assessment cycles are also included and are distinguished from new impairments via cell shading (see footnote section of each table). These tables also denote the results of comparing each individual aquatic life and aquatic recreation indicator to their respective criteria (i.e., standards); determinations made during the desktop phase of the assessment process (see Figure 4). Assessment of aquatic life is derived from the analysis of biological (fish and invert IBIs), DO, TSS, chloride, pH, TP, Chl-a, biochemical oxygen demand and un-ionized ammonia (NH_3) data, while the assessment of aquatic recreation in streams is based solely on bacteria (Escherichia coli) data. Included in each table is the specific aquatic life use classification for each stream reach: cold-water community (2A); cool or warm-water community (2B); or indigenous aquatic community (2C). Where applicable and sufficient data exists, assessments of other designated uses (e.g., class 7, drinking water, aquatic consumption) are discussed in the summary section of each aggregated 12-HUC subwatershed as well as in the watershed-wide results and discussion section.

Lake assessments

A summary of lake water quality is provided in the aggregated 12-HUC subwatershed sections where available data exists. This includes aquatic recreation (phosphorus, Chl-a, and Secchi) and aquatic life, where available (chloride). Similar to streams, parameter level and over all use decisions are included in the table.

Granite River Aggregated 12-HUC HUC 0903000103-01

The Granite River Subwatershed drains 47.81 square miles of Cook County and is the third smallest subwatershed within the Rainy River-Headwaters Watershed. This subwatershed lies along the international border between the United States and Canada, with additional drainage on the Canadian side. The headwaters of this subwatershed is North Lake (16-0331-00) and it continues to flow to the west through a rugged lake-dominated landscape of deep bedrock basins. One major inlet (Cross River) contributes its waters to Gunflint Lake (16-0356-00) along its western shoreline. Various small unnamed tributaries exist within this subwatershed and connect the numerous lakes. There are a total of 36 lakes greater than 10 acres, with the most prominent being Gunflint, North, Loon, Marabaeuf, Magnetic, Granite, Gneiss, Clover, and Larch. The majority of the lakes within this area have native lake trout populations. This subwatershed is dominated by forest (49.05%), open water (19.74%), and rangeland (15.34%). Only 14.15% is wetland, 1.65% is developed, 0.07% is barren/mining and there is no row-crop agriculture. This entire subwatershed lies within the Superior National Forest, with a portion (33.9%) of it within the Boundary Waters Canoe Area Wilderness (BWCAW). Much of the land is owned and managed by local, state, and federal entities (USGS, 2008). Both prescribed and wild fires have burned a large portion of this subwatershed, with the most notable being the Ham Lake Fire of 2007. As a result of the overall remoteness, short tributary streams, and many large bodies of water, there was only one biological sample from this subwatershed. However, chemistry data was obtained from numerous lakes.

Table 2. Aquatic life and recreation assessments on stream reaches: Granite River Aggregated 12-HUC. Reaches are organized upstream to downstream in the table.

AUID *Reach Name*, *Reach Description*	Biological Station ID	Reach Length (miles)	Use Class	Aquatic Life Indicators: Fish IBI	Invert IBI	Dissolved Oxygen	TSS	Secchi Tube	Chloride	pH	Ammonia -NH_3	Pesticides	Eutrophication	Aquatic Life	Aquatic Rec. (Bacteria)
09030001-974 **Larch Creek** **Headwaters to Boundary Waters Canoe Area Wilderness Boundary**	14RN098	3.64	CWg*	MTS	MTS	IF	IF	IF	- -	IF	IF	- -	IF	SUP	- -

Abbreviations for Indicator Evaluations: **MTS** = Meets Standard; **EXS** = Fails Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Impaired (Fails Standards)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.
Abbreviations for Use Class: **WWg** = warmwater general, **WWm** = Warmwater modified, **WWe** = Warmwater exceptional, **CWg** = Coldwater general, **CWe** = Coldwater exceptional,
LRVW = limited resource value water
*Assessments were completed using proposed use classifications changes that have not yet been written into rule.

Table 3. Lake assessments: Granite River Aggregated 12-HUC.

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators:			Aquatic Recreation Indicators:			Aquatic Life Use	Aquatic Recreation Use
							Fish IBI	Chloride	Pesticides	Total Phosphorus	Chlorophyll-a	Secchi		
Gneiss	16-0617-00	61.1	70	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	IF	- -	SUP
Granite	16-0580-00	38.1	45	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Crab	16-0357-00	78.0	17	- -	NLF	- -	- -	IF	- -	- -	- -	- -	IF	IF
North	16-0331-00	530.0	125	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	MTS	- -	IF
Gunflint	16-0356-00	2165.5	200	Deep Lake	NLF	I	- -	IF	- -	MTS	MTS	MTS	IF	SUP
Loon	16-0448-00	1099.9	202	Deep Lake	NLF	NT	- -	IF	- -	MTS	MTS	MTS	IF	SUP
Iron	16-0328-00	107.0	15	Shallow Lake	NLF	- -	- -	- -	- -	MTS	MTS	IF	- -	SUP
Mayhew	16-0337-00	218.4	80	Deep Lake	NLF	- -	- -	- -	- -	MTS	MTS	MTS	- -	SUP
Little Iron	16-0355-00	108.7	18	Shallow Lake	NLF	- -	- -	- -	- -	MTS	MTS	IF	- -	SUP

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators:			Aquatic Recreation Indicators:			Aquatic Life Use	Aquatic Recreation Use
							Fish IBI	Chloride	Pesticides	Total Phosphorus	Chlorophyll-a	Secchi		
Magnetic	16-0463-00	177.0	93	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Clove	16-0581-00	129.2	25	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Marabaeuf	16-0610-00	389.5	55	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP

Abbreviations for Ecoregion: DA = Driftless Area, NCHF = North Central Hardwood Forest, NGP = Northern Glaciated Plains, NLF = Northern Lakes and Forests, NMW = Northern Minnesota Wetlands, RRV = Red River Valley, WCBP = Western Corn Belt Plains
Abbreviations for Secchi Trend: D = decreasing/declining trend, I = increasing/improving trend, NT = no detectable trend, -- = not enough data
Abbreviations for Indicator Evaluations: -- = No Data, **MTS** = Meets Standard; **EXS** = Exceeds Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Not Support (Impaired, exceeds standard)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.

Summary

The Granite River Subwatershed had one assessable stream segment, containing one biological monitoring station, and eight lakes assessed for aquatic recreation (Table 2 and Table 3). All of the streams and lakes met the applicable standards or criteria and fully support aquatic life or aquatic recreation (Figure 16). Larch Creek (-974) was the only assessable stream reach within this subwatershed. The stream was evaluated for its viability to support a cold-water assemblage and to determine its appropriate use class designation (WWg or CWg). The biological and thermal data indicated that there was a reasonable potential for this reach to support a cold-water community. The thermal regime of Larch Creek (14RN098) was the coldest within the Rainy River-Headwaters Watershed, with an average summer (June 1 – August 31) temperature of 16.3ºC in 2014. Well over 97% of the temperatures recorded during the summer of 2014 were within the growth range of brook trout. The biological community contained several cool and cold-water obligates, including both fish (mottled sculpin and burbot) and macroinvertebrates (*Amphinemura, Heterotrissocladius,* and *Lype diversa*). As a result of this analysis, a use class change from warm-water (WWg) to cold-water (CWg) will be proposed through rulemaking. In the interim, the reach has been assessed using the cold-water IBI and biological criteria.

In-stream habitat was in fair condition and was likely influenced by disturbances within the stream channel and the drainage (Appendix 5). A BWCAW entry point is located just upstream of this reach, with an average of 240 visitors between 74 permits a year (Quinn, 2017). This recreational use, coupled with the recent Ham Lake fire of 2007, likely had a negative impact on the overall habitat score for this reach. Although in-stream habitat may be limiting this biological community in some aspects, the overall health of this drainage is excellent.

Gunflint (16-0356-00), Loon (16-0448-00), Mayhew (16-0337-00), Iron (16-0328-00), and Little Iron (16-0355-00) were assessed using either the Lake Trout (Class 2A) or Cool/Warm-Water (Class 2B) eutrophication standards. Loon, Gunflint, and Mayhew are classic oligotrophic trout lakes and are clearly meeting standards for TP, Chl-a, and Secchi transparency. These lakes have long-term transparency values near 6 meters (~ 20 feet). Little Iron and Iron Lakes are shallower, are influenced by wetland, and have naturally lower Secchi transparency (Figure 15). Gunflint has a statistically significant increase in transparency, starting in the early 2000s, but this is likely due to a change in a CLMP station location (from near shore to mid-lake). Given the size and volume of Gunflint Lake and its limited catchment disturbance, it is expected that transparency would remain stable over long-term. Lakes within the BWCAW that fully supported aquatic recreation based on satellite-estimated Secchi transparency included Clove (16-0581-00), Marabaeuf (16-0610-00), and Geniss (16-0617-00; Figure 83). In summary, all assessed lakes were meeting water quality standards and had excellent water quality.

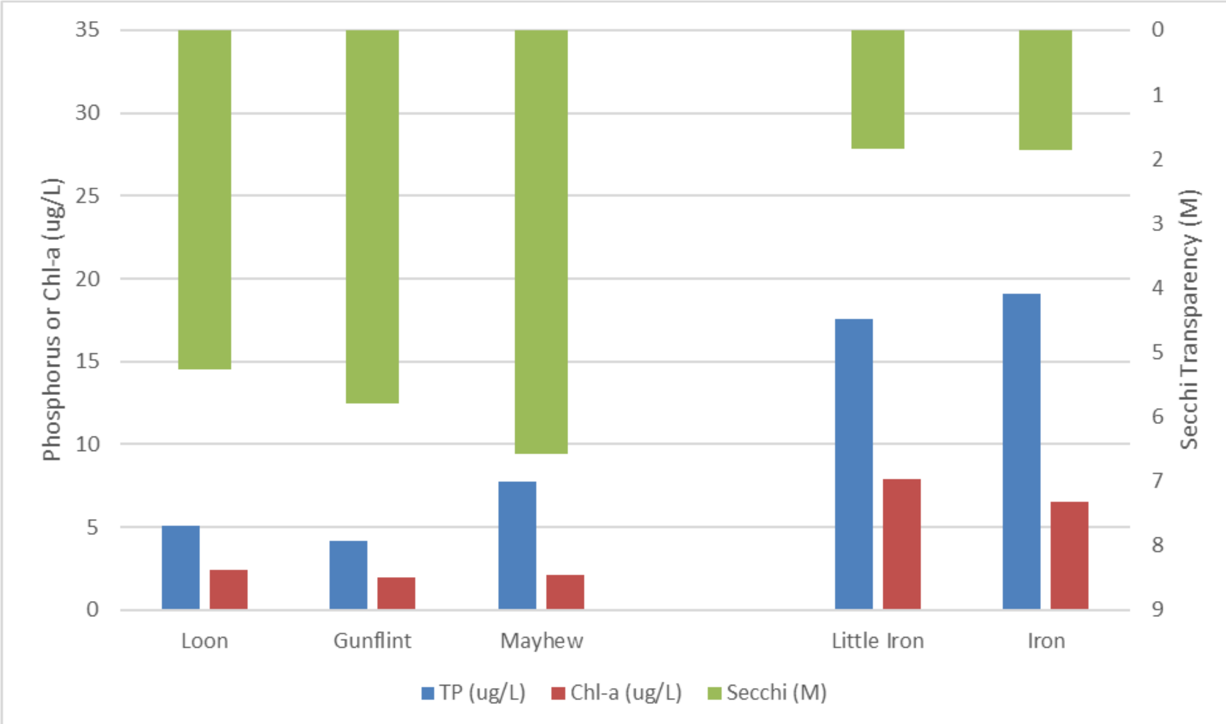


Figure 15. Water quality summary for assessed lakes in the Granite River Aggregated 12-HUC.

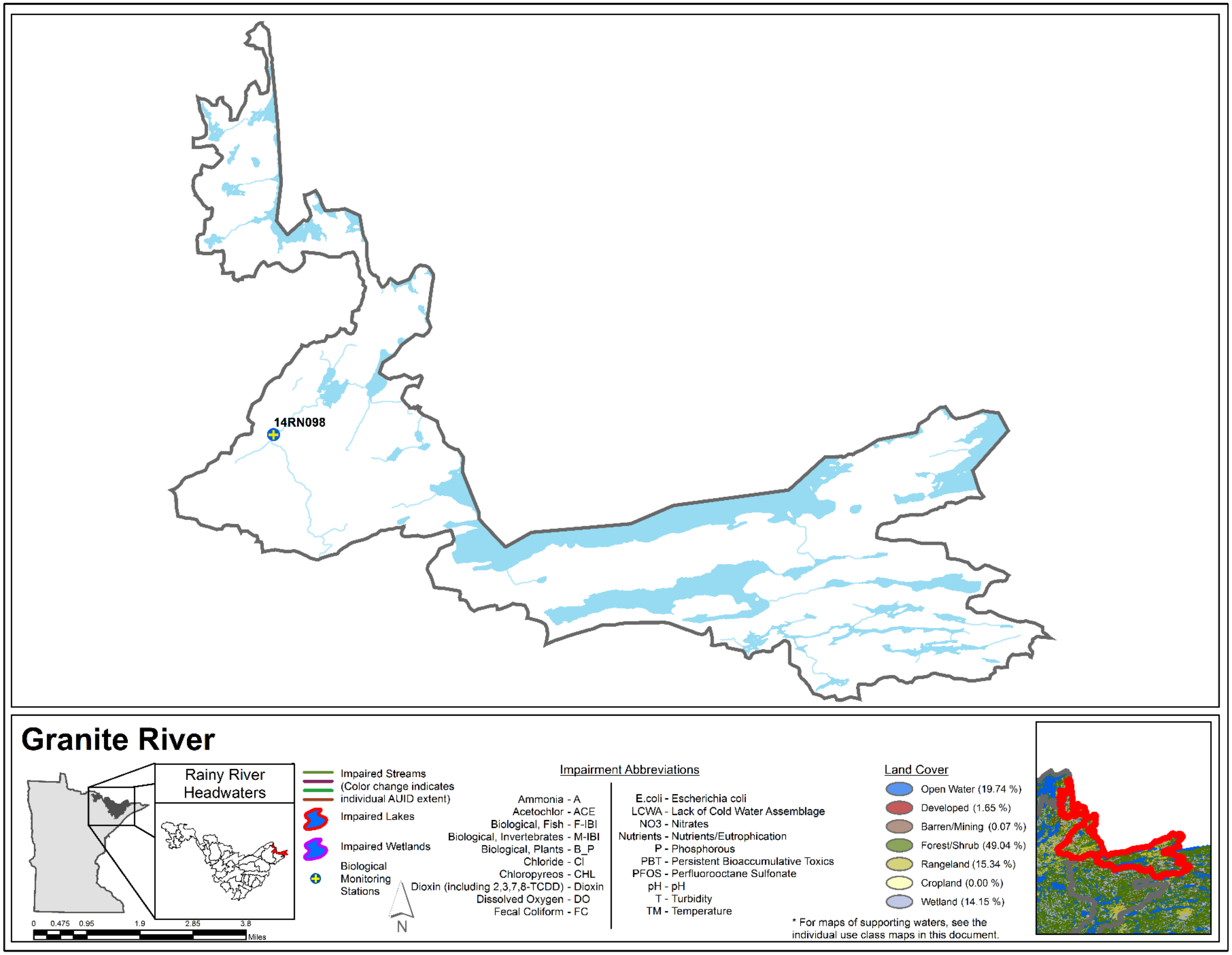


Figure 16. Currently listed impaired waters by parameter and land use characteristics in the Granite River Aggregated 12-HUC.

Cross River Aggregated 12-HUC HUC 0903000103-02

The Cross River Subwatershed drains 63.28 square miles of Cook County and is the tenth smallest subwatershed within the Rainy River-Headwaters Watershed. Various unnamed streams exist within this subwatershed that connect and feed the numerous lakes. The most significant tributary within this subwatershed is the Cross River, which starts at the outlet of Ham Lake (16-0608-00) and flows 3.8 miles before exiting this subwatershed into Gunflint Lake (16-0356-00). Other tributaries include Extortion, Ham Creek, and numerous unnamed streams. There are a total of 58 lakes greater than 10 acres, with the most prominent being Long Island, Cherokee, Round, Tucker, Gordon, Kiskadinna, Karl, Ham, and Snipe. This subwatershed is dominated by forest (64.86%), wetland (18.29%), and open water (10.86%). Only 4.80% is rangeland, 1.11% is developed, 0.05% is barren/mining, and 0.03% is row-crop agriculture. This entire subwatershed lies within the Superior National Forest, with the majority (80.4%) of it within the BWCAW. A portion of the Hairy Lake Primitive Management Area lies within this drainage. Much of the land is owned and managed by local, state, and federal entities (USGS, 2008). Both prescribed and wild fires have burned a portion of this subwatershed, with the most notable being the Famine Fire of 2006, Ham Lake Fire of 2007, Dawkins Fire of 2010, and Lizard Lake Fire of 2010. Intensive water chemistry sampling was conducted at the outlet of this subwatershed at County Road 12 (Gunflint Trail), 6.5 miles southeast of Trails End on the Cross River. The outlet is represented by water chemistry station S007-912 and biological station 14RN011.

Table 4. Aquatic life and recreation assessments on stream reaches: Cross River Aggregated 12-HUC. Reaches are organized upstream to downstream in the table.

AUID ***Reach Name***, *Reach Description*	Biological Station ID	Reach Length (miles)	Use Class	Aquatic Life Indicators: Fish IBI	Invert IBI	Dissolved Oxygen	TSS	Secchi Tube	Chloride	pH	Ammonia -NH_3	Pesticides	Eutrophication	Aquatic Life	Aquatic Rec. (Bacteria)
09030001-966 **Cross River** **Ham Lk Outlet to Gunflint Lk**	14RN011	3.79	WWe	MTS	MTS	IF	IF	MTS	MTS	MTS	MTS	- -	IF	SUP	SUP

Abbreviations for Indicator Evaluations: **MTS** = Meets Standard; **EXS** = Fails Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Impaired (Fails Standards)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.
Abbreviations for Use Class: **WWg** = warmwater general, **WWm** = Warmwater modified, **WWe** = Warmwater exceptional, **CWg** = Coldwater general, **CWe** = Coldwater exceptional, **LRVW** = limited resource value water
*Assessments were completed using proposed use classifications changes that have not yet been written into rule.

Table 5. Lake water aquatic recreation assessments: Cross River Aggregated 12-HUC.

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators: Fish IBI	Aquatic Life Indicators: Chloride	Aquatic Life Indicators: Pesticides	Aquatic Recreation Indicators: Total Phosphorus	Aquatic Recreation Indicators: Chlorophyll-a	Aquatic Recreation Indicators: Secchi	Aquatic Life Use	Aquatic Recreation Use
Lower George	16-0546-00	18.7	10	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Ron	16-0605-00	10.0	20	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Town	16-0458-00	86.2	60	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Doe	16-0548-00	12.9	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Vesper	16-0414-00	11.7	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Sebeka	16-0423-00	33.3	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Muskeg	16-0427-00	33.4	15	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Sitka	16-0513-00	30.7	50	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Cross Bay	16-0526-00	82.7	10	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators: Fish IBI	Aquatic Life Indicators: Chloride	Aquatic Life Indicators: Pesticides	Aquatic Recreation Indicators: Total Phosphorus	Aquatic Recreation Indicators: Chlorophyll-a	Aquatic Recreation Indicators: Secchi	Aquatic Life Use	Aquatic Recreation Use
Rib	16-0544-00	84.3	10	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Cave	16-0425-00	24.9	- -	- -	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Ross	16-0424-00	32.4	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Missing Link	16-0529-00	36.1	25	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Long Island	16-0460-00	895.7	69	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Cherokee	16-0524-00	852.0	142	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	IF	- -	SUP
Tucker	16-0417-00	145.7	42	Deep Lake	NLF	- -	- -	- -	- -	MTS	MTS	IF	- -	SUP
Kiskadinna	16-0428-00	116.8	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Karl	16-0461-00	124.4	75	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Snipe	16-0527-00	113.2	80	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators: Fish IBI	Aquatic Life Indicators: Chloride	Aquatic Life Indicators: Pesticides	Aquatic Recreation Indicators: Total Phosphorus	Aquatic Recreation Indicators: Chlorophyll-a	Aquatic Recreation Indicators: Secchi	Aquatic Life Use	Aquatic Recreation Use
Gordon	16-0569-00	143.5	93	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Round	16-0606-00	155.3	45	Deep Lake	NLF	- -	- -	IF	- -	- -	- -	IF	IF	IF
Ham	16-0608-00	120.2	40	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF

Abbreviations for Ecoregion: DA = Driftless Area, NCHF = North Central Hardwood Forest, NGP = Northern Glaciated Plains, NLF = Northern Lakes and Forests, NMW = Northern Minnesota Wetlands, RRV = Red River Valley, WCBP = Western Corn Belt Plains
Abbreviations for Secchi Trend: D = decreasing/declining trend, I = increasing/improving trend, NT = no detectable trend, -- = not enough data
Abbreviations for Indicator Evaluations: -- = No Data, **MTS** = Meets Standard; **EXS** = Exceeds Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Not Support (Impaired, exceeds standard)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.

Summary

The Cross River Subwatershed had one assessable stream segment, containing one biological monitoring station, and five lakes assessed for aquatic recreation (Table 4 and Table 5). All of the streams and lakes met the applicable standards or criteria and fully support aquatic life and/or aquatic recreation (Figure 17). The only biological monitoring station (14RN0011) was located on the Cross River (-966) near the outlet of this subwatershed. In-stream habitat was in good condition throughout this stream reach and was reflective of the quality of this drainage (Appendix 5). As a result of quality habitat and good water quality, a relatively diverse fish and macroinvertebrate community was present. The low amount of disturbance within this subwaterhed almost assured excellent biological integrity. A use class analysis indicated that this reach met the criteria for being designated as exceptional. Streams that have exceptional biological, chemical, and physical parameters are worthy of additional protection. Several sensitive fish species (longnose dace, mottled sculpin, etc.) were captured during monitoring and resulted in an F-IBI score (62.81) above the exceptional use threshold. Although the M-IBI (79.72) was just below the exceptional use threshold, the presence of numerous sensitive species and a state threatened species (Ocellated Darner: *Boyeria grafiana*) indicated exceptional biological quality. Conventional water chemistry sampling indicated that the water quality was excellent and was reflective of the upstream forests, wetlands, and lakes. Nutrient levels were consistently low (the lowest average phosphorus concentrations of the water chemistry stations in the entire Rainy River-Headwaters Watershed), although there were too few samples collected to make a formal assessment of river eutrophication. *E. coli* bacteria concentrations were also consistently low, indicating full-support for aquatic recreation.

Only one lake in this subwatershed, Tucker Lake (16-0417-00), was monitored for eutrophication (TP, Chl-a, and Secchi transparency). Total phosphorus and Chl-a levels were low and indicated mesotrophic conditions. The lake fully supports aquatic recreation. Lakes within the BWCAW that were assessed as fully supporting recreation based on satellite-estimated Secchi transparency included Town (16-0458-00), Cherokee (16-0524-00), Snipe (16-0527-00), and Gordon (16-0569-00; Figure 83). In summary, both the intensive water quality monitoring on the Cross River and the lakes in this subwatershed are high quality, reflecting the protected land in much of the subwatershed.

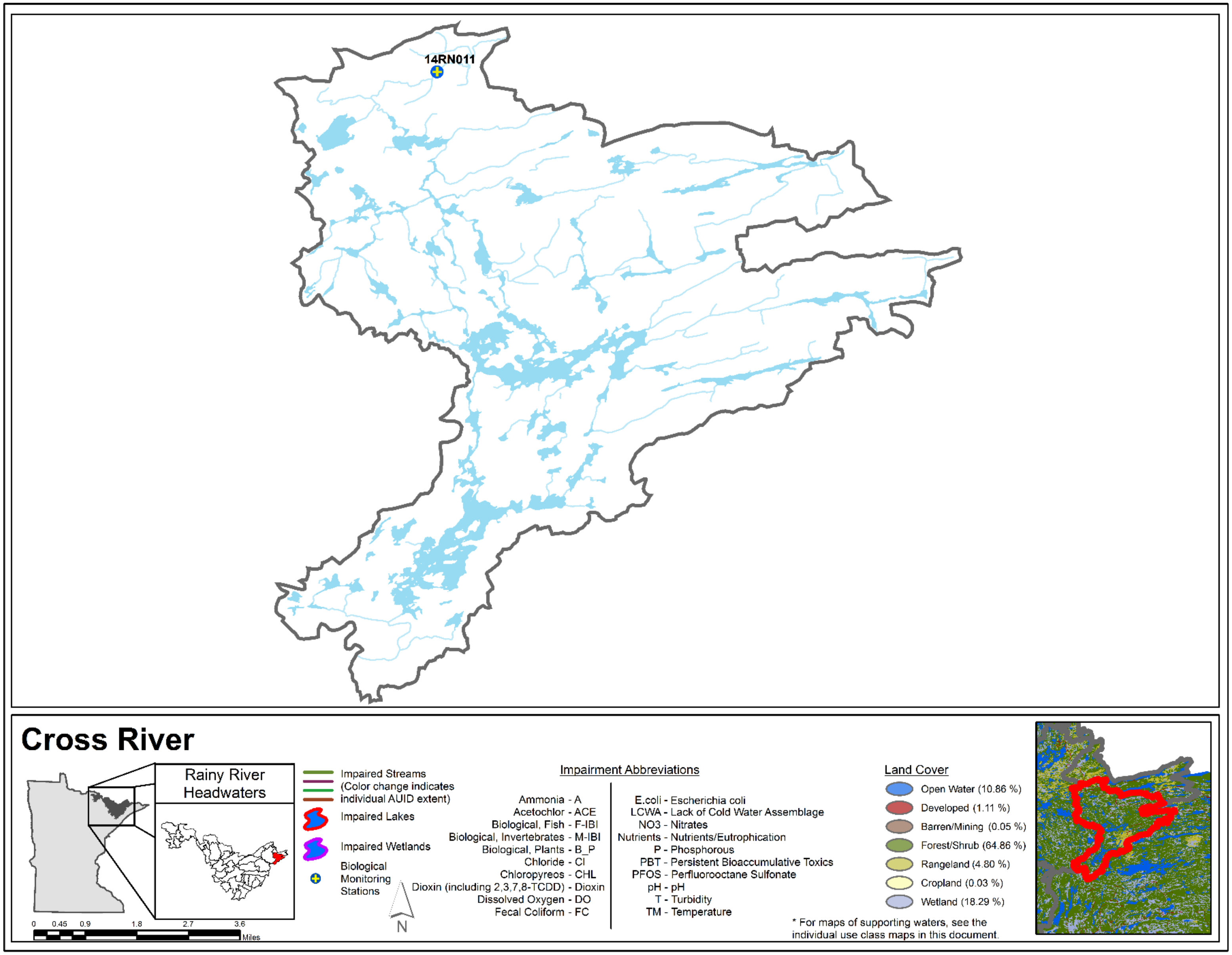


Figure 17. Currently listed impaired waters by parameter and land use characteristics in the Cross River Aggregated 12-HUC.

Saganaga Lake Aggregated 12-HUC HUC 0903000104-01

The Saganaga Lake Subwatershed drains 32.61 square miles of Cook (96.3%) and Lake (3.7%) counties and is the smallest subwatershed within the Rainy River-Headwaters Watershed. This subwatershed lies along the international border between the United States and Canada, with additional drainage on the Canadian side. Various unnamed streams exist within the drainage that connect and feed many lakes. Two major inlets (Granite and Sea Gull River) enter this subwatershed and contribute their waters directly to Saganaga Lake (16-0633-00). There are a total of 11 lakes greater than 10 acres, with the most prominent being Saganaga, Red Rock, Zephyr, Lone, and Swamp. This subwatershed is dominated by open water (37.80%), forest (36.32%), and wetland (22.80%). Only 3.08% is rangeland and there is no developed, barren/mining, or row-crop agriculture. This entire subwatershed lies within the Superior National Forest and the BWCAW. A portion of the Pitfall Lake Primitive Management Area lies within this drainage. Much of the land is owned and managed by local, state, and federal entities (USGS, 2008). A portion of this drainage was burned in the past 25 years, with the most notable fires being Sag Corridor Fire of 1995, Alpine Lake Fire of 2005, Cavity Lake Fire of 2006, and Ham Lake Fire of 2007. As a result of the overall remoteness, short tributary streams, and many large bodies of water; there was no biological or intensive water chemistry sampling conducted on rivers or streams within this subwatershed.

Table 6. Lake assessments: Saganaga Lake Aggregated 12-HUC.

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators:			Aquatic Recreation Indicators:			Aquatic Life Use	Aquatic Recreation Use
							Fish IBI	Chloride	Pesticides	Total Phosphorus	Chlorophyll-a	Secchi		
Tenor	16-0613-00	21.3	11	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Lone	16-0795-00	87.2	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Swamp	38-0012-00	135.3	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Saganaga	16-0633-00	4949.0	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	IF	IF	- -	IF
Red Rock	16-0793-00	449.3	64	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Zephyr	16-0813-00	143.5	47	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF

Abbreviations for Ecoregion: DA = Driftless Area, NCHF = North Central Hardwood Forest, NGP = Northern Glaciated Plains, NLF = Northern Lakes and Forests, NMW = Northern Minnesota Wetlands, RRV = Red River Valley, WCBP = Western Corn Belt Plains
Abbreviations for Secchi Trend: D = decreasing/declining trend, I = increasing/improving trend, NT = no detectable trend, -- = not enough data
Abbreviations for Indicator Evaluations: -- = No Data, **MTS** = Meets Standard; **EXS** = Exceeds Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Not Support (Impaired, exceeds standard)
Key for Cell Shading: ☐ = existing impairment, listed prior to 2014 reporting cycle; ☐ = new impairment; ☐ = full support of designated use; ☐ = insufficient information.

Summary

The Saganaga Lake Subwatershed had no assessable stream segments and four lakes assessed for aquatic recreation (Table 6). All of the lakes are high quality waters and most met the applicable standards or criteria and fully supported aquatic recreation (Figure 19). Chlorophyll-a concentrations on Saganaga (16-0633-00) exceeded the standard for protection of lake trout (3 µg/L) and Secchi transparency on average is lower than expected for a lake that supports lake trout. The phosphorus concentrations are very low – it is possible that changes to the zooplankton community could be leading to the higher than expected algae. It is important to note that concentrations are still quite low (4 ug/L), and a bloom would not be expected on this lake (Figure 18). Lakes within the BWCAW that were assessed as fully supporting recreational use based on satellite-estimated Secchi transparency included Lone (16-0795-00), Swamp (38-0012-00), and Red Rock (16-0793-00; Figure 83).

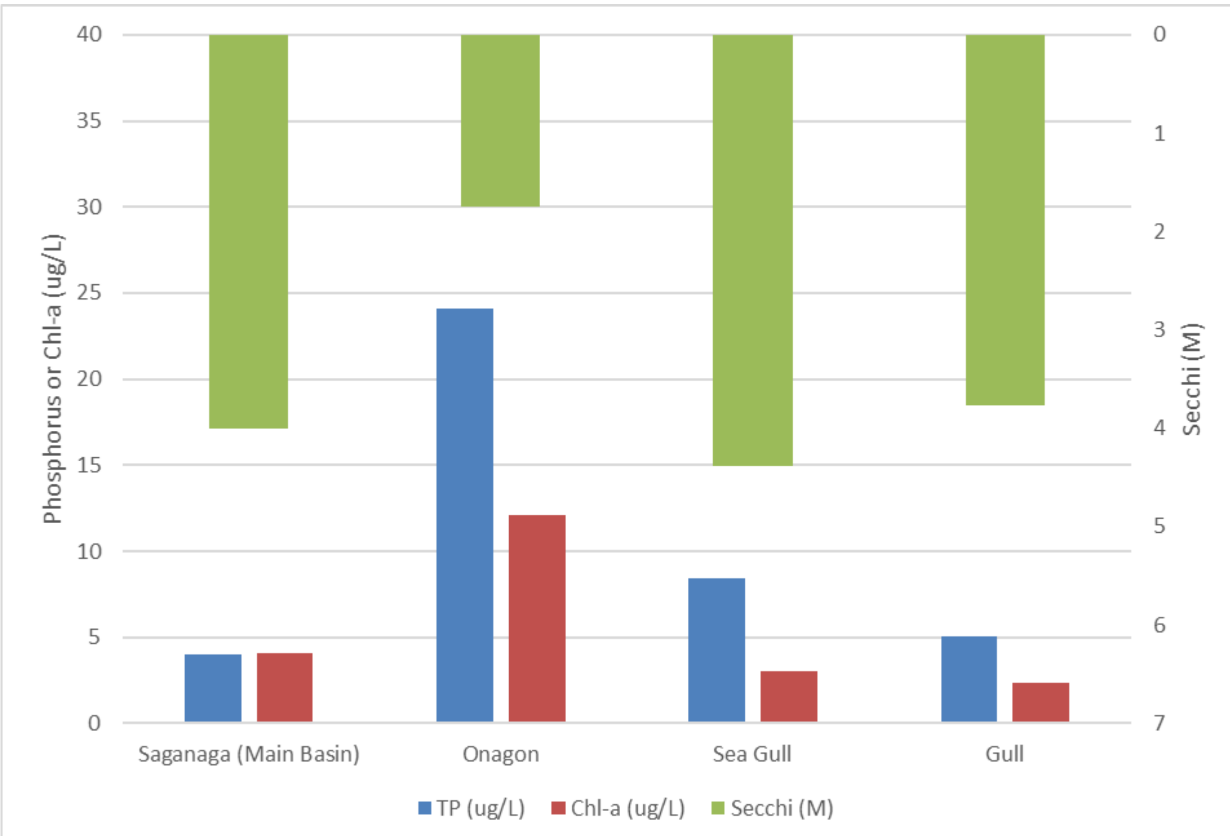


Figure 18. Water quality summary for assessed lakes in the Saganaga Lake and Sea Gull River Subwatersheds.

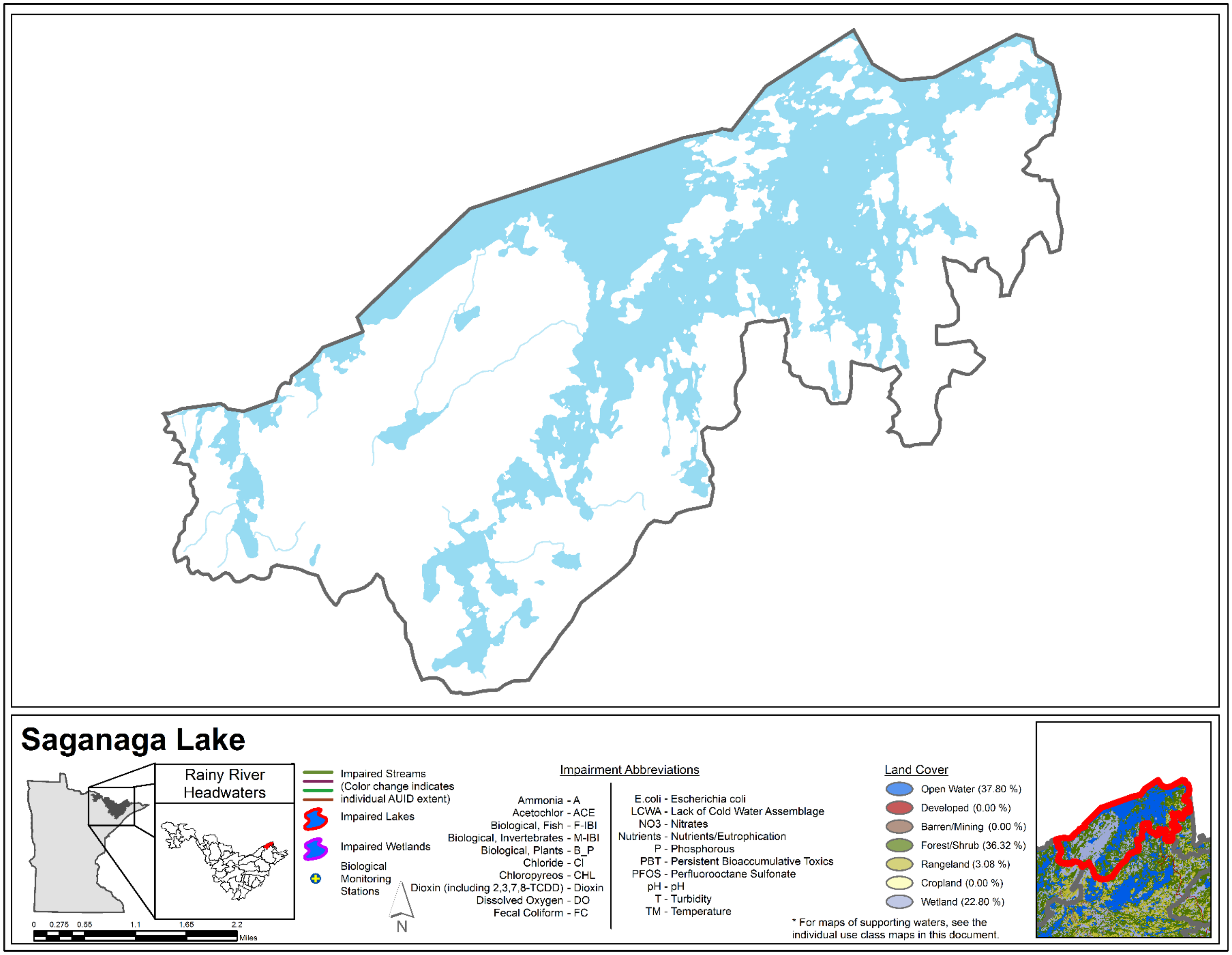


Figure 19. Currently listed impaired waters by parameter and land use characteristics in the Saganaga Lake Aggregated 12-HUC.

Sea Gull River Aggregated 12-HUC HUC 0903000104-02

The Sea Gull River Subwatershed drains 153.43 square miles of Cook (84.5%) and Lake (15.5%) counties and is the fourth largest subwatershed within the Rainy River-Headwaters Watershed. The headwaters begin in Sora Lake (16-0553-00) and flow 2.2 miles to the south through an unnamed creek. On its path to Frost Lake (16-0571-00), it passes through both Din and Iris Lakes before receiving additional flow from an unnamed tributary that connects Auk, Burt, and Moth Lakes. The Frost River begins at the outlet of Frost Lake. The river flows 4.5 miles to the west before turning to the north and flowing an additional 5.1 miles. Numerous unnamed tributary streams and lakes contribute water to the Frost River before it pours into Little Saganaga Lake (16-0809-00). Various small channels, lakes, and streams connect Little Saganaga to Gabimichigami, Ogishkemuncie, Jasper, Alpine, and finally to Sea Gull Lake. The Sea Gull River starts at the outlet of the Sea Gull Lake (16-0629-00) and flows to the north into Gull Lake (16-0632-00) before exiting the subwatershed and entering Saganaga Lake (16-0633-00). There are a total of 171 lakes greater than 10 acres, with the most prominent being Sea Gull, Little Saganaga, Gabimichigami, Alpine, Tuscarora, Ogishkemuncie, Gills, Frost, Peter, and Jasper. This subwatershed is dominated by forest (50.15%), wetland (19.97%), and open water (18.26%). Only 10.72% is rangeland (can included burned areas), 0.69% is barren/mining, 0.21% is developed, and there is no row-crop agriculture. This entire subwatershed lies within the Superior National Forest with the majority (92.7%) of it within the BWCAW. A portion of the Hairy Lake, Humpback Lake, Mugwump Lake, and Pitfall Lake Primitive Management Area are located within this drainage. Much of the land is owned and managed by local, state, and federal entities (USGS, 2008). A portion of this drainage has burned by wildfires, with the most notable fires being Sag Corridor Fire of 1995, Three Mile Fire of 2002, Arc Lake Fire of 2003, Honker Fire of 2003, Kek Fire of 2003, Tuscarora Fire of 2004, Alpine Lake Fire of 2005, Cavity Lake Fire of 2006, and Ham Lake Fire of 2007. As a result of the overall remoteness, short tributary streams, and many large bodies of water; there was no biological or intensive water chemistry sampling conducted on river and streams within this subwatershed.

Table 7. Lake assessments: Sea Gull River Aggregated 12-HUC.

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators:			Aquatic Recreation Indicators:			Aquatic Life Use	Aquatic Recreation Use
							Fish IBI	Chloride	Pesticides	Total Phosphorus	Chlorophyll-a	Secchi		
Spice	38-0189-00	25.8	27	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Green	16-0628-00	37.3	70	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Rattle	16-0720-00	41.1	30	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Bat	16-0752-00	83.8	100	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Kingfisher	16-0812-00	39.4	38	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	IF	- -	SUP
Flying	16-0602-00	37.8	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Skindance	38-0191-00	50.8	51	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Mueller	38-0193-00	23.5	36	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	MTS	- -	IF
Onagon	16-0619-00	20.3	- -	Deep Lake	NLF	NT	- -	- -	- -	MTS	EXS	IF	- -	SUP

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators: Fish IBI	Aquatic Life Indicators: Chloride	Aquatic Life Indicators: Pesticides	Aquatic Recreation Indicators: Total Phosphorus	Aquatic Recreation Indicators: Chlorophyll-a	Aquatic Recreation Indicators: Secchi	Aquatic Life Use	Aquatic Recreation Use
Virgin	16-0719-00	57.0	40	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Whipped	16-0739-00	54.9	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Fente	16-0741-00	33.7	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Glossy Squat	16-0781-00	25.7	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Seahorse	16-0786-00	26.1	21	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Hug	16-0674-00	27.7	35	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Zenith	16-0689-00	20.3	20	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
West Fern	16-0718-00	82.9	60	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Rog	16-0765-00	53.1	40	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Fay	16-0783-00	69.7	65	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators: Fish IBI	Chloride	Pesticides	Aquatic Recreation Indicators: Total Phosphorus	Chlorophyll-a	Secchi	Aquatic Life Use	Aquatic Recreation Use
Hoe	38-0143-00	46.1	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Vierge	38-0007-00	23.8	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Powell	16-0756-00	51.0	75	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Fern	16-0716-00	72.3	70	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Glee	16-0782-00	46.1	8	- -	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Agamok	38-0011-00	107.1	29	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	IF	- -	SUP
Elton	38-0126-00	125.7	53	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	MTS	- -	SUP
Makwa	38-0147-00	133.5	76	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	IF	- -	SUP
Tuscarora	16-0623-00	788.3	130	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Sea Gull	16-0629-00	3982.9	130	Deep Lake	NLF	NT	- -	IF	- -	MTS	IF	EXS	IF	SUP

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators: Fish IBI	Chloride	Pesticides	Aquatic Recreation Indicators: Total Phosphorus	Chlorophyll-a	Secchi	Aquatic Life Use	Aquatic Recreation Use
Gillis	16-0753-00	615.2	180	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Alpine	16-0759-00	885.3	65	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	MTS	- -	SUP
Little Saganaga	16-0809-00	1648.0	150	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	IF	- -	SUP
Gabimichigami	16-0811-00	1197.0	209	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	IF	- -	SUP
Ogishkemuncie	38-0180-00	769.3	70	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	IF	- -	SUP
Brandt	16-0600-00	106.4	80	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Paulson	16-0626-00	123.5	60	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Gull (Main Basin)	16-0632-01	169.6	40	Deep Lake	NLF	NT	- -	IF	- -	MTS	MTS	MTS	IF	SUP
Mesaba	16-0673-00	206.9	65	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Elm	16-0721-00	108.4	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators: Fish IBI	Chloride	Pesticides	Aquatic Recreation Indicators: Total Phosphorus	Chlorophyll-a	Secchi	Aquatic Life Use	Aquatic Recreation Use
Crooked	16-0723-00	240.3	75	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Mora	16-0732-00	213.9	40	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Hub	16-0748-00	117.3	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
French	16-0755-00	119.6	135	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Peter	16-0757-00	277.5	120	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Jasper	16-0768-00	256.4	125	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	IF	- -	SUP

Abbreviations for Ecoregion: DA = Driftless Area, NCHF = North Central Hardwood Forest, NGP = Northern Glaciated Plains, NLF = Northern Lakes and Forests, NMW = Northern Minnesota Wetlands, RRV = Red River Valley, WCBP = Western Corn Belt Plains
Abbreviations for Secchi Trend: D = decreasing/declining trend, I = increasing/improving trend, NT = no detectable trend, -- = not enough data
Abbreviations for Indicator Evaluations: -- = No Data, **MTS** = Meets Standard; **EXS** = Exceeds Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Not Support (Impaired, exceeds standard)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.

Summary

The Sea Gull River Subwatershed had no assessable stream segments and 33 lakes assessed for aquatic recreation (Table 7). All of the lakes met the applicable standards or criteria and fully supported aquatic recreation (Figure 20). Lakes with assessment-level water quality data in this subwatershed include Onagon (16-0619-00), Sea Gull (16-0629-00), and Gull (16-0632-01; Figure 18). Onagon Lake, a small lake without a public access near Sea Gull, is mesotrophic and fully supported aquatic recreation. Total Phosphorous concentrations met Class 2B standards for Onagon Lake; Chl-a concentrations slightly exceeded the standard. Sea Gull met all three eutrophication standards for protection of its lake trout designation. Transparency averages about 4.6 meters (15 feet). Gull Lake, immediately downstream of Sea Gull, is classified as a 2B water, and has very low phosphorus and chlorophyll concentrations very similar to conditions in Sea Gull. Many BWCAW lakes (30) in this subwatershed fully supported recreation based on satellite estimated Secchi transparency (Figure 83). Examples are Mesaba (16-0673-00), Tuscarora (16-0623-00), Gillis (16-0753-00), Alpine (16-0759-00), Jasper (16-0768-00), and Little Saganaga (16-0809-00).

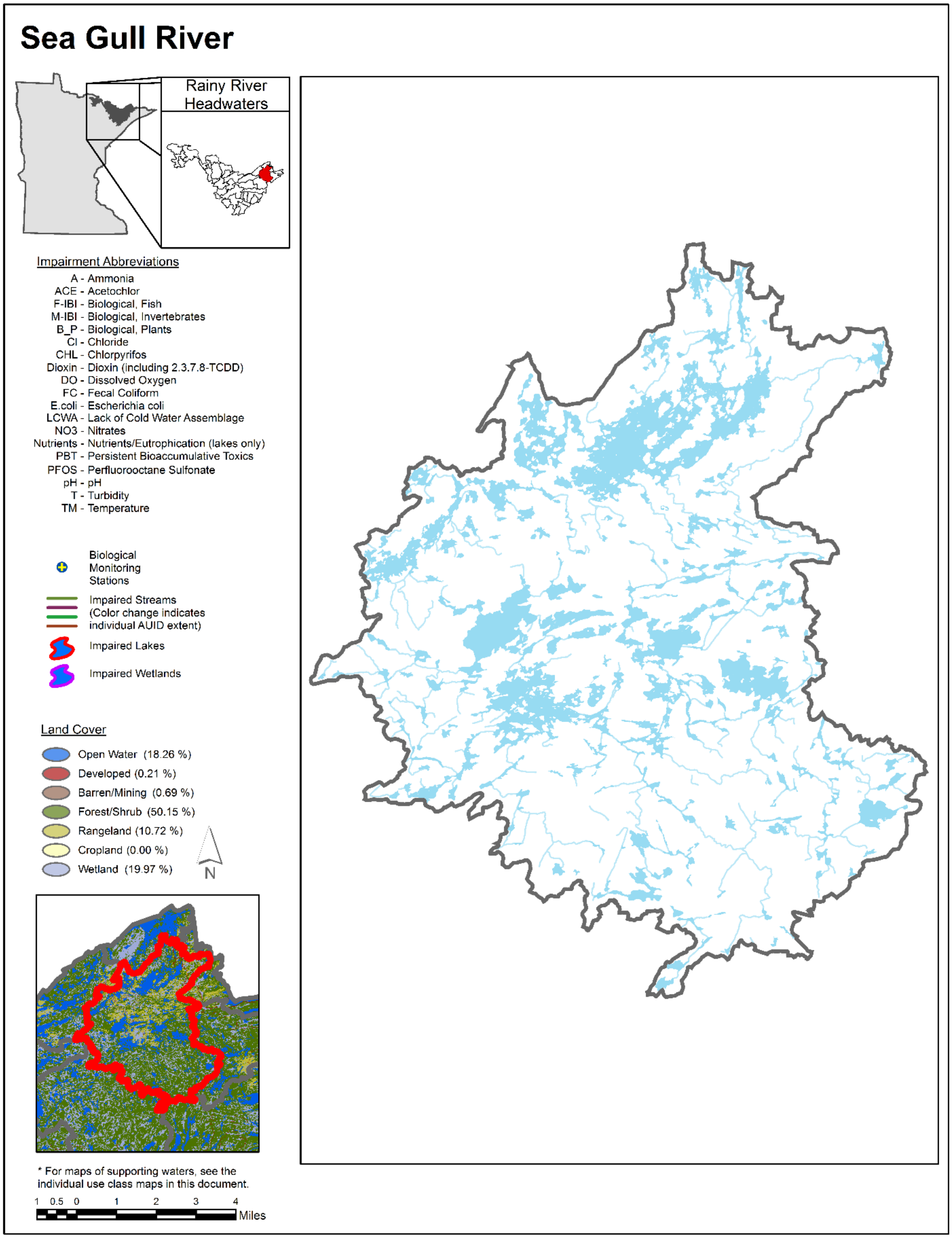


Figure 20. Currently listed impaired waters by parameter and land use characteristics in the Sea Gull River Aggregated 12-HUC.

Knife Lake Aggregated 12-HUC HUC 0903000105-01

The Knife Lake Subwatershed drains 66.75 square miles of Cook (3.0%) and Lake (97.0%) counties and is the eleventh smallest subwatershed within the Rainy River-Headwaters Watershed. This subwatershed lies along the international border between the United State and Canada, with additional drainage on the Canadian Side. The headwaters of this subwatershed begins at the outlet of Swamp Lake (38-0012-00) and flows to the southwest through Ottertrack, Little Knife, Knife, Seed, Carp, and Birch Lakes before entering Sucker Lake (38-0530-00). Newfound Lake (38-0619-00), a major inlet to this subwatershed, contributes its waters directly to Sucker Lake. The Prairie Portage Dam is located between Sucker Lake and Basswood Lake (38-0645-00), and is the outlet of this subwatershed. Numerous unnamed streams connect the various lakes within this subwatershed. There are a total of 72 lakes greater than 10 acres, with the most prominent being Knife, Kekekabic, Little Knife, Amoeber, Birch, Ester, Sucker and Ottertrack. This subwatershed is dominated by forest (45.11%), open water (29.04%), and wetland (19.30%). Only 6.39% is rangeland, 0.16% is barren/mining, and there is no developed or row-crop agriculture. This entire subwatershed lies within the Superior National Forest with all of it within the BWCAW. A portion of the Mugwump Lake, Pitfall Lake, and Spider Lake Primitive Management Area are located within this drainage. Much of the land is owned and managed by federal entities (USGS, 2008). A portion of this drainage has been burned in numerous wildfires, with the most notable being the Knife Lake Fire of 2005 and 2013, the Cavity Lake Fire of 2006, and the Kek Spider Fire of 2010. As a result of the overall remoteness, short tributary streams, and many large bodies of water; there was no biological or intensive water chemistry sampling conducted on rivers and streams within this subwatershed.

Table 8. Lake assessments: Knife Lake Aggregated 12-HUC.

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators:			Aquatic Recreation Indicators:			Aquatic Life Use	Aquatic Recreation Use
							Fish IBI	Chloride	Pesticides	Total Phosphorus	Chlorophyll-a	Secchi		
Fish	38-0161-00	98.3	30	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Gift	38-0162-00	39.4	35	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Link	38-0163-00	39.9	30	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Lunar	38-0168-00	63.8	50	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Lake of the Clouds	38-0169-00	29.9	110	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Canoe	38-0173-00	19.6	30	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Clam	38-0175-00	20.6	9.5	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Toe	38-0184-00	45.9	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Kekekabic Pond 2	38-0188-02	25.1	25	- -	NLF	- -	- -	- -	- -	- -	- -	MTS	- -	SUP

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators:			Aquatic Recreation Indicators:			Aquatic Life Use	Aquatic Recreation Use
							Fish IBI	Chloride	Pesticides	Total Phosphorus	Chlorophyll-a	Secchi		
Kekekabic Pond 3	38-0188-03	24.0	17	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Calico	38-0196-00	11.0	20	- -	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Totem	38-0216-00	15.5	10	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Kek	38-0228-00	55.0	130	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Jenny (West Bay)	38-0194-01	67.5	93	- -	NLF	NT	- -	- -	- -	- -	- -	MTS	- -	SUP
Strup	38-0360-00	70.6	105	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Frog	38-0520-00	50.0	38	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Sema	38-0386-00	73.0	70	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Bullfrog	38-0165-00	66.1	20	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Annie	38-0195-00	19.5	16	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators: Fish IBI	Chloride	Pesticides	Aquatic Recreation Indicators: Total Phosphorus	Chlorophyll-a	Secchi	Aquatic Life Use	Aquatic Recreation Use
Cherry	38-0166-00	155.0	80	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	MTS	- -	SUP
Topaz	38-0172-00	146.2	70	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	MTS	- -	SUP
Eddy	38-0187-00	120.2	95	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	MTS	- -	SUP
Hanson	38-0206-00	292.6	100	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	MTS	- -	SUP
Ester	38-0207-00	371.9	110	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	MTS	- -	SUP
Gijikiki	38-0209-00	112.1	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Ashdick	38-0210-00	108.9	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Ottertrack	38-0211-00	291.8	- -	Deep Lake	- -	NT	- -	- -	- -	- -	- -	MTS	- -	SUP
Rabbit	38-0214-00	117.1	90	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Amoeber	38-0227-00	405.4	110	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	MTS	- -	SUP

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators:			Aquatic Recreation Indicators:			Aquatic Life Use	Aquatic Recreation Use
							Fish IBI	Chloride	Pesticides	Total Phosphorus	Chlorophyll-a	Secchi		
Little Knife	38-0229-00	427.0	- -	Deep Lake	- -	- -	- -	- -	- -	- -	- -	MTS	- -	SUP
Wisini	38-0361-00	109.3	137	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	IF	- -	SUP
Skoota	38-0381-00	127.4	- -	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	MTS	- -	SUP
Spoon	38-0388-00	253.0	85	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	MTS	- -	SUP
Pickle	38-0389-00	105.0	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	MTS	- -	SUP
Bonnie	38-0390-00	101.8	10	Shallow Lake	NLF	NT	- -	- -	- -	- -	- -	MTS	- -	IF
Dix	38-0391-00	102.6	- -	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	MTS	- -	SUP
Carp	38-0521-00	114.1	- -	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	MTS	- -	SUP
Kekekabic	38-0226-00	1692.1	195	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	MTS	- -	SUP
Sucker	38-0530-00	376.9	30	Deep Lake	NLF	D	- -	IF	- -	- -	- -	MTS	IF	SUP

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators: Fish IBI	Aquatic Life Indicators: Chloride	Aquatic Life Indicators: Pesticides	Aquatic Recreation Indicators: Total Phosphorus	Aquatic Recreation Indicators: Chlorophyll-a	Aquatic Recreation Indicators: Secchi	Aquatic Life Use	Aquatic Recreation Use
Birch	38-0532-00	353.2	35	Deep Lake	NLF	I	- -	- -	- -	- -	- -	MTS	- -	SUP
Knife	38-0404-00	3691.7	179	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	MTS	- -	SUP

Abbreviations for Ecoregion: DA = Driftless Area, NCHF = North Central Hardwood Forest, NGP = Northern Glaciated Plains, NLF = Northern Lakes and Forests, NMW = Northern Minnesota Wetlands, RRV = Red River Valley, WCBP = Western Corn Belt Plains
Abbreviations for Secchi Trend: D = decreasing/declining trend, I = increasing/improving trend, NT = no detectable trend, -- = not enough data
Abbreviations for Indicator Evaluations: -- = No Data, **MTS** = Meets Standard; **EXS** = Exceeds Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Not Support (Impaired, exceeds standard)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.

Summary

The Knife Lake Subwatershed had no assessable stream segments and 32 lakes assessed for aquatic recreation (Table 8). All of the lakes in this subwatershed fully supported aquatic recreation based on satellite estimated Secchi transparency (Figure 21). Several of the lakes, including Sucker and Birch, have considerable Secchi transparency records from visits made by Northern Tier High Adventure Camp Boy Scouts. In particular, enough data exists to detect a declining trend in clarity on Sucker Lake and an improving trend in Birch Lake. Notable lakes in this subwatershed meeting recreation use include Sucker (38-0530-00), Birch (38-0532-00), Knife (38-0404-00), Little Knife (38-0229-00), Ottertrack (38-0211-00), and Kekekabic (38-0226-00; Figure 83).

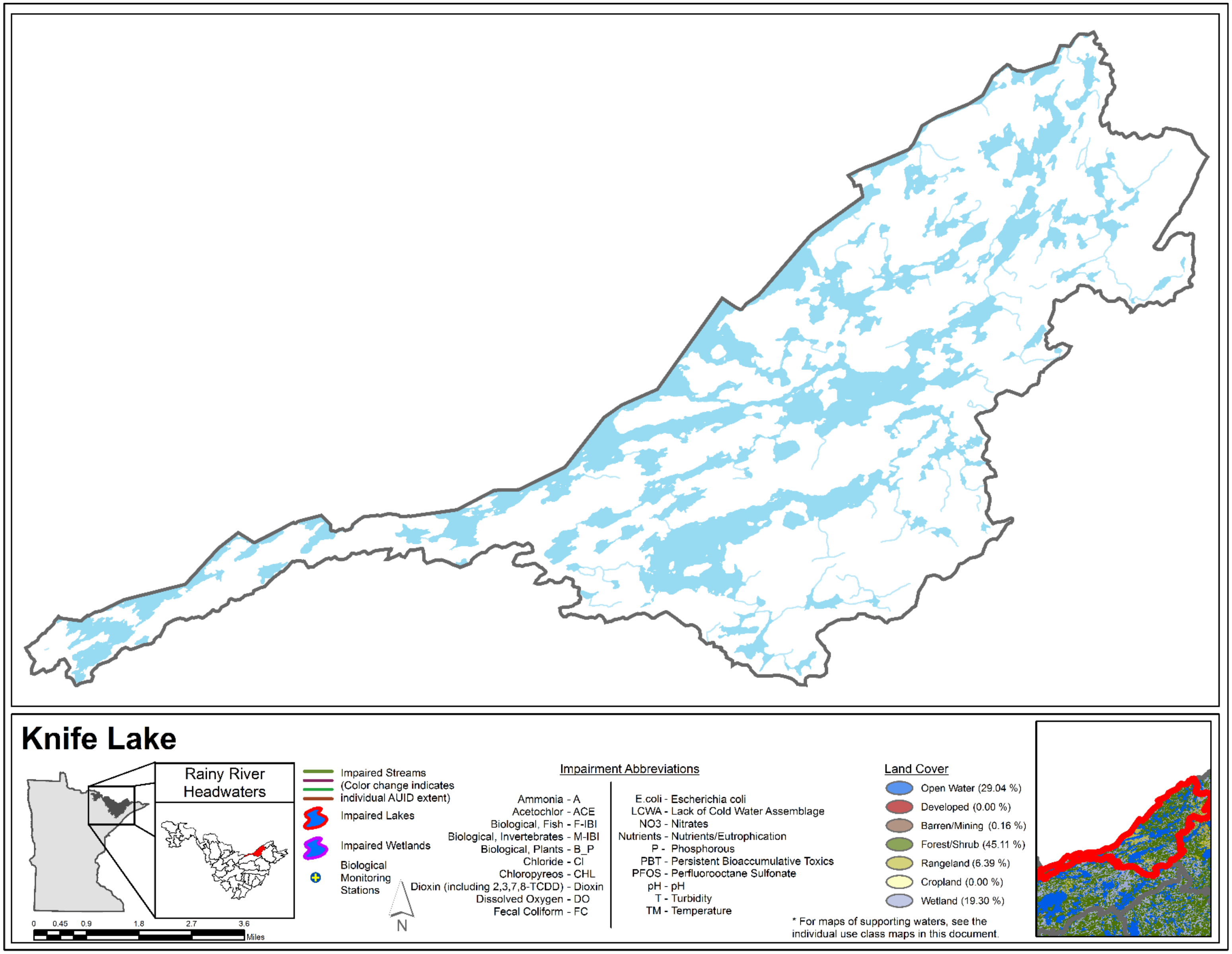


Figure 21. Currently listed impaired waters by parameter and land use characteristics in the Knife Lake Aggregated 12-HUC.

Moose Lake Aggregated 12-HUC HUC 0903000105-02

The Moose Lake Subwatershed drains 107.24 square miles of Lake County and is the eleventh largest subwatershed within the Rainy River-Headwaters Watershed. This subwatershed originated out of Van Lake (38-0117-00) and generally flows to the west until it reaches Newfound Lake (38-0619-00). On its course, it picks up tributary waters from Ensign, Boot, Snowbank, Disappointment, Parent, Ima, Thomas, and Fraser Lakes. Moose Lake also contributes its waters directly to Newfound Lake, along with water from its own tributaries: Triangle, Ojibway, and Jasper Lakes. Other smaller lakes contribute their waters through various small connector streams. Newfound Lake is the outlet of this subwatershed and contributes its water to Sucker Lake (38-0530-00) in the Knife Lake Subwatershed (0903000105-01). There are a total of 89 lakes greater than 10 acres, with most prominent being Snowbank, Thomas, Ensign, Moose, Disappointment, Ima, Fraser, Newfound, Parent, and Ojibway. This subwatershed is dominated by forest (45.19%), wetland (26.72%), and open water (26.62%). Only 0.87% is rangeland, 0.60% is developed, and there is no barren/mining or row-crop agriculture. This entire subwatershed lies within the Superior National Forest with the majority (75.4%) of it within the BWCAW. A portion of the Humpback Lake, Mugwump Lake and Spider Lake Primitive Management Areas are located within this drainage. Much of the land is owned and managed by local, state, and federal entities (USGS, 2008). A portion of this drainage was burned by fires, with the most notable fires being the Snowbank Fire of 2004, the Boot Fire of 2009, and the Kek Spider Fire of 2010. As a result of the overall remoteness, short tributary streams, and many large bodies of water; there was no biological or intensive water chemistry sampling conducted on rivers and streams in this subwatershed.

Table 9. Lake assessments: Moose Lake Aggregated 12-HUC.

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators:			Aquatic Recreation Indicators:			Aquatic Life Use	Aquatic Recreation Use
							Fish IBI	Chloride	Pesticides	Total Phosphorus	Chlorophyll-a	Secchi		
Unnamed	38-0632-00	14.2	14	- -	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Trader	38-0490-00	51.7	10	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	MTS	- -	IF
Haven	38-0505-00	15.1	5	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Missionary	38-0398-00	96.3	71	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	MTS	- -	SUP
Gerund	38-0366-00	89.5	85	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	MTS	- -	SUP
Shepo	38-0373-00	48.9	17	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Skull	38-0624-00	27.8	38	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Griddle	38-0629-00	26.1	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Ledge	38-0134-00	14.9	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators:			Aquatic Recreation Indicators:			Aquatic Life Use	Aquatic Recreation Use
							Fish IBI	Chloride	Pesticides	Total Phosphorus	Chlorophyll-a	Secchi		
Cap	38-0137-00	40.0	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Roe	38-0139-00	66.7	7	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Becoosin	38-0472-00	56.6	17	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Neglige	38-0492-00	30.5	58	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Solitude	38-0500-00	59.9	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Swing	38-0506-00	10.5	13	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Abinodji	38-0507-00	34.1	33	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Jitterbug	38-0509-00	26.2	5	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Cattyman	38-0510-00	17.3	9	Shallow Lake	NLF	NT	- -	IF	- -	IF	IF	IF	IF	IF
Adventure	38-0512-00	47.0	9	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators:			Aquatic Recreation Indicators:			Aquatic Life Use	Aquatic Recreation Use
							Fish IBI	Chloride	Pesticides	Total Phosphorus	Chlorophyll-a	Secchi		
Ahsub	38-0516-00	59.2	78	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Splash	38-0531-00	92.6	18	Shallow Lake	NLF	NT	- -	- -	- -	- -	- -	MTS	- -	IF
Spree	38-0623-00	28.1	- -	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Flash	38-0630-00	78.6	24	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Ahmakose	38-0365-00	40.5	68	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	MTS	- -	SUP
Muskrat	38-0376-00	25.9	18	Deep Lake	NLF	-	- -	- -	- -	- -	- -	IF	- -	SUP
Gibson	38-0508-00	33.8	24	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	MTS	- -	SUP
Raven	38-0113-00	174.8	56	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Sagus	38-0225-00	157.6	37	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Hatchet	38-0369-00	139.4	40	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators: Fish IBI	Chloride	Pesticides	Aquatic Recreation Indicators: Total Phosphorus	Chlorophyll-a	Secchi	Aquatic Life Use	Aquatic Recreation Use
Vera	38-0491-00	242.9	55	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	MTS	- -	SUP
Ashigan	38-0502-00	150.6	59	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	MTS	- -	SUP
Boot	38-0503-00	185.7	83	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	MTS	- -	SUP
Jordan	38-0511-00	149.4	66	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	MTS	- -	SUP
Parent	38-0526-00	450.0	50	Deep Lake	NLF	- -	- -	IF	- -	- -	- -	IF	IF	SUP
Ojibway	38-0640-00	354.6	110	Deep Lake	NLF	NT	- -	MTS	- -	MTS	MTS	MTS	IF	SUP
Jasper	38-0641-00	168.1	25	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Triangle	38-0715-00	293.4	43	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	IF	- -	IF
Thomas	38-0351-00	1445.5	110	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	MTS	- -	SUP
Fraser	38-0372-00	690.0	104	Deep Lake	NLF	D	- -	- -	- -	- -	- -	IF	- -	SUP

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators:			Aquatic Recreation Indicators:			Aquatic Life Use	Aquatic Recreation Use
							Fish IBI	Chloride	Pesticides	Total Phosphorus	Chlorophyll-a	Secchi		
Ima	38-0400-00	748.1	116	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	IF	- -	IF
Disappointment	38-0488-00	902.0	50	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	MTS	- -	SUP
Ensign	38-0498-00	1407.2	30	Deep Lake	NLF	NT	- -	MTS	- -	MTS	MTS	MTS	IF	SUP
Snowbank	38-0529-00	4603.4	150	Deep Lake	NLF	NT	- -	MTS	- -	MTS	MTS	MTS	IF	SUP
Newfound	38-0619-00	612.4	45	Deep Lake	NLF	NT	- -	IF	- -	IF	IF	MTS	IF	SUP
Moose	38-0644-00	1291.6	65	Deep Lake	NLF	NT	- -	MTS	- -	MTS	MTS	MTS	IF	SUP

Abbreviations for Ecoregion: DA = Driftless Area, NCHF = North Central Hardwood Forest, NGP = Northern Glaciated Plains, NLF = Northern Lakes and Forests, NMW = Northern Minnesota Wetlands, RRV = Red River Valley, WCBP = Western Corn Belt Plains
Abbreviations for Secchi Trend: D = decreasing/declining trend, I = increasing/improving trend, NT = no detectable trend, -- = not enough data
Abbreviations for Indicator Evaluations: -- = No Data, **MTS** = Meets Standard; **EXS** = Exceeds Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Not Support (Impaired, exceeds standard)
Key for Cell Shading: ☐ = existing impairment, listed prior to 2014 reporting cycle; ☐ = new impairment; ☐ = full support of designated use; ☐ = insufficient information.

Summary

The Moose Lake Subwatershed had no assessable stream segments and 32 lakes assessed for aquatic recreation (Table 9). All of the lakes met the applicable standards or criteria and fully supported aquatic recreation (Figure 23). Assessment level water quality datasets were collected on Snowbank (38-0529-00), Ojibway (38-0640-00), Moose (38-0644-00), and Ensign (38-0498-00; Figure 22). Both Snowbank and Ojibway contain lake trout. Both lakes had excellent water quality, and were meeting eutrophication criteria designated to protect cold-water fisheries. Snowbank has stable Secchi transparency, which averages about 5.6 meters (18 feet).

Moose Lake borders the BWCAW and is a very popular recreational water. Water quality here is also excellent, with TP, Chl-a, and Secchi transparency clearly meeting eutrophication standards. Moose has a robust long-term Secchi dataset, with over 150 Secchi readings in the last decade; transparency averages 4.5 meters (14 feet). Ensign Lake was part of a special monitoring partnership with Superior National Forest to investigate water quality in the most popular BWCAW lakes with high campsite densities (Ensign has about 40 campsites). Two stations on Ensign were sampled. Water quality was similar among stations; overall water quality was excellent and similar to other mesotrophic lakes in the area. Many other BWCAW lakes fully supported aquatic recreation based on satellite estimated Secchi transparency (Figure 83). Examples include Newfound (38-0619-00), Thomas (38-0351-00), Disappointment (38-0488-00), Gibson (38-0508-00), and Parent (38-0526-00).

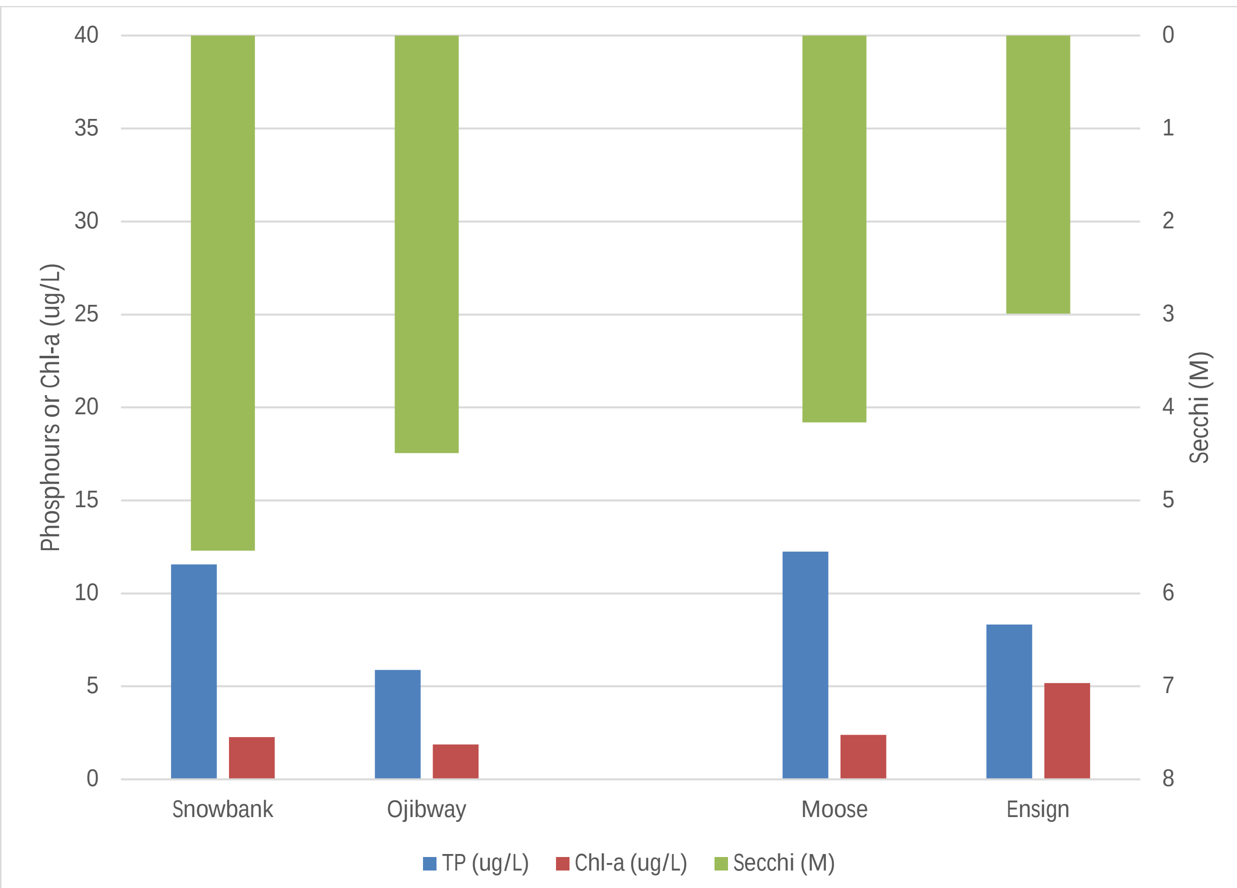


Figure 22. Water quality summary for assessed lakes in the Moose Lake Aggregated 12-HUC.

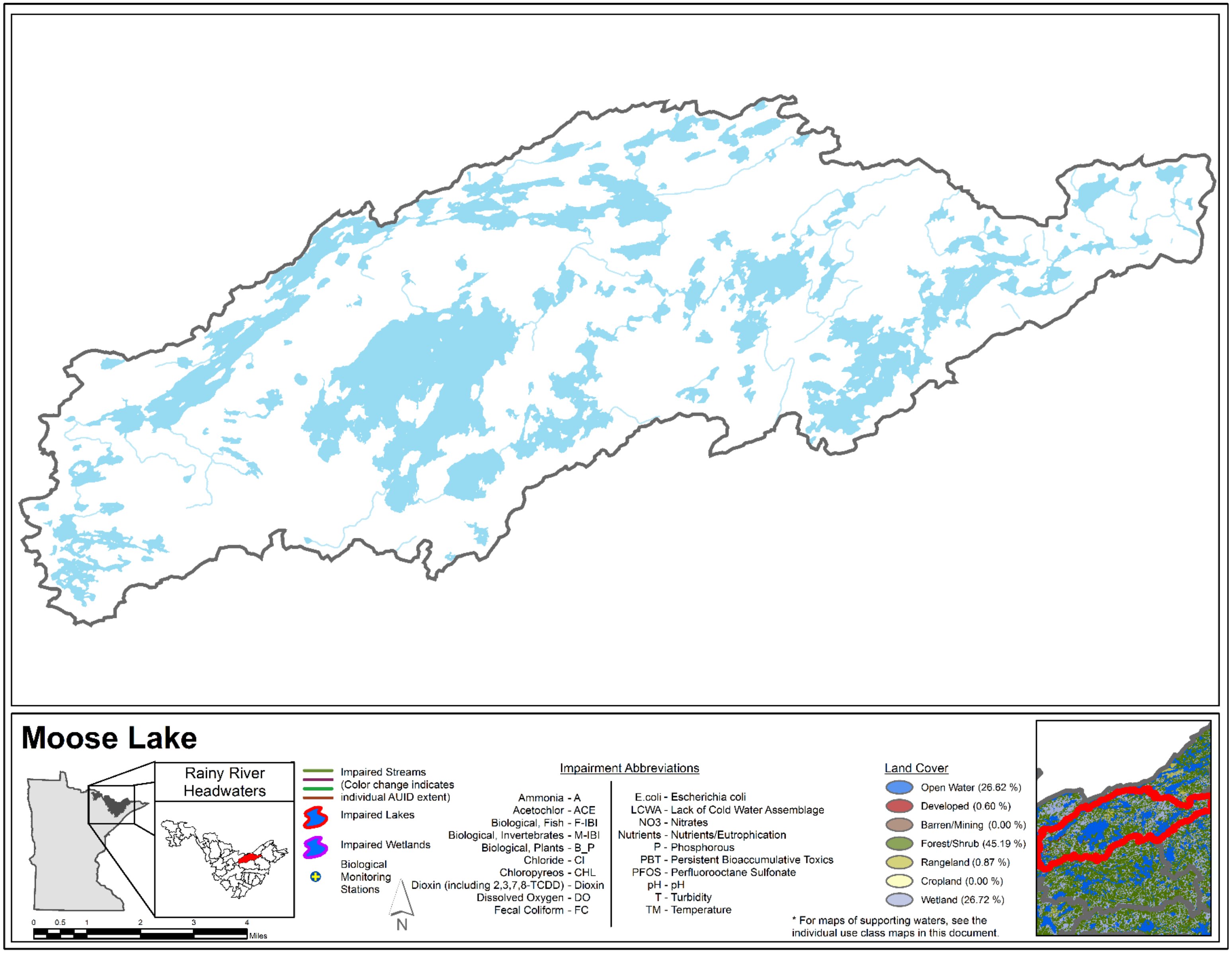


Figure 23. Currently listed impaired waters by parameter and land use characteristics in the Moose Lake Aggregated 12-HUC.

Lower Stony River Aggregated 12-HUC HUC 0903000106-01

The Lower Stony River Subwatershed drains 115.03 square miles of Lake (99.3%) and St. Louis (0.7%) counties and is the ninth largest subwatershed within the Rainy River-Headwaters Watershed. The headwaters of the Stony River flows 19.8 miles until it enters this subwatershed at Stony Lake (38-0660-00). Another major inlet (Greenwood River; 0903000106-03) enters this subwatershed through Stony Lake. An additional 123.38 square miles of drainage enters this subwatershed from the Upper Stony and Greenwood River. The Stony River continues to flow 19.7 miles to its confluence with Birch Lake (69-0003-00), while receiving additional flow from Camp E, Nip, Denley, and many other unnamed creeks. This subwatershed is a part of the larger Kawishiwi River system, which is the largest river system in the Rainy River-Headwaters Watershed. There are a total of 41 lakes greater than 10 acres, with the most prominent being Sand, Slate, Stony, Deep, Wampus, and Harris. This subwatershed is dominated by forest (52.03%), wetland (39.10%), and open water (4.92%). Only 2.75% is developed, 1.17% is rangeland, 0.04% is barren/mining, and there is no row-crop agriculture. This entire subwatershed lies within the Superior National Forest with a portion of it within the Sand Lake Peatland Scientific and Natural Area. Much of the land is owned and managed by local, state, and federal entities (USGS, 2008). Intensive water chemistry sampling was conducted at the outlet of the subwatershed at New Tomahawk Trail (FR-424), 8.5 miles east of Babbitt on the Stony River. The outlet is represented by water chemistry station S002-811 and biological station 14RN007.

Table 10. Aquatic life and recreation assessments on stream reaches: Lower Stony River Aggregated 12-HUC. Reaches are organized upstream to downstream in the table.

AUID *Reach Name*, *Reach Description*	Biological Station ID	Reach Length (miles)	Use Class	Aquatic Life Indicators: Fish IBI	Invert IBI	Dissolved Oxygen	TSS	Secchi Tube	Chloride	pH	Ammonia -NH_3	Pesticides	Eutrophication	Aquatic Life	Aquatic Rec. (Bacteria)
09030001-978 **Unnamed Creek** **Wadop Lk to Stony R**	14RN070	5.36	WWg	MTS	MTS	IF	IF	IF	- -	IF	IF	- -	IF	SUP	- -
09030001-804 **Nip Creek** **Jackpot Cr to T60 R11W S22, North Line**	14RN069	1.40	CWg	MTS	MTS	IF	IF	IF	- -	IF	IF	- -	IF	SUP	- -
09030001-555 **Harris Creek (Harris Lake Creek)** **Headwaters to T61 R10W S19, west line**	06RN009	3.93	CWg	MTS	- -	- -	- -	- -	- -	- -	- -	- -	- -	SUP	- -
09030001-573 **Nira Creek** **Harris Lk to Denley Cr**	11RN003	2.85	CWg	MTS	MTS	- -	- -	- -	- -	- -	- -	- -	- -	SUP	- -
09030001-627 **Denley Creek** **Nira Cr to Stony R**	14RN067	3.07	WWe	MTS	MTS	IF	IF	IF	- -	IF	IF	- -	IF	SUP	- -
09030001-985 **Stony River** **Unnamed Creek (Stony Lk Outlet) to Birch Lk**	05RN074 14RN007	19.65	WWg	MTS	MTS	IF	MTS	MTS	MTS	MTS	MTS	- -	MTS	SUP	SUP

Abbreviations for Indicator Evaluations: **MTS** = Meets Standard; **EXS** = Fails Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Impaired (Fails Standards)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.
Abbreviations for Use Class: **WWg** = warmwater general, **WWm** = Warmwater modified, **WWe** = Warmwater exceptional, **CWg** = Coldwater general, **CWe** = Coldwater exceptional,
LRVW = limited resource value water
*Assessments were completed using proposed use classifications changes that have not yet been written into rule.

Table 11. Lake assessments: Lower Stony River Aggregated 12-HUC.

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators:			Aquatic Recreation Indicators:			Aquatic Life Use	Aquatic Recreation Use
							Fish IBI	Chloride	Pesticides	Total Phosphorus	Chlorophyll-a	Secchi		
Pike	38-0670-00	75.0	8	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Two Deer	38-0671-00	43.1	11	- -	NLF	- -	- -	IF	- -	IF	IF	IF	IF	IF
Pitcha	38-0676-00	28.0	2	Shallow Lake	NLF	- -	- -	- -	- -	IF	- -	- -	- -	IF
Campers	38-0679-00	48.2	3	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Dunnigan	38-0664-00	83.2	14	Shallow Lake	NLF	NT	- -	IF	- -	MTS	MTS	IF	IF	SUP
Gypsy	38-0665-00	15.2	18	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
East Chub	38-0674-00	63.4	8	Shallow Lake	NLF	- -	- -	IF	- -	- -	- -	IF	IF	IF
Slate	38-0666-00	321.3	12	Shallow Lake	NLF	- -	- -	IF	- -	IF	IF	IF	IF	IF

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators:			Aquatic Recreation Indicators:			Aquatic Life Use	Aquatic Recreation Use
							Fish IBI	Chloride	Pesticides	Total Phosphorus	Chlorophyll-a	Secchi		
Sand	38-0735-00	480.8	10	Shallow Lake	NLF	- -	- -	IF	- -	IF	MTS	IF	IF	IF

Abbreviations for Ecoregion: DA = Driftless Area, NCHF = North Central Hardwood Forest, NGP = Northern Glaciated Plains, NLF = Northern Lakes and Forests, NMW = Northern Minnesota Wetlands, RRV = Red River Valley, WCBP = Western Corn Belt Plains
Abbreviations for Secchi Trend: D = decreasing/declining trend, I = increasing/improving trend, NT = no detectable trend, -- = not enough data
Abbreviations for Indicator Evaluations: -- = No Data, **MTS** = Meets Standard; **EXS** = Exceeds Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Not Support (Impaired, exceeds standard)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.

Summary

The Lower Stony River Subwatershed had six assessable stream segments, containing seven biological monitoring stations, and one lake assessed for aquatic recreation (Table 10 and Table 11). All of the streams and lakes met the applicable standards or criteria and fully support aquatic life and/or aquatic recreation (Figure 26). In-stream habitat tended to score worse downstream but was in fair condition overall (Appendix 5). One station (14RN070) located on an Unnamed Tributary to the Stony River had a poor habitat rating, which likely resulted from its low gradient, fine sediment, and headwater nature (Figure 24). The score for this station alone was low enough to push the overall rating for this subwatershed below the good rating. Despite the fair habitat rating, the low amount of disturbance within this subwatershed almost assured excellent biological integrity.

A use class analysis was conducted on all assessed rivers and streams within the Rainy River-Headwaters Watershed. Streams designated as exceptional receive additional protections from a more stringent water quality standard. Denley Creek (-627), a major tributary to the Stony River, met the exceptional use criteria. A total of 11 fish species were captured during monitoring at 14RN067, dominated by northern rebelly dace. The dominance of this species, along with the presence of other sensitive species indicated excellent water quality. The macroinvertebrate community also had a diverse species assemblage that contained several sensitive individuals.

Figure 24. Unnamed tributary to Stony River – 14RN070.

The upstream reaches of Denly Creek are designated cold-water resources (CWg) and include both Nira (-573) and Harris Creek (-555). The United States Forest Service (USFS) provided data for the two biolgocial monitoring stations (06RN009 and 11RN003) that were located on these stream reaches. A total of 11 fish species were captured during monitoring and comprised of a mixture of warm, cool, and cold-water obligates. The only biological monitoring station (06RN009) located on Harris Creek was just downstream of FR 1464 and had brook trout captured at all three visits. Nira Creek had one fish visit to 11RN003 and consisted mostly of cool/warm-water species. Macroinvertebrate suggested similar conditions as indicated by the fish community. This reach, along with Harris Creek, were assessed using the Northern Coldwater F-IBI and M-IBI and resulted in scores that suggested full support for aquatic life. Further information should be collected for Nira Creek to assess its viability to support a cold-water fishery.

Although not all of the stream reaches met the exceptional use (WWe and CWe) designation, all of the assessed streams in the Lower Stony River Subwatershed were in excellent condition and supported aquatic life. A total of 29 fish species and 3,965 individuals were captured during monitoring of the Stony River and its tributary streams, with several sensitive individuals present. The macorinvertebrate community also had a diversity of sensitive species and indicated simlar conditions as the fish.

Water quality at the outlet (Stony River; -985) of this subwatershed was in excellent condition. This stream segment has sufficient data for an assessment of river eutrophication, including 40 phosphorus observations and a late-summer DO dataset from a sonde deployment. Phosphorus concentrations clearly met standards Chl-a concentrations were consistently low, and low amounts of suspended sediment were observed. *E. coli* bacteria concentrations were consistently low in the Lower Stony River, and indicated full support for aquatic recreation.

Dunnigan (38-0664-00) and Sand Lake (37-0735-00) were assessed for aquatic recreation. Dunnigan fully supported aquatic recreation; phosphorus and chlorophyll levels were low. This lake has a robust dataset, as it was a long-term acid rain study lake, and is currently being monitored by the USFS for a special climate change study. Sand Lake is a naturally productive lake, and as such, phosphorus concentrations slightly exceed the standard (Figure 25); one sample drove the summer mean value above the 30 µg/L standard. Chlorophyll-a concentrations met the standard. Conversely, Secchi is naturally low due to bog staining from the surrounding wetlands. Overall, this lake didn't have sufficient information for an assessment of recreation. All other lakes in this subwatershed had insufficient monitoring data for assessments.

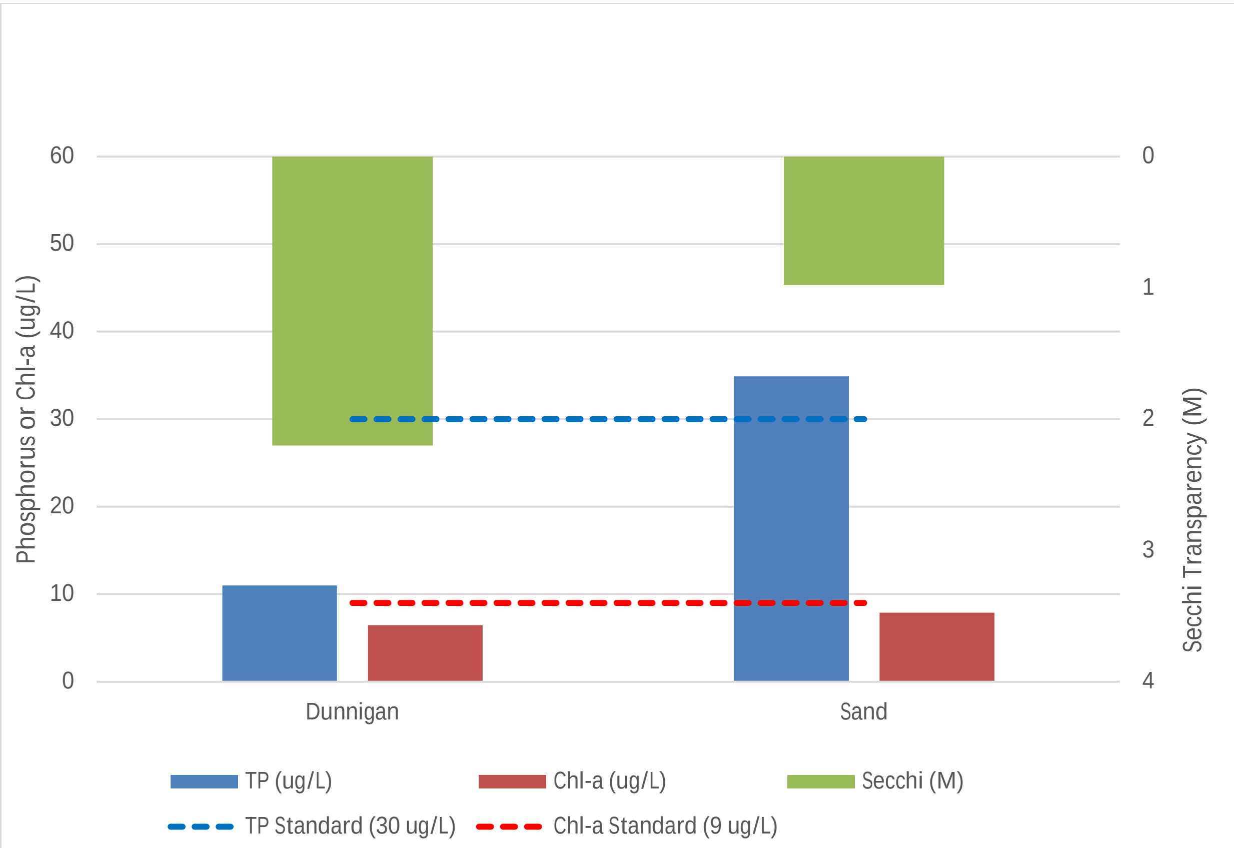


Figure 25. Water quality summary for select lakes in the Lower Stony River Aggregated 12-HUC.

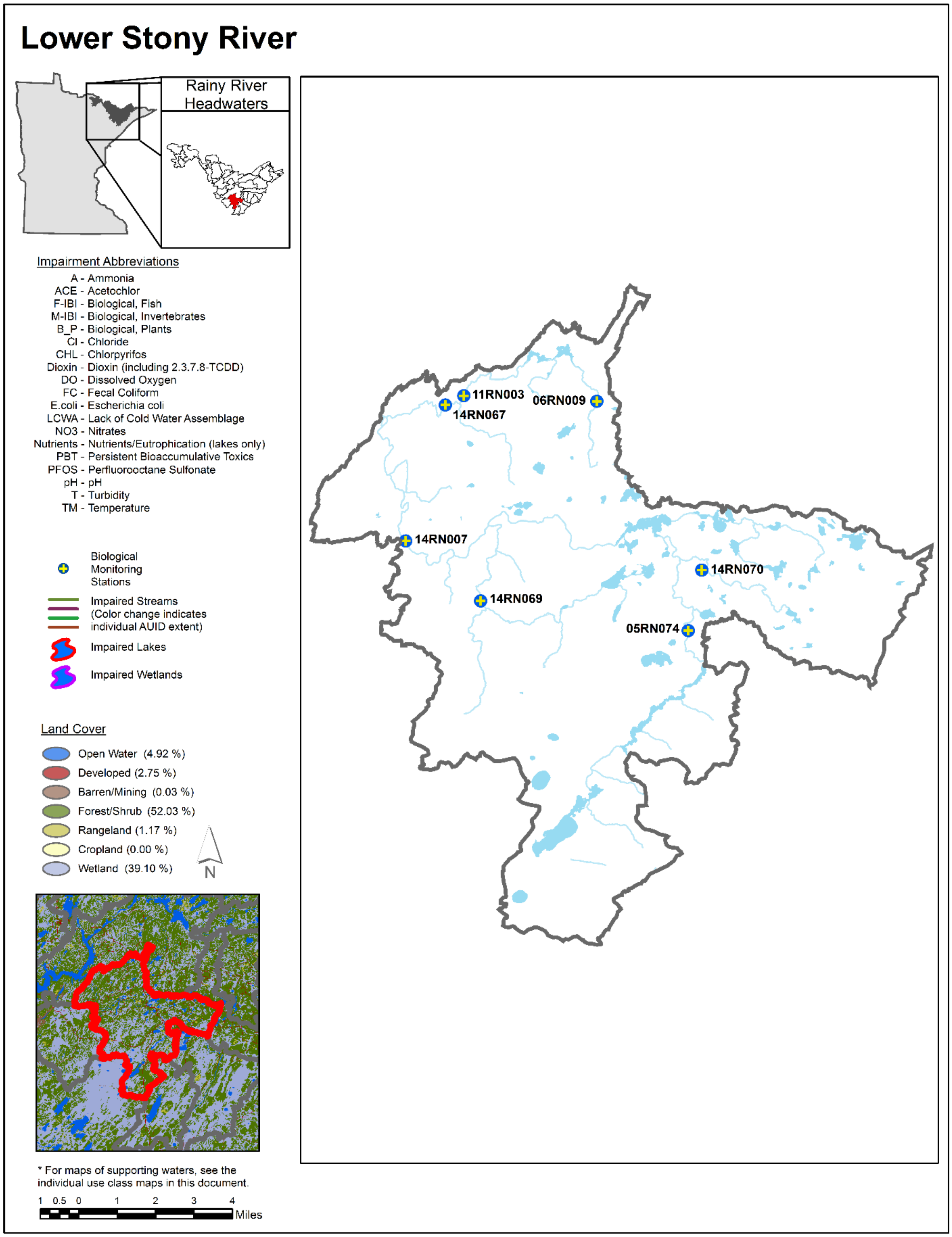


Figure 26. Currently listed impaired waters by parameter and land use characteristics in the Lower Stony River Aggregated 12-HUC.

Upper Stony River Aggregated 12-HUC HUC 0903000106-02

The Upper Stony River Subwatershed drains 74.72 square miles of Lake County and is the fifteenth smallest subwatershed within the Rainy River-Headwaters Watershed. The headwaters of the Stony River begin at Source Lake (38-0654-00) and continues to the northeast while receiving flow from Spur End Creek, Wilbar Creek, and multiple unnamed creeks. The Stony River then turns abruptly towards the northwest and flows through North McDougal (38-0656-00) and numerous other unnamed lakes before reaching its confluence with Stony Lake (38-0660-00) and exiting this subwatershed. This subwatershed is a part of the larger Kawishiwi River system, which is the largest river system in the Rainy River-Headwaters Watershed. There are a total of 14 lakes greater than 10 acres, with the most prominent being South McDougal, North McDougal, and Middle McDougal. This subwatershed is dominated by wetland (55.57%), forest (39.58%), and open water (2.99%). Only 1.07% is developed, 0.79% is rangeland, and there is no barren/mining or row-crop agriculture. This entire subwatershed lies within the Superior National Forest, with much of the land owned and managed by local, state, and federal entities (USGS, 2008). Intensive water chemistry sampling was conducted at the outlet of the subwatershed at FH 7 Spur (FR-933), 10.5 miles northwest of Isabella on the Stony River. The outlet is represented by water chemistry station S007-910 and biological station 14RN072.

Table 12. Aquatic life and recreation assessments on stream reaches: Upper Stony River Aggregated 12-HUC. Reaches are organized upstream to downstream in the table.

AUID *Reach Name*, *Reach Description*	Biological Station ID	Reach Length (miles)	Use Class	Aquatic Life Indicators: Fish IBI	Invert IBI	Dissolved Oxygen	TSS	Secchi Tube	Chloride	pH	Ammonia -NH_3	Pesticides	Eutrophication	Aquatic Life	Aquatic Rec. (Bacteria)
09030001-693 **Wilbar Creek** **Osier Cr to Stony R**	14RN075	1.49	WWg	MTS	MTS	IF	IF	IF	- -	IF	IF	- -	IF	SUP	- -
09030001-984 **Stony River** **Headwaters (Source Lk 38-0654-00) to Unnamed Creek (Stony Lake Outlet)**	14RN073 14RN072	19.74	WWg	MTS	MTS	IF	IF	MTS	MTS	MTS	MTS	- -	IF	SUP	IF

Abbreviations for Indicator Evaluations: **MTS** = Meets Standard; **EXS** = Fails Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Impaired (Fails Standards)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.
Abbreviations for Use Class: **WWg** = warmwater general, **WWm** = Warmwater modified, **WWe** = Warmwater exceptional, **CWg** = Coldwater general, **CWe** = Coldwater exceptional, **LRVW** = limited resource value water
*Assessments were completed using proposed use classifications changes that have not yet been written into rule.

Table 13. Lake assessments: Upper Stony River Aggregated 12-HUC.

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators: Fish IBI	Aquatic Life Indicators: Chloride	Aquatic Life Indicators: Pesticides	Aquatic Recreation Indicators: Total Phosphorus	Aquatic Recreation Indicators: Chlorophyll-a	Aquatic Recreation Indicators: Secchi	Aquatic Life Use	Aquatic Recreation Use
Osier	38-0420-00	70.6	- -	Shallow Lake	NLF	- -	- -	- -	- -	IF	IF	IF	- -	IF
Middle McDougal	38-0658-00	101.3	5	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
South McDougal	38-0659-00	273.2	5	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
North McDougal	38-0686-00	259.1	10	Shallow Lake	NLF	- -	- -	IF	- -	MTS	MTS	IF	IF	SUP

Abbreviations for Ecoregion: DA = Driftless Area, NCHF = North Central Hardwood Forest, NGP = Northern Glaciated Plains, NLF = Northern Lakes and Forests, NMW = Northern Minnesota Wetlands, RRV = Red River Valley, WCBP = Western Corn Belt Plains

Abbreviations for Secchi Trend: D = decreasing/declining trend, I = increasing/improving trend, NT = no detectable trend, -- = not enough data

Abbreviations for Indicator Evaluations: -- = No Data, **MTS** = Meets Standard; **EXS** = Exceeds Standard; **IF** = Insufficient Information

Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Not Support (Impaired, exceeds standard)

Key for Cell Shading: ☐ = existing impairment, listed prior to 2014 reporting cycle; ☐ = new impairment; ☐ = full support of designated use; ☐ = insufficient information.

Summary

The Upper Stony River Subwatershed had two assessable stream segments, containing three biological monitoring stations, and one lake assessed for aquatic recreation (Table 12 and Table 13). All of the streams and lakes met the applicable standards or criteria and fully support aquatic life and/or aquatic recreation (Figure 28). In-stream habitat in this subwatershed was in good condition and was one of the highest overall scores (80.17 out of 100) within the Rainy River-Headwaters Watershed (Appendix 5). As a result of quality in-stream habitat and good water quality, a relatively diverse fish and macroinvertebrate community was present. The low amount of disturbance within this subwaterhed almost assured excellent biological integrity. Streams that have exceptional biological, chemical, and physical parameters are worthy of additional protection in order to preserve their valuable aquatic resources.

A use class analysis was conducted on all assessed rivers and streams within the Rainy River-Headwaters Watershed. Streams designated as exceptional receive additional protections from a more stringent water quality standard. The Stoney River was not designated as exceptional but it did have some characteristics of an exceptional stream system. Two biological monitoring stations (14RN072 and 14RN073) are located along the Stony River proper (-984). A total of eight fish species were captured between the two stations, with several sensitive species present. Both stations had a F-IBI scores (14RN072: 83.1 and 14RN073: 87.3) that were well above the exceptional use threshold for the Northern Streams fish class (61). However, M-IBI scores were just below the exceptional use threshold.

In addition, Wilbar Creek (-693) met exceptional use standards for fish but had a mixture of results from its two macroinvetebrate samples. One macorinvertebrate sample was collected during fall of 2014 and resulted in a M-IBI score above the exceptional use standard, while the 2015 sample was just below it. Although similar habitats were sampled (rock, wood, and macrophytes) between the two dates, water levels appear to be lower in 2015. It is plausible that a beaver dam both upstream and downstream of the station (14RN075) could have caused the decrease in flows that were observed in 2015; ultimately resulting in different M-IBI scores. Although the M-IBI score did vary between sampling years, numerous sensitive species were captured indicating good water quality. Sixteen fish species dominated by several sensitive species (longnose dace, burbot, etc.) were sampled within this subwatershed. The macroinvertebrate community indicated similar conditions as the fish, with numerous sensitive species present.

An intensive water chemistry station (S007-910) was selected near the pour point of this subwatershed to represent the segment (-984) of the Stony River from the headwaters to Stony Lake (38-0660-00). Water quality at this station was good, reflecting the subwatershed's forest and wetland land cover and low gradient characteristics. The dataset was small, but did indicate that low concentrations of phosphorus are present in the stream. Sediment and Secchi tube datasets indicated standards were being met, no observations exceeded water quality standards, likely due to the wetland complexes assimilating suspended sediments. Too few bacteria samples were collected for a formal assessment of recreational use, although all samples had consistently low level of bacteria. This was expected given the remote setting of most of this subwatershed.

North McDougal (38-0686-00) was the only lake in this subwatershed that had sufficient data for an assessment of recreational use and was assessed as fully supporting. Very little algae grows in this lake. Secchi transparency is limited by natural bog-stain and is not reflective of the trophic state of the lake.

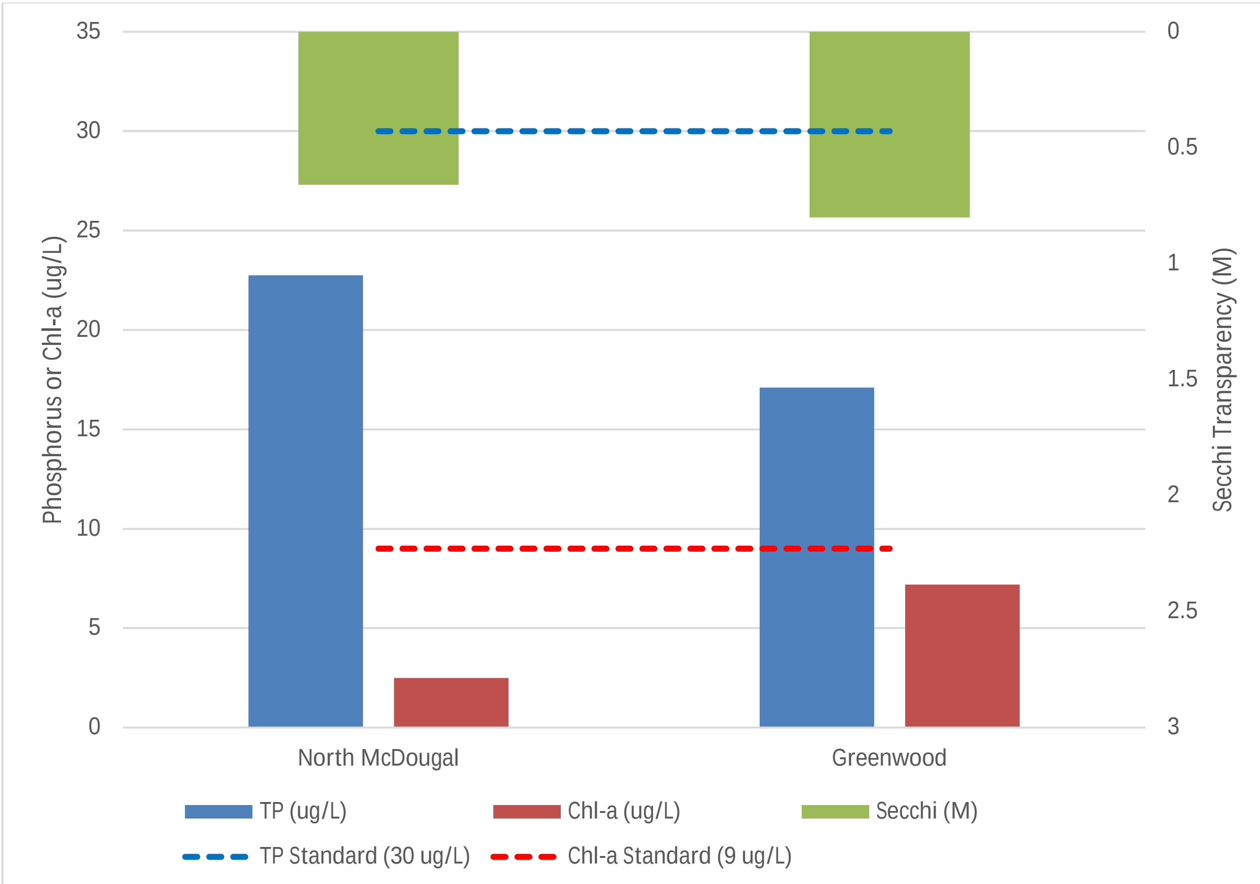


Figure 27. Water quality summary for select lakes in the Upper Stony River Aggregated 12-HUC.

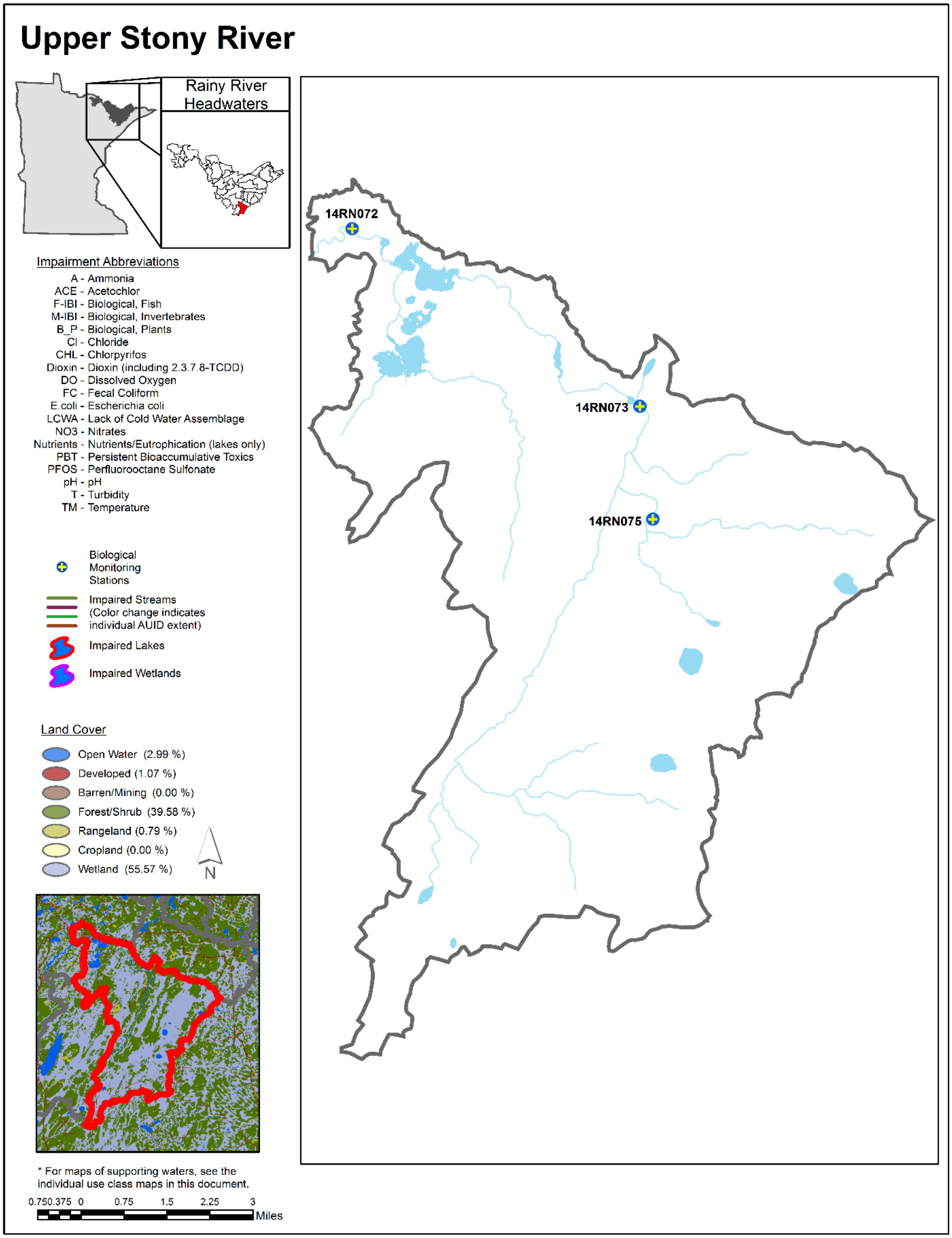


Figure 28. Currently listed impaired waters by parameter and land use characteristics in the Upper Stony River Aggregated 12-HUC.

Greenwood River Aggregated 12-HUC HUC 0903000106-03

The Greenwood River Subwatershed drains 48.66 square miles of Lake County and is the fourth smallest subwatershed within the Rainy River-Headwaters Watershed. The headwaters of this subwatershed begins in a forested wetland and continues to the northwest through South Greenwood Creek before reaching Greenwood Lake (38-0656-00). A pair of tributary streams, Wenho and Homestead Creek, enter Greenwood Lake from the east. The Greenwood River begins at the outlet of Greenwood Lake and flows north while picking up additional flow from Stockade Creek before entering the Lower Stony River Subwatershed at Stony Lake (38-0660-00). This subwatershed is a part of the larger Kawishiwi River system, which is the largest river system in the Rainy River-Headwaters Watershed. There are two lakes greater than 10 acres, which includes Greenwood and Phantom Lake. This subwatershed is dominated by wetland (52.47%), forest (40.67%), and open water (4.78%). Only 1.21% is rangeland, 0.87% developed, and there is no barren/mining or row-crop agriculture. This entire subwatershed lies within the Superior National Forest, with a large portion of the land owned and managed by local, state, and federal entities (USGS, 2008). The outlet of this subwatershed was only monitored for biology due to access issues. The outlet is represented by biological station 14RN075.

Table 14. Aquatic life and recreation assessments on stream reaches: Greenwood River Aggregated 12-HUC. Reaches are organized upstream to downstream in the table.

AUID *Reach Name*, *Reach Description*	Biological Station ID	Reach Length (miles)	Use Class	Aquatic Life Indicators: Fish IBI	Invert IBI	Dissolved Oxygen	TSS	Secchi Tube	Chloride	pH	Ammonia -NH_3	Pesticides	Eutrophication	Aquatic Life	Aquatic Rec. (Bacteria)
09030001-602 **Greenwood River** **Stockade Cr to Stony Lk**	14RN077	5.74	WWg	MTS	MTS	IF	IF	IF	- -	IF	IF	- -	IF	SUP	- -

Abbreviations for Indicator Evaluations: **MTS** = Meets Standard; **EXS** = Fails Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Impaired (Fails Standards)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.
Abbreviations for Use Class: **WWg** = warmwater general, **WWm** = Warmwater modified, **WWe** = Warmwater exceptional, **CWg** = Coldwater general, **CWe** = Coldwater exceptional, **LRVW** = limited resource value water
*Assessments were completed using proposed use classifications changes that have not yet been written into rule.

Table 15. Lake assessments: Greenwood River Aggregated 12-HUC.

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators:			Aquatic Recreation Indicators:			Aquatic Life Use	Aquatic Recreation Use
							Fish IBI	Chloride	Pesticides	Total Phosphorus	Chlorophyll-a	Secchi		
Greenwood	38-0656-00	1318.3	5	Shallow Lake	NLF	- -	- -	MTS	- -	MTS	MTS	IF	IF	SUP

Abbreviations for Ecoregion: DA = Driftless Area, NCHF = North Central Hardwood Forest, NGP = Northern Glaciated Plains, NLF = Northern Lakes and Forests, NMW = Northern Minnesota Wetlands, RRV = Red River Valley, WCBP = Western Corn Belt Plains
Abbreviations for Secchi Trend: D = decreasing/declining trend, I = increasing/improving trend, NT = no detectable trend, -- = not enough data
Abbreviations for Indicator Evaluations: -- = No Data, **MTS** = Meets Standard; **EXS** = Exceeds Standard; **IF** = Insufficient Information
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Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.

Summary

The Greenwood River Subwatershed had one assessable stream segment, containing one biological monitoring station, and one lake assessed for aquatic recreation (Table 14 and Table 15). All of the streams and lakes met the applicable standards or criteria and fully support aquatic life and/or aquatic recreation (Figure 29). The only biological monitoring station (14RN077) was located near the outlet of this subwatershed on the Greenwood River (-602). In-stream habitat was in good condition throughout this reach and was reflective of the entire drainage (Appendix 5). As a result of quality habitat and good water quality, a relatively diverse fish and macroinvertebrate community was present. The low amount of disturbance within this subwaterhed almost assured excellent biological integrity. Streams that have exceptional biological, chemical, and physical parameters are worthy of additional protection. Some parameters met the exceptional use standards but not enough of them to designate the reach as exceptional (WWe). A total of eight fish species were captured during monitoring. The reach was dominated by several sensitive species, including the longnose dace which comprised of 86.5% of the sample. In addition, several sensitive macroinvertebrates were captured during monitoring and indicated good water quality.

Greenwood (38-0656-00) was the only lake with assessment level water quality data in this subwatershed. Greenwood Lake is a very shallow, wild rice dominated lake, that fully supports aquatic recreation. In shallow lakes, such as Greenwood, chlorophyll levels are often low, as the lake is dominated by macrophytes (rooted vegetation) instead of algae. This lake had naturally low Secchi transparency due to bog staining from the surrounding wetlands (Figure 27).

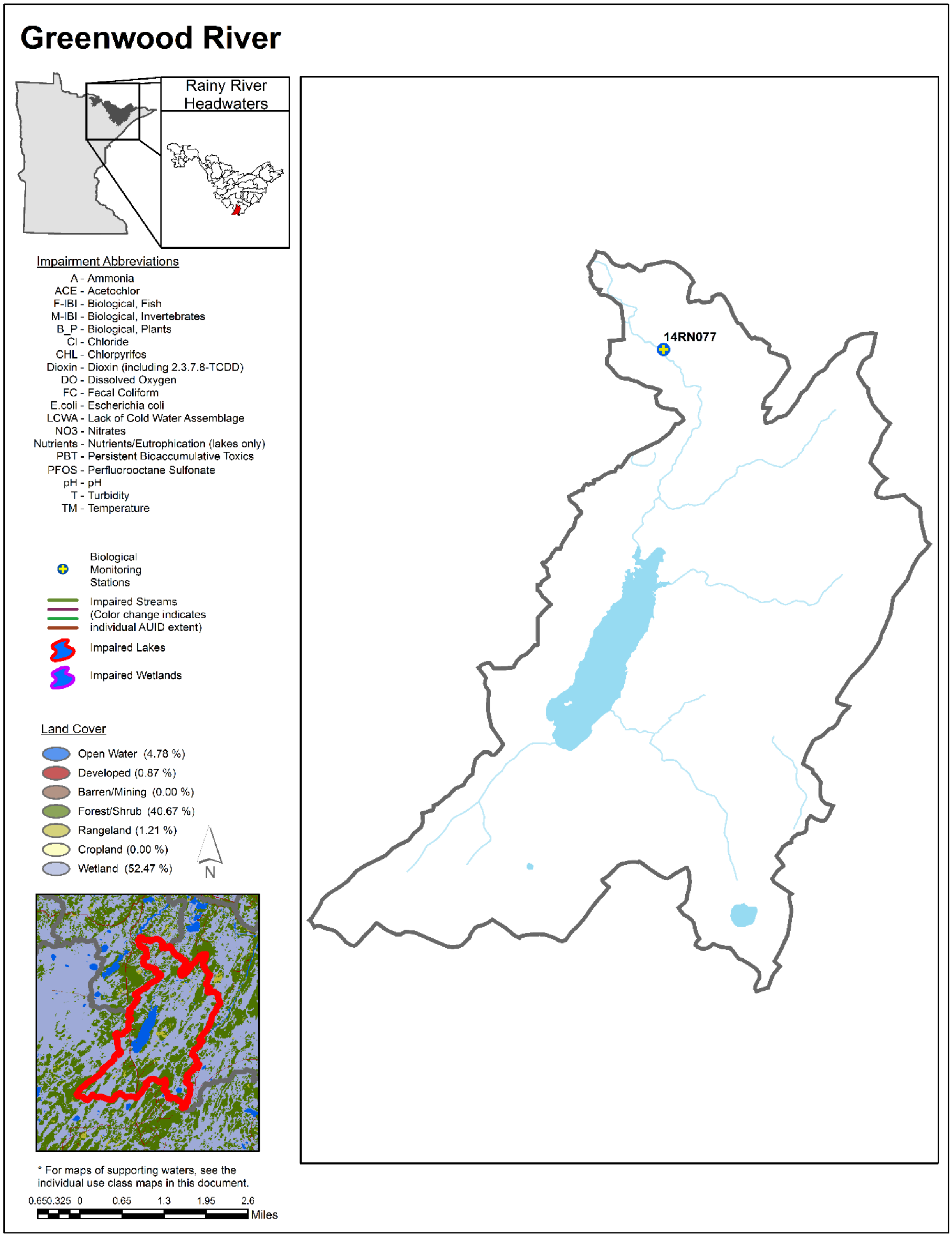

Figure 29. Currently listed impaired waters by parameter and land use characteristics in the Greenwood River Aggregated 12-HUC.

Isabella River Aggregated 12-HUC HUC 0903000107-01

The Isabella River Subwatershed drains 96.69 square miles of Cook (13.42%) and Lake (86.58%) counties and is the sixteenth largest subwatershed within the Rainy River-Headwaters Watershed. The headwaters of this subwatershed begins at Hog Lake and continues to the west through Hog Creek. As Hog Creek flows 14.6 miles towards Perent Lake (38-0220-00) it receives additional flow from Maggie, Cook, Bill, and Walten Creeks. Perent Lake receives additional water from Coffee Creek and other unnamed tributaries. The Perent River begins at the outlet of Perent Lake and flows 7.6 miles to the west toward Isabella Lake (38-0396-00), while receiving additional flow from Powwow Creek. The Isabella River begins at the outlet of Isabella Lake and flows 12.9 miles to the west towards Bald Eagle Lake (38-0637-00). The Isabella River receives additional flow from the Island River (0903000107-04), Mitawan (0903000107-03), and Little Isabella River Subwatersheds (0903000107-02) before exiting this subwatershed at its confluence with the Snake River. This subwatershed is a part of the larger Kawishiwi River system, which is the largest river system in the Rainy River-Headwaters Watershed. There are 44 lakes greater than 10 acres, with the most prominent being Ferne, Rice, Quadga, Isabella, and Perent. This subwatershed is dominated by forest (61.24%), wetland (28.76%), and open water (9.21%). Only 0.77% is developed, 0.02% is rangeland, and there is no row-crop agriculture or barren/mining. This entire subwatershed lies within the Superior National Forest, with the majority (70.51%) of it within the BWCAW. A portion of the Fungus Lake and Weasel Lake Primitive Management Area are located within this drainage. Much of the land is owned and managed by local, state, and federal entities (USGS, 2008). The Pagami Creek Fire of 2011 burned a significant portion (43.27%) of this drainage. As a result of the overall remoteness; there was no intensive water chemistry sampling conducted on rivers and streams within this subwatershed and only one biological monitoring stations (14RN100).

Table 16. Aquatic life and recreation assessments on stream reaches: Isabella River Aggregated 12-HUC. Reaches are organized upstream to downstream in the table.

AUID *Reach Name*, *Reach Description*	Biological Station ID	Reach Length (miles)	Use Class	Aquatic Life Indicators: Fish IBI	Invert IBI	Dissolved Oxygen	TSS	Secchi Tube	Chloride	pH	Ammonia -NH_3	Pesticides	Eutrophication	Aquatic Life	Aquatic Rec. (Bacteria)
09030001-676 **Hog Creek** **Unnamed Cr to Unnamed Cr**	14RN100	1.13	CWg*	MTS	MTS	IF	IF	IF	- -	IF	IF	- -	IF	SUP	- -

Abbreviations for Indicator Evaluations: **MTS** = Meets Standard; **EXS** = Fails Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Impaired (Fails Standards)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.
Abbreviations for Use Class: **WWg** = warmwater general, **WWm** = Warmwater modified, **WWe** = Warmwater exceptional, **CWg** = Coldwater general, **CWe** = Coldwater exceptional, **LRVW** = limited resource value water
*Assessments were completed using proposed use classifications changes that have not yet been written into rule.

Table 17. Lake assessments: Isabella River Aggregated 12-HUC.

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators:			Aquatic Recreation Indicators:			Aquatic Life Use	Aquatic Recreation Use
							Fish IBI	Chloride	Pesticides	Total Phosphorus	Chlorophyll-a	Secchi		
Coffee	38-0064-00	130.3	11	Shallow Lake	NLF	- -	- -	IF	- -	- -	- -	- -	IF	IF
Perent	38-0220-00	1603.7	38	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Isabella	38-0396-00	1077.5	18	Shallow Lake	NLF	NT	- -	- -	- -	MTS	MTS	MTS	- -	SUP

Abbreviations for Ecoregion: DA = Driftless Area, NCHF = North Central Hardwood Forest, NGP = Northern Glaciated Plains, NLF = Northern Lakes and Forests, NMW = Northern Minnesota Wetlands, RRV = Red River Valley, WCBP = Western Corn Belt Plains
Abbreviations for Secchi Trend: D = decreasing/declining trend, I = increasing/improving trend, NT = no detectable trend, -- = not enough data
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Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Not Support (Impaired, exceeds standard)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.

Summary

The Isabella River Subwatershed had one assessable stream segment, containing one biological monitoring station, and one lake assessed for aquatic recreation (Table 16 and Table 17). All of the streams and lakes met the applicable standards or criteria and fully support aquatic life and/or aquatic recreation (Figure 31). In-stream habitat was in good condition and is a reflection of the land use within this drainage (Appendix 5). As a result of quality in-stream habitat and good water quality, a relatively diverse fish and macroinvertebrate community was present throughout the subwatershed. The low amount of disturbance within this subwatershed almost assures excellent biological integrity.

Hog Creek (-676), a tributary to Perent Lake (38-0220-00) was assessed as a cold-water (CWg) stream. Both biological and temperature data indicated that conditions within this reach were more representative of cold-water stream. Only one assessable biological station (14RN0100) was located on this reach, with two fish visits conducted by the MPCA. Although they were not used in this assessment, four additional surveys from the USFS provided further insight into the biological condition of Hog Creek. A diversity of fish species were collected during the six fish visits, with several species typical of cool/cold-water conditions. Although this reach of Hog Creek is not a designated trout stream, the fish community was consistent with an assemblage of a cold-water (trout) stream. The macroinvertebrate community also contained several cold-water obligates (*Baetis tricaudatus*, *Boyeria grafiana*) and indicated similar conditions as the fish community (Figure 30). In addition, continuous water temperature data was available for the summers of 2014 and 2015 and are within the adequate growth range for brook trout. The summer (June 1 to August 31) average temperature ranged from 17.0 ºC in 2014 to 17.7 ºC in 2015, with thermal stress reached 10.4-21.7% of that time. As a result of this analysis, a proposed use class change from warm-water (WWg) to cold-water (CWg) was used in the assessment of Hog Creek. Overall, Hog Creek is meeting biological standards has good water quality throughout its upstream drainage.

Figure 30. Baetis tricaudatus, an important mayfly species to trout is one of the most widespread and abundant baetid in Minnesota.

Isabella Lake (38-0396-00) is the only lake with assessment level water quality data in this subwatershed. This popular BWCAW lake fully supports aquatic recreation. Phosphorus and chlorophyll concentrations were low. Mild algae blooms were observed after the fire, in lake 2011 and midsummer 2012. Since then concentrations of algae appear to have declined. Secchi transparency is limited in this lake by the bog-stained color of the water.

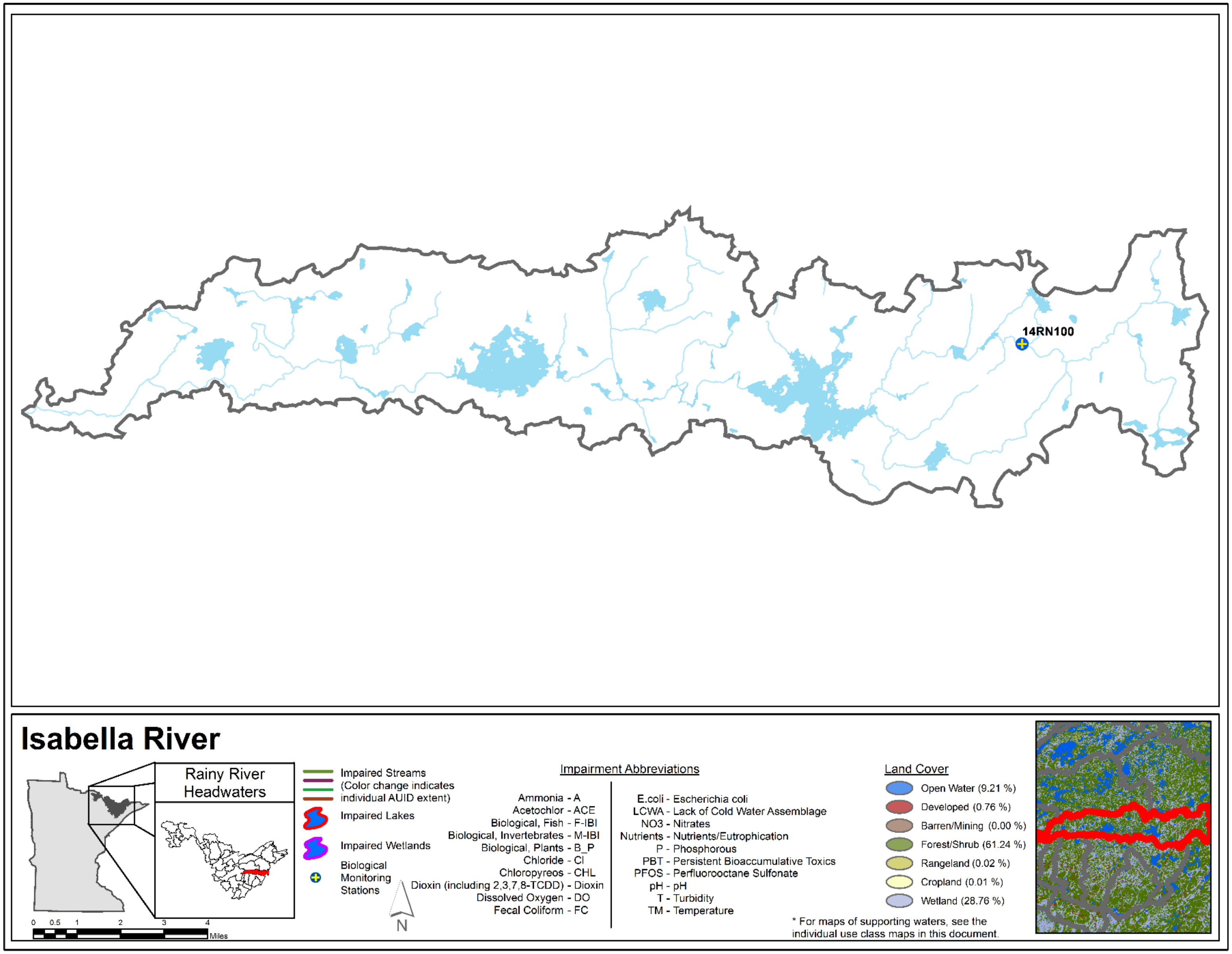

Figure 31. Currently listed impaired waters by parameter and land use characteristics in the Isabella River Aggregated 12-HUC.

Little Isabella River Aggregated 12-HUC HUC 0903000107-02

The Little Isabella River Subwatershed drains 51.49 square miles of Lake County and is the seventh smallest subwatershed within the Rainy River-Headwaters Watershed. The headwaters of the Little Isabella River begins in a forested wetland and flows 11.1 miles to the northeast while receiving additional flow from numerous unnamed tributaries before reaching Flat Horn Lake (38-0568-00). The Isabella River receives additional water from Weiss Creek, which connects to Flat Horn Lake through Gegoka Lake (38-0573-00). As the Little Isabella River exits Flat Horn Lake, it turns to the north and flows an additional 20.86 miles before reaching the Isabella River and exiting this subwatershed. On its path to the Isabella River it flows through Grouse (38-0557-00) and Dragon Lake (38-0552-00), while receiving additional flow from Sphagnum and numerous unnamed creeks. Numerous cold-water streams exist within this subwatershed with robust populations of brook trout (Figure 32). This subwatershed is a part of the larger Kawishiwi River system, which is the largest river system in the Rainy River-Headwaters Watershed. There are a total of 14 lakes greater than 10 acres, with the most prominent being Gegoka, Gourse, Gragon, Flat Horn, and Cat. This subwatershed is dominated by forest (60.55%) and wetland (32.26%). Only 3.52% is developed, 2.32% is open water, 1.33% is rangeland, 0.02% is row-crop agriculture, and there is no barren/mining. This entire subwatershed lies within the Superior National Forest, with a portion (6.36%) of it within the BWCAW. Much of the land is owned and managed by local, state, and federal entities (USGS, 2008). A small portion of this drainage has been burned by both prescribed and wild fires. Intensive water chemistry sampling was conducted at the outlet of the subwatershed at the end of Sand River Rd (FR-381), 13 miles northwest of Isabella on the Little Isabella River. The outlet is represented by water chemistry station S007-899 and biological station 14RN008.

Table 18. Aquatic life and recreation assessments on stream reaches: Little Isabella River Aggregated 12-HUC. Reaches are organized upstream to downstream in the table.

AUID *Reach Name*, *Reach Description*	Biological Station ID	Reach Length (miles)	Use Class	Aquatic Life Indicators: Fish IBI	Invert IBI	Dissolved Oxygen	TSS	Secchi Tube	Chloride	pH	Ammonia -NH_3	Pesticides	Eutrophication	Aquatic Life	Aquatic Rec. (Bacteria)
09030001-577 **Sphagnum Creek** **Headwaters to Little Isabella R**	06RN016	3.82	CWg	MTS	- -	- -	- -	- -	- -	- -	- -	- -	- -	SUP	- -
09030001-530 **Little Isabella River** **Headwaters to Flat Horn Lk**	14RN079	11.05	CWe	MTS	MTS	IF	IF	IF	- -	IF	IF	- -	IF	SUP	- -
09030001-561 **Little Isabella River** **Dragon Lk to Boundary Waters Canoe Area Wilderness Boundary**	14RN008	10.52	CWg	MTS	MTS	IF	IF	MTS	MTS	MTS	MTS	- -	IF	SUP	SUP

Abbreviations for Indicator Evaluations: **MTS** = Meets Standard; **EXS** = Fails Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Impaired (Fails Standards)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.
Abbreviations for Use Class: **WWg** = warmwater general, **WWm** = Warmwater modified, **WWe** = Warmwater exceptional, **CWg** = Coldwater general, **CWe** = Coldwater exceptional, **LRVW** = limited resource value water
*Assessments were completed using proposed use classifications changes that have not yet been written into rule.

Table 19. Lake assessments: Little Isabella River Aggregated 12-HUC.

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators:			Aquatic Recreation Indicators:			Aquatic Life Use	Aquatic Recreation Use
							Fish IBI	Chloride	Pesticides	Total Phosphorus	Chlorophyll-a	Secchi		
Flat Horn	38-0568-00	51.1	10	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Grouse	38-0557-00	121.3	10	Shallow Lake	NLF	NT	- -	- -	- -	MTS	MTS	MTS	- -	SUP
Gegoka	38-0573-00	140.5	7	Shallow Lake	NLF	- -	- -	MTS	- -	MTS	MTS	IF	IF	SUP

Abbreviations for Ecoregion: DA = Driftless Area, NCHF = North Central Hardwood Forest, NGP = Northern Glaciated Plains, NLF = Northern Lakes and Forests, NMW = Northern Minnesota Wetlands, RRV = Red River Valley, WCBP = Western Corn Belt Plains
Abbreviations for Secchi Trend: D = decreasing/declining trend, I = increasing/improving trend, NT = no detectable trend, -- = not enough data
Abbreviations for Indicator Evaluations: -- = No Data, **MTS** = Meets Standard; **EXS** = Exceeds Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Not Support (Impaired, exceeds standard)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.

Summary

The Little Isabella River Subwatershed had three assessable stream segments, containing three biological monitoring stations, and two lakes assessed for aquatic recreation (Table 18 and Table 19). All of the streams and lakes met the applicable standards or criteria and fully support aquatic life and/or aquatic recreation (Figure 34). In-stream habitat was in good condition with the highest overall habitat score (84.08 out of 100) in the Rainy River-Headwaters Watershed (Appendix 5). As a result of quality in-stream habitat and good water quality, a relatively diverse fish and macroinvertebrate community was surveyed during monitoring. The low amount of disturbance within this subwatershed almost assures excellent biological integrity. A portion of this subwatershed had exceptional performing biological, chemical, and physical parameters and are worthy of additional protection in order to preserve them.

Figure 32. Brook Trout (Salvelinus fontinalis) require clear, cool, and well-oxygenated waterbodies (Becker, 1983).

A use class analysis was conducted on all assessed waterbodies within the Rainy River-Headwaters Watershed. Streams designated as exceptional receive additional protections from a more stringent water quality standard. The upstream reach of the Little Isabella River (-530), from its headwaters to Flat Horn Lake, met the exceptional use criteria. One biological monitoring station (14RN079) was located just upstream of the Little Isabella River Campground (Superior National Forest). This station was sampled once by the MPCA for both fish and macroinvertebrates, with additional fish data provided by the USFS. All five of the fish visits were above the exceptional use standard, with numerous sensitive fish species present during monitoring. A total of 14 fish species were captured consisting primarily of blacknose dace, brook trout, and longnose dace. The macroinvertebrate community indicated similar conditions, with a high number of species and several sensitive individuals.

The Little Isabella River and its tributaries have a vibrant brook trout population that is well known to local anglers (Figure 32). The downstream reach (-561) of the Little Isabella River had one biological monitoring station (14RN008) that was monitored just upstream of BWCAW entry point #75 (Little Isabella River). This station had a diversity of in-stream habitat and a variety of fish species (15). Although the F-IBI is just below the exceptional use threshold, numerous sensitive species (longnose dace, mottled sculpin, blacknose shiner, etc.) were captured including brook trout, which is a sensitive cold-water obligate. The macroinvertebrate community performed well on the M-IBI, with a score (54.66) above the exceptional use threshold. Numerous sensitive species were present during monitoring; including several cold-water obligates (Glossosma, Brachycentrus, and Rhyacophila).

Data for Sphagnum Creek (-577), a tributary to the Little Isabella River, was provided by the USFS and consisted of two fish visits at 06RN016. A total of six fish species were surveyed and contained some sensitive species (brook trout, mottled sculpin). Not all parameters were meeting exceptional use standards but it did indicate good water quality.

The intensive water chemistry station was located near the outlet of the Little Isabella River off Sand River Road (FR 381), adjacent to the Little Isabella River BWCAW entry point (#75). The conventional parameters collected at this location indicate excellent water quality. Sediment and nutrient concentrations were consistently low. The DO dataset here was lacking early morning data. Of the 46 samples collected, three were below the 7mg/L cold-water standard (CWg). There is potential that the oxygen concentrations drop further during the early morning hours and stress fish. *E. coli* bacteria concentrations were consistently low in the Little Isabella River and indicated full support for aquatic recreation.

Grouse (38-0557-00) and Gegoka Lake (38-0573-00) fully support aquatic recreation. Gegoka is shallow and has algae concentrations at the water quality standard (Figure 33). Mild blooms will occur on this lake from time to time. Both Grouse and Gegoka have low levels of phosphorus, well below the standard but have naturally low transparency due to bog staining effects from the surrounding wetlands.

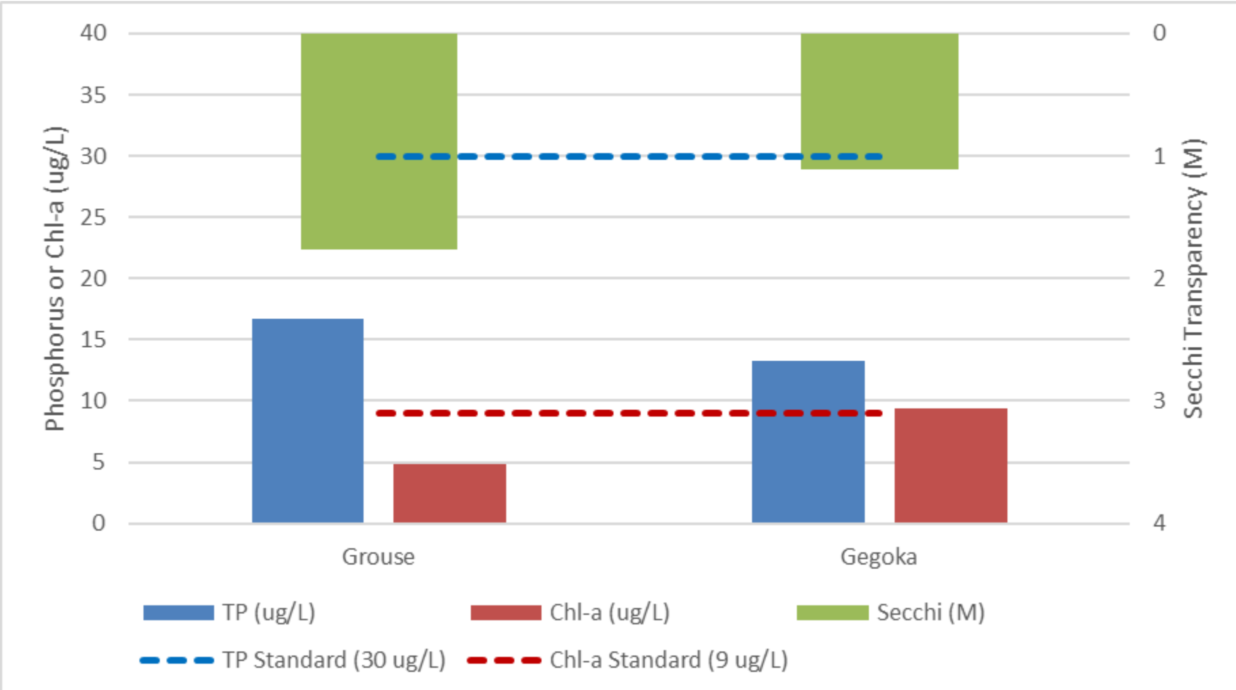

Figure 33. Water quality summary for assessed lakes in Little Isabella River Aggregated 12-HUC.

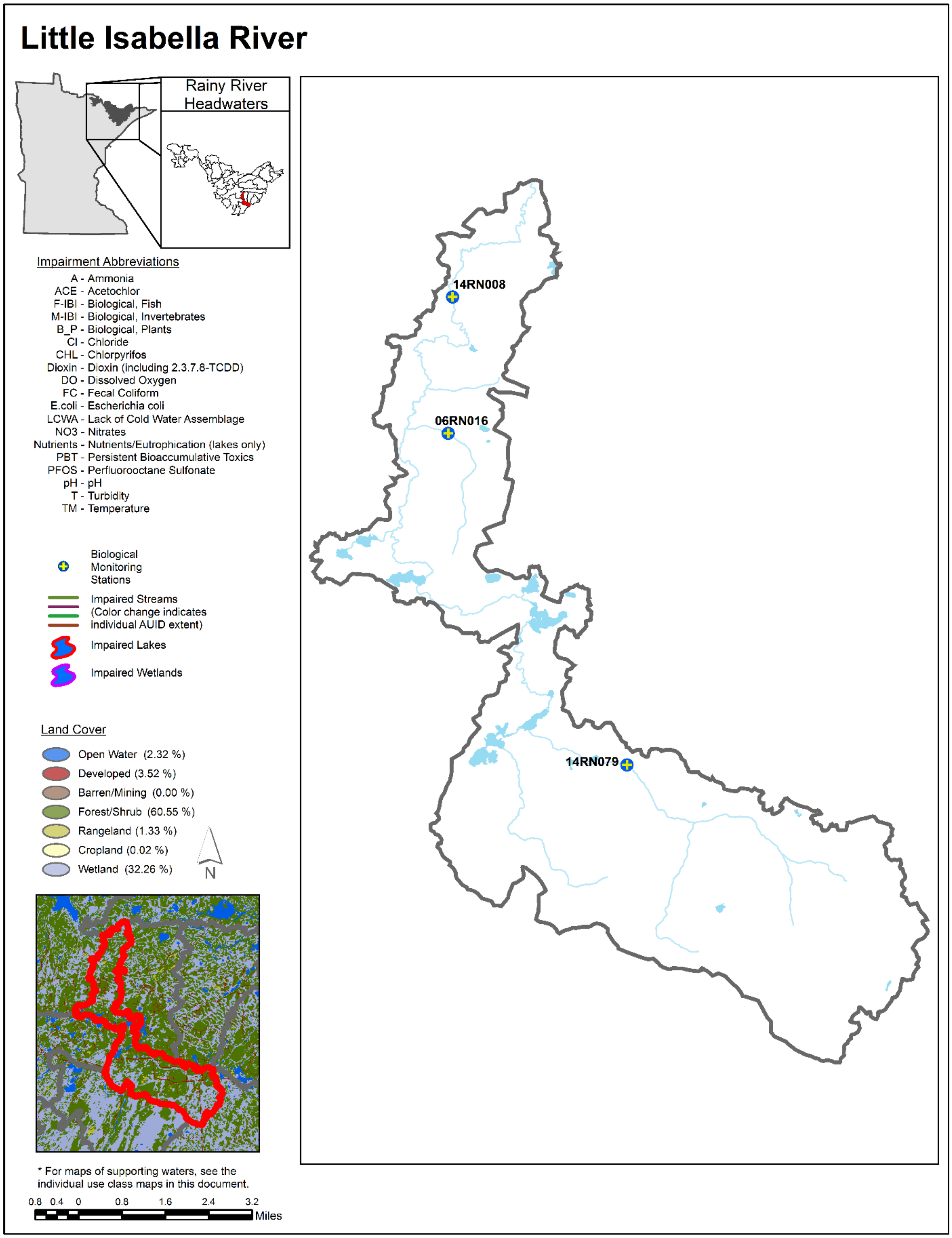

Figure 34. Currently listed impaired waters by parameter and land use characteristics in the Little Isabella River Aggregated 12-HUC.

Mitawan Creek Aggregated 12-HUC HUC 0903000107-03

The Mitawan Creek Subwatershed drains 42.06 square miles of Lake County and is the second smallest subwatershed within the Rainy River-Headwaters Watershed. The headwaters of this subwatershed begins in a forested wetland and continues to the northwest 2.8 miles through Hill Creek before reaching Mitawan Lake (38-0561-00). A small channel connects both Kitigan (38-0559-00) and Mitawan Lake. Mitiwan Creek begins at the outlet of Kitigan Lake and continues 14.2 miles to its confluence with the Isabella River, while receiving additional flow from Victor, Jack Pine, Inga, and various unnamed tributaries. Numerous cold-water stream exist within this subwatershed and support a vibrant brook trout population. This subwatershed is a part of the larger Kawishiwi River system, which is the largest river system in the Rainy River-Headwaters Watershed. There are a total of 10 lakes greater than 10 acres, with the most prominent being Bog, Mitawan, and Kitigan. This subwatershed is dominated by forest (63.15%) and wetland (29.46%). Only 3.33% is developed, 2.83% is open water, 1.23% is rangeland, and there is no barren/mining or row-crop agriculture. This entire subwatershed lies within the Superior National Forest, with a portion (18.34%) of it within the BWCAW. Much of the land is owned and managed by local, state, and federal entities (USGS, 2008). A portion of this drainage was burned in the Pagami Creek fire of 2011, along with other wild and prescribed fires. As a result of the overall remoteness; there was no intensive water chemistry sampling conducted on rivers and streams within this subwatershed.

Table 20. Aquatic life and recreation assessments on stream reaches: Mitawan Creek Aggregated 12-HUC. Reaches are organized upstream to downstream in the table.

AUID *Reach Name*, *Reach Description*	Biological Station ID	Reach Length (miles)	Use Class	Aquatic Life Indicators: Fish IBI	Invert IBI	Dissolved Oxygen	TSS	Secchi Tube	Chloride	pH	Ammonia -NH_3	Pesticides	Eutrophication	Aquatic Life	Aquatic Rec. (Bacteria)
09030001-556 **Hill Creek** **Headwaters to Mitawan Lk**	06RN010	2.78	CWg	MTS	- -	- -	- -	- -	- -	- -	- -	- -	- -	SUP	- -
09030001-564 **Jack Pine Creek** **T60 R8W S18, east line to Mitawan Cr**	14RN081	7.15	CWe	MTS	MTS	IF	IF	IF	- -	IF	IF	- -	IF	SUP	- -
09030001-558 **Inga Creek** **Majava Lk to T 60 R10W S 14, north line**	15RN082	6.36	CWg	MTS	MTS	IF	IF	MTS	- -	MTS	IF	- -	IF	SUP	- -
09030001-560 **Inga Creek** **T60 R10W S14, south line to Mitawan Cr**	14RN082	1.54	CWg	MTS	MTS	IF	IF	IF	- -	IF	IF	- -	IF	SUP	- -
09030001-568 **Mitawan Creek** **Kitigan Lk to T61 R9W S13, north line**	05RN073 06RN014 05RN190	8.18	CWe	MTS	MTS	IF	IF	MTS	- -	MTS	IF	- -	IF	SUP	- -

Abbreviations for Indicator Evaluations: **MTS** = Meets Standard; **EXS** = Fails Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Impaired (Fails Standards)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.
Abbreviations for Use Class: **WWg** = warmwater general, **WWm** = Warmwater modified, **WWe** = Warmwater exceptional, **CWg** = Coldwater general, **CWe** = Coldwater exceptional, **LRVW** = limited resource value water
*Assessments were completed using proposed use classifications changes that have not yet been written into rule.

Table 21. Lake assessments: Mitawan Creek Aggregated 12-HUC.

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators: Fish IBI	Aquatic Life Indicators: Chloride	Aquatic Life Indicators: Pesticides	Aquatic Recreation Indicators: Total Phosphorus	Aquatic Recreation Indicators: Chlorophyll-a	Aquatic Recreation Indicators: Secchi	Aquatic Life Use	Aquatic Recreation Use
Kitigan	38-0559-00	68.5	8	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Mitawan	38-0561-00	186.4	27	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF

Abbreviations for Ecoregion: DA = Driftless Area, NCHF = North Central Hardwood Forest, NGP = Northern Glaciated Plains, NLF = Northern Lakes and Forests, NMW = Northern Minnesota Wetlands, RRV = Red River Valley, WCBP = Western Corn Belt Plains
Abbreviations for Secchi Trend: D = decreasing/declining trend, I = increasing/improving trend, NT = no detectable trend, -- = not enough data
Abbreviations for Indicator Evaluations: -- = No Data, **MTS** = Meets Standard; **EXS** = Exceeds Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Not Support (Impaired, exceeds standard)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.

Summary

The Mitawan Creek Subwatershed had five assessable stream segments, containing seven biological monitoring stations, and no lakes assessed for aquatic recreation (Table 20 and Table 21). All of the streams met the applicable standards or criteria and fully support aquatic life (Figure 36). In-stream habitat was in good condition and was a reflection of the land use throughout this subwatershed (Appendix 5). As a result of quality in-stream habitat and high water quality, a relatively diverse fish and macroinvertebrate community was captured during monitoring. The low amount of disturbance within this subwatershed almost assures excellent biological integrity. Streams that have exceptional performing biological, chemical, and physical parameters are worthy of additional protection in order to preserve them.

A use class analysis was conducted on all assessed waterbodies within the Rainy River-Headwaters Watershed. Streams designated as exceptional receive additional protections from a more stringent water quality standard. Two stream reaches, Jack Pine (-564) and Mitawan Creek (-568), met all the required parameters for this designation. Most streams throughout this subwatershed are designated trout streams and have a vibrant brook trout population

Jack Pine Creek (-564), a tributary to Mitawan Creek, is a small headwater stream that supports a robust fish and macroinvertebrate community. The only biological monitoring station (14RN081) located on this reach had a fish community dominated by individuals (creek chub, mottled sculpin, etc.) that are endemic to cold-water streams, including multiple year classes of brook trout. The average summer temperature (June 1 – August 31) of 16.5 oC is easily within the growth range for brook trout. The macroinvertebrate community was also comprised of several sensitive species, with numerous cold-water obligates present.

Mitawan Creek (-568) receives flow from both Hill and Jack Pine Creeks, along with numerous other lakes and streams. There are three stations located on this reach, with five fish visits conducted by the MPCA. A long-term biological monitoring station was established at 05RN073 to measure variability in sampling efforts, long-term resource trends, and climate change (Figure 35). The USFS provided an additional seven fish visits that gave further insight into the biological condition of Mitawan Creek. A total of 14 fish species were captured with the most prevalent being creek chub, blacknose dace, brook trout, and mottled sculpin. Several sensitive cool and cold-water obligates were sampled at the three stations, indicative of exceptional water quality. This reach also had a rich macroinvertebrate community dominated by several sensitive and cold-water obligate species. All of the F-IBI and M-IBI scores met the exceptional use standard, resulting in this reach being designated as exceptional (CWe). In addition, the thermal regime supported a brook trout fishery, with an average summer temperature of 18.9 oC in 2013, 18.6 oC in 2015 at 05RN073, and 17.2 oC in 2015 at 05RN190. Stress for brook trout was only reach 12.9-38.4% of the time between the sampling dates and sampling locations.

Figure 35. Mitawan Creek (05RN073) long-term biological monitoring station.

Considered the headwaters of this subwatershed, Hill Creek (-556) had one biological monitoring station (06RN010) located near its pour point to Mitawan Lake (38-0561-00). A total of eight visits were provided by the USFS containing a total of 11 fish species. This stream community was dominated by brook trout (23-87%), with several other sensitive species present. In addition, numerous warm-water species were captured in low numbers and only at a single fish visit. These species are likely migrants from the nearby lake and are not typical of a cold-water stream community. Despite this influence in species composition, numerous cold-water obligates were captured indicating excellent water quality.

Inga Creek contributes its waters to Mitawan Creek after both streams enter the BWCAW. Two biological monitoring stations (14RN082 and 15RN082) were located on separate stream reaches (-560 and -558). Both stations met aquatic life standards. A total of three fish visits were conducted between the two stations, with two of the three visits meeting the exceptional use standard. Nine fish species were captured during monitoring, with both sensitive and cold-water obligates present (mottled sculpin, brook trout). The only fish visit below the exceptional use threshold lacked the presence of brook trout. Overall, M-IBI scores varied but all stations had numerous sensitive species and indicated full support of aquatic life. One station was just below the general use threshold but within the confidence interval. Habitats sampled were limited to aquatic macrophytes despite the habitat survey indicating riffle, woody debris, and undercut banks being available. The macroinvertebrate community was numerically dominated by a single snail species (Hydrobiidae) but there were several sensitive species present. In comparison, the downstream reach (-560; 14RN082) was sampled two weeks later in 2015. The macroinvertebrate sample was collected from three habitat types (woody debris, aquatic macrophytes, and undercuts banks) and contained a sensitive cold-water macroinvertebrate community. Although some indicators suggested that the stream was exceptional, it did not meet all the requirements necessary to receive the exceptional use (CWe) designation.

No lakes within this subwatershed had sufficient data for water quality assessments. Data was limited to Secchi transparency on Kitigan (38-0559-00) and Mitawan Lakes, with transparencies in excess of two meters observed.

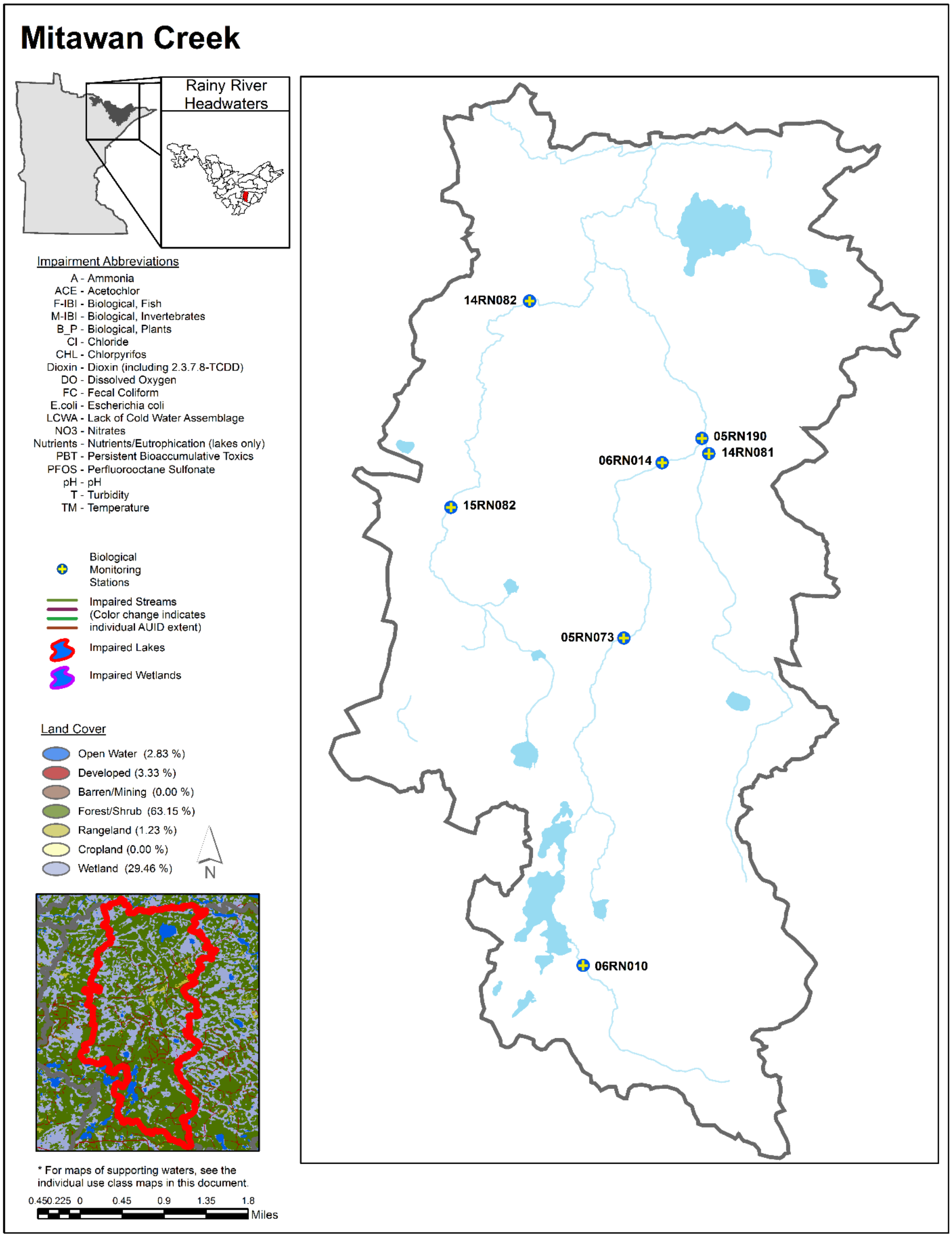

Figure 36. Currently listed impaired waters by parameter and land use characteristics in the Mitawan Creek Aggregated 12-HUC.

Island River Aggregated 12-HUC HUC 0903000107-04

The Island River Subwatershed drains 99.80 square miles of Lake County and is the fourteenth largest subwatershed within the Rainy River-Headwaters Watershed. Its headwaters starts in Elixir Lake (38-0218-00) and continues downstream through a tributary to Fulton Creek. Harris Lake (38-0048-00) receives flow from Fulton Creek and two additional unnamed tributaries before pouring into Harris Creek. Harris Creek continues 4.3 miles to Silver Island Lake (38-0219-00), while receiving additional flow from numerous unnamed tributaries. The Island River begins at the outlet of Silver Island Lake and flows to the west 13.6 miles to its confluence with the Isabella River, while receiving additional flow from the Dumbbell River (Dumbbell River Aggregated 12-HUC), Comfort Creek, Jack Creek, and Arrowhead Creek. Numerous cold-water streams are in this subwatershed, supporting a vibrant brook trout population. This subwatershed is a part of the larger Kawishiwi River system, which is the largest river system in the Rainy River-Headwaters Watershed. There are a total of 47 lakes greater than 10 acres, with the most prominent being Silver Island, Windy, T, Harriet, and Sister. This subwatershed is dominated by forest (54.98%) and wetland (35.42%) Only 6.57% is open water, 2.48% is developed, 0.55% is rangeland, and there is no barren/mining or row-crop agriculture. This entire subwatershed lies within the Superior National Forest, with a small portion (7.00%) of it within the BWCAW. Much of the land is owned and managed by local, state, and federal entities (USGS, 2008). A small portion of this subwatershed was burned by the Pagami Creek fire of 2011. Intensive water chemistry sampling was conducted at the outlet of the subwatershed at Tomahawk Road (FR-377), 12 miles north of Isabella on the Island River. The outlet is represented by water chemistry station S007-779 and biological station 14RN009.

Table 22. Aquatic life and recreation assessments on stream reaches: Island River Aggregated 12-HUC. Reaches are organized upstream to downstream in the table.

AUID *Reach Name*, Reach Description	Biological Station ID	Reach Length (miles)	Use Class	Aquatic Life Indicators: Fish IBI	Invert IBI	Dissolved Oxygen	TSS	Secchi Tube	Chloride	pH	Ammonia -NH_3	Pesticides	Eutrophication	Aquatic Life	Aquatic Rec. (Bacteria)
09030001-979 **Harriet Creek** **Harriet Lk to Silver Island Lk**	14RN084	4.26	CWg*	MTS	MTS	IF	IF	IF	- -	IF	IF	- -	IF	SUP	- -
09030001-529 **Island River** **Headwaters (Silver Island Lk 38-0219-00) to Island Lk**	14RN083 15EM097	4.60	WWg	MTS	MTS	IF	IF	IF	- -	IF	IF	- -	IF	SUP	- -
09030001-586 **West Camp Creek** **Headwaters to Camp Cr**	14RN087	6.11	CWg	MTS	- -	IF	IF	IF	- -	IF	IF	- -	IF	SUP	- -
09030001-801 **Trappers Creek** **Trappers Lk to T60 R8W S28, north line**	06RN017	1.54	CWg	MTS	- -	- -	- -	- -	- -	- -	- -	- -	- -	SUP	- -
09030001-550 **Arrowhead Creek** **Spear Lk to Island R**	14RN086 14RN085	18.79	CWg	MTS	MTS	IF	IF	IF	- -	IF	IF	- -	IF	SUP	- -
09030001-563 **Island River** **Island Lk to Isabella R**	14RN009	7.74	WWg	MTS	- -	IF	IF	MTS	MTS	EXS	MTS	- -	IF	SUP	SUP

Abbreviations for Indicator Evaluations: **MTS** = Meets Standard; **EXS** = Fails Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Impaired (Fails Standards)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use ; = insufficient information.
Abbreviations for Use Class: **WWg** = warmwater general, **WWm** = Warmwater modified, **WWe** = Warmwater exceptional, **CWg** = Coldwater general, **Cwe** = Coldwater exceptional,
LRVW = limited resource value water
*Assessments were completed using proposed use classifications changes that have not yet been written into rule.

Table 23. Lake assessments: Island River Aggregated 12-HUC.

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators:			Aquatic Recreation Indicators:			Aquatic Life Use	Aquatic Recreation Use
							Fish IBI	Chloride	Pesticides	Total Phosphorus	Chlorophyll-a	Secchi		
Elixir	38-0218-00	15.5	8	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	-	IF
Scarp	38-0058-00	40.8	15	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	-	IF
Nine A.M.	38-0445-00	15.1	14	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	-	IF
Fulton	38-0056-00	38.8	17.5	- -	NLF	- -	- -	- -	- -	- -	- -	IF	-	IF
Sylvania	38-0395-00	77.0	4.5	- -	NLF	- -	- -	- -	- -	- -	- -	IF	-	IF
Trappers	38-0431-00	19.0	13	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	-	IF
Wye	38-0042-00	52.6	10	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	-	IF
Harriet	38-0048-00	259.6	35	- -	NLF	- -	- -	MTS	- -	MTS	MTS	MTS	IF	SUP
Sister	38-0050-00	124.2	15	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators: Fish IBI	Aquatic Life Indicators: Chloride	Aquatic Life Indicators: Pesticides	Aquatic Recreation Indicators: Total Phosphorus	Aquatic Recreation Indicators: Chlorophyll-a	Aquatic Recreation Indicators: Secchi	Aquatic Life Use	Aquatic Recreation Use
T	38-0066-00	291.4	11	Shallow Lake	NLF	- -	- -	MTS	- -	MTS	MTS	IF	IF	SUP
Windy	38-0068-00	459.7	39	Deep Lake	NLF	- -	- -	MTS	- -	MTS	MTS	IF	IF	SUP
Section 29	38-0292-00	100.5	20	Deep Lake	NLF	- -	- -	MTS	- -	MTS	MTS	IF	IF	SUP
Eighteen	38-0432-00	103.9	8	Shallow Lake	NLF	- -	- -	MTS	- -	MTS	MTS	MTS	IF	SUP
Silver Island	38-0219-00	1231.2	15	Shallow Lake	NLF	- -	- -	MTS	- -	MTS	MTS	IF	IF	SUP

Abbreviations for Ecoregion: DA = Driftless Area, NCHF = North Central Hardwood Forest, NGP = Northern Glaciated Plains, NLF = Northern Lakes and Forests, NMW = Northern Minnesota Wetlands, RRV = Red River Valley, WCBP = Western Corn Belt Plains
Abbreviations for Secchi Trend: D = decreasing/declining trend, I = increasing/improving trend, NT = no detectable trend, -- = not enough data
Abbreviations for Indicator Evaluations: -- = No Data, **MTS** = Meets Standard; **EXS** = Exceeds Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Not Support (Impaired, exceeds standard)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.

Summary

The Island River Subwatershed had six assessable stream segments, containing eight biological monitoring stations, and six lakes assessed for aquatic recreation (Table 22 and Table 23). All of the streams and lakes met the applicable standards or criteria and fully support aquatic life and/or aquatic recreation (Figure 38). In-stream habitat was in good condition and is a reflection of the upstream drainage (Appendix 5). As a result of quality in-stream habitat and good water quality, a relatively diverse fish and macroinvertebrate community was present throughout the subwatershed. The low amount of disturbance within the subwatershed almost assures excellent biological integrity. A use class analysis was conducted on all assessed waterbodies within the Rainy River-Headwaters Watershed. Streams that support an exceptional use designation receive additional protections from a more stringent water quality standard. Although specific parameters met the exceptional criteria, not all the requirements were met to receive the exceptional use designation (WWe and CWe) but did indicate excellent water quality.

The upstream reach (-979) of this subwatershed was located on Harriet Creek which contained one biological monitoring station (14RN084). This stream reach was assessed for its viability to support a cold-water assemblage and to determine its appropriate use class designation (WWg or CWg). Both biological and thermal data indicated that there was a reasonable potential for this reach to support a cold-water community. The MPCA collected both fish and macroinvertebrate data from this station during 2014 and 2015 season. The 2014 sample had an F-IBI score (42.72) that was just above the general use threshold, while the 2015 sample (79.34) was well above the exceptional use threshold. The 2014 F-IBI score was driven down by a small number of warm-water individuals (pumpkinseed, iowa darter) that likely migrated upstream from Silver Island Lake (38-0219-00). A total of 10 fish species were captured and was dominated by creek chubs, longnose dace, and pearl dace. Numerous sensitive species (longnose dace, pearl dace, and mottled sculpin) indicated good water quality. Species richness was very high for the macroinvertebrate community, with several sensitive and cold-water obligates present. The 2014 sample contained Ocellated Darner (*Boyeria grafiana*), which is a species of special concern. The thermal regime was also suggested support for a brook trout fishery, with an average temperature of 18.3 °C and thermal stress reached 29.1% during the summer months (June 1 – August 31) of 2015. In addition, the USFS also provided fish community data for five visits at two separate stations along this reach. Although this data was not directly used in the assessment of aquatic life, it does provide further insight into the condition of this waterbody.

Three other known cold-water (trout) streams fully supporting aquatic life. Arrowhead (-550), Trappers (-801), and West Camp Creeks (-586) all support a robust brook trout fishery, with numerous cold-water obligates present. Both West Camp and Trappers Creek contribute their waters to Arrowhead Creek. Brook trout were most abundant in Arrowhead Creek, but tended to decrease in abundance with an increase in drainage area. This trend may be a result of variations in thermal regime and habitat between stations. The macroinvertebrate community also consisted of numerous sensitive species, including several cold-water obligates. Additional fish community data was provided by the USFS for both Trappers and Arrowhead Creek. Trappers Creek (06RN017) was assessed as fully supporting for aquatic life using this data.

The Island River is the largest warm-water system within this drainage. It had three biological monitoring stations (14RN009, 14RN083, 15EM097) located along two stream reaches (-529 and -563). The upstream reach had two biological monitoring stations that were partially overlapping. One station was established as part of the IWM program, while the other was established using the systematic random sampling design of the EMAP. Both stations had a robust fish and macroinvertebrate community that contained several sensitive species. The M-IBI score varied between years. The variation may have been the result of fluctuations in water levels and habitat sampled. The downstream reach

(-563) had one biological monitoring station (14RN009) that was located just upstream of the BWCAW entry point #34 (Island River). This station had the lowest gradient value (0.001m/km) of all the stations monitored in the Rainy River-Headwaters Watershed. This stream attribute was reflected in the fish community. A low number of individuals (48) and species typical of wetland habitats were sampled. Despite having fair habitat conditions, two sensitive species (blacknose shiner, mottled sculpin) were sampled and indicated good water quality. Macroinvertebrates were not sampled in this reach due to non-wadeable water depth. Water quality conditions were at expected levels, and are similar to those in other low gradient wetland dominated streams within Superior National Forest. Nutrient and sediment levels were low. Island River did have pH and dissolved oxygen exceedances; there is potential that at times oxygen levels may drop low enough to stress the fish community. *E. coli* bacteria concentrations were consistently low at this location and indicated full support for aquatic recreation.

A summary of water quality data for select lakes in the Island River subwatershed is shown in Figure 37. All lakes with assessment level data (Eighteen, Harriet, T, Windy, and Silver Island) fully supported aquatic recreation. Total phosphorus and Chl-a concentrations met standards for Class 2B lakes in the NLF Ecoregion. Some naturally bog stained lakes, such as Silver Island and T, had transparencies below the water quality standard, but algal levels were low indicating support for recreational activities.

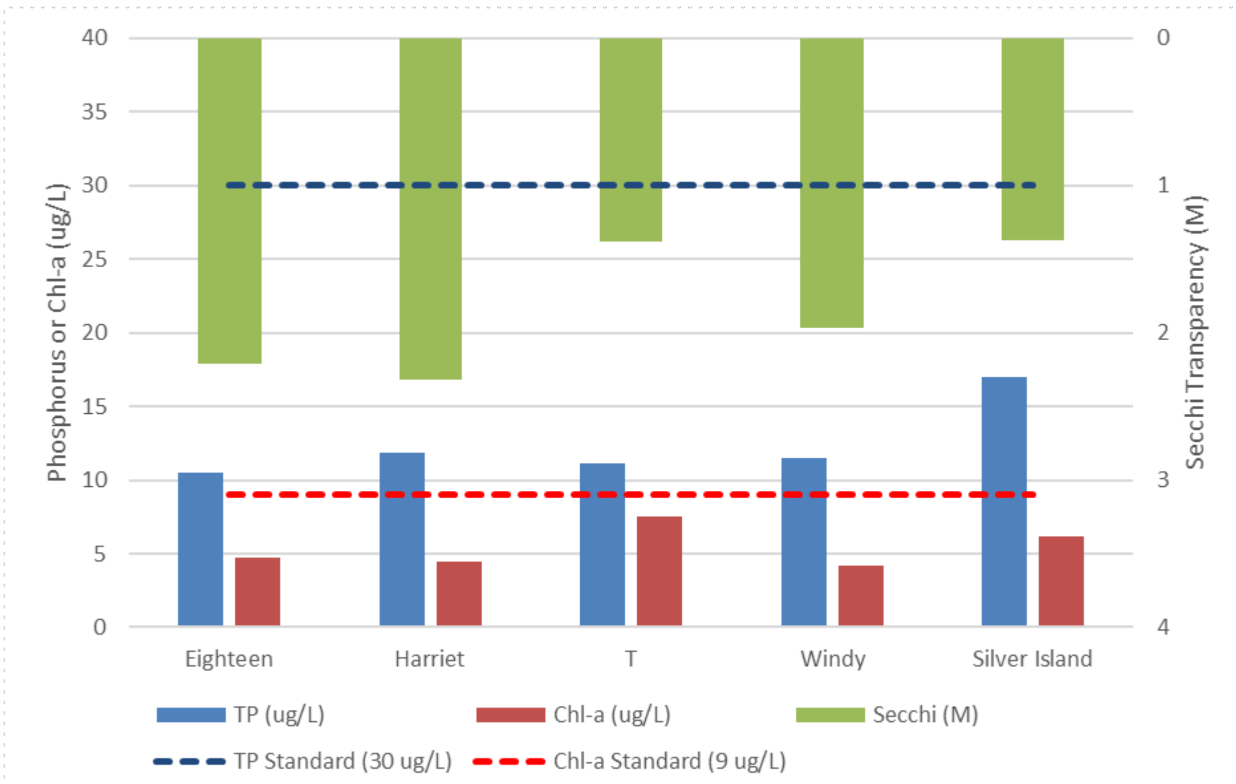

Figure 37. Water quality summary for select lakes in the Island River Aggregated 12-HUC.

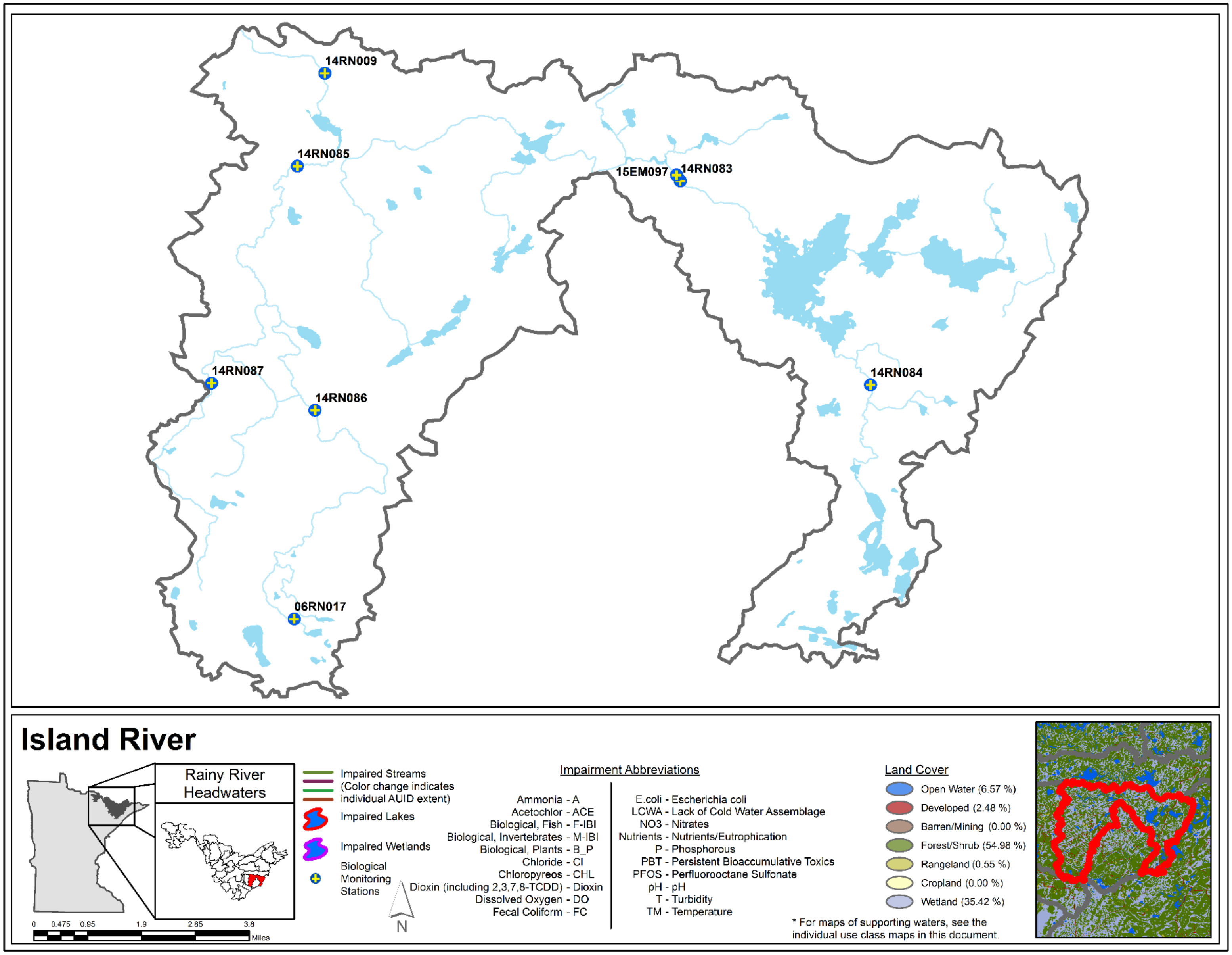

Figure 38. Currently listed impaired waters by parameter and land use characteristics in the Island River Aggregated 12-HUC.

Dumbbell River Aggregated 12-HUC HUC 0903000107-05

The Dumbbell River Subwatershed drains 50.52 square miles of Lake County and is the sixth smallest subwatershed within the Rainy River-Headwaters Watershed. Its headwaters starts at Dumbbell Lake (38-0393-00) and continues downstream through Dumbbell River. After traveling north for 5.4 miles it merges with Tomlinson Creek and continues in that general direction for an additional 12.5 miles, while receiving additional flow from Scott, Folly, and numerous unnamed creeks. This subwatershed is a part of the larger Kawishiwi River system, which is the largest river system in the Rainy River-Headwaters Watershed. Numerous cold-water streams exist within this subwatershed. There are a total of 19 lakes greater than 10 acres, with the most prominent being Dumbbell, Wanless, Plum, Divide, and Tanner. This subwatershed is dominated by forest (61.35%), wetland (32.01%), and open water (3.74%). Only 2.21% is developed, less than 1% are rangeland and barren/mining, and no row-crop agriculture. This entire subwatershed lies within the Superior National Forest with much of the land owned and managed by local, state, and federal entities. Intensive water chemistry sampling was conducted at the outlet of the subwatershed at Lake 29 E Road (FR 356), 11.5 miles northeast of Isabella on the Dumbbell River. The outlet is represented by water chemistry station S007-898 and biological station 14RN010.

Table 24. Aquatic life and recreation assessments on stream reaches: Dumbbell River Aggregated 12-HUC. Reaches are organized upstream to downstream in the table.

AUID *Reach Name*, *Reach Description*	Biological Station ID	Reach Length (miles)	Use Class	Aquatic Life Indicators: Fish IBI	Invert IBI	Dissolved Oxygen	TSS	Secchi Tube	Chloride	pH	Ammonia –NH_3	Pesticides	Eutrophication	Aquatic Life	Aquatic Rec. (Bacteria)
09030001-578 **Tomlinson Creek** **Headwaters to Dumbbell R**	14RN101	6.01	CWg	MTS	- -	- -	- -	- -	- -	- -	- -	- -	- -	SUP	- -
09030001-574 **Scott Creek** **Headwaters (Scott Lk 38-0271-00) to Dumbbell R**	14RN091	6.51	CWg	MTS	MTS	IF	IF	IF	- -	IF	IF	- -	IF	SUP	- -
09030001-773 **Folly Creek** **Folly Lk outlet to Green Wing Cr**	14RN090	2.47	CWg	MTS	MTS	IF	IF	IF	- -	IF	IF	- -	IF	SUP	- -
09030001-632 **Dumbbell River** **Tomlinson Cr to Scott Cr**	14RN089	5.87	CWg	MTS	- -	IF	IF	IF	- -	IF	IF	- -	IF	SUP	- -
09030001-634 **Dumbbell River** **Unnamed Cr to Island R**	14RN010	4.17	WWg	MTS	MTS	IF	IF	MTS	MTS	MTS	MTS	- -	IF	SUP	SUP

Abbreviations for Indicator Evaluations: **MTS** = Meets Standard; **EXS** = Fails Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Impaired (Fails Standards)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.
Abbreviations for Use Class: **WWg** = warmwater general, **WWm** = Warmwater modified, **WWe** = Warmwater exceptional, **CWg** = Coldwater general, **CWe** = Coldwater exceptional, **LRVW** = limited resource value water
*Assessments were completed using proposed use classifications changes that have not yet been written into rule.

Table 25. Lake assessments: Dumbbell River Aggregated 12-HUC.

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators: Fish IBI	Aquatic Life Indicators: Chloride	Aquatic Life Indicators: Pesticides	Aquatic Recreation Indicators: Total Phosphorus	Aquatic Recreation Indicators: Chlorophyll-a	Aquatic Recreation Indicators: Secchi	Aquatic Life Use	Aquatic Recreation Use
Tanner	38-0255-00	56.5	5	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Homestead	38-0269-00	44.5	7	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Redskin	38-0440-00	43.8	30	- -	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Dumbbell	38-0393-00	413.7	40	- -	NLF	- -	- -	MTS	- -	MTS	MTS	MTS	IF	SUP

Abbreviations for Ecoregion: DA = Driftless Area, NCHF = North Central Hardwood Forest, NGP = Northern Glaciated Plains, NLF = Northern Lakes and Forests, NMW = Northern Minnesota Wetlands, RRV = Red River Valley, WCBP = Western Corn Belt Plains
Abbreviations for Secchi Trend: D = decreasing/declining trend, I = increasing/improving trend, NT = no detectable trend, -- = not enough data
Abbreviations for Indicator Evaluations: -- = No Data, **MTS** = Meets Standard; **EXS** = Exceeds Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Not Support (Impaired, exceeds standard)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.

Summary

The Dumbbell River Subwatershed had five assessable stream segments, containing five biological monitoring stations, and one lake assessed for aquatic recreation (Table 24 and Table 25). All streams and lakes met the applicable standards or criteria and fully support aquatic life and/or aquatic recreation (Figure 39). A use class analysis was conducted on all assessed waterbodies within the Rainy River-Headwaters Watershed. Streams that support an exceptional use designation receive additional protections from a more stringent water quality standard. Although specific parameters met the exceptional criteria, not all the requirements were met to receive the exceptional use designation (WWe and CWe) but did indicated good water quality throughout this subwatershed. The low amount of disturbance within the subwatershed almost assures excellent biological integrity.

The Dumbbell River, along with three other major tributaries, were assessed in this effort. In-stream habitat was in good condition and is a reflection of quality of the upstream drainage (Appendix 5). As a result of quality habitat and good water quality, a relatively diverse fish and macroinvertebrate community was present throughout this subwatershed. A total of 22 fish species were captured, with numerous sensitive individuals present. The biological community transitioned from cool/cold-water obligates in the headwaters to warm/cool-water individuals near the pour point. The headwaters (<15 sq mi) of this subwatershed had F-IBI scores that were very similar, with the exception of Scott Creek (-574) which was significantly better than the other stations. Scott Creek (14RN091) had an F-IBI score that was just above the exceptional use threshold and an M-IBI just below it. A single adult brook trout was captured at this location, indicated good water quality. This was the only station within this subwatershed where a trout species was captured. In addition, the macroinvertebrate community consisted of several sensitive species, including a species of special concern (Ocellated Darner; *Boyeria grafiana*). This species was also found at the adjacent drainage, Folly Creek (-773).

Tomlinson Creek (-578), the smallest tributary assessed, drains a total of 6.21 mi^2 before entering the Dumbbell River. The USFS provided fish data for this station (14RN101), which consisted of nine species with numerous sensitive individuals present (longnose dace, mottled sculpin, etc.). Although trout were not present during monitoring of this cold-water stream, numerous other cool/cold-water obligates were present.

The Dumbbell River had two biological monitoring stations located along two stream reaches. There was a considerable amount of variation in species composition between the two stations. The upstream reach (-632) is considered a cold-water (CWg) resource, along with its tributaries, while the downstream reach (-634) is designated as warm-water (WWg). Although the thermal regime and species composition varied between stations, both stations had numerous sensitive species that indicated good water quality. Macroinvertebrates were only sampled at the downstream station due to habitat limitations in the upper reaches of this river, which was relatively low gradient (0.020 m/km). A diverse macroinvertebrate community (50 unique species) were collected in 2014, with several sensitive species present. Nutrient and sediment concentrations were low at this location, consistently meeting water quality standards. *E. coli* bacteria concentrations were consistently low, and indicated full support for aquatic recreation.

Dumbbell Lake (38-0393-00) was sampled by MPCA staff in 2013 and 2014 and was the only lake with sufficient data available for assessment purposes in this subwatershed. Phosphorus, Chl-a, and Secchi transparency were consistently meeting NLF water quality standards. Summer average total phosphorus concentrations in the headwaters of this subwatershed (Dumbbell Lake) were essentially the same as those at the 10X station, (~ 13 µg/L) indicating near-oligotrophic conditions. Dumbbell is a high quality lake, with summer average clarity of 3.1 meters (10.1 feet). The other small lakes in this subwatershed did not have sufficient data for assessments.

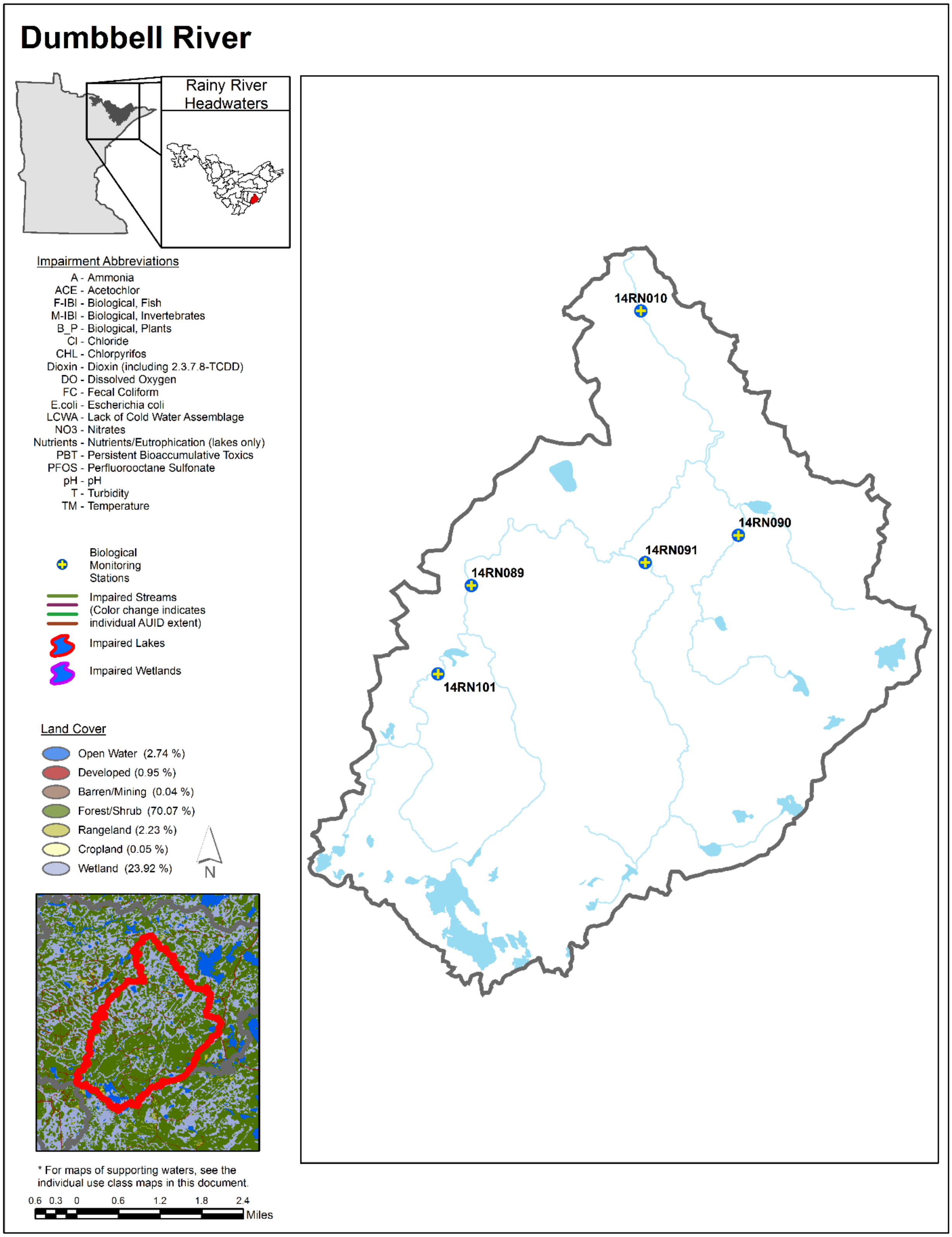

Figure 39. Currently listed impaired waters by parameter and land use characteristics in the Dumbbell River Aggregated 12-HUC.

South Kawishiwi River Aggregated 12-HUC HUC 0903000108-01

The South Kawishiwi River Subwatershed drains 202.14 square miles of Lake (68.3%) and St. Louis (31.7%) counties and is the largest subwatershed within the Rainy River-Headwaters Watershed. The South Kawishiwi River splits off from the Kawishiwi River at the south outlet of the Lower Kawishiwi River Subwatershed (0903000109-01). It continues to flow to the southeast towards Birch Lake (69-0003-00) while receiving additional flow from Little Gabbro Lake, Clear Lake, Eskwagama Lake, Filson Creek, and many more unnamed tributaries. Little Gabbro Lake (38-0703-00) receives water from Gabbro Lake (38-0701-00) and other unnamed tributaries. Bald Eagle Lake (38-0637-00) connects to Gabbro Lake through a narrow channel and contributes its waters from many tributary streams. A major tributary stream, the Island River, exits the Island River Subwatershed (0903000107-01) and enters this subwatershed on the east side of Bald Eagle Lake. The Snake River, August Creek, and other minor tributary streams connect to Bald Eagle Lake directly. Two other subwatersheds enter Birch Lake directly along its south shoreline; including the Dunka (0903000108-02) and Stoney River (0903000106-01). The Birch River and Keely Creek are two notable streams that enter Birch Lake directly. There are a total of 47 lakes greater than 10 acres, with the most prominent being Birch, Bald Eagle, Gabbro, Bear Head, and Gull. Birch Lake is centrally located within this subwatershed and receives water from numerous small and large drainages before flowing though the South Kawishiwi River, then entering the Kawishiwi River (Fall Lake) subwatershed (0903000111-01) before pouring into White Iron Lake (69-0004-00). This subwatershed is dominated by forest (53.46%), wetland (30.53%), and open water (12.42%). Only 1.67% is rangeland, 1.63% is developed, 0.27% is barren/mining and 0.02% is row-crop agriculture. The majority of this subwatershed lies within the Superior National Forest, with a smaller portion (26.1%) within the BWCAW. A portion of the Weasel Lake Primitive Management Area and Bear Head Lake State Park lies within this drainage. Much of the land is owned and managed by local, state, and federal entities (USGS, 2008). A small portion of this subwatershed was burned in the Little Gabbro fire of 1995, Turtle Lake fire of 2006, and the Pagami Creek fire of 2011. Intensive water chemistry sampling was conducted at the outlet of the subwatershed at Highway 1, 8 miles southeast of Ely on the South Kawishiwi River. The outlet is represented by water chemistry station S000-108.

Table 26. Aquatic life and recreation assessments on stream reaches: South Kawishiwi River Aggregated 12-HUC. Reaches are organized upstream to downstream in the table.

AUID *Reach Name*, *Reach Description*	Biological Station ID	Reach Length (miles)	Use Class	Aquatic Life Indicators: Fish IBI	Invert IBI	Dissolved Oxygen	TSS	Secchi Tube	Chloride	pH	Ammonia -NH_3	Pesticides	Eutrophication	Aquatic Life	Aquatic Rec. (Bacteria)
09030001-531 **Snake River** **Headwaters to T 61 R9W S18, north line**	06RN015	8.83	CWg	MTS	MTS	NA	- -	MTS	- -	EXS	- -	- -	- -	SUP	- -
09030001-542 **Snake River** **T61 R9W S7, south line to T61 R10W S12, north line**	14RN064	1.71	CWe	MTS	MTS	IF	IF	IF	- -	IF	IF	- -	IF	SUP	- -
09030001-674 **August Creek** **August Lk to Boundary Waters Canoe Area Wilderness Boundary**	11RN001 05RN065	2.80	WWg	MTS	MTS	IF	IF	IF	- -	IF	IF	- -	IF	SUP	- -
09030001-605 **Filson Creek** **Omaday Lk to South Kawishiwi R**	11RN005 14RN063	5.37	WWg	- -	MTS	IF	IF	MTS	- -	EXS	IF	- -	IF	SUP	- -
09030001-684 **Keely Creek** **Headwaters (Heart Lk 38-0692-00) to Birch Lk**	14RN062 11RN002	7.53	WWg	MTS	MTS	IF	IF	MTS	- -	IF	IF	- -	IF	SUP	- -
09030001-519 **Birch River** **Isaac Lk to Birch Lk**	14RN061	9.50	WWg	MTS	- -	IF	IF	MTS	- -	IF	IF	- -	IF	SUP	- -

Abbreviations for Indicator Evaluations: **MTS** = Meets Standard; **EXS** = Fails Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Impaired (Fails Standards)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.
Abbreviations for Use Class: **WWg** = warmwater general, **WWm** = Warmwater modified, **WWe** = Warmwater exceptional, **CWg** = Coldwater general, **CWe** = Coldwater exceptional, **LRVW** = limited resource value water
*Assessments were completed using proposed use classifications changes that have not yet been written into rule.

AUID ***Reach Name*****,** *Reach Description*	Biological Station ID	Reach Length (miles)	Use Class	Aquatic Life Indicators: Fish IBI	Invert IBI	Dissolved Oxygen	TSS	Secchi Tube	Chloride	pH	Ammonia -NH_3	Pesticides	Eutrophication	Aquatic Life	Aquatic Rec. (Bacteria)
09030001-537 **South Kawishiwi River** **Boundary Waters Canoe Area Wilderness Boundary to Birch Lk**	- -	6.55	WWg	- -	- -	IF	IF	MTS	IF	MTS	IF	- -	MTS	SUP	- -
09030001-536 **South Kawishiwi River** **NE tio of Birch Lk to dam**	- -	1.52	WWg	- -	- -	IF	MTS	MTS	MTS	MTS	MTS	- -	MTS	NA	SUP

Abbreviations for Indicator Evaluations: **MTS** = Meets Standard; **EXS** = Fails Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Impaired (Fails Standards)
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*Assessments were completed using proposed use classifications changes that have not yet been written into rule.

Table 27. Lake assessments: South Kawishiwi River Aggregated 12-HUC.

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators:			Aquatic Recreation Indicators:			Aquatic Life Use	Aquatic Recreation Use
							Fish IBI	Chloride	Pesticides	Total Phosphorus	Chlorophyll-a	Secchi		
Arthur	69-0154-00	71.0	19	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Little	69-0056-00	66.3	24	Deep Lake	NLF	- -	- -	IF	- -	- -	- -	- -	IF	IF
August	38-0691-00	223.5	19	Shallow Lake	NLF	- -	- -	IF	- -	- -	- -	IF	IF	IF
Little Gabbro	38-0703-00	188.7	26	Deep Lake	NLF	- -	- -	- -	- -	MTS	MTS	MTS	- -	SUP
Turtle	38-0704-00	343.5	9	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Bald Eagle	38-0637-00	1251.6	36	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Gabbro	38-0701-00	1044.3	50	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Birch	69-0003-00	7314.5	25	Deep Lake	NLF	NT	- -	MTS	- -	MTS	MTS	IF	IF	SUP

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators:			Aquatic Recreation Indicators:			Aquatic Life Use	Aquatic Recreation Use
							Fish IBI	Chloride	Pesticides	Total Phosphorus	Chlorophyll-a	Secchi		
Bear Head	69-0254-00	648.6	46	Deep Lake	NLF	NT	- -	MTS	- -	MTS	MTS	MTS	IF	SUP

Abbreviations for Ecoregion: DA = Driftless Area, NCHF = North Central Hardwood Forest, NGP = Northern Glaciated Plains, NLF = Northern Lakes and Forests, NMW = Northern Minnesota Wetlands, RRV = Red River Valley, WCBP = Western Corn Belt Plains
Abbreviations for Secchi Trend: D = decreasing/declining trend, I = increasing/improving trend, NT = no detectable trend, -- = not enough data
Abbreviations for Indicator Evaluations: -- = No Data, **MTS** = Meets Standard; **EXS** = Exceeds Standard; **IF** = Insufficient Information
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Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.

Summary

The South Kawishiwi River Subwatershed had eight assessable stream segments, containing nine biological monitoring stations, and four lake assessed for aquatic recreation (Table 26 and Table 27). All streams and lakes met the applicable standards or criteria and fully support aquatic life and/or aquatic recreation (Figure 42). The low amount of disturbance within the subwatershed almost assures excellent biological integrity. A use class analysis was conducted on all assessed waterbodies within the Rainy River-Headwaters Watershed. Streams that support an exceptional use designation receive additional protections from a more stringent water quality standard.

The Snake River had two stream reaches (-531 and -542) assessed for their support of aquatic life. The downstream reach (-542) met all the requirments to receive the exceptional use desgination (CWe). This catchment contains the only cold-water (trout) resource within this subwatershed and is known to support a vibrant brook trout population. Biological condition varied little among stations (06RN015 and 14RN064) but tended to improve with an increase in drainage. This may be related to habitat differences as a result of changes in stream gradient (1.99-12.25 m/km) and are likely not the result of water quality issues. Data provided by the USFS was used for the assessment of the upstream reach (-531), with both fish and macroinvertebrates performing well compaired to their respective impairment thresholds. A total of 14 fish species were captured throughout this drainage consisting of numerous sensitive species (brook trout, burbot, and mottled sculpin). A series of macroinvertebrate samples were collected by the USFS, with only one visit within the MPCA's index period. The 2014 macroinvertebrate sample was above the exceptional use threshold, with numerous sensitive caddisflies, mayflies, and stoneflies present. Both fish and macroinvertebrate communities contained several cold-water obligates and indicated good water quality.

An additional four stream reaches (-519, -605, -674, & -684) were assessed using fish and macroinvertebrates to determine support for aquatic life. The majority of biological data was collected by the MPCA but additional information was provided by the USFS for three stream reaches; including August (-674), Filson (-605), and Keely Creek (-684). All four of these stream reaches met water quality standards for warm-water streams, with several parameters meeting the exceptional use standard. A diversity of stream habitat, gradient, size, drainage, and thermal regime resulted in 24 fish species being captured throughout this subwatershed. The macroinvertebrate community also contain 173 unique taxonomic groupings, with numerous sensitive species that are indicative of good water quality.

The stream water quality monitoring station for this subwatershed was on the South Kawishiwi River just below the Minnesota Highway 1 Dam. As such, this location represents conditions in Birch Lake as well as the South Kawishiwi River. This location was historically monitored by the MPCA as a long-term milestone station but most of these data pre-date the 10-year assessment period. More recent data collected from this location indicates excellent water quality. Phosphorus and Chl-a data indicate that the river eutrophication standards are being met. Water clarity and pH datasets also meet standards, reflective of this subwatershed's natural condition. The aquatic life assessment of this river segment incidated full support for aquatic life, based solely on the robust chemistry datasets, since biological data were not available. *E. coli* data were not collected at his location because of the proximity to Birch Lake; rather, Birch Lakes' aquatic recreational use assessment is a better reflection of conditions on this reach of the South Kawishiwi River.

Lakes with assessment-level datasets in this subwatershed include Little Gabbro (38-0703-00), Birch (69-0003-00), and Bear Head (69-0254-00; Figure 41). Bald Eagle Lake (38-0637-00), within the BWCAW, was assessed fully supports aquatic recreation based on satellite estimated Secchi transparency. Bear Head Lake is a DNR/MPCA sentinel lake, a detailed report on this high quality lake is found here (https://www.pca.state.mn.us/sites/default/files/wq-2slice69-0254.pdf; MPCA, January 2012). Water quality has been fairly consistent in Bear Head since intensive monitoring began in 2008, with a slight decline in phosphorus concentrations in recent years (Figure 40).

Birch Lake, a polymictic mesotrophic lake, was monitored by MPCA staff in 2008-2009. TP and chl-a levels at that time were close to, but still meeting standards (Figure 41). Additional recent monitoring by the White Iron Chain of Lakes Association (WICOLA) and Minnesota Power yielded similar concentrations. Residence time in this lake/reservoir is rapid, estimated at 70 days due to the high flow volumes in the South Kawishiwi River. The low Secchi transparency in this lake is due to natural bog staining from the surrounding catchment and is not in response to elevated chl-a concentrations (MPCA, 2011). Overall, all assessed lakes in this subwatershed are high quality, reflective of the catchment's environmental setting. A detailed MPCA report summarizing lake water quality conditions in the Kawishiwi River drainage of the Rainy River-Headwaters Watershed (https://www.pca.state.mn.us/sites/default/files/wq-ws3-09030001.pdf; MPCA, January 2011). This report was published in 2011 and includes detailed information of the area's environmental setting, hydrology, lake water quality conditions, and modeling.

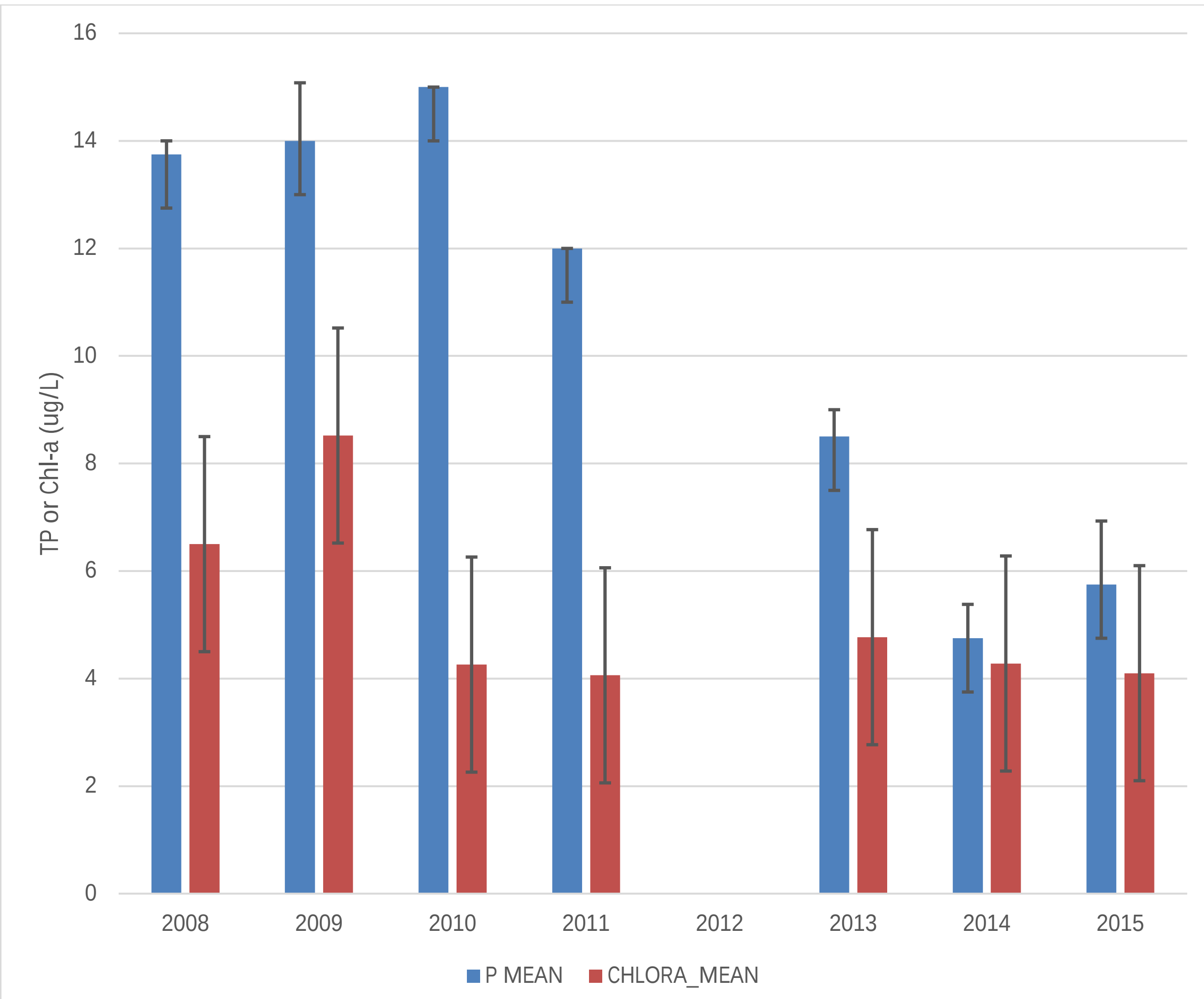

Figure 40. Bearhead Lake water quality trends, 2008-2015 summer mean TP and Chl-a.

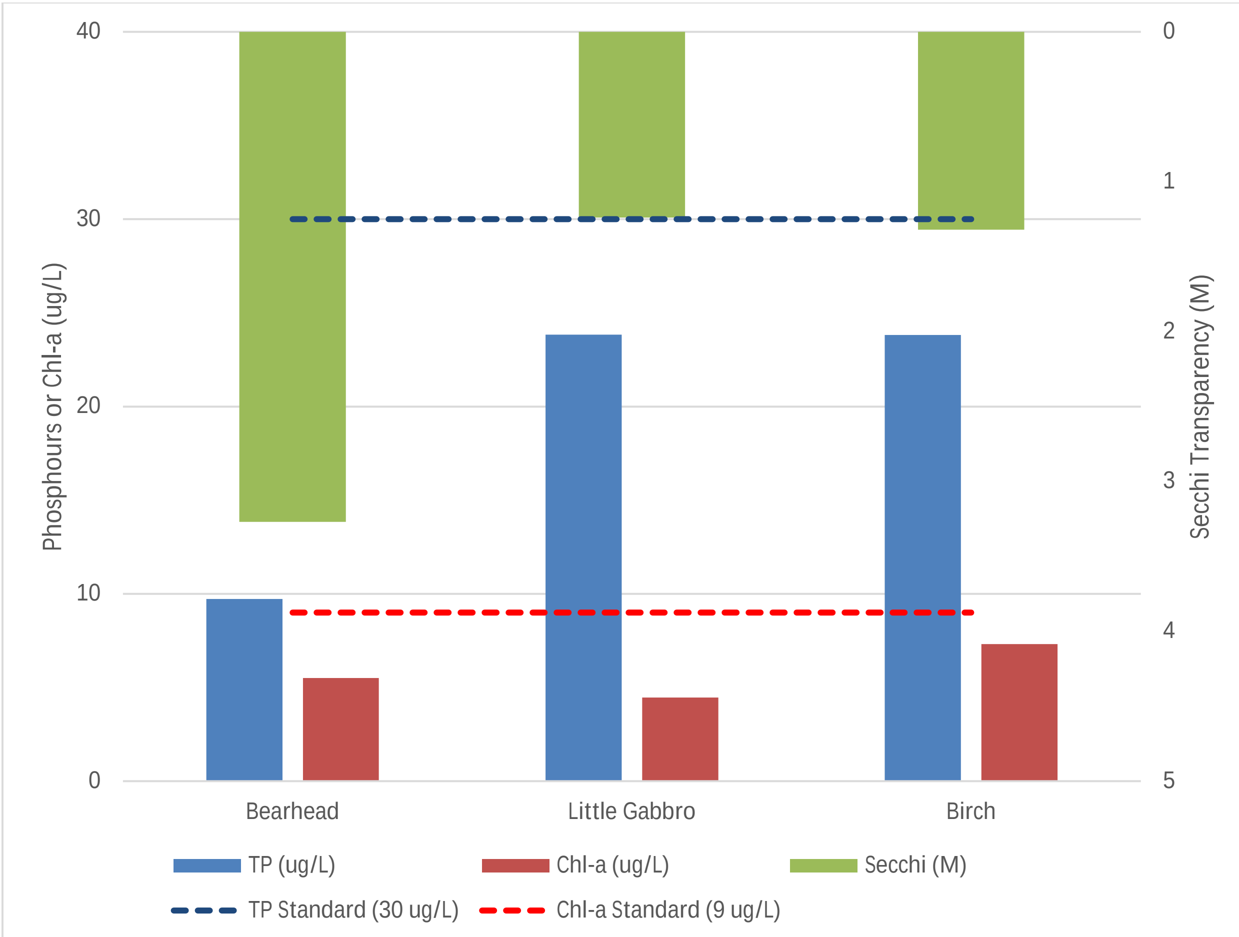

Figure 41. Water quality summary for assessed lakes in the South Kawishiwi River Aggregated 12-HUC.

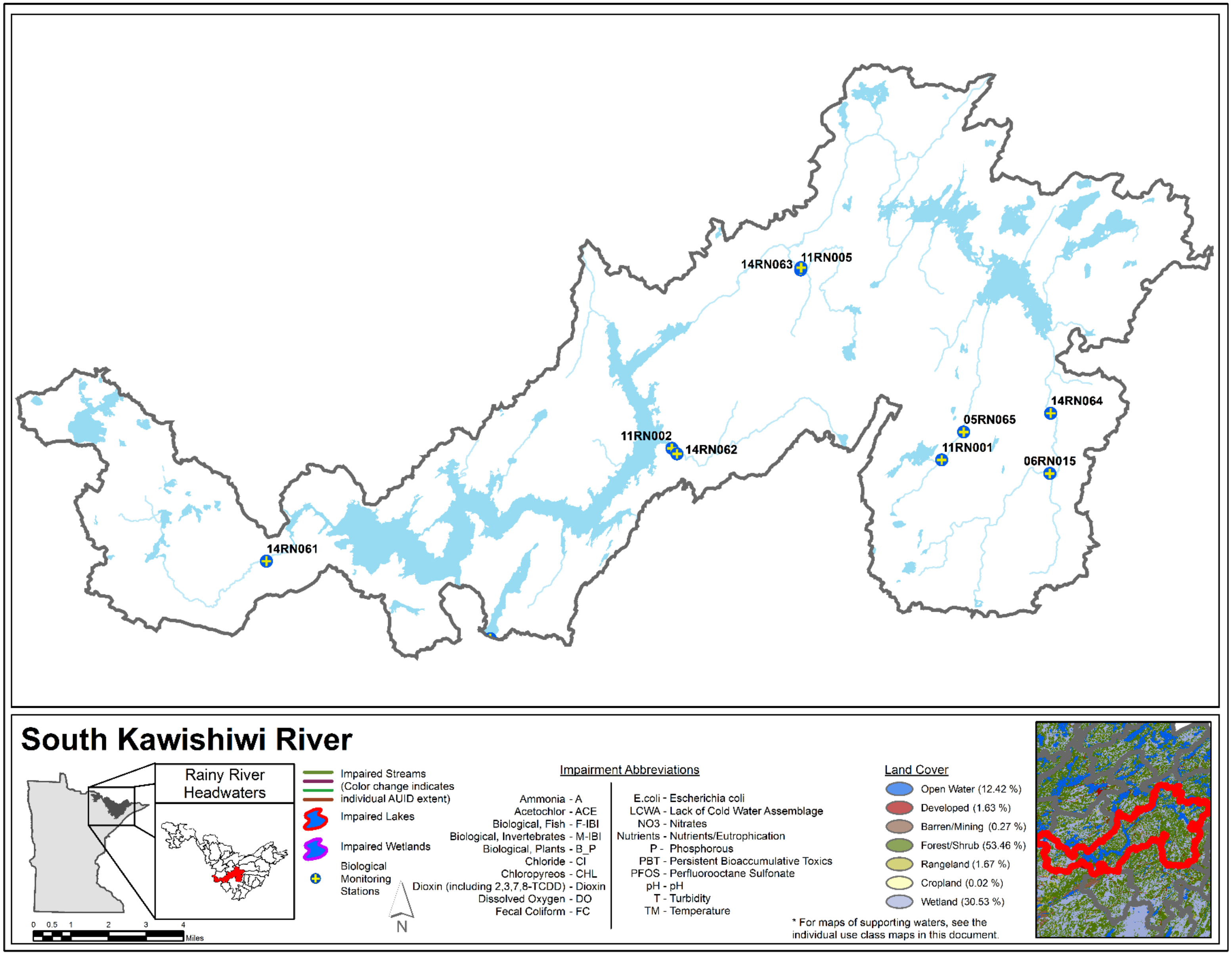

Figure 42. Currently listed impaired waters by parameter and land use characteristics in the South Kawishiwi River Aggregated 12-HUC.

Dunka River Aggregated 12-HUC HUC 0903000108-02

The Dunka River Subwatershed drains 58.17 square miles of Lake (19.4%) and St. Louis (80.6%) counties and is the ninth smallest subwatershed within the Rainy River-Headwaters Watershed. The headwaters of the Dunka River starts in a forested wetland and continue downstream 16.9 miles, while receiving additional flow from Langley, Twenty Proof, and numerous unnamed tributaries. The Dunka River contributes its waters to Birch Lake (69-0003-00) in the South Kawishiwi River Subwatershed (090300008-01). This subwatershed is a part of the larger Kawishiwi River system, which is the largest river system in the Rainy River-Headwaters Watershed. There are a total of four lakes greater than 10 acres, with the most prominent being Argo Lake. This subwatershed is dominated by forest (45.67%) and wetland (44.77%). Only 5.84% is barren/mining, 1.25% is open water, 1.24% is developed, 1.23% is rangeland, and there is no row-crop agriculture. A portion of the Peter Mitchel Mine lies within this subwatershed and crosses the hydrological boundary between the Rainy River and Lake Superior basins. The majority of this drainage lies within the Superior National Forest, with much of it owned and managed by local, state, and federal entities (USGS, 2008). Intensive water chemistry sampling was conducted at the outlet of the subwatershed adjacent to Scott Road (CR-623), 3.5 miles east of Babbitt on the Dunka River. The outlet is represented by water chemistry station S007-766 and biological station 14RN006.

Table 28. Aquatic life and recreation assessments on stream reaches: Dunka River Aggregated 12-HUC. Reaches are organized upstream to downstream in the table.

AUID987 ***Reach Name*,** *Reach Description*	Biological Station ID	Reach Length (miles)	Use Class	Aquatic Life Indicators: Fish IBI	Invert IBI	Dissolved Oxygen	TSS	Secchi Tube	Chloride	pH	Ammonia -NH_3	Pesticides	Eutrophication	Aquatic Life	Aquatic Rec. (Bacteria)
09030001-986 **Dunka River** **Headwaters to Unnamed Ditch**	15RN037 14RN065 15RN036	12.07	WWg	MTS	MTS	NA	IF	MTS	- -	IF	IF	- -	IF	SUP	- -
09030001-987 **Dunka River** **Unnamed Ditch to Birch Lk**	15RN035 14RN006	4.81	CWg*	MTS	MTS	NA	IF	MTS	MTS	MTS	MTS	- -	MTS	SUP	SUP

Abbreviations for Indicator Evaluations: **MTS** = Meets Standard; **EXS** = Fails Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Impaired (Fails Standards)
Key for Cell Shading: ☐ = existing impairment, listed prior to 2014 reporting cycle; ☐ = new impairment; ☐ = full support of designated use; ☐ = insufficient information.
Abbreviations for Use Class: **WWg** = warmwater general, **WWm** = Warmwater modified, **WWe** = Warmwater exceptional, **CWg** = Coldwater general, **CWe** = Coldwater exceptional,
LRVW = limited resource value water
*Assessments were completed using proposed use classifications changes that have not yet been written into rule.

Summary

The Dunka River Subwatershed had two assessable stream segments, containing five biological monitoring stations, and no lakes assessed for aquatic recreation (Table 28). All of the streams met the applicable standards or criteria and fully support aquatic life and/or aquatic recreation (Figure 43). The Dunka River proper consists of two stream segments, which were both assessed in this effort for their support of aquatic life. This entire waterbody was considered for its viability to support a cold-water assemblage and to determine its appropriate use class designation (WWg or CWg). Both biological and thermal data indicate a reasonable potential for the lower reaches (-987) of the Dunka River to support a cold-water community. The DNR currently classifies the entire Dunka River, from the headwaters to Birch Lake, as warm-water. A community based fish survey completed by the DNR in 1968 and 1975 revealed that the lower reaches did not contain any trout species but did comprise of several cool/cold-water obligates (mottled sculpin, etc.). A more recent biological monitoring survey conducted by the MPCA in 2014 and 2015 found several adult brook trout at mile 1.9 (14RN006). The DNR did not have any records of stocking trout in the Dunka River but stocking did occur in nearby streams during the mid-1970s. This does not necessarily mean that they did not stock the Dunka River during this period but only that they do not have any records. With no recent stocking occurring and adult brook trout present, there is a strong indication of natural reproduction of trout is occurring within the lower reaches of the Dunka River. The more recent survey also contained six fish species that are cool/cold-water obligates. In addition, the macroinvertebrate community revealed the presence of three cold-water obligates (Ephemerella, Eukiefferiella, Glossosomatidae) at mile 1.9 and 2.6 (15RN035). Temperature data collected by the MPCA during the summer months of 2014 and 2015 indicated that the thermal regime within the lower reaches of the Dunka River was supportive of a marginal brook trout fishery. Thermal stress for brook trout ranged from 17.0-42.0% of the time recorded during the summer months. Although temperatures tended to be warmer in 2015, the average summer temperatures were still within the growth range for brook trout (19.69-19.72oC).

In-stream habitat was in good condition despite some more intensive land use within this drainage (Appendix 5). This diverse and high quality habitat is likely mitigating any real changes in F-IBI and M-IBI scores. Both F-IBI and M-IBI scores varied but were all above their respective impairment thresholds. A total of 18 fish species were captured throughout this drainage, along with 127 unique macroinvertebrate taxonomic groupings. Numerous sensitive fish and macroinvertebrate species were captured and indicated good water quality. Phosphorus concentrations are low on the Dunka River. Dissolved oxygen frequently drops below the water quality standard on this reach. With the cold water designation, concentrations should remain above 7 mg/L. This subwatershed is dominated by wetlands, and paired with the high quality biological community present, dissolved oxygen is not a good measure of aquatic health in this subwatershed. Water clarity (i.e. Secchi tube) and pH datasets are robust and are meeting standards. *E. coli* bacteria concentrations were consistently low at this location and indicated full support for aquatic recreation.

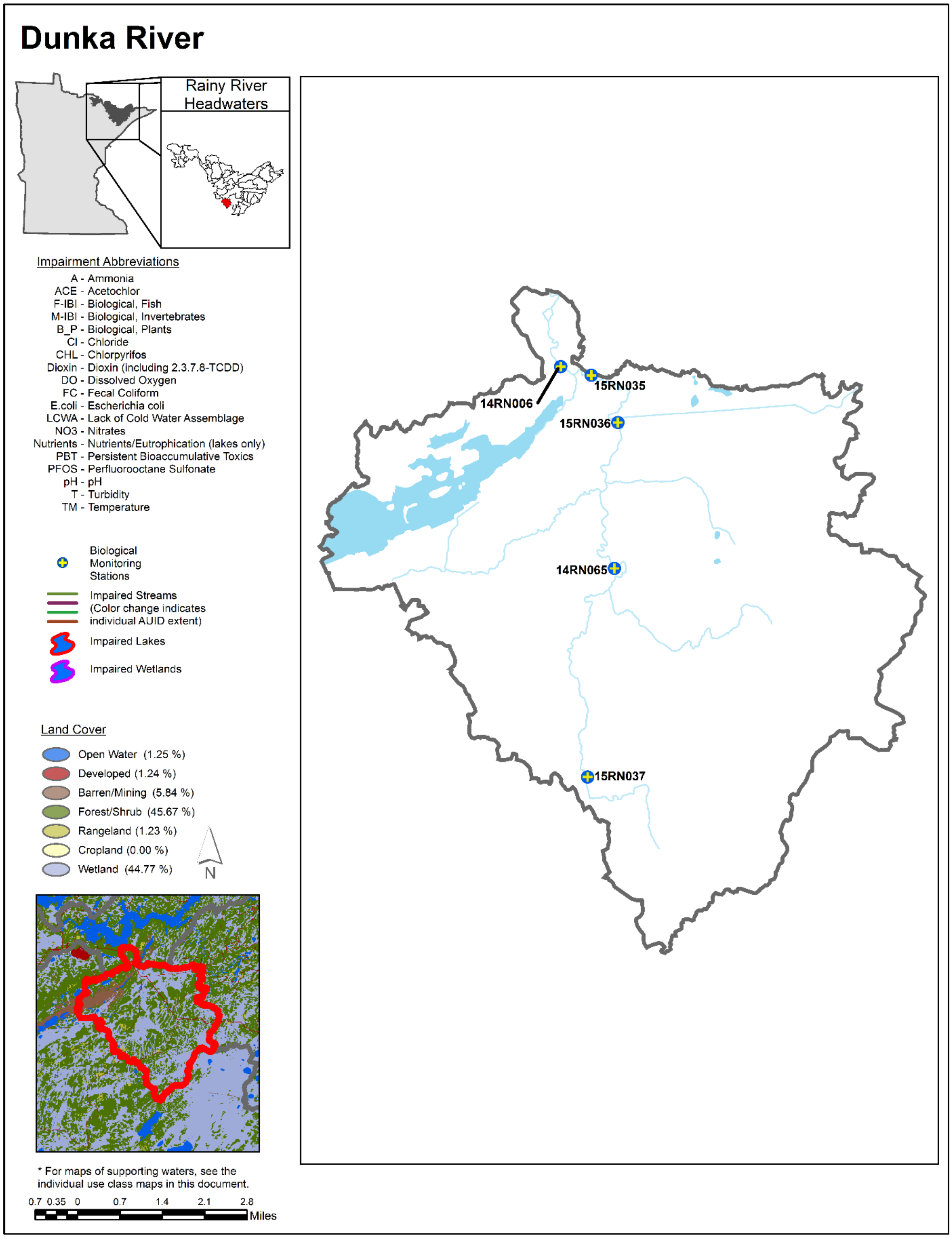

Figure 43. Currently listed impaired waters by parameter and land use characteristics in the Dunka River Aggregated 12-HUC.

Lower Kawishiwi River Aggregated 12-HUC HUC 0903000109-01

The Lower Kawishiwi River Subwatershed drains 135.83 square miles of Lake County and is the fifth largest subwatershed within the Rainy River-Headwaters Watershed. This subwatershed begins at the outlet of Alice Lake (38-0330-00) and the Upper Kawishiwi River Subwatershed (0903000109-02). The Kawishiwi River flows to the west through Lake Insula (38-0397-00), while receiving additional flow from Arrow, Hope, and numerous unnamed tributaries. A small channel connects Insula to Hudson Lake (38-0484-00), where it receives additional water from Ahmoo and Wilder Creeks. As the Kawishiwi River continues to the west, it passes through Lake Four, Three, Two and One, while receiving additional water from Pagami Creek and numerous unnamed tributaries. The South Kawishiwi River splits off of the Kawishiwi River after passing through numerous rapids just west of Lake One (38-0605-00) and exits this subwatershed. The Kawishiwi River continues for an additional 7.9 miles before exiting this subwatershed and pouring into Farm Lake (38-0779-00). There are a total of 80 lakes greater than 10 acres, with the most prominent being Insula, Three, One, Clearwater, Four, Two, Hudson, and Greenstone. This subwatershed is dominated by forest (61.43%), wetland (22.93%), and open water (15.33%). Only 0.17% is developed, 0.14% is rangeland and there is no barren/mining or row-crop agriculture. This entire subwatershed lies within the Superior National Forest, with a large portion (92.93%) of it within the BWCAW. A portion of the Drag Lake, Fungus Lake and Weasel Lake Primitive Management Area are located within this drainage. Much of the land within this drainage is owned and managed by local, state, and federal entities (USGS, 2008). As a result of the overall remoteness, short tributary streams, and many large bodies of water; there was no biological or intensive water chemistry sampling conducted on rivers and streams within this subwatershed.

Table 29. Lake assessments: Lower Kawishiwi River Aggregated 12-HUC.

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators:			Aquatic Recreation Indicators:			Aquatic Life Use	Aquatic Recreation Use
							Fish IBI	Chloride	Pesticides	Total Phosphorus	Chlorophyll-a	Secchi		
Conchu	38-0720-00	48.3	67	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Rifle	38-0610-00	39.2	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Delta	38-0527-00	25.6	7	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Kiana	38-0334-00	207.5	56	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Carol	38-0340-00	101.6	- -	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Fire	38-0483-00	107.9	30	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Hudson	38-0484-00	408.8	35	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	MTS	- -	SUP
Horseshoe	38-0580-00	202.7	40	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Greenstone	38-0718-00	329.1	72	Deep Lake	NLF	- -	- -	IF	- -	- -	- -	- -	IF	IF

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators: Fish IBI	Chloride	Pesticides	Aquatic Recreation Indicators: Total Phosphorus	Chlorophyll-a	Secchi	Aquatic Life Use	Aquatic Recreation Use
Insula	38-0397-00	3024.9	63	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	MTS	- -	SUP
Four	38-0528-00	677.7	25	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	MTS	- -	SUP
Three	38-0600-00	921.5	37	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	MTS	- -	IF
One	38-0605-00	890.8	57	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Two	38-0608-00	542.9	35	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	MTS	- -	SUP
Clearwater	38-0638-00	637.3	46	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
North Branch Kawishiwi	38-0738-00	546.9	55	Deep Lake	NLF	- -	- -	- -	- -	MTS	MTS	IF	- -	SUP

Abbreviations for Ecoregion: DA = Driftless Area, NCHF = North Central Hardwood Forest, NGP = Northern Glaciated Plains, NLF = Northern Lakes and Forests, NMW = Northern Minnesota Wetlands, RRV = Red River Valley, WCBP = Western Corn Belt Plains
Abbreviations for Secchi Trend: D = decreasing/declining trend, I = increasing/improving trend, NT = no detectable trend, -- = not enough data
Abbreviations for Indicator Evaluations: -- = No Data, **MTS** = Meets Standard; **EXS** = Exceeds Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Not Support (Impaired, exceeds standard)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.

Summary

The Lower Kawishiwi River Subwatershed had no assessable stream segments. A total of 12 BWCAW lakes were assessed for aquatic recreation (Table 29). All of the lakes were high quality, met the applicable standards based on satellite estimated Secchi transparency (Figure 83) and fully supported aquatic recreation (Figure 44).

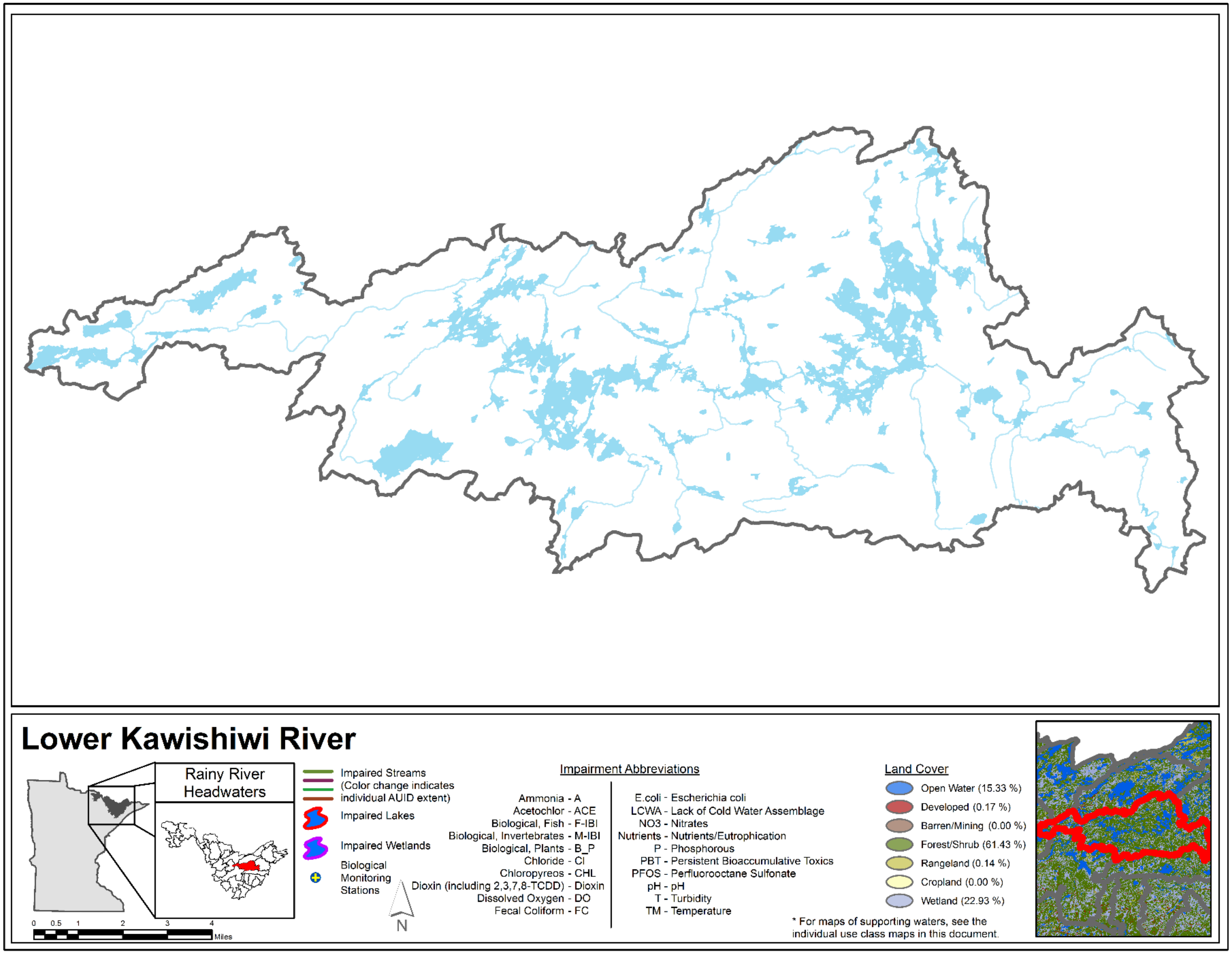

Figure 44. Currently listed impaired waters by parameter and land use characteristics in the Lower Kawishiwi River Aggregated 12-HUC.

Upper Kawishiwi River Aggregated 12-HUC HUC 0903000109-02

The Upper Kawishiwi River Subwatershed drains 130.59 square miles of Cook (29.1%) and Lake (70.9%) counties and is the sixth largest subwatershed within the Rainy River-Headwaters Watershed. The headwaters of this subwatershed begins at Kawishiwi Lake (38-0080-00) and continues 0.7 miles to the north through the Kawishiwi River. After reaching Square Lake (38-0074-00), it turns to the northeast and continues 1.3 miles to Kawasachong Lake (38-0070-00). The Kawishiwi River exits Kawasachong Lake along its northwest shoreline and continues 3.0 miles until it reaches Lake Polly (38-0104-00). Additional water is received by Lake Polly from the Phoebe River, which flows 6.0 miles from its headwaters through a lake dominated landscape. The Kawishiwi River exits Lake Polly along its north shore and continues an additional 1.3 miles before reaching Koma Lake (38-0098-00), which connects to Malberg Lake (38-0090-00) through a narrow channel. The Louse River flows 7.9 miles to the west and receives additional flow from Barto Creek before contributing its waters to Malberg Lake. The Kawishiwi River exits Malberg Lake along its northeast shoreline and continues an additional 7.5 miles before reaching Alice Lake (38-0330-00). On its route to Alice Lake it receives additional flow from numerous unnamed tributaries. There are a total of 105 lakes greater than 10 acres, with the most prominent being Alice, Phoebe, Polly, Adams, Grace, Malberg, and Kawishiwi. This subwatershed is dominated by forest (61.20%), wetland (25.96%), and open water (12.69%). Less than 1% is developed, with no rangeland, barren/mining, or row-crop agriculture. This entire subwatershed lies within the Superior National Forest, with a large amount of it (99.7%) within the BWCAW. A portion of the Fungus Lake and Humpback Lake Primitive Management Area are located within this drainage. Much of the land within this drainage is owned and managed by state and federal entities (USGS, 2008). A small portion of this subwatershed was burned in the Douse fire of 1991 and the Pagami Creek fire of 2011. As a result of the overall remoteness, short tributary streams, and many large bodies of water; there was no intensive water chemistry sampling conducted on rivers and streams within this subwatershed.

Table 30. Aquatic life and recreation assessments on stream reaches: Upper Kawishiwi River Aggregated 12-HUC. Reaches are organized upstream to downstream in the table.

AUID *Reach Name*, *Reach Description*	Biological Station ID	Reach Length (miles)	Use Class	Aquatic Life Indicators: Fish IBI	Invert IBI	Dissolved Oxygen	TSS	Secchi Tube	Chloride	pH	Ammonia -NH_3	Pesticides	Eutrophication	Aquatic Life	Aquatic Rec. (Bacteria)
09030001-982 **Phoebe Creek** **Hazel Lk to Lk Polly**	14RN095	2.84	WWg	MTS	MTS	IF	- -	- -	- -	IF	- -	- -	- -	SUP	- -
09030001-990 **Kawishiwi River** **Kawasachong Lk to Lk Polly**	14RN094	2.96	WWg	MTS	MTS	IF	- -	- -	- -	IF	- -	- -	- -	SUP	- -

Abbreviations for Indicator Evaluations: **MTS** = Meets Standard; **EXS** = Fails Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Impaired (Fails Standards)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.
Abbreviations for Use Class: **WWg** = warmwater general, **WWm** = Warmwater modified, **WWe** = Warmwater exceptional, **CWg** = Coldwater general, **CWe** = Coldwater exceptional, **LRVW** = limited resource value water
*Assessments were completed using proposed use classifications changes that have not yet been written into rule.

Table 31. Lake assessments: Upper Kawishiwi River Aggregated 12-HUC.

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators: Fish IBI	Chloride	Pesticides	Aquatic Recreation Indicators: Total Phosphorus	Chlorophyll-a	Secchi	Aquatic Life Use	Aquatic Recreation Use
Bugo	38-0222-00	30.4	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Panhandle	38-0150-00	10.7	22	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Pan	38-0151-00	93.8	59	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	MTS	- -	SUP
Anit	38-0157-00	18.3	19	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Ella	16-0658-00	51.5	6	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Kivaniva	38-0108-00	45.5	49	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Fee	38-0132-00	29.3	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Vee	38-0131-00	34.8	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Unnamed	38-0321-00	22.3	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators:			Aquatic Recreation Indicators:			Aquatic Life Use	Aquatic Recreation Use
							Fish IBI	Chloride	Pesticides	Total Phosphorus	Chlorophyll-a	Secchi		
Cacabic	38-0329-00	26.8	30	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Hazel	38-0069-00	96.3	7	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Baskatong	38-0073-00	68.6	6	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Kawasachong	38-0070-00	161.3	11	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Square	38-0074-00	126.5	- -	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Kawishiwi	38-0080-00	388.7	12	Shallow Lake	NLF	NT	- -	- -	- -	- -	- -	MTS	- -	IF
Malberg	38-0090-00	414.8	33	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Koma	38-0098-00	252.6	14	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Polly	38-0104-00	485.3	21	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	IF	- -	IF
Boulder	38-0140-00	262.7	54	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators:			Aquatic Recreation Indicators:			Aquatic Life Use	Aquatic Recreation Use
							Fish IBI	Chloride	Pesticides	Total Phosphorus	Chlorophyll-a	Secchi		
Adams	38-0153-00	489.3	84	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Beaver	38-0223-00	217.7	76	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	MTS	- -	SUP
River	38-0338-00	109.4	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Fishdance	38-0343-00	160.0	50	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Phoebe	16-0808-00	611.2	25	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Alice	38-0330-00	1485.1	53	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	MTS	- -	SUP
Grace	16-0657-00	441.5	16	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Beth	16-0659-00	171.3	22	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP

Abbreviations for Ecoregion: DA = Driftless Area, NCHF = North Central Hardwood Forest, NGP = Northern Glaciated Plains, NLF = Northern Lakes and Forests, NMW = Northern Minnesota Wetlands, RRV = Red River Valley, WCBP = Western Corn Belt Plains
Abbreviations for Secchi Trend: D = decreasing/declining trend, I = increasing/improving trend, NT = no detectable trend, -- = not enough data
Abbreviations for Indicator Evaluations: -- = No Data, **MTS** = Meets Standard; **EXS** = Exceeds Standard; **IF** = Insufficient Information
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Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.

Summary

The Upper Kawishiwi River Subwatershed had two assessable stream segments, containing two biological monitoring stations, and 18 lakes assessed for aquatic recreation (Table 30 and Table 31). All of the streams and lakes met the applicable standards or criteria and fully support aquatic life and/or aquatic recreation (Figure 46). Streams that have exceptional performing biological, chemical, and physical parameters are worthy of additional protection. A use class analysis was conducted on all assessed waterbodies within the Rainy River-Headwaters Watershed. Streams that support an exceptional use designation receive additional protections from a more stringent water quality standard. Although specific parameters met the exceptional criteria, not all the requirements were met to receive the exceptional use designation (WWe and CWe) but did indicate excellent water quality. The low amount of disturbance within the subwatershed almost assures excellent biological integrity.

Figure 45. The Kawishiwi River (14RN094) biological monitoring station.

The headwaters of the Kawishiwi River, a major river system within the Rainy River-Headwaters Watershed, lies within this subwatershed. A single biological monitoring station (14RN094) was located along a stretch of this river between Kawasachong Lake (38-0070-00) and Lake Polly (38-0104-00). The majority of this stream segment (-990) was burned during the Pagami Creek wild fire of 2011 (Figure 45). Despite the dramatic change from a heavily forested riparian area to charred trees with sparse vegetation, the biological community and habitat are in relatively good condition (Appendix 5). Both fish and macroinvertebrate IBIs are above the impairment threshold indicating full support for aquatic life. Although only 29 individual fish were captured during monitoring, a relatively diverse assemblage (8 species) was present with numerous sensitive species (iowa darter, longnose dace, etc.). In addition, the macroinvertebrate community contained a diversity of sensitive mayflies, stoneflies, and caddisflies, with the sample being dominated by one sensitive caddies species (*Chimarra*).

The Phoebe River also contributes its waters to Lake Polly before preceding further downstream through the Kawishiwi River. One biological monitoring station (14RN095) was located along a segment (-982) of the Phoebe River between Hazel Lake (38-0069-00) and Lake Polly. The majority (4 out of 5) of the fish species captured during monitoring of this location were shared with the station (14RN094) located on the Kawishiwi River. Several sensitive fish (longnose dace, rock bass, etc.) and macroinvertebrate species were captured and was reflected in their good IBI scores. The macroinvertebrate community was dominated by a number of caddisflies, namely *Hydropsychid* speices.

The Upper Kawishiwi River has many high quality lakes that fully supported aquatic recreation, such as Alice (38-0330-00) and Beth (16-0659-00). Several other subwatersheds deep within the BWCAW, such as the Upper Kawishiwi, had many lakes that fully supported aquatic recreation based on satellite estimated Secchi transparency. Examples of these lake-dominated subwatersheds include: Basswood Lake, Lower Kawishiwi, Crooked Lake, Horse River, Knife Lake, Boulder River, and Lac La Croix. As expected, high quality lakes abound in the BWCAW and throughout the Rainy River-Headwaters Watershed. In many individual lakes, lake transparency data collected from BWCAW volunteers (such as the Boy Scouts of America at the Northern Tier High Adventure Base near Ely) corroborated these assessment decisions.

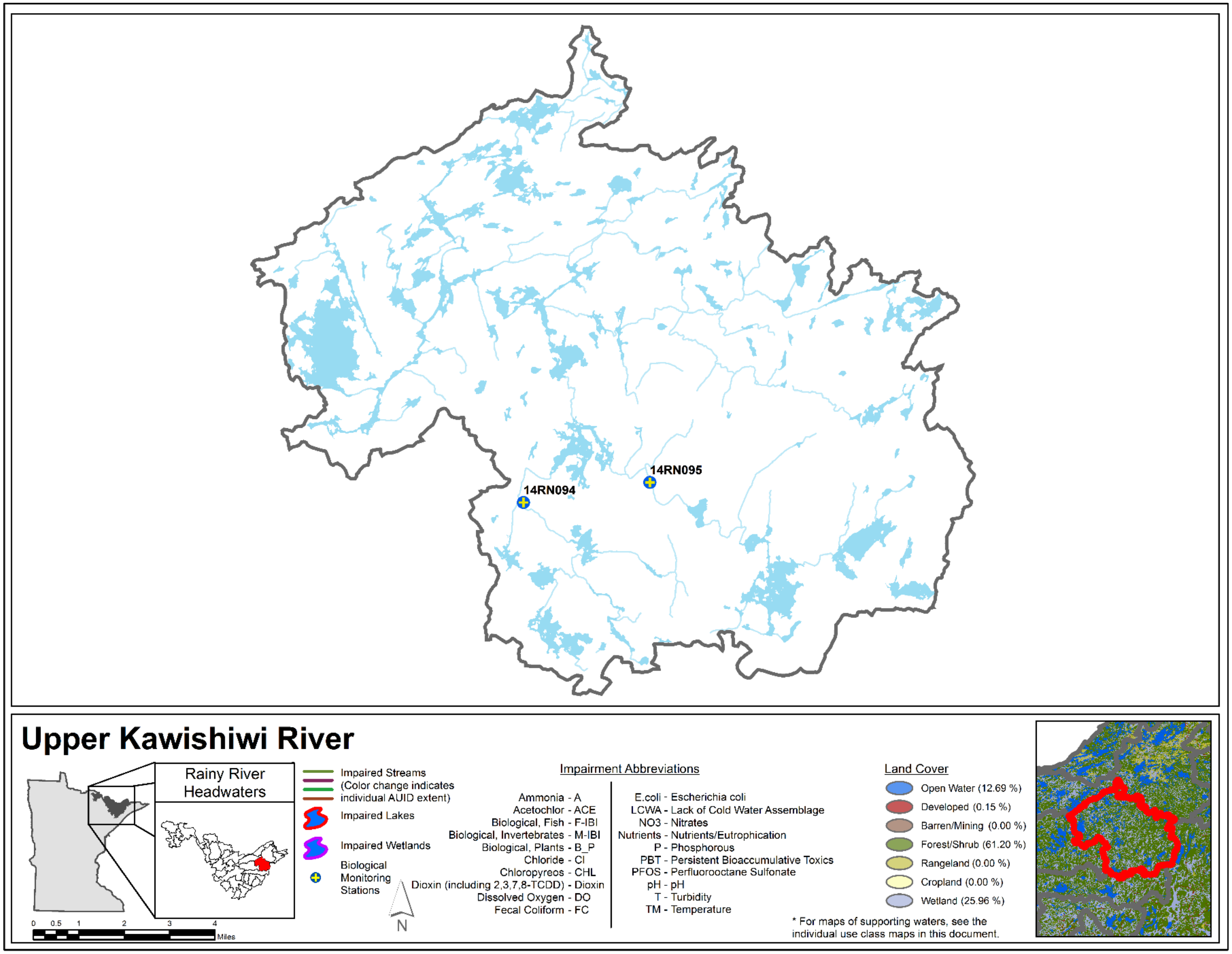

Figure 46. Currently listed impaired waters by parameter and land use characteristics in the Upper Kawishiwi River Aggregated 12-HUC.

Shagawa River Aggregated 12-HUC HUC 0903000110-01

The Shagawa River Subwatershed drains 104.24 square miles of Lake (1.5%) and St. Louis (98.5%) counties and is the twelfth largest subwatershed within the Rainy River-Headwaters Watershed. There are a total of 38 lakes greater than 10 acres, with the most prominent being Burntside, Shagawa, Crab, Slim, and Wolf. The largest and most popular lake, Burntside Lake (69-0118-00), has numerous contributing streams, including Crab Creek, Tamarack Creek, Dead River, and many more unnamed tributaries. The Burntside River starts at the outlet of Burntside Lake and continues 7.9 miles east to Shagawa Lake (69-0069-00). In addition to receiving water from Burntside River, Shagawa Lake also receives water from Longstorff, Armstrong, and many unnamed tributaries. The Shagawa River begins at the outlet of Shagawa Lake, which flows 2.85 miles until it exits this subwatershed and contributes its waters to Fall Lake (38-0811-00). The subwatershed is dominated by forest (53.72%), wetland (22.31%), and open water (19.59%). Only 3.42% is developed, 0.86% is rangeland, 0.07% row-crop agriculture, and 0.03% barren/mining. The majority of this subwatershed lies within the Superior National Forest, with a small portion (15.1%) of it within the BWCAW. Much of the land within this subwatershed is owned and managed by local, state, and federal entities. The Burntside Islands Scientific and Natural Area lies within this subwatershed. This subwatershed is a part of the larger Kawishiwi River system, which is the largest river system in the Rainy River-Headwaters Watershed. Intensive water chemistry sampling was conducted at the outlet of the subwatershed at the Snowmobile Trail off CSAH 88, one mile southwest of Winton on the Shagawa River. The outlet is represented by water chemistry station S007-905 and biological station 14RN004.

Table 32. Aquatic life and recreation assessments on stream reaches: Shagawa River Aggregated 12-HUC. Reaches are organized upstream to downstream in the table.

AUID *Reach Name*, *Reach Description*	Biological Station ID	Reach Length (miles)	Use Class	Aquatic Life Indicators: Fish IBI	Invert IBI	Dissolved Oxygen	TSS	Secchi Tube	Chloride	pH	Ammonia -NH_3	Pesticides	Eutrophication	Aquatic Life	Aquatic Rec. (Bacteria)
09030001-976 **Crab Creek** **Boundary Waters Canoe Area Wilderness Boundary to Burntside Lk**	14RN052	1.45	WWg	MTS	MTS	IF	IF	IF	- -	IF	IF	- -	IF	SUP	- -
09030001-808 **Burntside River** **Burntside Lk to Shagawa Lk**	14RN051	7.91	CWg	MTS	- -	- -	IF	IF	- -	- -	- -	- -	IF	SUP	- -
09030001-565 **Longstorff Creek** **Mitchell Lk to Shagawa Lk**	15RN055 14RN055	3.71	WWg	MTS	MTS	IF	IF	IF	- -	IF	IF	- -	IF	SUP	- -
09030001-535 **Shagawa River** **Shagawa Lk to Fall Lk**	14RN004	3.09	WWg	MTS	MTS	IF	IF	MTS	MTS	MTS	MTS	- -	MTS	SUP	SUP

Abbreviations for Indicator Evaluations: **MTS** = Meets Standard; **EXS** = Fails Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Impaired (Fails Standards)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.
Abbreviations for Use Class: **WWg** = warmwater general, **WWm** = Warmwater modified, **WWe** = Warmwater exceptional, **CWg** = Coldwater general, **CWe** = Coldwater exceptional, **LRVW** = limited resource value water
*Assessments were completed using proposed use classifications changes that have not yet been written into rule.

Table 33. Lake assessments: Shagawa River Aggregated 12-HUC.

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators: Fish IBI	Chloride	Pesticides	Aquatic Recreation Indicators: Total Phosphorus	Chlorophyll-a	Secchi	Aquatic Life Use	Aquatic Recreation Use
Fenske	69-0085-00	104.3	43	Deep Lake	NLF	- -	- -	MTS	- -	MTS	MTS	MTS	IF	SUP
Mitchell	69-0116-00	245.0	38	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	MTS	- -	IF
Everett	69-0120-00	109.4	15	Shallow Lake	NLF	- -	- -	IF	- -	- -	- -	MTS	IF	IF
Wolf	69-0161-00	267.9	28	Deep Lake	NLF	NT	- -	- -	- -	MTS	MTS	MTS	- -	SUP
East Twin	69-0163-01	219.2	51	Shallow Lake	NLF	- -	- -	- -	- -	MTS	MTS	MTS	- -	SUP
West Twin	69-0163-02	219.2	18	Deep Lake	NLF	- -	- -	MTS	- -	MTS	MTS	MTS	IF	SUP
East Twin	69-0174-00	120.7	22	Deep Lake	NLF	- -	- -	IF	- -	- -	- -	- -	IF	IF
Little Rice	69-0180-00	122.9	5	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Slim	69-0181-00	309.6	49	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators: Fish IBI	Aquatic Life Indicators: Chloride	Aquatic Life Indicators: Pesticides	Aquatic Recreation Indicators: Total Phosphorus	Aquatic Recreation Indicators: Chlorophyll-a	Aquatic Recreation Indicators: Secchi	Aquatic Life Use	Aquatic Recreation Use
Shagawa	69-0069-00	2314.9	48	Deep Lake	NLF	I	- -	MTS	- -	MTS	MTS	MTS	IF	SUP
Burntside	69-0118-00	7191.4	157	Deep Lake	NLF	D	- -	MTS	- -	MTS	MTS	MTS	IF	SUP

Abbreviations for Ecoregion: DA = Driftless Area, NCHF = North Central Hardwood Forest, NGP = Northern Glaciated Plains, NLF = Northern Lakes and Forests, NMW = Northern Minnesota Wetlands, RRV = Red River Valley, WCBP = Western Corn Belt Plains
Abbreviations for Secchi Trend: D = decreasing/declining trend, I = increasing/improving trend, NT = no detectable trend, -- = not enough data
Abbreviations for Indicator Evaluations: -- = No Data, **MTS** = Meets Standard; **EXS** = Exceeds Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Not Support (Impaired, exceeds standard)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.

Summary

The Shagawa River Subwatershed had four assessable stream segments, containing five biological monitoring stations, and seven lakes assessed for aquatic recreation (Table 32 and Table 33). All of the streams and lakes met the applicable standards or criteria and fully support aquatic life and/or aquatic recreation (Figure 52). In-stream habitat was in good condition overall despite this drainage being the most developed subwatershed within the Rainy River-Headwaters Watershed (Appendix 5). A use class analysis was conducted on all assessed waterbodies within the Rainy River-Headwaters Watershed. Streams that could support an exceptional use designation received additional protections from a more stringent water quality standard. Although some indicators met the exceptional criteria, not all the requirements were met to receive the exceptional use designation (WWe and CWe) but did indicated good water quality.

Stream characteristics (habitat, gradient, thermal regime, etc.) were diverse throughout this subwatershed. As a result, there was a relatively diverse fish (28 species) and macroinvertebrate (114 taxonomic groupings) community. Crab Creek (-976), a small headwater stream, had habitat characteristics that were better than any other stream within this subwatershed resulting in biological scores near the exceptional use criteria. This was no surprise since most of the upstream drainage lies within the BWCAW and is protected from intensive land use practices.

Two streams segments (-808 and -565) that contribute their water directly to Shagawa Lake (69-069-00) were assessed for their support of aquatic life. Station (14RN051) located on the Burntside River (-808) was a low gradient system with fair habitat consisting of fine sediments and other substrate attributes that drove the score down. Although the habitat score was lower, the fish community performed well and consisted of several sensitive species that are typical of these conditions. Longstorff Creek, a cold-water tributary, originally had one biological monitoring stations (14RN055) located near the outlet. This station was monitored in 2014 for fish and macroinvertebrates, with a fish community that was dominated by lake species. An additional station (15RN055) was added to this reach (-565) in 2015 to analyze its potential as a cold-water resource. Several sensitive fish species were found at both stations but lacked any real strong signal indicating a cold-water resource. Although cold-water obligate species were not abundant in the sample, historical data from the DNR shows that natural reproduction of brook trout did occur along this reach in the early 1990s. Paired with thermal data collected by the MPCA and the macroinvertebrate community, there is a reasonable potential for this reach to support a cold-water assemblage. Both fish and macroinvertebrate IBIs meet cold-water standards, resulting in a full support designation for aquatic life along this stream reach.

The outlet of this subwatershed was monitored on the Shagawa River (-535) just one mile downstream of Shagawa Lake. Both fish and macroinvertebrate IBIs indicated full support for this reach, with fish meeting exceptional use standards. The overall F-IBI was likely inflated as a result of the stations (14RN004) proximity to two large bodies of water. Although the F-IBI may be inflated, the fish community did contain several sensitive species and indicated good water quality. Two macroinvertebrate samples were taken at this location between 2014-2015 and had numerous sensitive species present. Stream water quality data at this location indicated excellent water quality, sediment and nutrient levels were low (similar to conditions in Shagawa Lake). Chloride samples, an indicator of urbanization, elevated above background conditions (5-8 mg/L), but far below the standard for protection of aquatic life. *E. coli* bacteria concentrations were consistently low and indicated full support for aquatic recreation.

Several lakes in the subwatershed had sufficient data for an assessment of aquatic recreation. All of these lakes had good to excellent water quality (Figure 47) and were assessed as fully supporting. Burntside Lake (69-0118-00)) has more stringent standards, designed to protect its lake trout population, and was also assessed as fully supporting. Burntside Lake was monitored by MPCA staff in 1994 and 2012-2013, with cooperation from the Burntside Lake Association; water quality conditions were similar among years (Figure 48). The long-term average Secchi transparency in the lake is about 6.2 meters (~ 20 feet), and is relatively stable, although clarity has decreased slightly in recent years (Figure 49). Burntside remains a very high quality lake resource.

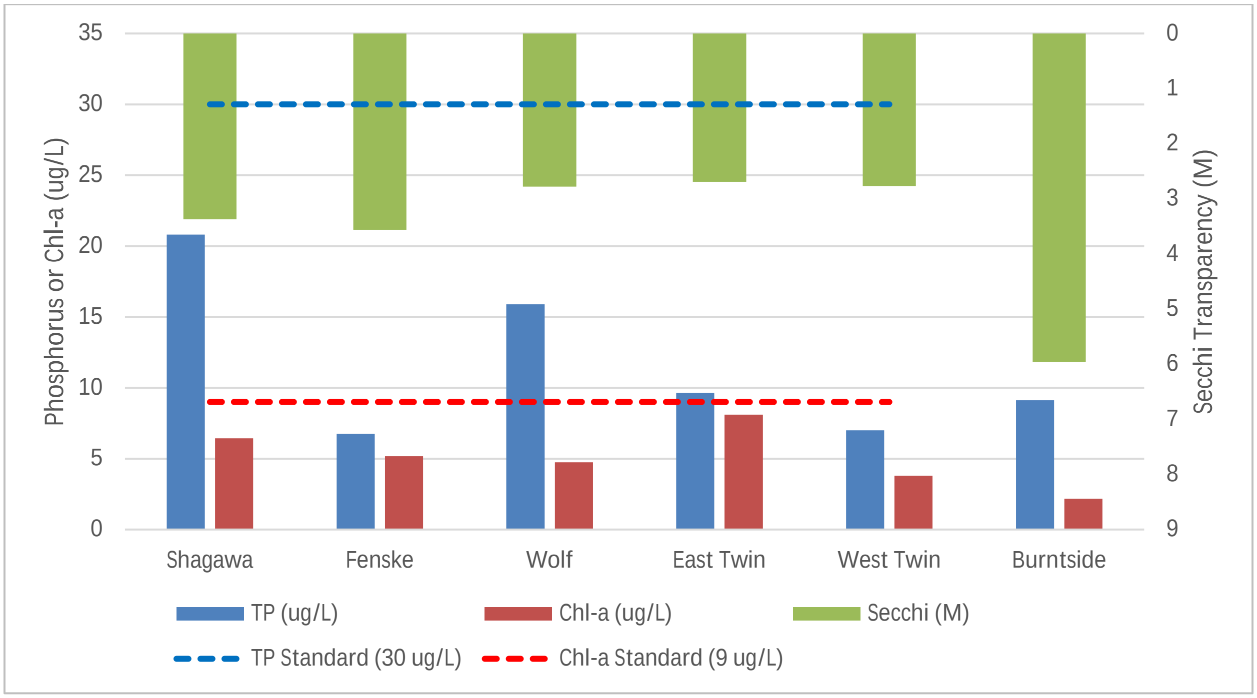

Figure 47. Assessed lakes in the Shagawa River Aggregated 12-HUC.

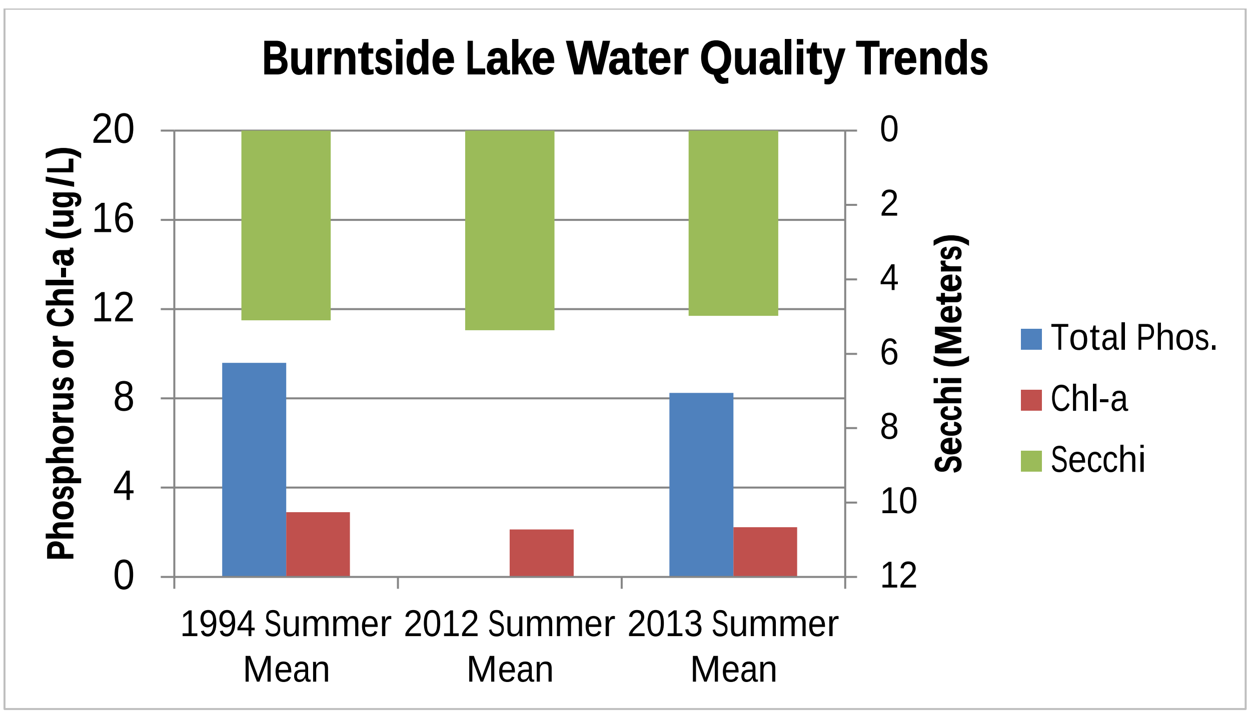

Figure 48. Burtnside Lake water quality summary.

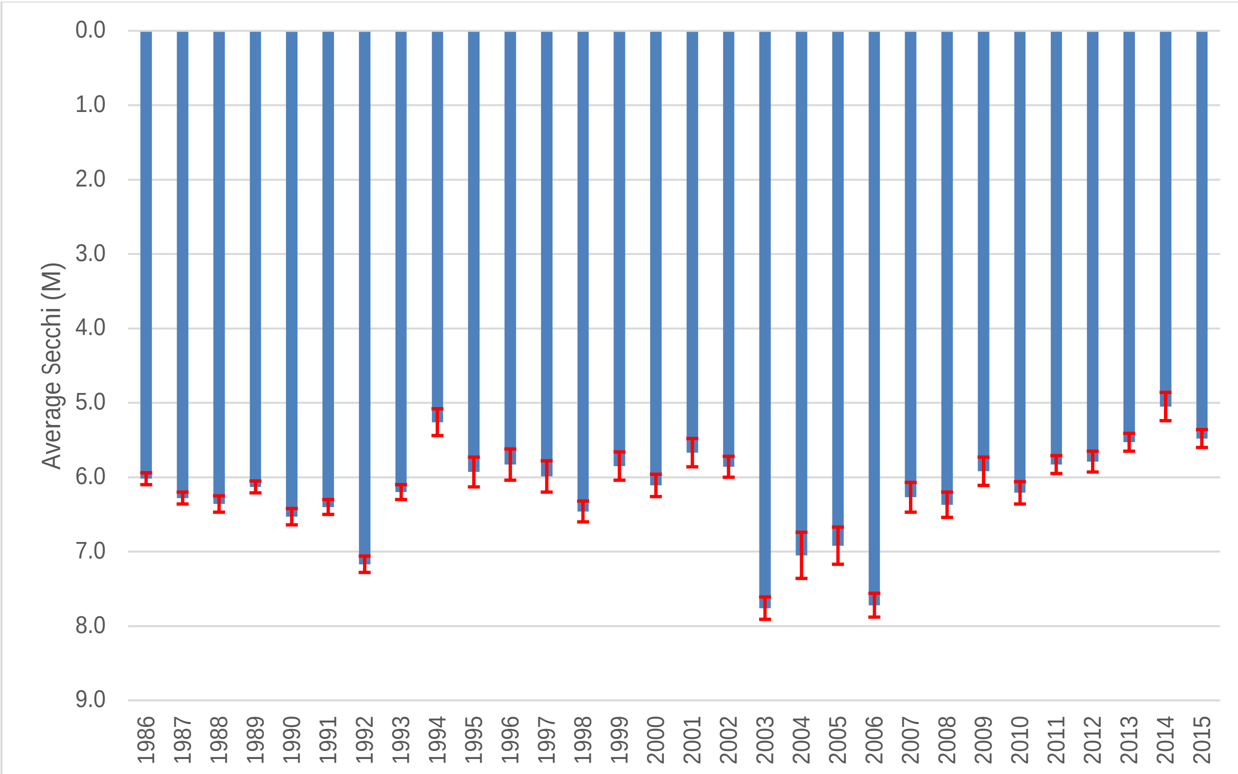

Figure 49. Burtnside Lake secchi trends.

Shagawa Lake is perhaps the most intensively studied lake in Minnesota, and a prominent national example of water quality restoration. The EPA started monitoring the lake in the 1960s to study the impact of Ely's wastewater discharge to the lake. Water quality has dramatically improved in Shagawa since wastewater treatment improvements were initiated in the 1970s. Chlorophyll-a concentrations peaked near 50 µg/L in the 1970's and were down to near 14 µg/L in the 2000s (MPCA, 2011). Currently, summer average Chl-a concentrations were 6.4 µg/L (Figure 50); the lake meets all three eutrophication standards and fully supports aquatic recreation. Shagawa also has one of the longest citizen-collected Secchi datasets in the state, with annual sampling back to the late 1970s. The dramatic increase in water clarity is evident in Figure 51; which shows that clarity averaged less than 2 meters in the early 1980s to near 3.5 meters (11.5 feet) currently. Slim Lake (69-0181-00) is the only assessed lake within the BWCAW in this subwatershed. The lake fully supports aquatic recreation based on satellite-estimated Secchi transparency (Figure 83).

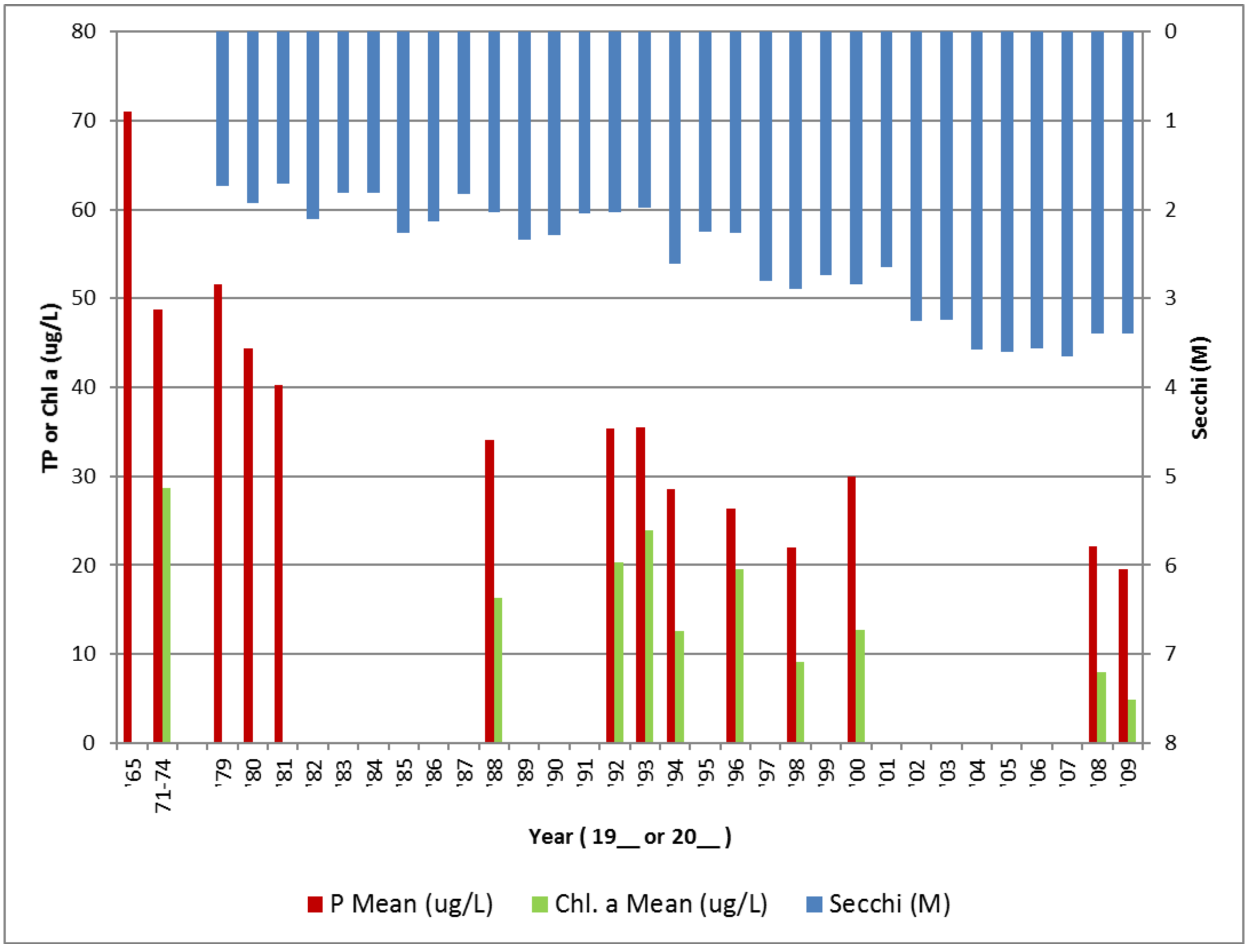

Figure 50. Shagawa Lake water quality trends.

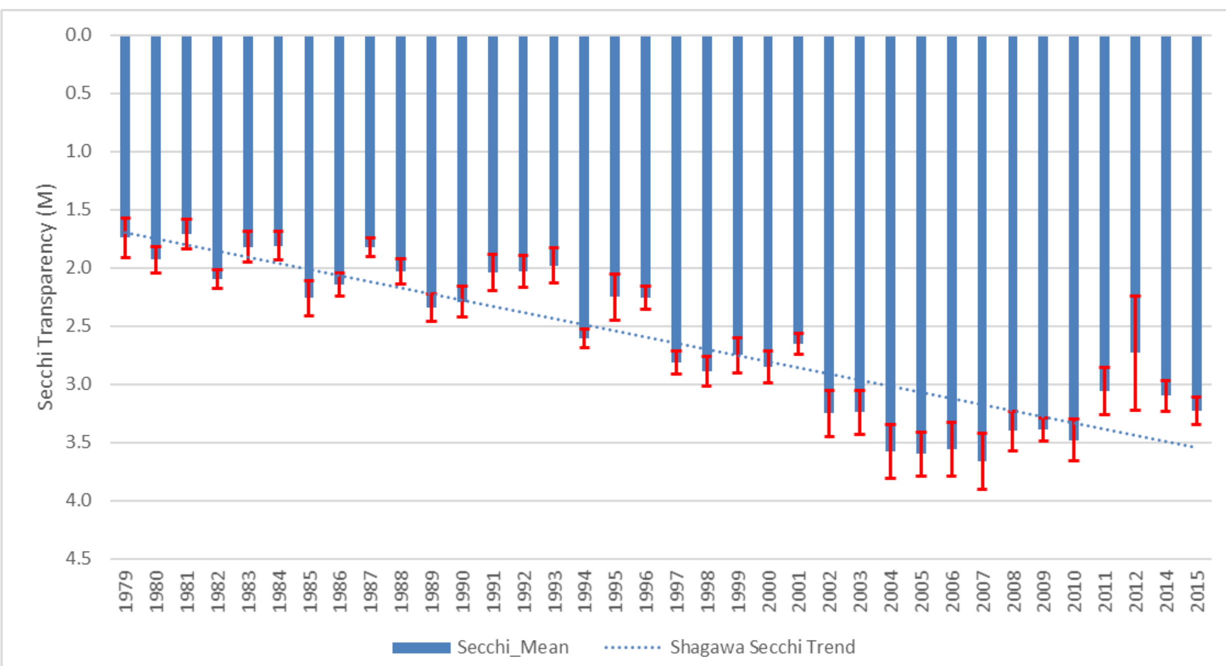

Figure 51. Shagawa Lake Secchi transparency trends.

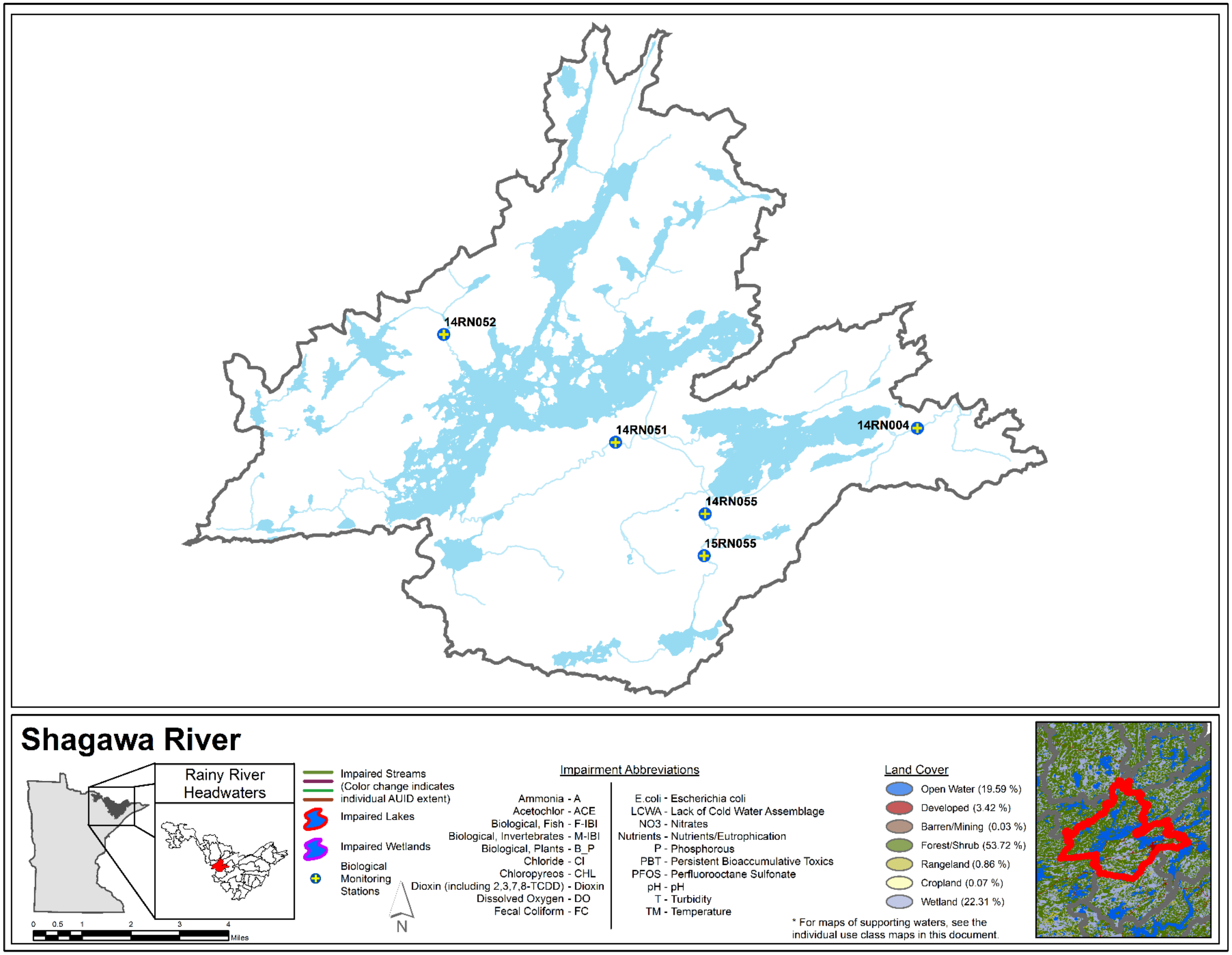

Figure 52. Currently listed impaired waters by parameter and land use characteristics in the Shagawa River Aggregated 12-HUC.

Kawishiwi River (Fall Lake) Aggregated 12-HUC HUC 0903000111-01

The Kawishiwi River (Fall Lake) Subwatershed drains 73.22 square miles of Lake (79.2%) and St. Louis (20.8%) counties and is the fourteenth smallest subwatershed within the Rainy River-Headwaters Watershed. This subwatershed has four major inlets (South Kawishiwi, Bear Island, Kawishiwi, and Shagawa River) that contribute 1,276.81 square miles of drainage. Both the Bear Island and South Kawishiwi Rivers enter White Iron Lake (69-0004-00) along its southern shoreline. White Iron Lake is connected to Farm (38-0779-00), South Farm (38-0778-00), and Garden Lake (38-0782-00) through a series of channels. The Kawishiwi River enters Farm Lake along its eastern shoreline and continues through Garden Lake, where a short 0.2 mile section of river connects Garden to Fall Lake (38-0811-00). The famous Kawishiwi River Falls are located on this section of river, along with a hydropower dam operated by Minnesota Power. The Shagawa River Subwatershed (0903000110-01) enters Fall Lake from the west, along with Squaw Creek from the north. A pair of rapids connect Fall Lake to Newton Lake (38-0784-00) and eventually exit this subwatershed into Basswood Lake (38-0645-00). This subwatershed is a part of the larger Kawishiwi River system, which is the largest river system in the Rainy River-Headwaters Watershed. Numerous small tributary streams contribute waters to the many lakes in the subwatershed. There are a total of 15 lakes greater than 10 acres, with the most prominent being White Iron, Fall, Farm, Garden, and South Farm. This subwatershed is dominated by forest (46.99%), wetland (29.27%), and open water (20.45%). Only 2.06% is developed, 1.17% is rangeland, 0.05% is row-crop agriculture and 0.01% is barren/mining. This entire subwatershed lies within the Superior National Forest, with a small portion (17.97%) it within the BWCAW. Much of the land within this subwatershed is owned and managed by local, state, and federal entities (USGS, 2008). The Kawishiwi Pines Scientific and Natural Area lies within this subwatershed. As a result of short tributary streams and many large bodies of water; there was no biological or intensive water chemistry sampling conducted within this subwatershed.

Table 34. Lake assessments: Kawishiwi River (Fall Lake) Aggregated 12-HUC.

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators: Fish IBI	Aquatic Life Indicators: Chloride	Aquatic Life Indicators: Pesticides	Aquatic Recreation Indicators: Total Phosphorus	Aquatic Recreation Indicators: Chlorophyll-a	Aquatic Recreation Indicators: Secchi	Aquatic Life Use	Aquatic Recreation Use
Cedar	38-0810-00	459.8	42	Deep Lake	NLF	- -	- -	MTS	- -	MTS	MTS	MTS	IF	SUP
South Farm	38-0778-00	562.2	30	Deep Lake	NLF	NT	- -	- -	- -	MTS	MTS	IF	- -	SUP
Farm	38-0779-00	1282.6	56	Deep Lake	NLF	D	- -	- -	- -	MTS	MTS	MTS	- -	SUP
Garden	38-0782-00	636.0	55	Deep Lake	NLF	D	- -	- -	- -	MTS	MTS	IF	- -	SUP
Fall	38-0811-00	2234.5	32	Deep Lake	NLF	NT	- -	MTS	- -	MTS	MTS	IF	IF	SUP
White Iron	69-0004-00	3150.8	47	Deep Lake	NLF	NT	- -	MTS	- -	MTS	MTS	IF	IF	SUP

Abbreviations for Ecoregion: DA = Driftless Area, NCHF = North Central Hardwood Forest, NGP = Northern Glaciated Plains, NLF = Northern Lakes and Forests, NMW = Northern Minnesota Wetlands, RRV = Red River Valley, WCBP = Western Corn Belt Plains
Abbreviations for Secchi Trend: D = decreasing/declining trend, I = increasing/improving trend, NT = no detectable trend, -- = not enough data
Abbreviations for Indicator Evaluations: -- = No Data, **MTS** = Meets Standard; **EXS** = Exceeds Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Not Support (Impaired, exceeds standard)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.

Summary

The Kawishiwi River (Fall Lake) Subwatershed had no assessable stream segments and six lakes assessed for aquatic recreation (Table 34). All of the lakes met the applicable standards or criteria to fully support aquatic recreation (Figure 54). This subwatershed did not include significant stream monitoring or biological montoring, due to its lake dominated characterstics. Several large and prominant lakes in this subwatershed outside of the BWCAW have extensive water quality datasets, including the White Iron Chain, which has long been moitored by WICOLA. White Iron Lake (69-0004-00) is also a DNR/MPCA Sentinel Lake; a detailed report can be found here https://www.pca.state.mn.us/sites/default/files/wq-2slice69-0004.pdf.

Figure 53 shows the water quality summary for prominent lakes in the subwatershed. All have levels of phosphorus and Chl-a that fully support aquatic recreation. Like most lakes within the Kawishiwi River system, natural bog staining influences water clarity, and many lakes do not meet the two meter Secchi standard for Class 2B warm/cool-water lakes. Cedar Lake (38-0810-00), a high quality lake near Winton, is not directly on the Kawishiwi River , has a much smaller drainage area, and much lower nutrient and algal concentrations. Long-term trends in Secchi vary for the lakes shown in Figure 53. Farm (38-0779-00) may have a slight decline, Garden (38-0782-00) has a statistically significant decline in transparency of about one foot per decade, White Iron and South Farm (38-0778-00) have no discernable trend, and Fall (38-0811-00) and Cedar have insufficient data to determine long-term trends. Trends or patterns in long-term transparency in these lakes along the Kawishiwi River are very likely due to variability in climate and water levels, and not the result of a water quality decline. Phosphorus and Chl-a levels are fairly consistent over the same time periods, due to the long-term monitoring efforts of WICOLA. For more information on long term trends in Secchi transparency, see this MPCA report: https://www.pca.state.mn.us/sites/default/files/wq-s2-08.pdf.

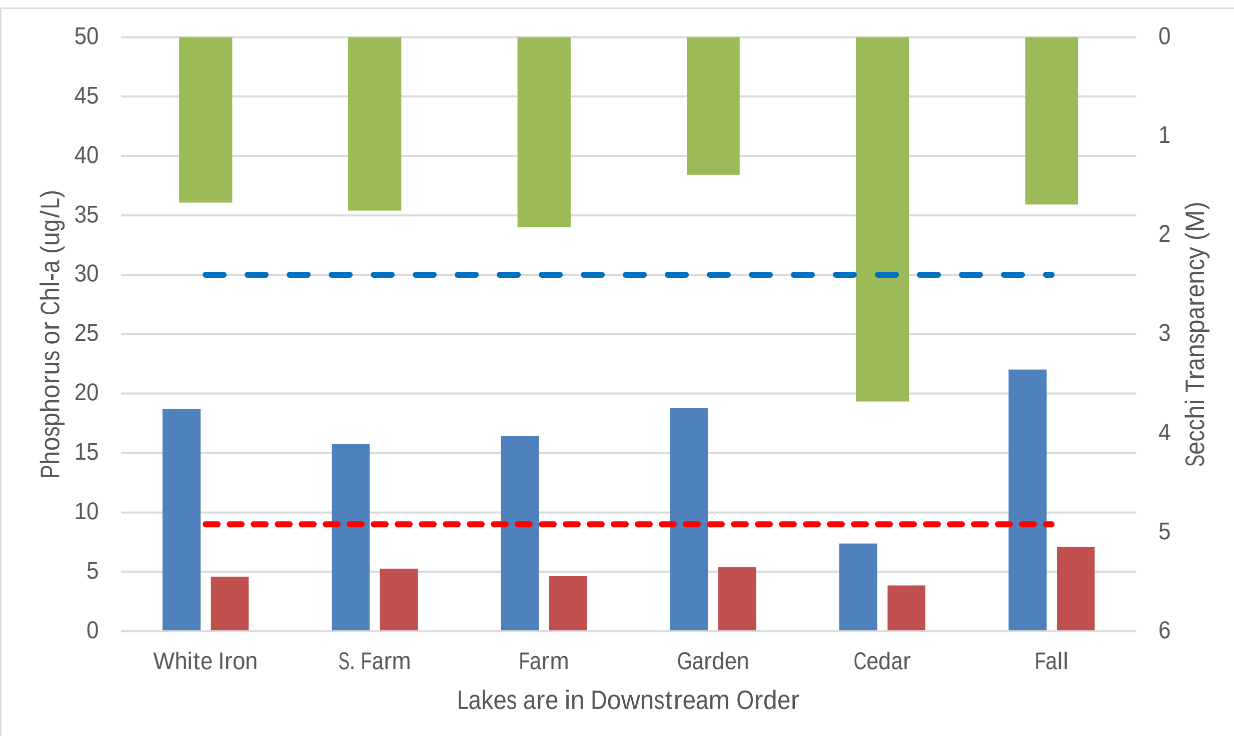

Figure 53. Water quality summary for assessed lakes in the Kawishiwi River (Fall Lake) Aggregated 12-HUC.

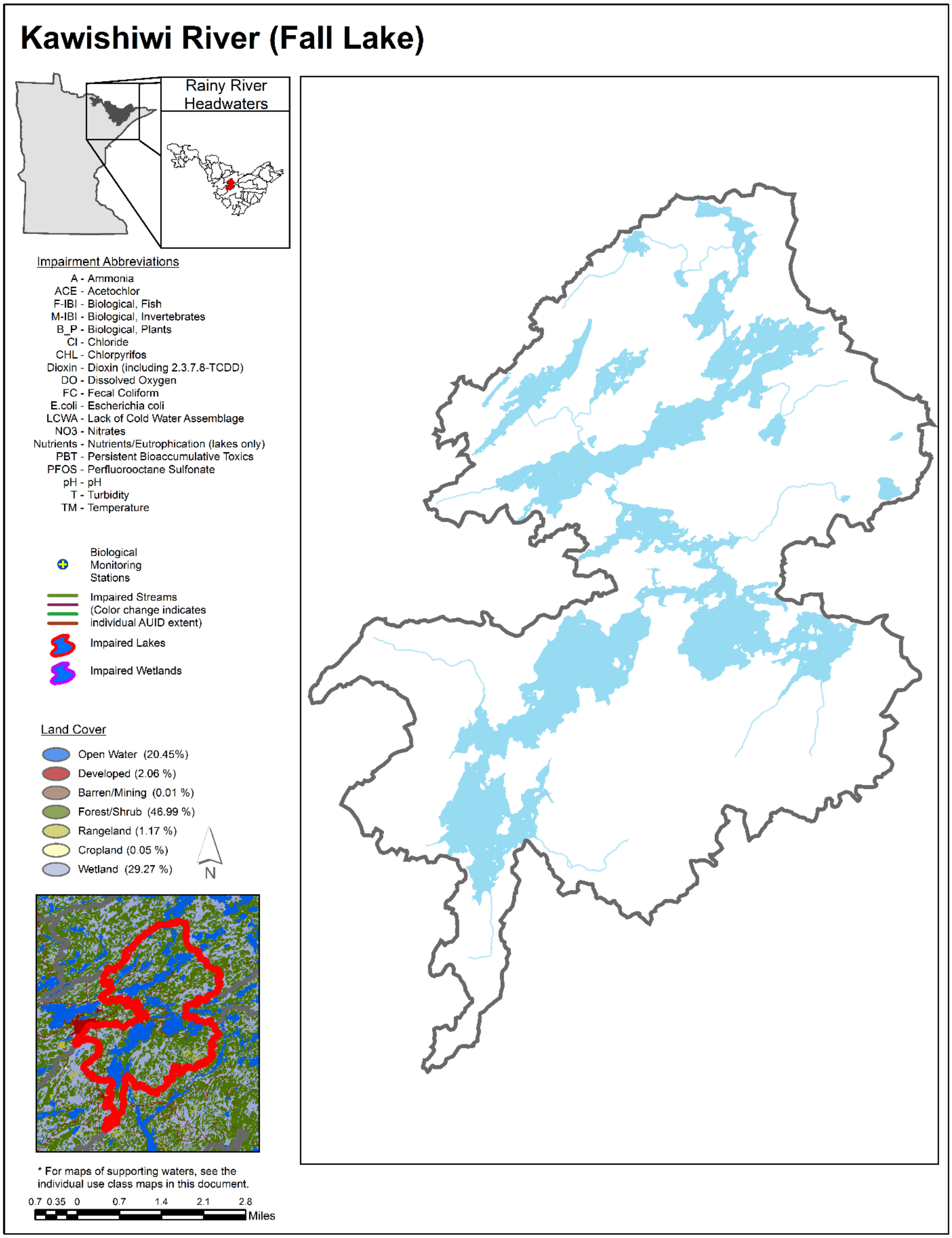

Figure 54. Currently listed impaired waters by parameter and land use characteristics in the Kawishiwi River (Fall Lake) Aggregated 12-HUC.

Bear Island River Aggregated 12-HUC HUC 0903000111-02

The Bear Island River Subwatershed drains 66.87 square miles of St. Louis County and is the twelfth smallest subwatershed within the Rainy River-Headwaters Watershed. Several small tributaries enter Bear Island Lake, with the largest being the Beaver River. Originating from Meadow Lake, the Beaver River flows 10.6 miles through numerous large wetland complexes before entering the lake. The Bear Island River starts at the outlet of Bear Island Lake and flows to the northeast for 2.4 miles before entering One Pine Lake. From here, the Bear Island River receives additional flow from Johnson Creek before continuing another 3.6 miles to White Iron Lake. The Bear Island River Subwatershed is a tributary to the larger Kawishiwi River which is the largest river system in the Rainy River-Headwaters Watershed. Streams within this subwatershed tended to be low gradient, short connectors to large bodies of water (lakes and wetlands). There are a total of 13 lakes greater than10 acres, with the most prominent being One Pine, Johnson, and Bear Island Lake. This subwatershed is dominated by forest (44.98%), wetlands (41.65%), and open water (9.58%). Only 2.13% is rangeland, 1.61% is developed, 0.03% is row-crop agriculture, and 0.02% is barren/mining. The majority of this subwatershed lies within the Superior National Forest, with much of the land under state and federal management (USGS, 2008). The Bear Island State Park, Bear Island State Forest, and Purvis Lake-Ober Foundation Scientific Natural Area are located within this subwatershed. Intensive water chemistry sampling was conducted at the outlet of the subwatershed at Highway 1, 3 miles south of Ely on the Bear Island River. The outlet is represented by water chemistry station S000-912 and biological station 14RN005.

Table 35. Aquatic life and recreation assessments on stream reaches: Bear Island River Aggregated 12-HUC. Reaches are organized upstream to downstream in the table.

AUID *Reach Name*, *Reach Description*	Biological Station ID	Reach Length (miles)	Use Class	Aquatic Life Indicators: Fish IBI	Invert IBI	Dissolved Oxygen	TSS	Secchi Tube	Chloride	pH	Ammonia -NH_3	Pesticides	Eutrophication	Aquatic Life	Aquatic Rec. (Bacteria)
09030001-708 **Johnson Creek** **Headwaters (Mud Lk 69-0060-00) to Johnson Lk**	14RN060	4.34	WWg	MTS	MTS	IF	IF	IF	- -	IF	IF	IF	IF	SUP	- -
09030001-663 **Beaver River** **Unnamed Cr to Bear Island Lk**	14RN059	2.75	WWg	MTS	- -	IF	IF	IF	- -	IF	IF	IF	IF	SUP	- -
09030001-665 **Bear Island River** **Bear Island Lk to One Pine Lk**	14RN058	2.40	WWg	MTS	MTS	IF	IF	IF	- -	IF	IF	IF	IF	SUP	- -
09030001-608 **Bear Island River** **One Pine Lk to White Iron Lk**	14RN005	3.59	WWg	MTS	MTS	IF	IF	MTS	MTS	MTS	MTS	- -	MTS	SUP	SUP

Abbreviations for Indicator Evaluations: **MTS** = Meets Standard; **EXS** = Fails Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Impaired (Fails Standards)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.
Abbreviations for Use Class: **WWg** = warmwater general, **WWm** = Warmwater modified, **WWe** = Warmwater exceptional, **CWg** = Coldwater general, **CWe** = Coldwater exceptional, **LRVW** = limited resource value water
*Assessments were completed using proposed use classifications changes that have not yet been written into rule.

Table 36. Lake assessments: Bear Island River Aggregated 12-HUC.

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators:			Aquatic Recreation Indicators:			Aquatic Life Use	Aquatic Recreation Use
							Fish IBI	Chloride	Pesticides	Total Phosphorus	Chlorophyll-a	Secchi		
Blueberry	69-0054-00	124.0	6	Shallow Lake	NLF	- -	- -	- -	- -	EXS	EXS	IF	- -	IMP
One Pine	69-0061-00	352.4	13	Shallow Lake	NLF	- -	- -	MTS	- -	MTS	MTS	IF	IF	SUP
Johnson	69-0117-00	446.7	18	Shallow Lake	NLF	- -	- -	- -	- -	MTS	MTS	IF	- -	SUP
Bear Island	69-0115-00	2319.7	70	Deep Lake	NLF	NT	- -	MTS	- -	MTS	MTS	MTS	IF	SUP

Abbreviations for Ecoregion: DA = Driftless Area, NCHF = North Central Hardwood Forest, NGP = Northern Glaciated Plains, NLF = Northern Lakes and Forests, NMW = Northern Minnesota Wetlands, RRV = Red River Valley, WCBP = Western Corn Belt Plains
Abbreviations for Secchi Trend: D = decreasing/declining trend, I = increasing/improving trend, NT = no detectable trend, -- = not enough data
Abbreviations for Indicator Evaluations: -- = No Data, **MTS** = Meets Standard; **EXS** = Exceeds Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Not Support (Impaired, exceeds standard)
Key for Cell Shading: ☐ = existing impairment, listed prior to 2014 reporting cycle; ☐ = new impairment; ☐ = full support of designated use; ☐ = insufficient information.

Summary

The Bear Island River Subwatershed had four assessable stream segments, containing four biological monitoring stations, and four lakes assessed for aquatic recreation (Table 35 and Table 36). Nearly all of the streams and lakes met the applicable standards or criteria and fully support aquatic life and aquatic recreation (Figure 56). In-stream habitat was in good condition despite the low gradient nature of most streams (Appendix 5). As a result of quality in-stream habitat and good water quality, a relatively diverse fish and macroinvertebrate community was present throughout the subwatershed.

Johnson Creek (14RN060) is a small (5.82 mi^2 drainage area) headwater stream connecting Mud Lake (69-0060-00) to Johnson Lake (69-0117-00). The F-IBI score (30.62) was below the impairment threshold but within the confidence interval, while the M-IBI score (52.15 and 74.61) met aquatic life standards. This drainage had minimal disturbance and was dominated by wetlands, with numerous beaver dams located along this stream reach. A low number of individuals (fish) were captured and were dominated by species typical of wetland conditions. The macroinvertebrate community was also represented by numerous species typical of glide/pool habitats. As a result, the F-IBI score was more of an indication of wetland conditions within this drainage and was not a true signal of an aquatic life impairment driven by anthropogenic stressors.

One biological monitoring station (14RN059) was located on the Beaver River approximately a mile and a half from its confluence with Bear Island Lake (69-0115-00). The sampling reach was dominated by wetland like habitat with dense macrophytes, both emergent and submergent, present throughout the reach. In addition, several large wetlands are located upstream of the station. Both the fish and macroinvertebrate communities were dominated by species typical of wetland habitats.

Biological condition tended to improve as you moved downstream and out of the heavily wetland influenced headwaters of this drainage. The Bear Island River had two biological monitoring stations on two stream reaches. The most upstream station (14RN058) was located between Bear Island and One Pine Lake, while the other station (14RN005) was located just upstream of Highway 1 between One Pine and White Iron Lake. Both fish and macroinvertebrates were in good condition with numerous sensitive species captured. Conventional water quality parameters at the Highway 1 monitoring station indicate excellent water quality, reflective of the low amount of developed land in this subwatershed. Suspended sediment and nutrient levels were consistently low and met standards. Dissolved oxygen met the standards; however early morning data, when concentrations would be lowest, was not available in the dataset. *E. coli* bacteria concentrations were also consistently low, meeting standards, and indicated full support for aquatic recreational use.

Four lakes in this subwatershed were monitored for eutrophication parameters (TP, Chl-a, and Secchi transparency) for an assessment of recreational use. Three lakes (One Pine, Bear Island, & Johnson) met NLF ecoregion standards and fully supported aquatic recreation. Johnson and One Pine had naturally low Secchi transparency due to the influence of bog staining from the surrounding wetlands (Figure 55).

Blueberry Lake (69-0054-00) a small, very shallow lake located 6 miles south of Ely did not meet NLF lake water quality standards. It was reviewed by MPCA staff to determine if the impairment was caused by naturally occurring conditions. The lake has a maximum depth of 6 feet, and has experienced periodic winterkills in the past due to its shallow depth. The lakeshore and catchment is forested and in public ownership except for one small private developed parcel at the lake's outlet. This shallow lake has a very large catchment to lake ratio (44:1), so wetland and forest runoff rapidly enters Blueberry Lake. Throughout the NLF ecoregion, shallow, wetland dominated lakes, especially those with large catchments, may naturally exceed current Class 2B eutrophication standards. Blueberry Lake was found to be exceeding eutrophication standards due to natural conditions. In summary, all monitored lakes had water quality at expected conditions, given the low amount of disturbance throughout this subwatershed.

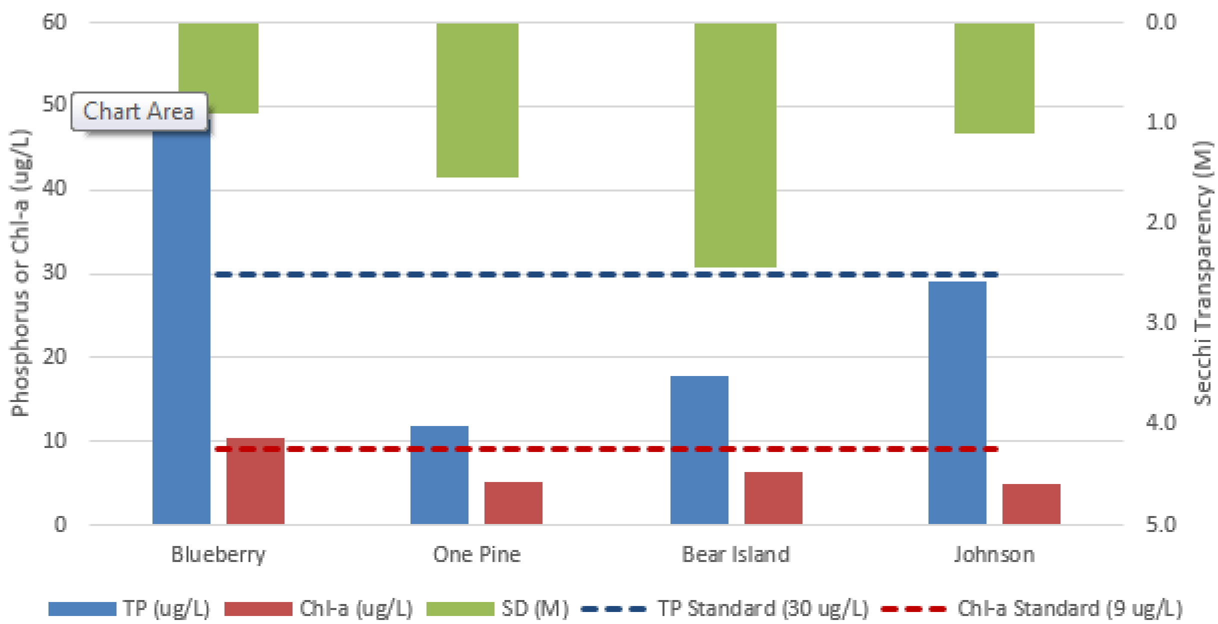

Figure 55. Water quality summary for select lakes in the Bear Island River Aggregated 12-HUC.

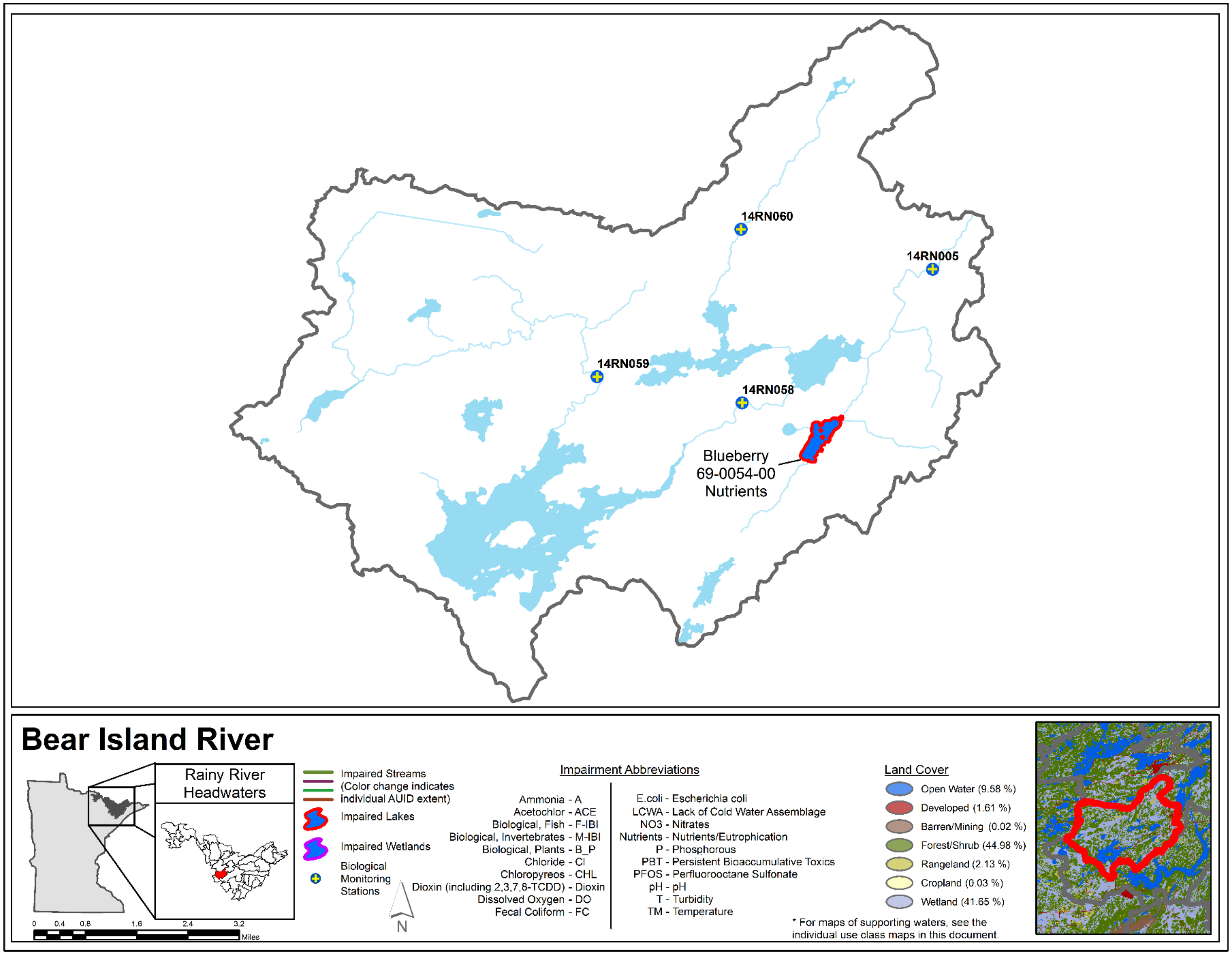

Figure 56. Currently listed impaired waters by parameter and land use characteristics in the Bear Island River Aggregated 12-HUC.

Basswood Lake Aggregated 12-HUC HUC 0903000112-01

The Basswood Lake Subwatershed drains 125.85 square miles of Lake (81.8%) and St. Louis (18.2%) counties and is the seventh largest subwatershed within the Rainy River-Headwaters Watershed. This subwatershed lies along the international border between the United States and Canada, with additional drainage on the Canadian side. Two major inlets (Newton and Sucker Lakes) contribute their waters directly to Basswood Lake (38-0645-00). Numerous rivers and streams connect various large bodies of water to Basswood Lake and include: Range River, Spawn Creek, Muskeg Creek, and various other unnamed tributaries. There are a total of 40 lakes greater than 10 acres, with the most prominent being Basswood, Wind, Wood, Manomin, and Ella Hall. This subwatershed is dominated by forest (45.80%), wetland (28.61%), and open water (25.34%). Only 0.19% is developed, 0.06% is rangeland, and there is no barren/mining or row-crop agriculture. This entire subwatershed lies within the Superior National Forest, with a portion (72.13%) of it within the BWCAW. Much of the land within this subwatershed is owned and managed by local, state, and federal entities (USGS, 2008). As a result of overall remoteness, short tributary streams and many large bodies of water; there was no biological or intensive water chemistry sampling conducted within this subwatershed.

Table 37. Lake assessments: Basswood Lake Aggregated 12-HUC.

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators:			Aquatic Recreation Indicators:			Aquatic Life Use	Aquatic Recreation Use
							Fish IBI	Chloride	Pesticides	Total Phosphorus	Chlorophyll-a	Secchi		
Sandpit	38-0786-00	59.1	53	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	MTS	- -	SUP
Alruss	69-0005-00	26.6	45	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Found	38-0620-00	58.7	38	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Washte	38-0626-00	77.9	8	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Tee	69-0083-00	37.9	25	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Tofte	38-0724-00	131.2	70	Deep Lake	NLF	NT	- -	MTS	- -	MTS	MTS	MTS	IF	SUP
Indiana	38-0725-00	138.3	31	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	MTS	- -	SUP
Good	38-0726-00	178.7	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Hula	38-0728-00	130.1	6	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators: Fish IBI	Chloride	Pesticides	Aquatic Recreation Indicators: Total Phosphorus	Chlorophyll-a	Secchi	Aquatic Life Use	Aquatic Recreation Use
Little Long	69-0066-00	318.8	45	Deep Lake	NLF	NT	- -	- -	- -	MTS	MTS	MTS	- -	SUP
Low	69-0070-00	288.2	40	Deep Lake	NLF	- -	- -	IF	- -	- -	- -	- -	IF	IF
Grassy	69-0082-00	244.8	15	Shallow Lake	NLF	- -	- -	IF	- -	- -	- -	- -	IF	IF
Wind	38-0642-00	918.3	32	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	MTS	- -	SUP
Basswood	38-0645-00	14050.8	111	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	MTS	- -	SUP
Wood	38-0729-00	604.2	21	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF

Abbreviations for Ecoregion: DA = Driftless Area, NCHF = North Central Hardwood Forest, NGP = Northern Glaciated Plains, NLF = Northern Lakes and Forests, NMW = Northern Minnesota Wetlands, RRV = Red River Valley, WCBP = Western Corn Belt Plains
Abbreviations for Secchi Trend: D = decreasing/declining trend, I = increasing/improving trend, NT = no detectable trend, -- = not enough data
Abbreviations for Indicator Evaluations: -- = No Data, **MTS** = Meets Standard; **EXS** = Exceeds Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Not Support (Impaired, exceeds standard)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.

Summary

The Basswood Lake Subwatershed had no assessable stream segments and nine lakes assessed for aquatic recreation (Table 37). All of the lakes met the applicable standards or criteria and fully support aquatic recreation (Figure 57). Lakes within the Basswood Lake Subwatershed are highlighted by Basswood (38-0645-00), a large (14,000 acre) prominent lake on the international border. Basswood and nine other BWCAW fully supported aquatic recreation based on remotely sensed Secchi transparency; other prominent lakes that fully support aquatic recreation include Wind (38-0642-00) and Indiana (38-0725-00). Little Long Lake (69-0066-00), between Shagawa and Burntside Lakes, was the only lake with sufficient water quality monitoring data for an assessment. This high quality lake had low levels of phosphorus and chlorophyll, and was meeting all eutrophication standards.

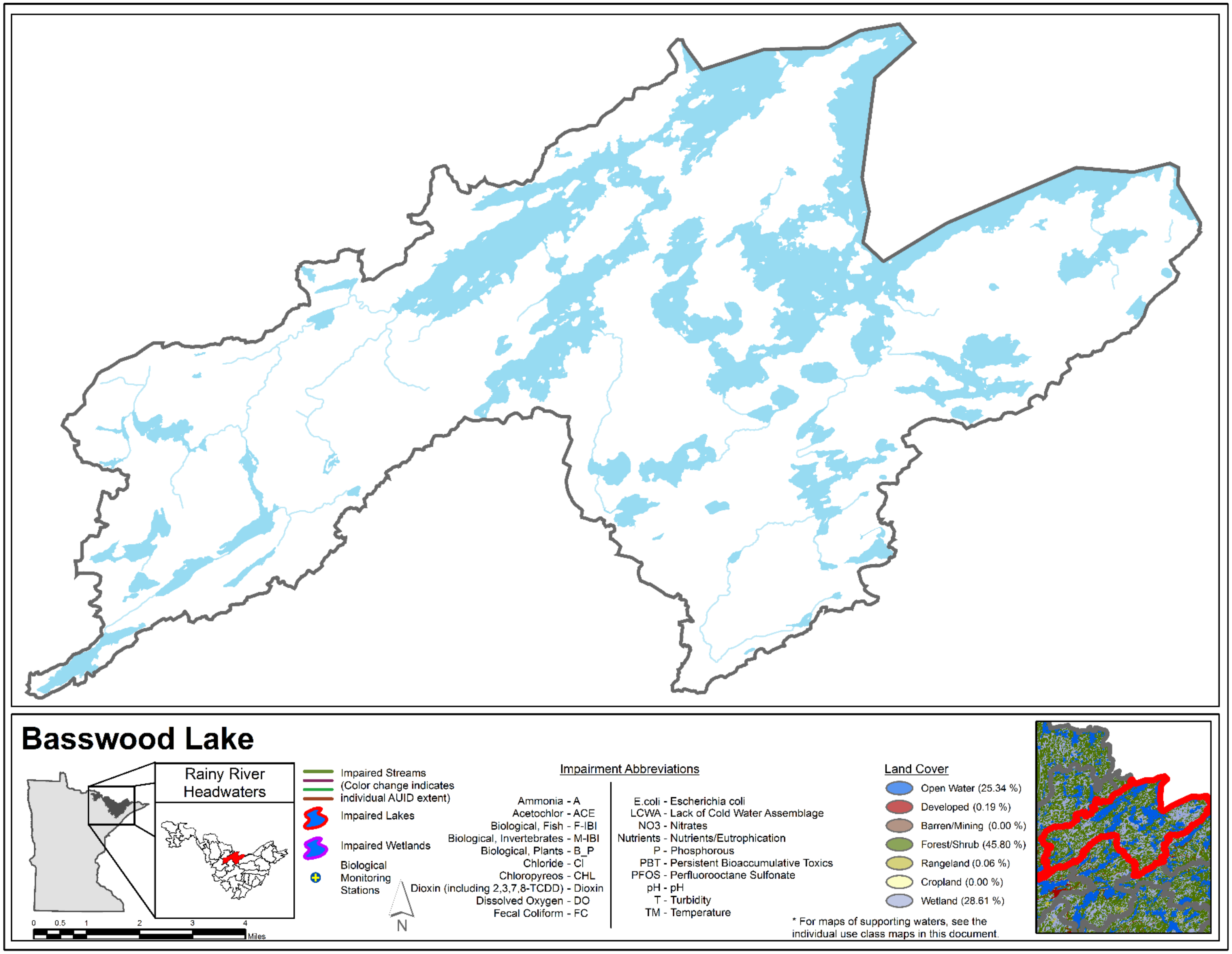

Figure 57. Currently listed impaired waters by parameter and land use characteristics in the Basswood Lake Aggregated 12-HUC.

Crooked Lake Aggregated 12-HUC HUC 0903000113-01

The Crooked Lake Subwatershed drains 96.78 square miles of Lake (29.0%) and St. Louis (71.0%) counties and is the fifteenth largest subwatershed within the Rainy River-Headwaters Watershed. This subwatershed lies along the international border between the United States and Canada, with additional drainage on the Canadian side. Two major inlets (Horse River and Basswood Lake Subwatersheds) contribute their waters to the Basswood River, which extends 5.3 miles along the international border. The Basswood River then pours into Crooked Lake, which extends 20.0 miles along this same border. Numerous named (Papoose, Sinneeg, and Bunggee Creek) and unnamed tributary streams enter Crooked Lake before it contributes its waters to Iron Lake (69-0121-00). The Beartrap River also contributes its waters to Iron Lake after flowing 4.2 miles from its headwaters in Beartrap Lake, while receiving additional flow from Spring, Sterling, and many unnamed creeks. Iron Lake extends 4.7 miles along the international border before exiting this subwatershed and contributing its waters to Bottle Lake (69-1064-00). There are a total of 36 lakes greater than 10 acres, with the most prominent being Crooked, Iron, Jackfish, Sinneeg, and Sterling. This subwatershed is dominated by forest (56.09%), wetland (27.78%), and open water (15.96%). Only 0.12% is developed, 0.05% is rangeland, and there is no barren/mining or row-crop agriculture. This entire subwatershed lies within the Superior National Forest, with the majority (96.3%) of it within the BWCAW. A portion of the Tick Lake and Sundial Lake Primitive Management Area lies within this drainage. Much of the land within this subwatershed is owned and managed by local, state, and federal entities (USGS, 2008). As a result of overall remoteness, short tributary streams and many large bodies of water; there was no biological or intensive water chemistry sampling conducted within this subwatershed.

Table 38. Lake assessments: Crooked Lake Aggregated 12-HUC.

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators:			Aquatic Recreation Indicators:			Aquatic Life Use	Aquatic Recreation Use
							Fish IBI	Chloride	Pesticides	Total Phosphorus	Chlorophyll-a	Secchi		
Maingan	38-0796-00	21.7	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Wabosons	38-0806-00	34.1	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Niki	38-0814-00	53.0	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Papoose	38-0818-00	39.8	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Fox	69-0204-00	28.6	7	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Pakwene	38-0797-00	23.3	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Chippewa	38-0809-00	82.5	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Wagosh	69-0088-00	45.9	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Dark	69-0202-00	32.7	10	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators: Fish IBI	Aquatic Life Indicators: Chloride	Aquatic Life Indicators: Pesticides	Aquatic Recreation Indicators: Total Phosphorus	Aquatic Recreation Indicators: Chlorophyll-a	Aquatic Recreation Indicators: Secchi	Aquatic Life Use	Aquatic Recreation Use
Jackfish	38-0794-00	206.7	- -	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Bear Trap	69-0089-00	119.9	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Sinneeg	69-0090-00	157.5	32	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Sunday	69-0104-00	115.7	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	MTS	- -	SUP
Rush	69-0203-00	110.1	- -	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Sterling	69-0206-00	154.4	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Crooked	38-0817-00	5191.3	160	Deep Lake	NLF	D	- -	- -	- -	- -	- -	MTS	- -	SUP
Iron	69-0121-00	1462.1	65	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	MTS	- -	SUP

Abbreviations for Ecoregion: DA = Driftless Area, NCHF = North Central Hardwood Forest, NGP = Northern Glaciated Plains, NLF = Northern Lakes and Forests, NMW = Northern Minnesota Wetlands, RRV = Red River Valley, WCBP = Western Corn Belt Plains
Abbreviations for Secchi Trend: D = decreasing/declining trend, I = increasing/improving trend, NT = no detectable trend, -- = not enough data
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Key for Cell Shading: ☐ = existing impairment, listed prior to 2014 reporting cycle; ☐ = new impairment; ☐ = full support of designated use; ☐ = insufficient information.

Summary

The Crooked Lake Subwatershed had no assessable stream segments and 14 lakes assessed for aquatic recreation (Table 38). All of the lakes met the applicable standards or criteria and fully support aquatic recreation (Figure 58). Lakes within the Crooked Lake subwatershed are highlighted by Crooked (38-0817-00) and Iron Lake (69-0121-00), large and prominent lakes on the international border near the center of the BWCAW. This subwatershed had 14 lakes that fully support aquatic recreation based on remotely sensed Secchi transparency. Other prominent lakes that fully support aquatic recreation include Jackfish (38-0794-00), Sinneeg (69-0090-00), and Sterling (69-0206-00).

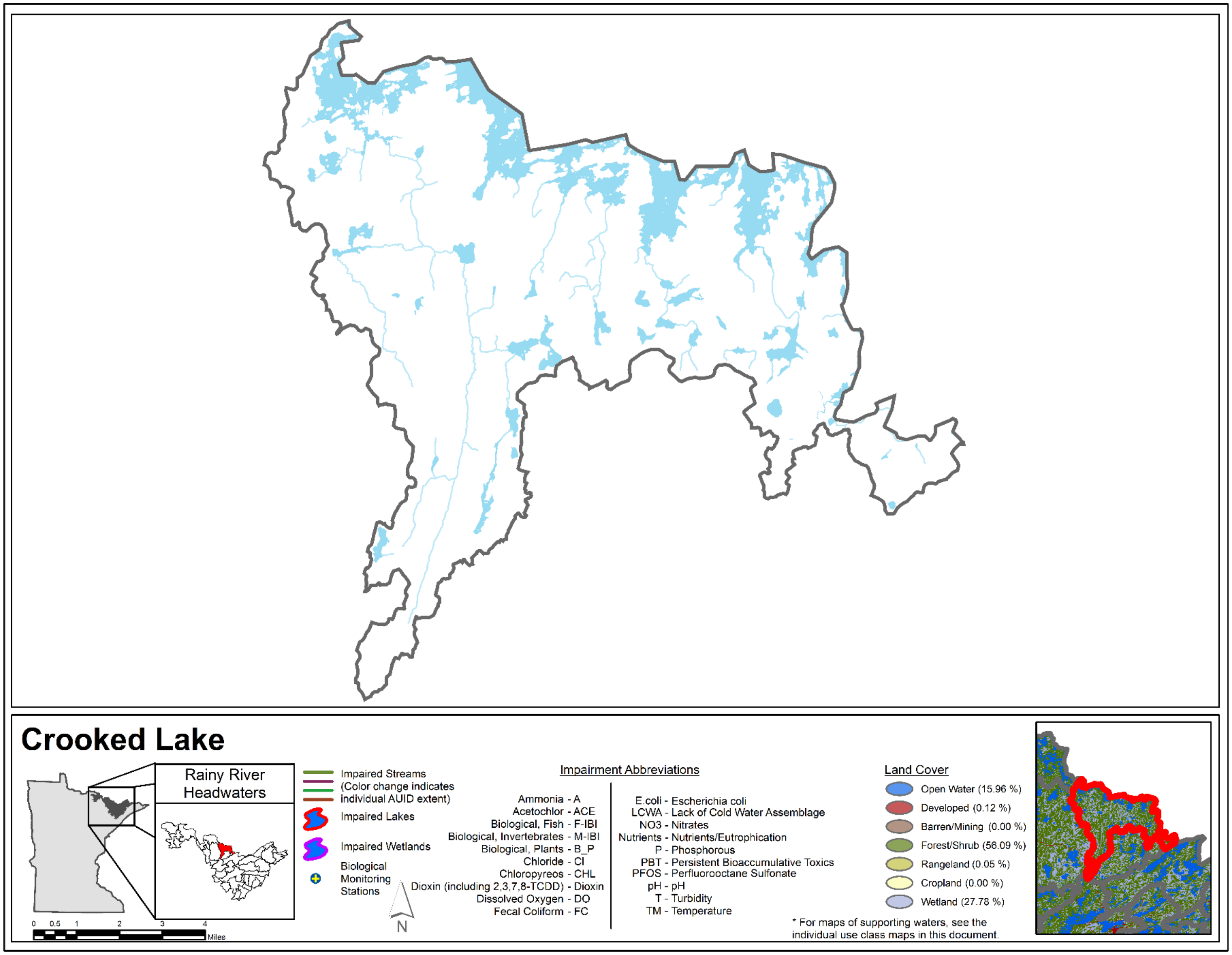

Figure 58. Currently listed impaired waters by parameter and land use characteristics in the Crooked Lake Aggregated 12-HUC.

Horse River Aggregated 12-HUC HUC 0903000113-02

The Horse River Subwatershed drains 51.82 square miles of Lake (35.9%) and St. Louis (64.1%) counties and is the eighth smallest subwatershed within the Rainy River-Headwaters Watershed. This subwatershed encompasses Fourtown Lake (38-0813-00), which has three main tributaries that enter it from the north, south, and west. The northern tributary flows 8.4 miles through Gull, Gun, Bullet, and Moosecamp Lake before contributing its waters to Fourtown Lake. Boot Lake (69-0100-00) receives water from four unnamed tributaries before connecting to Fourtown Lake by a narrow channel along its western shoreline. The southern tributary to Fourtown Lake flows 8.9 miles from its headwaters in Hopkins Lake (69-0101-00), while connecting with South Hegman (69-0075-02), Nels (69-0080-00), Picket (69-0079-00), and Mudro Lake (69-0078-00). Horse Lake receives majority of its waters from Fourtown and Tin Can Mike Lake (38-0785-00) before it connects to the Horse River. The Horse River flows 4.3 miles before exiting this subwatershed and contributing its waters to the Basswood River. There are a total of 27 lakes greater than 10 acres, with the most prominent being Fourtown, Horse, Gun, Boot, and Nels. This subwatershed is dominated by forest (55.28%), wetland (30.32%), and open water (13.96%). Only 0.31% is rangeland, 0.14% is developed, and there is no barren/mining or row-crop agriculture. This entire subwatershed lies within the Superior National Forest, with a large portion (77.3%) of it within the BWCAW. A portion of the Tick Lake Primitive Management Area lies within this drainage. Much of the land within this subwatershed is owned and managed by local, state, and federal entities (USGS, 2008). As a result of overall remoteness, short tributary streams and many large bodies of water; there was no intensive water chemistry sampling conducted on rivers and streams within this subwatershed.

Table 39. Aquatic life and recreation assessments on stream reaches: Horse River Aggregated 12-HUC. Reaches are organized upstream to downstream in the table.

AUID ***Reach Name***, *Reach Description*	Biological Station ID	Reach Length (miles)	Use Class	Aquatic Life Indicators: Fish IBI	Invert IBI	Dissolved Oxygen	TSS	Secchi Tube	Chloride	pH	Ammonia -NH_3	Pesticides	Eutrophication	Aquatic Life	Aquatic Rec. (Bacteria)
09030001-719 **Horse River** **Headwaters (Horse Lk 38-0792-00) to Rainy R**	14RN002	4.27	WWg	MTS	MTS	IF	- -	IF	- -	IF	- -	- -	- -	SUP	- -

Abbreviations for Indicator Evaluations: **MTS** = Meets Standard; **EXS** = Fails Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Impaired (Fails Standards)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.
Abbreviations for Use Class: **WWg** = warmwater general, **WWm** = Warmwater modified, **WWe** = Warmwater exceptional, **CWg** = Coldwater general, **CWe** = Coldwater exceptional, **LRVW** = limited resource value water
*Assessments were completed using proposed use classifications changes that have not yet been written into rule.

Table 40. Lake assessments: Horse River Aggregated 12-HUC.

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators:			Aquatic Recreation Indicators:			Aquatic Life Use	Aquatic Recreation Use
							Fish IBI	Chloride	Pesticides	Total Phosphorus	Chlorophyll-a	Secchi		
Bullet	38-0815-00	42.1	10	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Regenbogen	69-0081-00	11.3	34	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
First	69-0119-00	15.6	40	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Mudro	69-0078-00	90.3	76	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Mudhole	69-0091-00	10.4	- -	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Tin Can Mike	38-0785-00	141.2	29	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	MTS	- -	SUP
Moosecamp	38-0816-00	163.4	16	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
South Hegman	69-0075-02	184.6	55	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Nels	69-0080-00	177.6	30	Deep Lake	NLF	- -	- -	- -	- -	MTS	MTS	IF	- -	SUP

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators: Fish IBI	Aquatic Life Indicators: Chloride	Aquatic Life Indicators: Pesticides	Aquatic Recreation Indicators: Total Phosphorus	Aquatic Recreation Indicators: Chlorophyll-a	Aquatic Recreation Indicators: Secchi	Aquatic Life Use	Aquatic Recreation Use
Gull	69-0092-00	168.2	13	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Gun	69-0093-00	335.8	57	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	MTS	- -	SUP
Fairy	69-0094-00	102.9	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Boot	69-0100-00	313.6	27	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Horse	38-0792-00	698.5	25	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	MTS	- -	SUP
Fourtown	38-0813-00	1164.5	25	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	IF	- -	IF

Abbreviations for Ecoregion: DA = Driftless Area, NCHF = North Central Hardwood Forest, NGP = Northern Glaciated Plains, NLF = Northern Lakes and Forests, NMW = Northern Minnesota Wetlands, RRV = Red River Valley, WCBP = Western Corn Belt Plains
Abbreviations for Secchi Trend: D = decreasing/declining trend, I = increasing/improving trend, NT = no detectable trend, -- = not enough data
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Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.

Summary

The Horse River Subwatershed had one assessable stream segment, containing one biological monitoring station, and nine lakes assessed for aquatic recreation (Table 39 and Table 40). All of the streams and lakes met the applicable standards or criteria and fully support aquatic life and aquatic recreation (Figure 59). The only biological monitoring station (14RN002) was located near the outlet of this subwatershed on the Horse River (-719). In-stream habitat characteristics varied widely along this 4.3 mile long stream segment (-719) but was in good condition at the biological monitoring station (Appendix 5). As a result of quality habitat and good water quality, a relatively diverse fish and macroinvertebrate community was present. Several sensitive fish (longnose dace, burbot, etc.) and macroinvertebrate species (mayflies, stoneflies, caddisflies, and dragonflies) were present and indicated excellent water quality. This was expected, as the majority of the upstream drainage is undeveloped and lies within the BWCAW. Most lakes in the Horse River subwatershed are within the BWCAW. They are high quality and fully support aquatic recreation based on remotely sensed Secchi data (Figure 83). Nels Lake (69-0080-00), just outside the BWCAW, was monitored by a local partner and had excellent water quality that fully supported aquatic recreation.

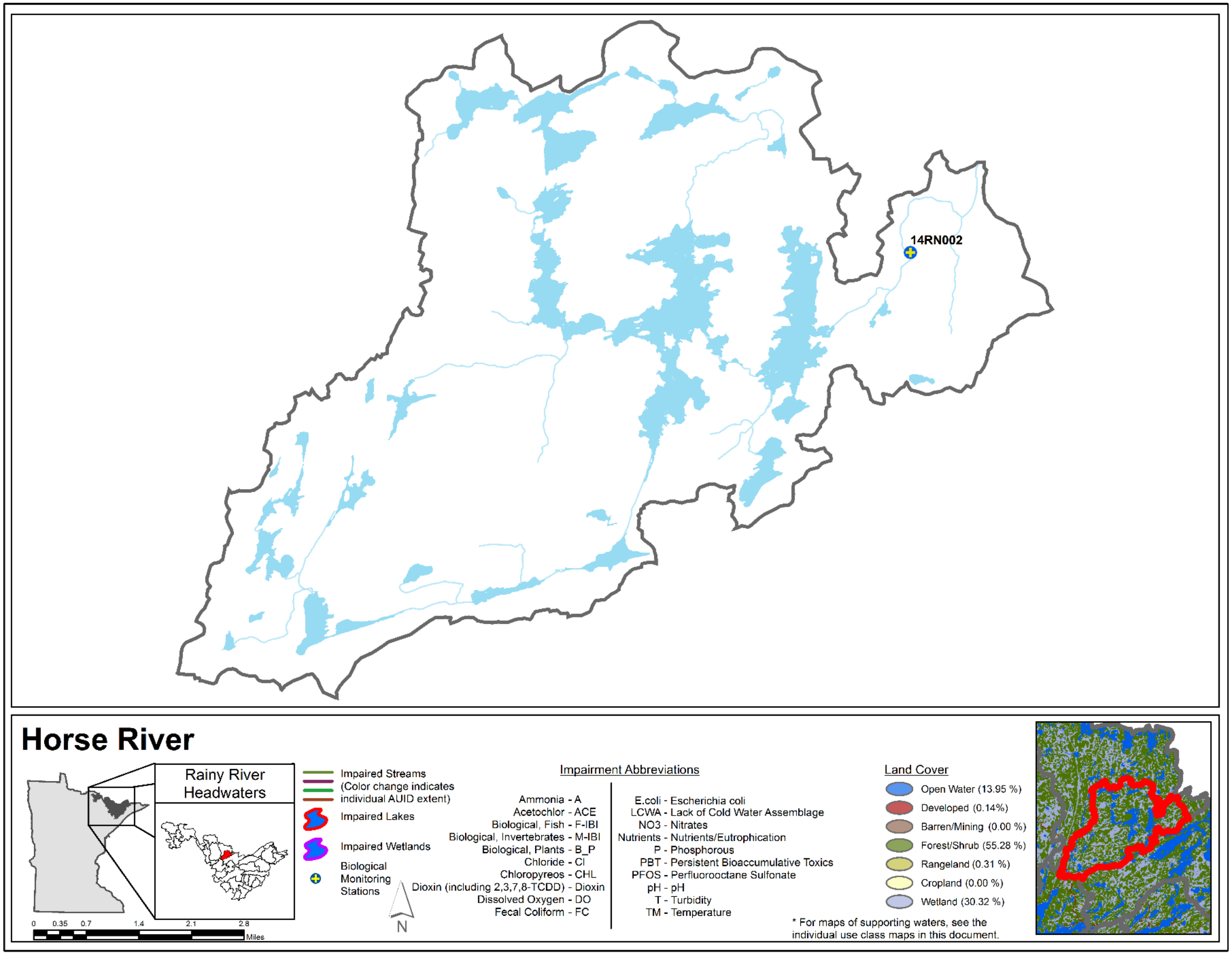

Figure 59. Currently listed impaired waters by parameter and land use characteristics in the Horse River Aggregated 12-HUC.

Boulder River Aggregated 12-HUC HUC 0903000118-01

The Boulder River Subwatershed drains 155.06 square miles of St. Louis County and is the third largest subwatershed within the Rainy River-Headwaters Watershed. There are many perennial streams throughout this subwatershed, with the most notable being the Boulder, Moose, Portage, Stuart, Nina Moose, and Dahlgren Rivers. The Moose River begins at the outlet of Big Moose Lake (69-0316-00) and flows 12.7 miles to the north, while receiving additional flow from Bezhik, Big Bull, Tubfull, Johns, and numerous unnamed creeks. The Portage River, from the outlet of Rice Lake (69-0185-00), flows 20.8 miles to the north while receiving additional flow from Duck, Bill, Legend, and numerous unnamed creeks. Both the Moose and Portage River contribute their waters to Nina Moose Lake (69-0340-00). The Nina Moose River, beginning at the outlet of Nina Moose Lake, flows 3.3 miles to the north. The Nina Moose River receives additional flow from Ramshead Creek, Oyster River, and numerous unnamed tributaries before contributing its waters to Lake Agnes (69-0223-00). The Boulder River, beginning at the outlet of Lake Agnes, flows 2.9 miles to the northeast before exiting this subwatershed and contributing its waters to Lac La Croix Lake (69-0224-00). Before exiting this subwatershed, the Boulder River receives additional flow from Dahlgren River. The Dahlgren River begins at the outlet of Stuart Lake (69-0205-00) and flows 3.8 miles to the north. The largest contributing stream to Stuart Lake is the Stuart River, which flows 9.0 miles from its headwaters in Baldpate Lake (69-0198-00). There are a total of 42 lakes greater than 10 acres, with the most prominent being Big, Agnes, Big Moose, Stuart, and Oyster. This subwatershed is dominated by forest (57.76%), wetland (32.06%), and open water (9.72%). Only 0.41% is developed, 0.05% is rangeland and there is no barren/mining or row-crop agriculture. This entire subwatershed lies within the Superior National Forest, with the majority (72.5%) of it within the BWCAW. A portion of the Canthook Lake, Sundial Lake, and Weeny Lake Primitive Management Area lies within this drainage. Much of the land within this subwatershed is owned and managed by local, state, and federal entities (USGS, 2008). As a result of overall remoteness, there was no intensive water chemistry sampling conducted on rivers and streams within this subwatershed.

Table 41. Aquatic life and recreation assessments on stream reaches: Boulder River Aggregated 12-HUC. Reaches are organized upstream to downstream in the table.

AUID *Reach Name*, *Reach Description*	Biological Station ID	Reach Length (miles)	Use Class	Aquatic Life Indicators: Fish IBI	Invert IBI	Dissolved Oxygen	TSS	Secchi Tube	Chloride	pH	Ammonia -NH_3	Pesticides	Eutrophication	Aquatic Life	Aquatic Rec. (Bacteria)
09030001-744 **Duck Creek** **Boundary Waters Canoe Area Wilderness Boundary to Portage R**	14RN047	3.12	WWg	MTS	MTS	IF	IF	IF	--	IF	IF	--	IF	SUP	--
09030001-788 **Portage River** **T65 R14W S24, east line to T65 R13W S19, north line**	14RN045	0.92	WWg	MTS	MTS	IF	IF	IF	--	IF	IF	--	IF	SUP	--
09030001-601 **Portage River** **T65 R14W S12, east line to Nina Moose Lk**	14RN044 10EM109	2.42	WWg	MTS	MTS	IF	IF	IF	--	IF	IF	--	IF	SUP	--
09030001-975 **Bezhik Creek** **Boundary Waters Canoe Area Wilderness Boundary to Moose R**	14RN036	0.90	WWe	MTS	MTS	IF	IF	IF	--	IF	IF	--	IF	SUP	--
09030001-521 **Moose River** **T65 R14W S34, south line to T65 R14W S11, 0.09 mi above south line**	14RN035 05RN076 14RN034	7.62	WWg	MTS	--	IF	IF	IF	--	IF	MTS	--	IF	SUP	--
09030001-650 **Nina Moose River** **Nina Moose Lk to Ramshead Cr**	14RN043	2.40	WWg	MTS	MTS	IF	--	IF	--	IF	--	--	--	SUP	--

Abbreviations for Indicator Evaluations: **MTS** = Meets Standard; **EXS** = Fails Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Impaired (Fails Standards)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.
Abbreviations for Use Class: **WWg** = warmwater general, **WWm** = Warmwater modified, **WWe** = Warmwater exceptional, **CWg** = Coldwater general, **CWe** = Coldwater exceptional, **LRVW** = limited resource value water
*Assessments were completed using proposed use classifications changes that have not yet been written into rule.

Table 42. Aquatic life and recreation assessments on stream reaches: Boulder River Aggregated 12-HUC. Reaches are organized upstream to downstream in the table.

AUID *Reach Name*, *Reach Description*	Biological Station ID	Reach Length (miles)	Use Class	Aquatic Life Indicators: Fish IBI	Invert IBI	Dissolved Oxygen	TSS	Secchi Tube	Chloride	pH	Ammonia -NH_3	Pesticides	Eutrophication	Aquatic Life	Aquatic Rec. (Bacteria)
09030001-733 **Stuart River** **Jerry Cr to Mule Cr**	14RN041	3.81	WWg	- -	MTS	IF	- -	IF	- -	IF	- -	- -	- -	SUP	- -

Abbreviations for Indicator Evaluations: **MTS** = Meets Standard; **EXS** = Fails Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Impaired (Fails Standards)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.
Abbreviations for Use Class: **WWg** = warmwater general, **WWm** = Warmwater modified, **WWe** = Warmwater exceptional, **CWg** = Coldwater general, **CWe** = Coldwater exceptional, **LRVW** = limited resource value water
*Assessments were completed using proposed use classifications changes that have not yet been written into rule.

Table 43. Lake assessments: Boulder River Aggregated 12-HUC.

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators:			Aquatic Recreation Indicators:			Aquatic Life Use	Aquatic Recreation Use
							Fish IBI	Chloride	Pesticides	Total Phosphorus	Chlorophyll-a	Secchi		
Nibin	69-0208-00	38.1	- -	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Meander	69-0329-00	97.4	25	Deep Lake	NLF	NT	- -	IF	- -	IF	IF	IF	IF	IF
Hook	69-0182-00	87.1	13	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Bibon	69-0207-00	26.2	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Emerald	69-0335-00	72.4	34	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Lamb	69-0341-00	98.2	20	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Nina Moose	69-0340-00	411.1	6	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Rocky	69-0342-00	118.7	40	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Big	69-0190-00	1873.5	22	Deep Lake	NLF	NT	- -	MTS	- -	MTS	MTS	MTS	IF	SUP

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators: Fish IBI	Aquatic Life Indicators: Chloride	Aquatic Life Indicators: Pesticides	Aquatic Recreation Indicators: Total Phosphorus	Aquatic Recreation Indicators: Chlorophyll-a	Aquatic Recreation Indicators: Secchi	Aquatic Life Use	Aquatic Recreation Use
Stuart	69-0205-00	770.3	40	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Agnes	69-0223-00	1044.4	30	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	MTS	- -	IF
Oyster	69-0330-00	766.4	130	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP

Abbreviations for Ecoregion: DA = Driftless Area, NCHF = North Central Hardwood Forest, NGP = Northern Glaciated Plains, NLF = Northern Lakes and Forests, NMW = Northern Minnesota Wetlands, RRV = Red River Valley, WCBP = Western Corn Belt Plains
Abbreviations for Secchi Trend: D = decreasing/declining trend, I = increasing/improving trend, NT = no detectable trend, -- = not enough data
Abbreviations for Indicator Evaluations: -- = No Data, **MTS** = Meets Standard; **EXS** = Exceeds Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Not Support (Impaired, exceeds standard)
Key for Cell Shading: ☐ = existing impairment, listed prior to 2014 reporting cycle; ☐ = new impairment; ☐ = full support of designated use; ☐ = insufficient information.

Summary

The Boulder River Subwatershed had seven assessable stream segments, containing 10 biological monitoring station, and seven lakes assessed for aquatic recreation (Table 41 and Table 43). All of the streams and lakes met the applicable standards or criteria and fully support aquatic life and/or aquatic recreation (Figure 61). The low amount of disturbance within the subwatershed almost assures excellent biological integrity. Streams that have exceptional performing biological, chemical, and physical characteristics are worthy of additional protection. A use class analysis was conducted on all assessed waterbodies within the Rainy River-Headwaters Watershed. Streams that could support an exceptional use designation received additional protections from a more stringent water quality standard. Although many of the streams within this subwatershed met some of the exceptional use criteria, only Bezhik Creek (-975) met all the requirements to be designated as such (WWe). Bezhik Creek had one biological monitoring station (14RN036) that contain several sensitive fish and macroinvertebrate species. A rich diversity of species were found during monitoring indicating excellent water quality. This entire drainage is undeveloped, with the majority of it within the BWCAW. Bezhik Creek eventually contributes its waters to the Moose River.

Although the Moose River (-521) was not designated as exceptional, many individual biological stations (14RN035, 05RN076, 14RN034) had characteristics of an exceptional resource. F-IBI scores tended to decline with the increase of drainage but were still all above or near (65.2-76.0) the exceptional use standard. This trend may be due to natural variation in habitat and species composition between the stations and not a true indication of declining water quality. A long-term biological monitoring station (05RN076) was located just downstream of Moose Loop Rd (FR 464), 17 miles northwest of Ely. The station had three fish visits that varied in F-IBI score from just below (66.3 and 68.9) to above (72.8) the exceptional use threshold (Figure 60). Only one macroinvertebrate sample (05RN076) was taken along this reach in 2005. Although this data was not used in the assessment (>10 years old), it did have numerous sensitive species and an M-IBI above the exceptional use threshold. In-stream habitat was fair, likely a consequence of the low gradient (0.02-0.27 m/km), fine sediments, and headwater nature of this specific stream segment. This stream segment should be consider for extra protections in the Watershed Restoration and Protection Strategy.

Figure 60. The Moose River (05RN076), a pristine waterbody that flows out and back into the BWCAW.

Six other biological monitoring stations are located along five stream reaches including the Portage River (-601 and -788), Nina Moose River (-650), Stuart River (-733), and Duck Creek (-744). All of these stations meet the applicable standards for aquatic life, with four of the five fish visits and one of the six macroinvertebrate visits meeting exceptional use standards. All six stations had a good habitat rating and supported a diversity of fish and macroinvertebrates (Appendix 5). A total of 26 fish species, including a number of sensitive species, were captured during the monitoring of this subwatershed. The macroinvertebrate community also indicated similar conditions, with 142 unique taxonomic groups present. This entire subwatershed had outstanding performing biological, chemical, and physical characteristics, worthy of additional protection.

Most lakes in the Boulder River Subwatershed are deep within the BWCAW and as such are high quality. Numerous lakes within this subwatershed fully support aquatic recreation based on remote sensed Secchi transparency (Figure 83). Examples include: Oyster (69-0330-00), Stuart (69-0205-00), and

Emerald (69-0335-00). Big Lake (69-0190-00), on the Echo Trail northwest of Ely, was monitored by the MPCA. This lake, located on the edge of the BWCAW had excellent water quality clearly met eutrophication standards to protect aquatic recreation.

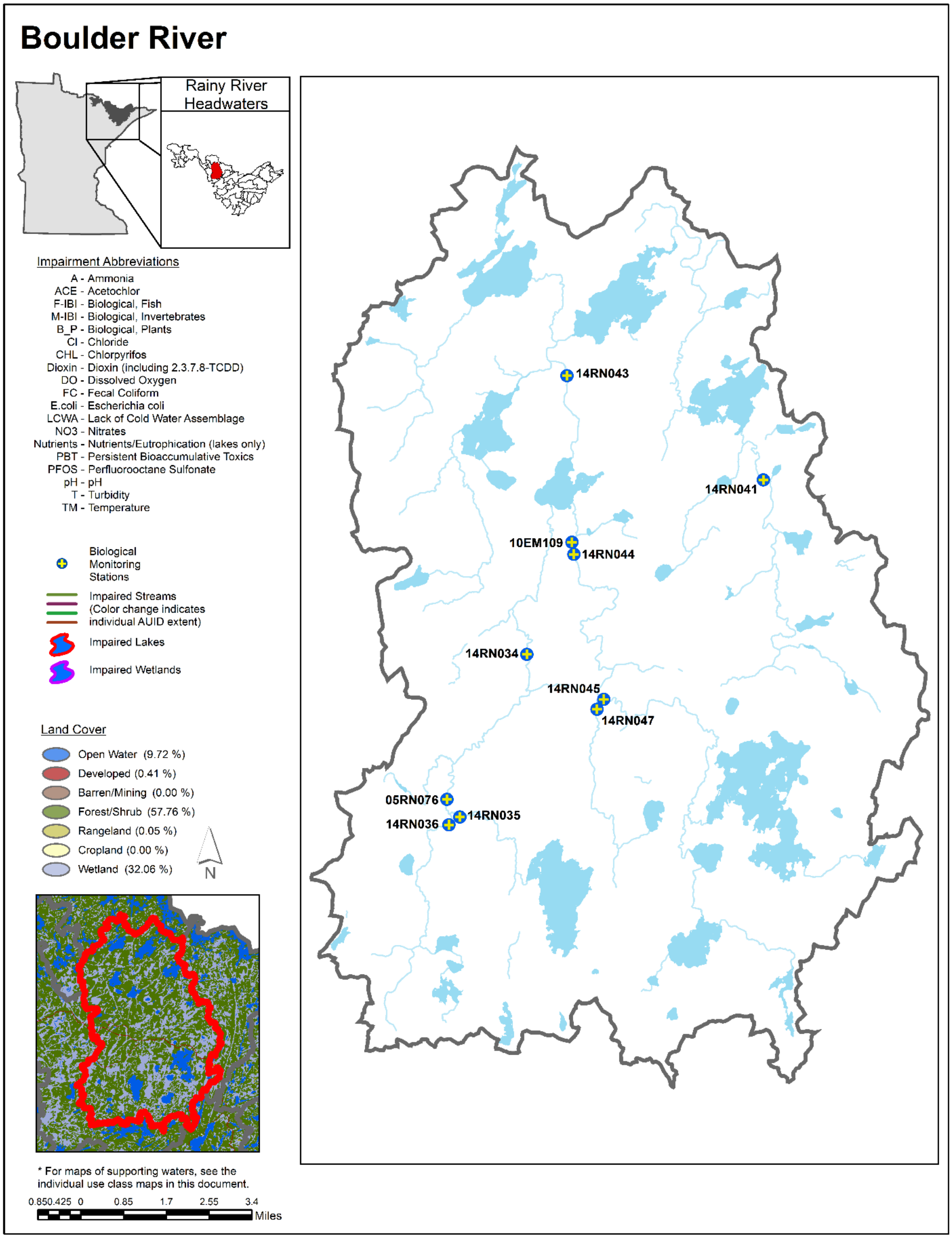

Figure 61. Currently listed impaired waters by parameter and land use characteristics in the Boulder River Aggregated 12-HUC.

Lac La Croix Aggregated 12-HUC HUC 0903000119-01

The Lac La Croix Subwatershed drains 92.66 square miles of St. Louis County and is the sixteenth smallest subwatershed within the Rainy River-Headwaters Watershed. This subwatershed lies along the international border between the United States and Canada, with additional drainage on the Canadian side. Lac La Croix (69-0224-00), the largest lake within this subwatershed, has a surface area of 29,596.7 acres and over 482.4 miles of shoreline between the United States and Canada. Many named and unnamed streams connect lakes within this subwatershed to Lac La Croix. Two major inlets (Boulder River and Crooked Lake Subwatersheds) connect to the eastern side of Lac La Croix. There are a total of 53 lakes greater than 10 acres, with the most prominent being Lac La Croix, Ge-Be-On-Equat, Takucmich, Hustler, Finger, Pocket and Gun. This subwatershed is dominated by forest (57.45%), open water (31.65%), and wetland (10.90%). There is no developed, rangeland, barren/mining, or row-crop agriculture within this subwatershed. This entire subwatershed lies within the Superior National Forest and the BWCAW, with all of the land under state and federal management (USGS, 2008). A portion of the Weeny Lake Primitive Management Area lies within this drainage. Numerous fires have burned a portion of this subwatershed, with the most notable being the Gun Lake fire of 1991, Coleman fire of 2006, and the Shell Lake fire of 2010. As a result of overall remoteness, short tributary streams and many large bodies of water; there was no biological or intensive water chemistry sampling conducted within this subwatershed.

Table 44. Lake assessments: Lac La Croix Aggregated 12-HUC.

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators:			Aquatic Recreation Indicators:			Aquatic Life Use	Aquatic Recreation Use
							Fish IBI	Chloride	Pesticides	Total Phosphorus	Chlorophyll-a	Secchi		
Little Beartrack	69-0479-00	46.6	35	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Little Hustler	69-0332-00	66.8	70	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
South	69-0474-00	34.4	10	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Hustler	69-0343-00	270.6	60	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	IF	- -	SUP
Green	69-0358-00	151.3	23	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Takucmich	69-0369-00	339.9	150	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Eugene	69-0473-00	182.2	60	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Steep	69-0475-00	99.8	40	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Slim	69-0478-00	138.3	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators: Fish IBI	Aquatic Life Indicators: Chloride	Aquatic Life Indicators: Pesticides	Aquatic Recreation Indicators: Total Phosphorus	Aquatic Recreation Indicators: Chlorophyll-a	Aquatic Recreation Indicators: Secchi	Aquatic Life Use	Aquatic Recreation Use
Beartrack	69-0480-00	158.6	55	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
North	69-0488-00	166.2	10	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Lac la Croix	69-0224-00	13706.6	169	Deep Lake	NLF	NT	- -	- -	- -	- -	- -	IF	- -	SUP
Ge-Be-On-Equat	69-0350-00	656.0	55	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP

Abbreviations for Ecoregion: DA = Driftless Area, NCHF = North Central Hardwood Forest, NGP = Northern Glaciated Plains, NLF = Northern Lakes and Forests, NMW = Northern Minnesota Wetlands, RRV = Red River Valley, WCBP = Western Corn Belt Plains
Abbreviations for Secchi Trend: D = decreasing/declining trend, I = increasing/improving trend, NT = no detectable trend, -- = not enough data
Abbreviations for Indicator Evaluations: -- = No Data, **MTS** = Meets Standard; **EXS** = Exceeds Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Not Support (Impaired, exceeds standard)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.

Summary

The Lac La Croix Subwatershed had no assessable stream segments and 13 lakes assessed for aquatic recreation based on satellite estimates of Secchi transparency (Table 44). All of the lakes met the applicable standards or criteria and fully support aquatic recreation (Figure 62). Examples of high quality lakes in this subwatershed that fully support aquatic recreation include Lac La Croix (69-0224-00), Slim (69-0478-00), and Beartrack (69-0480-00).

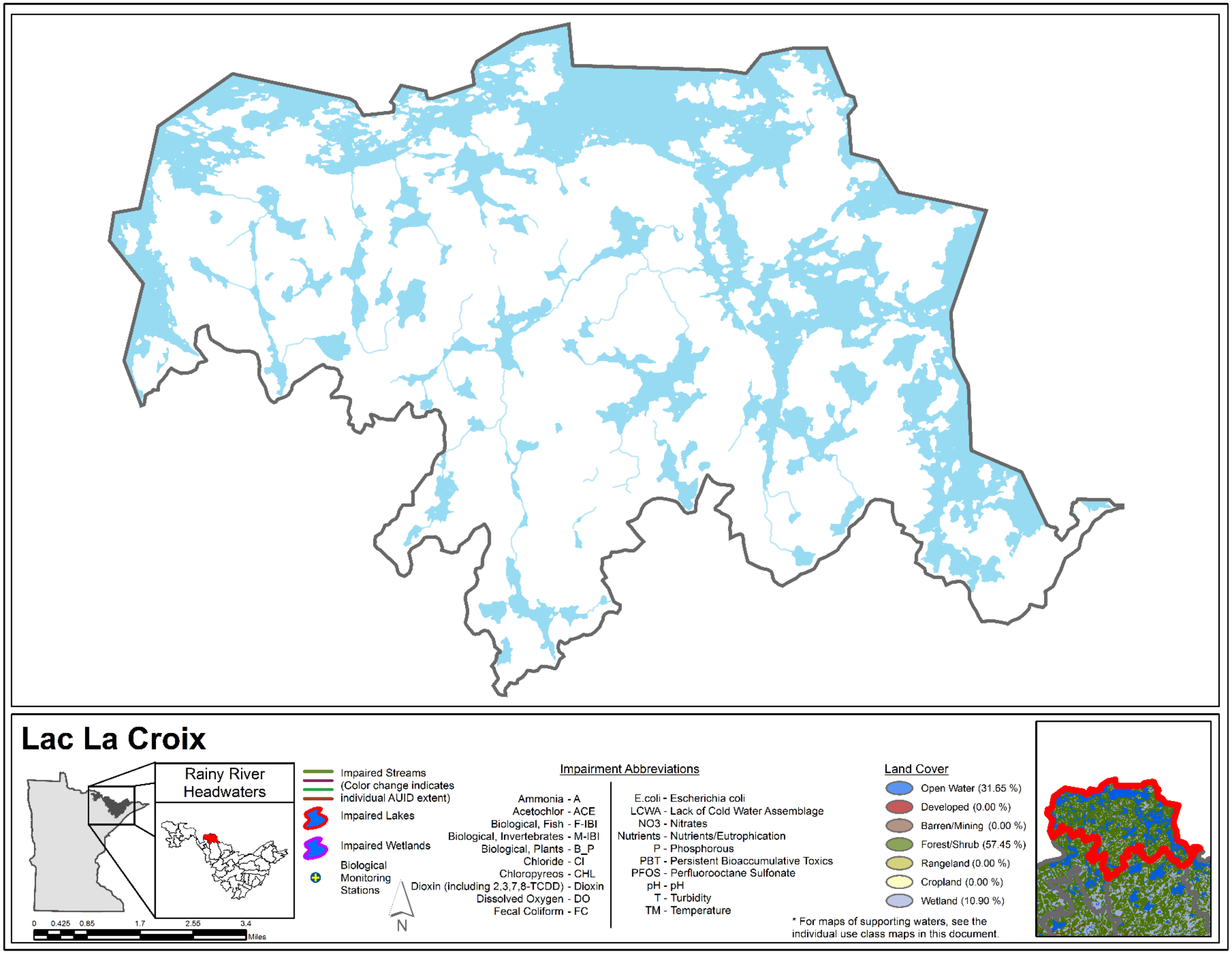

Figure 62. Currently listed impaired waters by parameter and land use characteristics in the Lac La Croix Aggregated 12-HUC.

Loon River Aggregated 12-HUC HUC 0903000120-01

The Loon River Subwatershed drains 68.35 square miles of St. Louis County and is the thirteenth smallest subwatershed within the Rainy River-Headwaters Watershed. This subwatershed lies along the international border between the United States and Canada, with additional drainage on the Canadian side. Two major inlets enter this subwatershed from the north (Lac La Croix Subwatershed) and south (Little Indian Sioux River Subwatershed) shoreline of Loon Lake (69-0470-00). The Loon River begins at the outlet of Loon Lake and flows 4.8 miles to the west, while receiving additional flow from Beaver Stream and numerous unnamed tributaries. Little Vermilion Lake (69-0608-00) receives water from the Loon River, along with other tributary streams, before exiting this subwatershed and contributing its waters to Sand Point Lake (69-0617-00). There are a total of 28 lakes greater than 10 acres, with the most prominent being Loon, Little Vermilion, Shell, Lynx, and Heritage. This subwatershed is dominated by forest (66.20%), wetland (21.74%), and open water (11.81%). Only 0.22% is rangeland, 0.03% is developed, and there is no barren/mining or row-crop agriculture. The Superior National Forest encompasses this entire subwatershed, with the majority (85.8%) of it within the BWCAW. Much of the land within this subwatershed is owned and managed by local, state, and federal entities (USGS, 2008). The Shell Lake fire of 2010 has burned a small portion of this subwatershed. As a result of overall remoteness, short tributary streams and many large bodies of water; there was no biological or intensive water chemistry sampling conducted within this subwatershed.

Table 45. Lake assessments: Loon River Aggregated 12-HUC.

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators:			Aquatic Recreation Indicators:			Aquatic Life Use	Aquatic Recreation Use
							Fish IBI	Chloride	Pesticides	Total Phosphorus	Chlorophyll-a	Secchi		
Little Shell	69-0384-00	90.1	- -	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Lynx	69-0383-00	283.8	85	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	MTS	- -	SUP
Shell	69-0461-00	486.4	15	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Heritage	69-0469-00	211.1	40	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Little Vermilion	69-0608-00	430.8	52	Deep Lake	NLF	- -	- -	IF	- -	MTS	MTS	MTS	IF	SUP
Loon	69-0470-00	1935.9	75	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP

Abbreviations for Ecoregion: DA = Driftless Area, NCHF = North Central Hardwood Forest, NGP = Northern Glaciated Plains, NLF = Northern Lakes and Forests, NMW = Northern Minnesota Wetlands, RRV = Red River Valley, WCBP = Western Corn Belt Plains
Abbreviations for Secchi Trend: D = decreasing/declining trend, I = increasing/improving trend, NT = no detectable trend, -- = not enough data
Abbreviations for Indicator Evaluations: -- = No Data, **MTS** = Meets Standard; **EXS** = Exceeds Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Not Support (Impaired, exceeds standard)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.

Summary

The Loon River Subwatershed had no assessable stream segments and five lakes assessed for aquatic recreation (Table 45). All of the lakes met the applicable standards or criteria and fully support aquatic recreation (Figure 63). Little Vermilion Lake (69-0608-00) drains the Loon River and BWCAW lakes upstream; nutrient and algal levels based on monitoring conducted by the MPCA and VNP were in low. Water levels in Little Vermilion Lake are controlled by a dam at the Namakan Lake outlet at Kettle Falls on the Minnesota/Ontario border. A few BWCAW lakes upstream fully support aquatic recreation based on satellite estimated Secchi transparency, such as Loon (69-0470-00) and Lynx Lakes (69-0383-00; Figure 83).

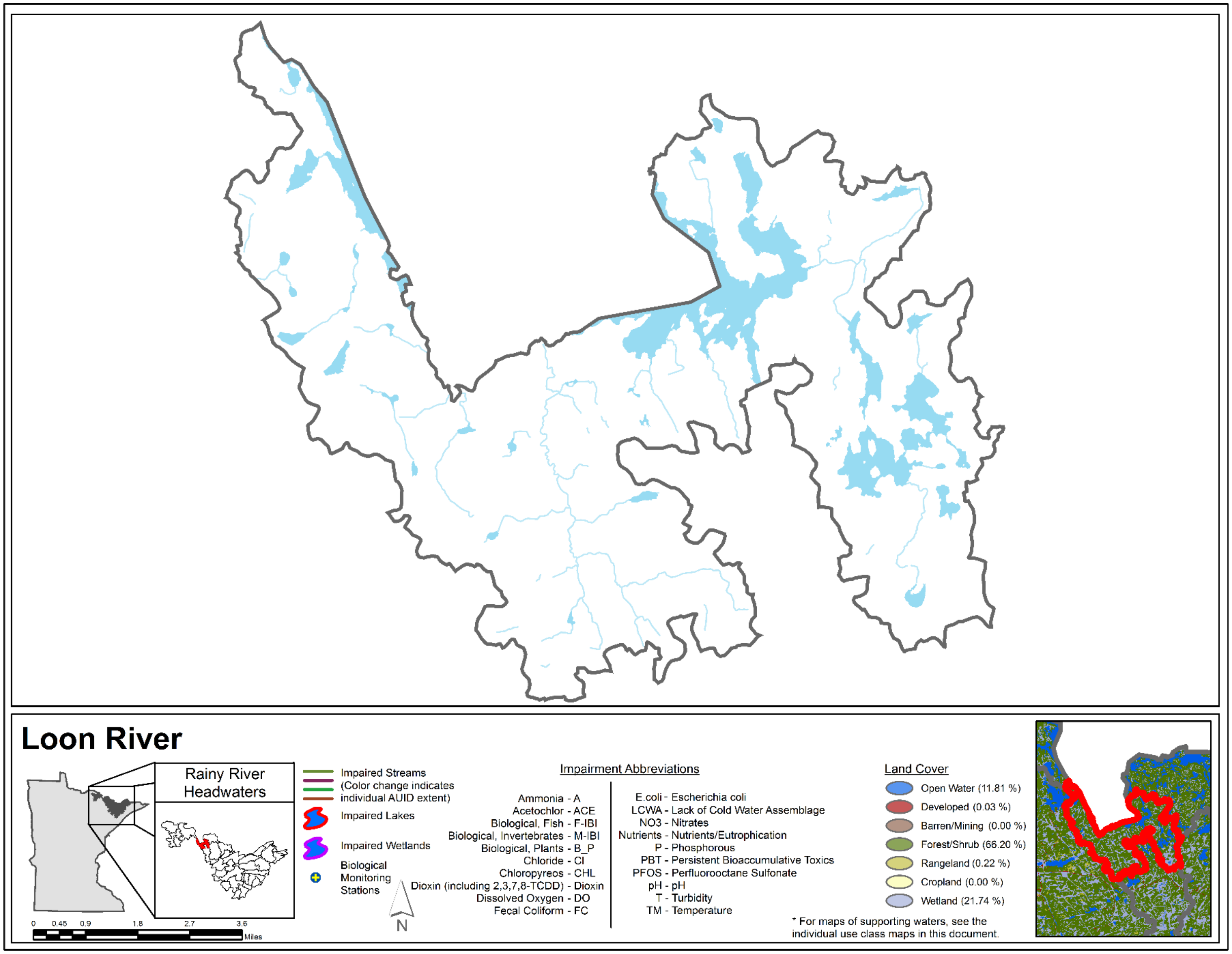

Figure 63. Currently listed impaired waters by parameter and land use characteristics in the Loon River Aggregated 12-HUC.

Little Indian Sioux River Aggregated 12-HUC HUC 0903000120-02

The Little Indian Sioux River Subwatershed drains 100.59 square miles of St. Louis County and is the thirteenth largest subwatershed within the Rainy River-Headwaters Watershed. Its headwaters start in a lake rich landscape before draining through the Korb River. Cummings Lake (69-0325-00) receives water from the Korb River and numerous unnamed tributaries before entering Otter Lake (69-0326-00). The Little Indian Sioux River begins at the outlet of Otter Lake and flows to the west. After traveling 6.41 miles, it turns to the north and travels an additional 21.5 miles before passing through Upper (69-0465-00) and Lower Pauness Lakes (69-0464-00). The Little Indian Sioux River continues 2.0 miles to the north from the outlet of Lower Pauness Lake before exiting this subwatershed and contributing its waters to Loon Lake (69-0470-00). On its path, the Little Indian Sioux River receives additional flow from the Little Pony River, Maruins, Teds, Urho, Bellow, Spike Horn, Limpy, Range Line, Jeanette and numerous unnamed creeks. There are a total of 30 lakes greater than 10 acres, with the most prominent being Cummings, Jeanette, and Bootleg. This subwatershed is dominated by forest (62.77%), wetland (28.94%), and open water (7.79%). Only 0.44% is developed, 0.06% is rangeland, and there is no barren/mining or row-crop agriculture. The Superior National Forest encompasses this entire subwatershed, with the majority (70.0%) of it within the BWCAW. A portion of the Canthook Lake Primitive Management Area lies within this drainage. Much of the land within this subwatershed is owned and managed by local, state, and federal entities (USGS, 2008). Portions of this subwatershed have been burned by the Trout Lake fire of 2005 and Cummings Lake fire of 2012. Intensive water chemistry sampling was conducted at the outlet of the subwatershed at Tomahawk Rd (FR 377), 12 miles north of Isabella on the Island River. The outlet is represented by water chemistry station S007-903 and biological station 14RN003.

Table 46. Aquatic life and recreation assessments on stream reaches: Little Indian Sioux River Aggregated 12-HUC. Reaches are organized upstream to downstream in the table.

AUID *Reach Name*, *Reach Description*	Biological Station ID	Reach Length (miles)	Use Class	Aquatic Life Indicators: Fish IBI	Invert IBI	Dissolved Oxygen	TSS	Secchi Tube	Chloride	pH	Ammonia -NH_3	Pesticides	Eutrophication	Aquatic Life	Aquatic Rec. (Bacteria)
09030001-557 **Little Indian Sioux River** **T65 R15W S35, south line to T65 R15W S1, north line**	15RN033 14RN003	9.66	WWg	MTS	MTS	IF	MTS	MTS	MTS	EXS	MTS	- -	MTS	SUP	SUP

Abbreviations for Indicator Evaluations: **MTS** = Meets Standard; **EXS** = Fails Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Impaired (Fails Standards)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.
Abbreviations for Use Class: **WWg** = warmwater general, **WWm** = Warmwater modified, **WWe** = Warmwater exceptional, **CWg** = Coldwater general, **CWe** = Coldwater exceptional, **LRVW** = limited resource value water
*Assessments were completed using proposed use classifications changes that have not yet been written into rule.

Table 47. Lake assessments: Little Indian Sioux River Aggregated 12-HUC.

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators:			Aquatic Recreation Indicators:			Aquatic Life Use	Aquatic Recreation Use
							Fish IBI	Chloride	Pesticides	Total Phosphorus	Chlorophyll-a	Secchi		
Little Crab	69-0296-00	58.5	15	Shallow Lake	NLF	- -	- -	IF	- -	IF	IF	IF	IF	SUP
Lower Pauness	69-0464-00	115.3	35	Deep Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	SUP
Upper Pauness	69-0465-00	189.0	10	Shallow Lake	NLF	- -	- -	- -	- -	- -	- -	IF	- -	IF
Jeanette	69-0456-00	592.3	15	Shallow Lake	NLF	NT	- -	MTS	- -	MTS	MTS	IF	IF	SUP

Abbreviations for Ecoregion: DA = Driftless Area, NCHF = North Central Hardwood Forest, NGP = Northern Glaciated Plains, NLF = Northern Lakes and Forests, NMW = Northern Minnesota Wetlands, RRV = Red River Valley, WCBP = Western Corn Belt Plains
Abbreviations for Secchi Trend: D = decreasing/declining trend, I = increasing/improving trend, NT = no detectable trend, -- = not enough data
Abbreviations for Indicator Evaluations: -- = No Data, **MTS** = Meets Standard; **EXS** = Exceeds Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Not Support (Impaired, exceeds standard)
Key for Cell Shading: ☐ = existing impairment, listed prior to 2014 reporting cycle; ☐ = new impairment; ☐ = full support of designated use; ☐ = insufficient information.

Summary

The Little Indian Sioux River Subwatershed had one assessable stream segment, containing two biological monitoring stations, and three lakes assessed for aquatic recreation (Table 46 and Table 47). All of the streams and lakes met the applicable standards or criteria and fully support aquatic life and/or aquatic recreation (Figure 64). In-stream habitat was in good condition despite the low gradient nature of the majority of the Little Indian Sioux River (Appendix 5). As a result of quality in-stream habitat and good water quality, a relatively diverse fish and macroinvertebrate community was present throughout this subwatershed.

The Little Indian Sioux River was the only stream segment (-557) assessed in this effort, with two biological monitoring stations located on each side of the Echo Trail. The downstream station (14RN003) was originally established in 2014 to characterize the biological condition throughout this reach. Due to difficult sampling conditions at this location, an additional station (15RN033) was establish upstream of the Echo Trail on a low gradient section of river. The upstream section was not sampled for macroinvertebrates as a result of water depth but data from 14RN003 was available for this assessment. Fish community data was only available from 15RN033. A total of seven species were captured, dominated by individuals that are indicative of low gradient, fine sediment, and wetland types of habitat. Several sensitive fish and macroinvertebrate species were captured during monitoring indicating good water quality.

An intensive water chemistry station was also located along this reach (-557). Conventional parameters in this chemistry dataset indicate excellent water quality, reflective of the catchment's wilderness setting; nutrients and sediment levels are low; standards are being met, including those for river eutrophication. Most of the pH samples were less than the 6.5 standard; many of the wetland dominated streams in this subwatershed have low pH; it is likely attributed to natural conditions. Dissolved oxygen is very stable, and consistently above the 5 mg/L standard, based on sonde deployment dataset. *E. coli* bacteria concentrations were consistently low, and indicated full support for aquatic recreation.

Jeanette (69-0456-00), a popular recreational lake with a Superior National Forest Campground, was the only lake in this subwatershed with sufficient chemistry data to assess for aquatic recreation. Jeanette meets standards for phosphorus and Chl-a and fully supports aquatic recreation. Secchi transparency is naturally below the 2-meter standard due to bog staining from the surrounding wetlands. Little Crab (69-0296-00) and Lower Pauness Lake (69-0464-00), within the BWCAW, fully support aquatic recreation based on remotely sensed Secchi transparency (Figure 83).

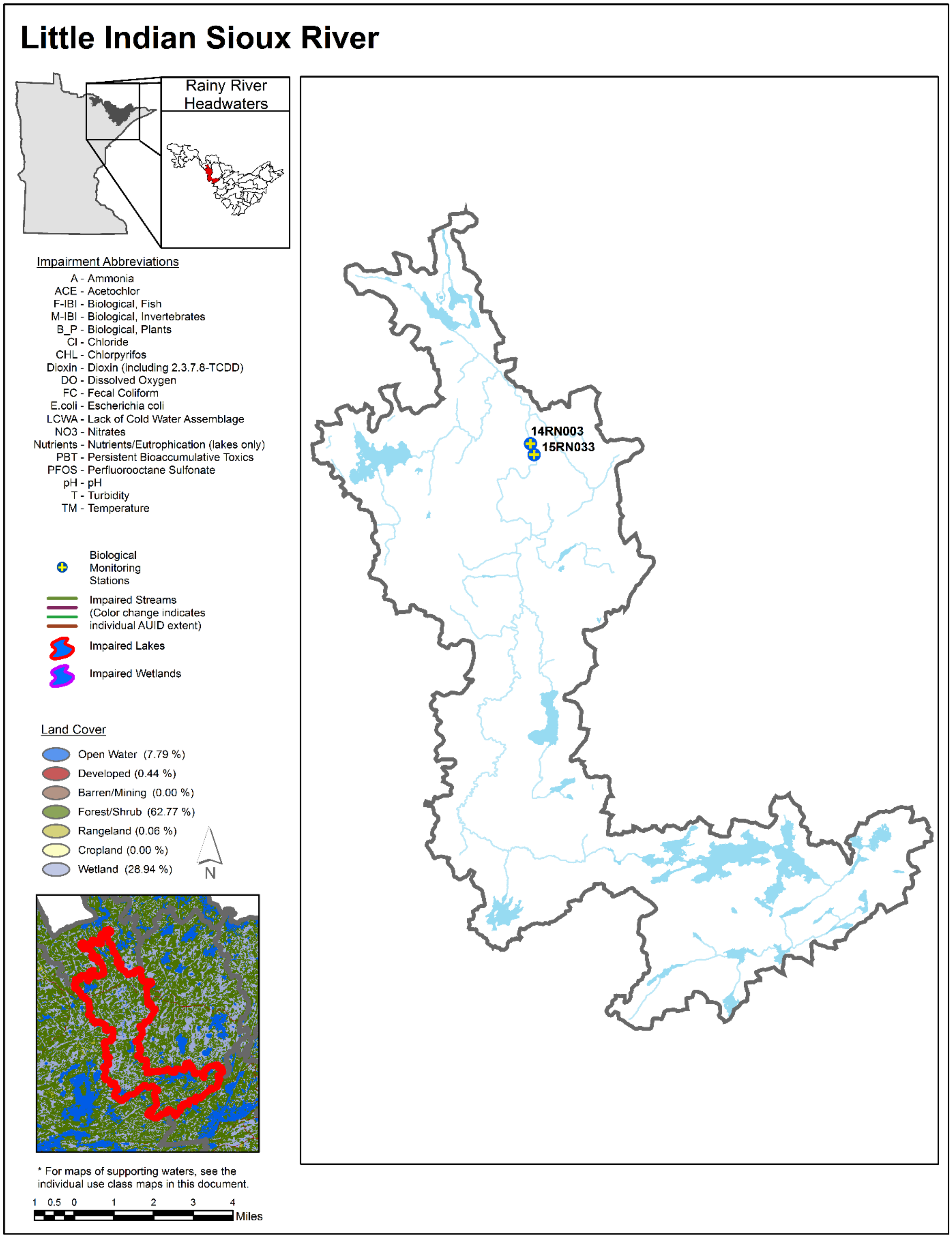

Figure 64. Currently listed impaired waters by parameter and land use characteristics in the Little Indian Sioux River Aggregated 12-HUC.

Ash River Aggregated 12-HUC HUC 0903000123-01

The Ash River Subwatershed drains 108.16 square miles of St. Louis County and is the tenth largest subwatershed within the Rainy River-Headwaters Watershed. The headwaters of this subwatershed begins in Ash Lake and continues 32.7 miles to the north through the Ash River before exiting this subwatershed. Before contributing its waters to Kabetogama Lake (69-0845-00), the Ash River receives additional flow from the Black Duck River, Kinmount, Camp Ninety, Gannon, and numerous unnamed creeks. There are a total of 10 lakes greater than 10 acres, with the most prominent being Ash, Pearl, and Gannon. This subwatershed is dominated by forest (70.07%), wetland (23.92%), and open water (2.74%). Only 2.23% is rangeland, 0.95% is developed, 0.05% is row-crop agriculture, and 0.04% is barren/mining. The Superior National Forest encompasses the majority of this subwatershed, with the rest of the area (4.1%) within the VNP. Much of this subwatershed is owned and managed by local, state, and federal entities (USGS, 2008). Intensive water chemistry sampling was conducted at the outlet of the subwatershed at the Ash River Recreational Trail, 10 miles north of Ash Lake on the Ash River. The outlet is represented by water chemistry stationS007-902 and biological station 14RN001.

Table 48. Aquatic life and recreation assessments on stream reaches: Ash River Aggregated 12-HUC. Reaches are organized upstream to downstream in the table.

AUID ***Reach Name*****,** *Reach Description*	**Biological Station ID**	**Reach Length (miles)**	**Use Class**	**Aquatic Life Indicators:** Fish IBI	Invert IBI	Dissolved Oxygen	TSS	Secchi Tube	Chloride	pH	Ammonia -NH_3	Pesticides	Eutrophication	**Aquatic Life**	**Aquatic Rec. (Bacteria)**
09030001-868 **Camp Ninety Creek** **Unnamed Cr to T68 R19W S20, north line**	14RN015	3.25	WWg	MTS	MTS	- -	IF	IF	- -	- -	- -	- -	IF	SUP	- -
09030001-823 **Kinmount Creek** **Unnamed Cr to Ash R**	14RN014	2.28	CWg	MTS	MTS	IF	IF	IF	- -	IF	IF	- -	IF	SUP	- -
09030001-819 **Ash River** **Headwaters (Ash Lk 69-0964-00) to Black Duck R**	14RN099 14RN012	16.24	CWg	MTS	MTS	IF	IF	IF	- -	IF	- -	- -	IF	SUP	- -
09030001-818 **Ash River** **Black Duck R to Ash River Falls**	14RN001	12.46	CWg	MTS	- -	EXS	EXS	EXS	MTS	MTS	MTS	- -	IF	IMP	SUP

Abbreviations for Indicator Evaluations: **MTS** = Meets Standard; **EXS** = Fails Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Impaired (Fails Standards)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.
Abbreviations for Use Class: **WWg** = warmwater general, **WWm** = Warmwater modified, **WWe** = Warmwater exceptional, **CWg** = Coldwater general, **CWe** = Coldwater exceptional,
LRVW = limited resource value water
*Assessments were completed using proposed use classifications changes that have not yet been written into rule.

Table 49. Lake assessments: Ash River Aggregated 12-HUC.

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators:			Aquatic Recreation Indicators:			Aquatic Life Use	Aquatic Recreation Use
							Fish IBI	Chloride	Pesticides	Total Phosphorus	Chlorophyll-a	Secchi		
Ash	69-0864-00	689.0	29	Deep Lake	NLF	NT	- -	IF	- -	MTS	MTS	MTS	IF	SUP

Abbreviations for Ecoregion: DA = Driftless Area, NCHF = North Central Hardwood Forest, NGP = Northern Glaciated Plains, NLF = Northern Lakes and Forests, NMW = Northern Minnesota Wetlands, RRV = Red River Valley, WCBP = Western Corn Belt Plains
Abbreviations for Secchi Trend: D = decreasing/declining trend, I = increasing/improving trend, NT = no detectable trend, -- = not enough data
Abbreviations for Indicator Evaluations: -- = No Data, **MTS** = Meets Standard; **EXS** = Exceeds Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Not Support (Impaired, exceeds standard)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.

Summary

The Ash River Subwatershed had four assessable stream segments, containing five biological monitoring stations, and one lake assessed for aquatic recreation (Table 48 and Table 49). Most of the streams and lakes met the applicable standards or criteria and fully support aquatic life and/or aquatic recreation (Figure 66). In-stream habitat was in fair condition throughout this subwatershed and tended to decrease in quality in the more downstream reaches (Appendix 5). This lower habitat quality may be related to the decrease in stream gradient from the headwaters to its pour point. Stations located closer to the pour point had less riffle habitat and a decrease in coarse substrates. Although species composition was only slightly different between stations, species that were more indicative of riffle types of habitat were more prevalent near the headwaters. Areas of more intense land use occur within this subwatershed and may be contributing to the degradation of the Ash River and its tributaries. This entire subwatershed was assessed for its viability to support a cold-water assemblage and to determine the appropriate use class designation (CWg or WWg). Stream temperatures were relatively marginal for a trout fishery with an average summer (June 1 – August 31) temperature of 19.34 to 20.68 °C in 2014 and 2015. Thermal stress for brook trout varied throughout the summer from 40.5% near the headwaters to 63.0% at the pour point of the Ash River. Brown Trout may be more successful within this drainage, as it pertains to stream temperature, with thermal stress for Brown Trout occurring from 2.2 to 21.2% of the time during the summer. Stream temperatures, although still marginal, tended to be cooler within smaller tributary streams.

The biological community varied only slightly in species composition and condition throughout this subwatershed. A total of 19 fish species, comprised of individuals typical of cool/warm-water streams (common shiner, hornyhead chub, and johnny darter) were surveyed. Several sensitive fish species were present and indicated good water quality. In addition, macroinvertebrates were collected at three of the four stream segments and indicated similar conditions. Rock substrate was sampled at two stations on the Ash River but lacked species typical of this habitat and instead had a community that was more reflective of a low gradient warm-water stream. Although both the biological and thermal regime indicated cool-water conditions, this stream reach will retain its current cold-water designation (CWg) as a result of cooler water temperatures that may support a put-and-take brown trout fishery, coupled by the DNR's plans to manage it as such.

Camp Ninety Creek (-868), a small headwater stream, was the only designated warm-water stream to be assessed in this subwatershed. One biological monitoring station (14RN015) was located along this 3.3 mile long reach. A relatively diverse fish community (16 species) was found at this station, with numerous sensitive species that indicated good water quality. The macroinvertebrate community was dominated by one mayfly species (*Caenis diminuta*), with several other low gradient species present. Water quality throughout this drainage is of special concern, as it is an upstream resource of VNP.

The Ash River subwatershed is fairly unique compared to others within the Rainy River-Headwaters Watershed, possessing characteristics similar to the adjacent Rat Root River drainage (a tributary to Rainy Lake), such as extensive forested wetlands. Forestland ownership is mixed in this area, among Federal, State, St. Louis County, and private lands. The Ash River intensive water chemistry monitoring station indicated high concentrations of TSS and low stream transparency (Figure 65). This subwatershed also had considerably higher stream phosphorus than found in most of the Rainy River-Headwaters Watershed. Oxygen concentrations were below the standard in most samples.

MPCA staff observed locations of stream bank erosion in the vicinity of a cattle pasture/farm near the Black Duck River intensive water chemistry station (and nearby tributary streams), as well as areas of unstable steam geomorphology in other stream reaches within the subwatershed. Forest harvest has been considerable in portions of these subwatersheds since ~ 2000 (National Park Service, 2017; and http://earthenginepartners.appspot.com/google.com/science-2013-global-forest). These observations, coupled with relatively high concentrations of sediment and nutrients in these drainages, prompted the MPCA to conduct additional follow-up water quality monitoring in 2016. These data, combined with the previous two years of data indicated the lower Ash stream segments did not meet the TSS standard, suggesting non-support for aquatic life. These stream segments will be added to the impaired waters list. MPCA stressor identification staff will conduct additional investigations in these subwatersheds in 2017.

In the lower Ash River, downstream of the Black Duck River confluence, bacteria levels decline. This reach does have the potential for occasional high bacteria counts; it is unclear if recreation use is supported.

Ash Lake (69-0864-00) is a mesotrophic lake that fully supports aquatic recreation. Ash Lake periodically experience mild algae blooms, but phosphorus levels clearly met the standard, and indicate nutrient conditions similar to other moderately developed mesotrophic lakes in the vicinity.

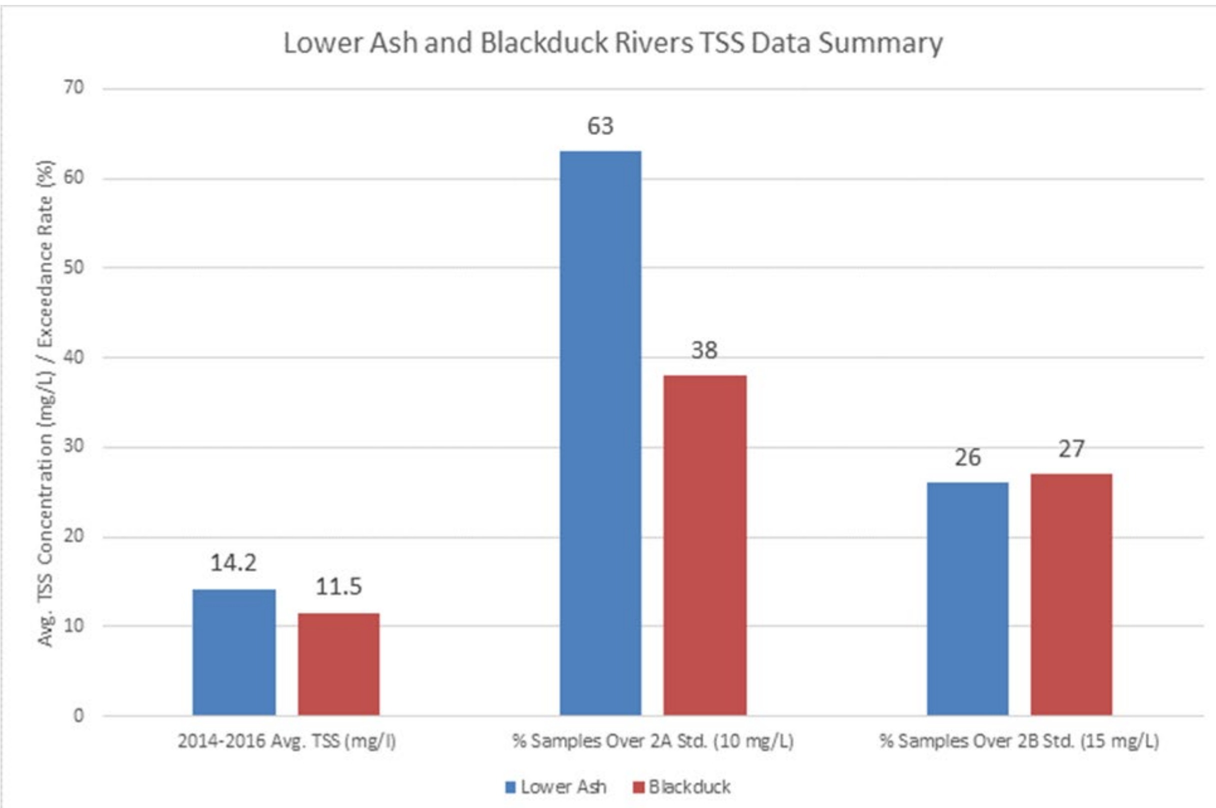

Figure 65. Total suspended solids concentrations in the Black Duck and Ash River Aggregated 12-HUC.

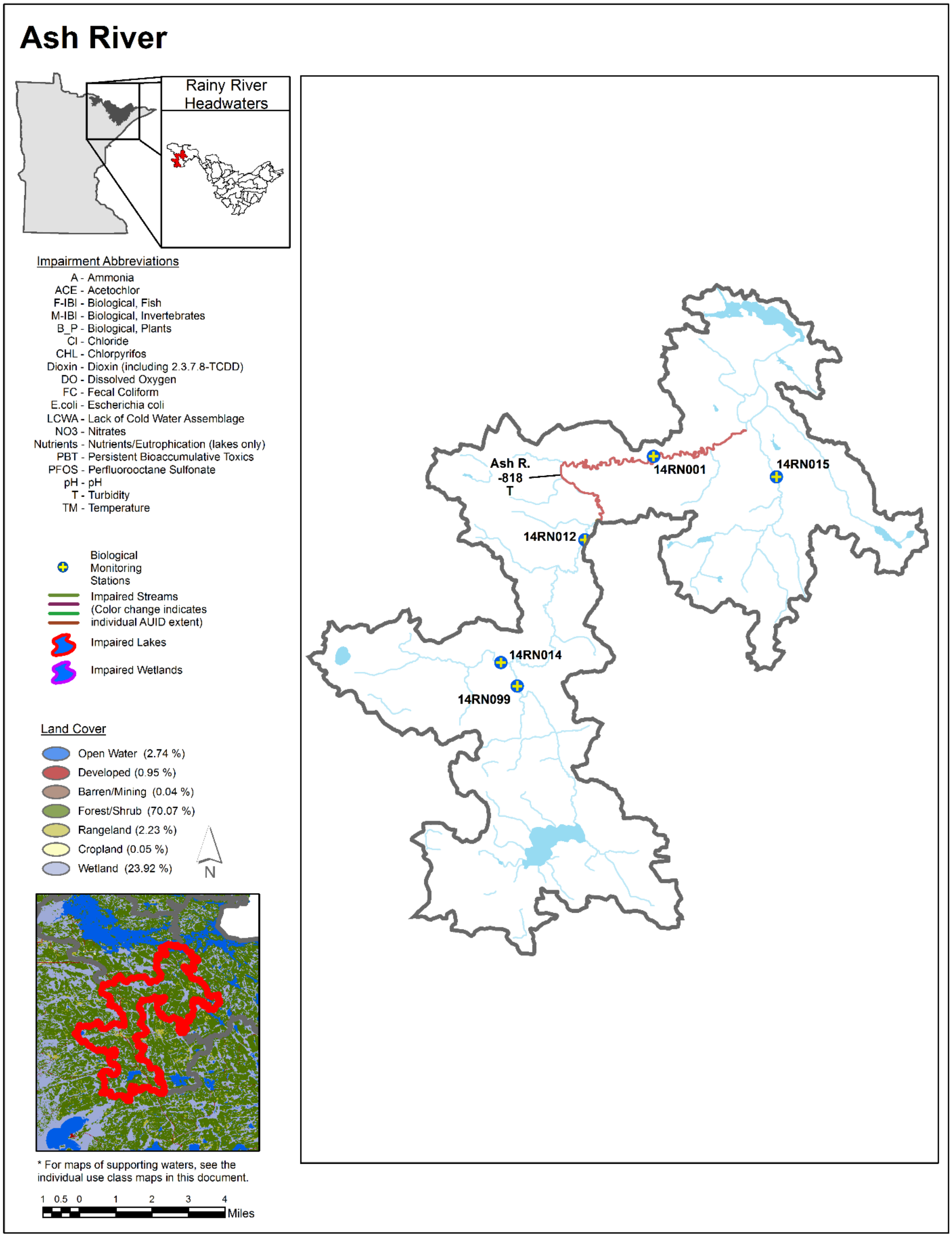

Figure 66. Currently listed impaired waters by parameter and land use characteristics in the Ash River Aggregated 12-HUC.

Black Duck River Aggregated 12-HUC HUC 0903000123-03

The Black Duck River Subwatershed drains 50.07 square miles of St. Louis County and is the fifth smallest subwatershed within the Rainy River-Headwaters Watershed. Originating from Black Duck Lake, the Black Duck River flows 16.1 miles to the north before exiting this subwatershed and contributing its flow to the Ash River. Numerous named and unnamed streams contribute its waters to the Black Duck River, with the most notable being Ninemile and Fawn Creek. There are a total of four lakes greater than 10 acres, with the most prominent being Black Duck and Chub. This subwatershed is dominated by forest (67.22%), wetland (22.57%), and rangeland (5.07%). Only 5.05% is open water, 0.09% is developed, and there is no barren/mining or row-crop agriculture. This entire subwatershed lies within the Superior National Forest, with much of the land owned and managed by local, state, and federal entities (USGS, 2008). Intensive water chemistry sampling was conducted at the outlet of the subwatershed at Sheep Ranch Road, 5 miles northeast of Ash Lake on the Black Duck River. The outlet is represented by water chemistry station S008-618 and biological station 14RN017.

Table 50. Aquatic life and recreation assessments on stream reaches: Black Duck River Aggregated 12-HUC. Reaches are organized upstream to downstream in the table.

AUID *Reach Name*, *Reach Description*	Biological Station ID	Reach Length (miles)	Use Class	Aquatic Life Indicators: Fish IBI	Invert IBI	Dissolved Oxygen	TSS	Secchi Tube	Chloride	pH	Ammonia -NH_3	Pesticides	Eutrophication	Aquatic Life	Aquatic Rec. (Bacteria)
09030001-827 **Ninemile Creek** **Chub Lk to Black Duck R**	14RN021	6.44	CWg	MTS	MTS	IF	IF	IF	- -	IF	IF	- -	IF	SUP	- -
09030001-820 **Black Duck River** **Headwaters (Black Duck Lk 69-0842-00) to Ash R**	14RN018 14RN017	16.08	CWg	MTS	MTS	EXS	EXS	EXS	MTS	IF	MTS	- -	IF	IMP	IMP

Abbreviations for Indicator Evaluations: **MTS** = Meets Standard; **EXS** = Fails Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Impaired (Fails Standards)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.
Abbreviations for Use Class: **WWg** = warmwater general, **WWm** = Warmwater modified, **WWe** = Warmwater exceptional, **CWg** = Coldwater general, **CWe** = Coldwater exceptional, **LRVW** = limited resource value water
*Assessments were completed using proposed use classifications changes that have not yet been written into rule.

Table 51. Lake assessments: Black Duck River Aggregated 12-HUC.

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators:			Aquatic Recreation Indicators:			Aquatic Life Use	Aquatic Recreation Use
							Fish IBI	Chloride	Pesticides	Total Phosphorus	Chlorophyll-a	Secchi		
Black Duck	69-0842-00	1240.7	30	Deep Lake	NLF	NT	- -	IF	- -	MTS	MTS	MTS	IF	SUP

Abbreviations for Ecoregion: DA = Driftless Area, NCHF = North Central Hardwood Forest, NGP = Northern Glaciated Plains, NLF = Northern Lakes and Forests, NMW = Northern Minnesota Wetlands, RRV = Red River Valley, WCBP = Western Corn Belt Plains
Abbreviations for Secchi Trend: D = decreasing/declining trend, I = increasing/improving trend, NT = no detectable trend, -- = not enough data
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Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.

Summary

The Black Duck River Subwatershed had two assessable stream segments, containing three biological monitoring stations, and one lake assessed for aquatic recreation (Table 50 and Table 51). Only Ninemile Creek and Black Duck Lake met the applicable standards or criteria and fully support aquatic life and/or aquatic recreation (Figure 67). In-stream habitat was in fair condition overall, with two of the four stations having poor habitat attributes (Appendix 5). Areas of more intense land use occur within this subwatershed and may be contributing to the degradation of the Black Duck River and its tributary streams. Streams within this subwatershed showed significant signs of degradation that may be linked to anthropogenic stressors.

This entire subwatershed was assessed for its viability to support a cold-water assemblage and to determine the appropriate use class designation (WWg vs CWg). Stream temperatures were relatively marginal for a trout fishery, with an average summer (June 1 – August 31) temperature of 18.88 to 20.80 °C in 2014 and 2015. Thermal stress for brook trout varied throughout the summer from 33.5% to 62.9%. Brown trout may be more successful within this drainage, as it pertains to stream temperature, with thermal stress reached 2.0-18.7% of the summer. Stream temperatures, although marginal, tended to be cooler within smaller tributary streams.

The biological community varied little in species composition and condition throughout this subwatershed. A total of 17 fish species were surveyed, comprised of individuals typical of cool/warm-water streams (common shiner, hornyhead chub, and johnny darter). A mixture of sensitive and tolerant fish species indicated fair water quality. The macroinvertebrate community indicated similar conditions, with the presence of *Gomphus lividus* (dragonfly) at Ninemile Creek (14RN021). This is a common dragonfly species found in the eastern United States and is well documented in Wisconsin but is the only record of this species in the MPCAs extensive record (Wisconsin Odonate Survey, 2015). Although both the biological and thermal regime indicated that, this system is at best, only a marginal cold-water resource. This stream reach will maintain its current cold-water designation (CWg) as a result of cooler temperatures that may be supportive of a put-and-take brown trout fishery, coupled by the DNR's plans to manage it as such. Water quality throughout this drainage is of special concern, as it is an upstream resource of VNP.

The Black Duck River Subwatershed is fairly unique compared to others within the Rainy River-Headwaters Watershed, possessing characteristics similar to the adjacent Rat Root River Subwatersheds (Rainy River-Rainy Lake Watershed), such as extensive forested wetlands. Forest land is under Federal, State, St. Louis County, and private land ownership. The intensive water chemistry monitoring station on the Black Duck River had high concentrations of TSS and low stream transparency. This subwatershed also had considerably higher stream phosphorus than found in most of the Rainy River-Headwaters Watershed. Dissolved oxygen conditions, based on both spot sampling and a sonde deployment, indicate concentrations were often below the 7 mg/L cold-water standardMPCA staff observed locations of stream bank erosion in the vicinity of a cattle pasture/farm near the Black Duck River 10X station (and nearby tributary streams), as well as areas of unstable steam geomorphology in other stream reaches within this subwatershed. Forest harvest has been considerable in portions of these subwatersheds since ~ 2000 (http://earthenginepartners.appspot.com/google.com/science-2013-global-forest). These observations, coupled with relatively high concentrations of sediment and nutrients in these subwatersheds, prompted the MPCA to conduct additional follow-up water quality monitoring in 2016. These data, combined with the previous two years of data, and a high percentage of TSS tolerant macroinvertebrates collected in the MPCA's biological samples, indicated the Black Duck stream segment did not meet the TSS standard, and consequently did not support aquatic life. MPCA stressor identification staff will be conducting additional investigations in these subwatersheds in 2017.

E. coli bacteria concentrations were consistently high in the Black Duck River in 2014-2016. All three summer months had geometric mean concentrations that exceeded the standard, and about half of the individual samples exceeded the maximum standard of 1,260 colonies / 100 mL. Several *E. coli* samples were > 2,000 colonies, indicating a severe threat to aquatic recreation. Watershed investigations and additional bacteria monitoring in the headwaters and downstream of the agricultural area suggest this location as a potential source of bacteria to the Black Duck River. Based on the entire dataset, the Black Duck River does not support aquatic recreation because of consistently high bacteria concentrations.

The only lake monitored in the Black Duck River Subwatershed fully supports aquatic recreation. Black Duck Lake (69-0842-00) periodically experience mild algae blooms, but phosphorus levels clearly met the standard, and indicate nutrient conditions similar to other moderately developed mesotrophic lakes in the vicinity.

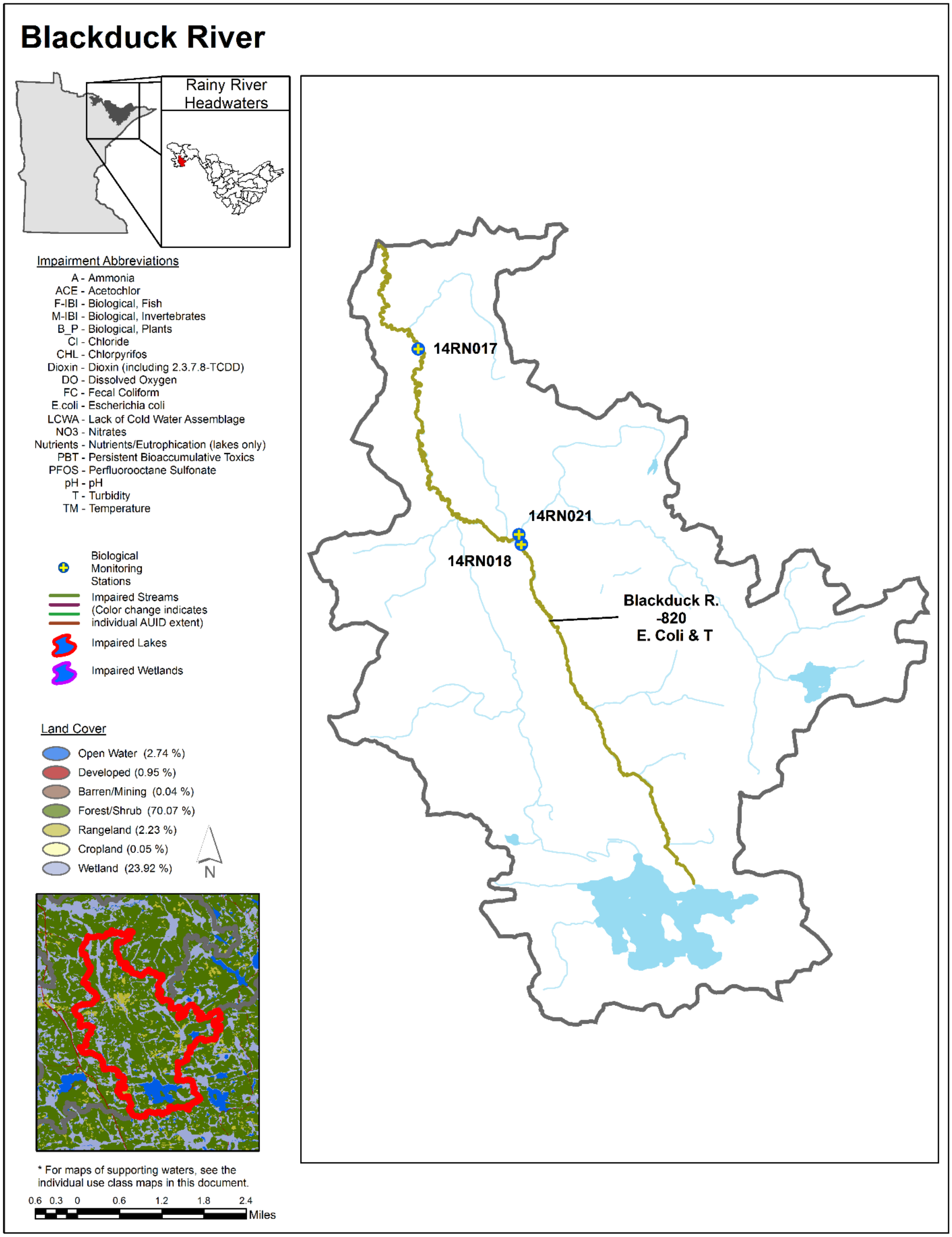

Figure 67. Currently listed impaired waters by parameter and land use characteristics in the Black Duck River Aggregated 12-HUC.

Kabetogama Lake Aggregated 12-HUC HUC 0903000124-01

The Kabetogama Lake Subwatershed drains 118.86 square miles of St. Louis County and is the eighth largest subwatershed within the Rainy River-Headwaters Watershed. This subwatershed encompasses Kabetogama Lake (69-0845-00) and many of its numerous tributaries. The Ash River (0903000123-01) is the only major inlet to Kabetogama Lake and two outlets (Gold Portage and Namakan Lake). There are a total of seven lakes greater than 10 acres, with the most prominent being Kabetogama, Elk, and Jorgens. This subwatershed is dominated by forest (46.32%), open water (28.62%), and wetland (23.58%). Only 0.88% is rangeland, 0.49% is developed, 0.11% is row-crop agriculture, and there is no barren/mining. The majority (72.3%) of this subwatershed lies within the VNP, with a smaller portion (20.9%) in the Superior National Forest. Much of the land within this subwatershed is owned and managed by local, state, and federal entities (USGS, 2008). As a result of overall remoteness, short tributary streams and many large bodies of water; there was no biological or intensive water chemistry sampling conducted on rivers and streams within this subwatershed.

Table 52. Lake assessments: Kabetogama Lake Aggregated 12-HUC.

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators:			Aquatic Recreation Indicators:			Aquatic Life Use	Aquatic Recreation Use
							Fish IBI	Chloride	Pesticides	Total Phosphorus	Chlorophyll-a	Secchi		
Kabetogama	69-0845-00	22325.0	50	Deep Lake	NLF	I	- -	IF	- -	MTS	MTS	MTS	IF	SUP

Abbreviations for Ecoregion: DA = Driftless Area, NCHF = North Central Hardwood Forest, NGP = Northern Glaciated Plains, NLF = Northern Lakes and Forests, NMW = Northern Minnesota Wetlands, RRV = Red River Valley, WCBP = Western Corn Belt Plains
Abbreviations for Secchi Trend: D = decreasing/declining trend, I = increasing/improving trend, NT = no detectable trend, -- = not enough data
Abbreviations for Indicator Evaluations: -- = No Data, **MTS** = Meets Standard; **EXS** = Exceeds Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Not Support (Impaired, exceeds standard)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.

Summary

The Kabetogama Lake Subwatershed had no assessable stream segments and one lake, Kabetogama, assessed for aquatic recreation (Table 52). Kabetogama Lake met the applicable standards or criteria and supports aquatic recreation (Figure 68). The large lakes within the Park have long been monitored by the National Park Service and the USGS; these organizations have provided the data for Kabetogama Lake (Figure 69). The National Park's large lakes have seen an improvement in water quality (a reduction in Chl-a concentrations) since about 2000, following a change in water level management that allowed a more natural water regime (Christensen et al). Water levels in these lakes are controlled by a dam at the Namakan Lake outlet at Kettle Falls on the Minnesota / Ontario border; lake levels are regulated by the International Joint Commission. Lake Kabetogama also has a statistically significant improvement in transparency in recent years. The lakes of the Namakan Reservoir (Namakan, Kabetogama, Sand Point, Little Vermilion, and Crane) have a rapid residence time, estimated at 0.6 years (Kallemeyn etal., 2003), which is a likely a key factor in their response to changes in water level management.

Kabetogama (69-0845-00) is a mesotrophic to eutrophic lake that meets standards to protect aquatic recreation, although it is known to experience moderate to severe algal blooms mid to late summer (Chl-a > 10 ug/L), particularly in isolated bays separated from the lake's main water-flow paths. In particular, it is important to note that while Chl-a concentrations on average have declined, the range of concentrations is still quite large, with Chl-a as high as 67 ug/L observed in the 2000-2011 study completed by the National Park Service and USGS. The study also found that cyanotoxins are present in the lake, which can be a risk to lake users and their pets (Christensen et al). While overall recreation is supported, it will be important for users of the lake to be aware of current conditions and adjusting their recreation plans accordingly, if necessary.

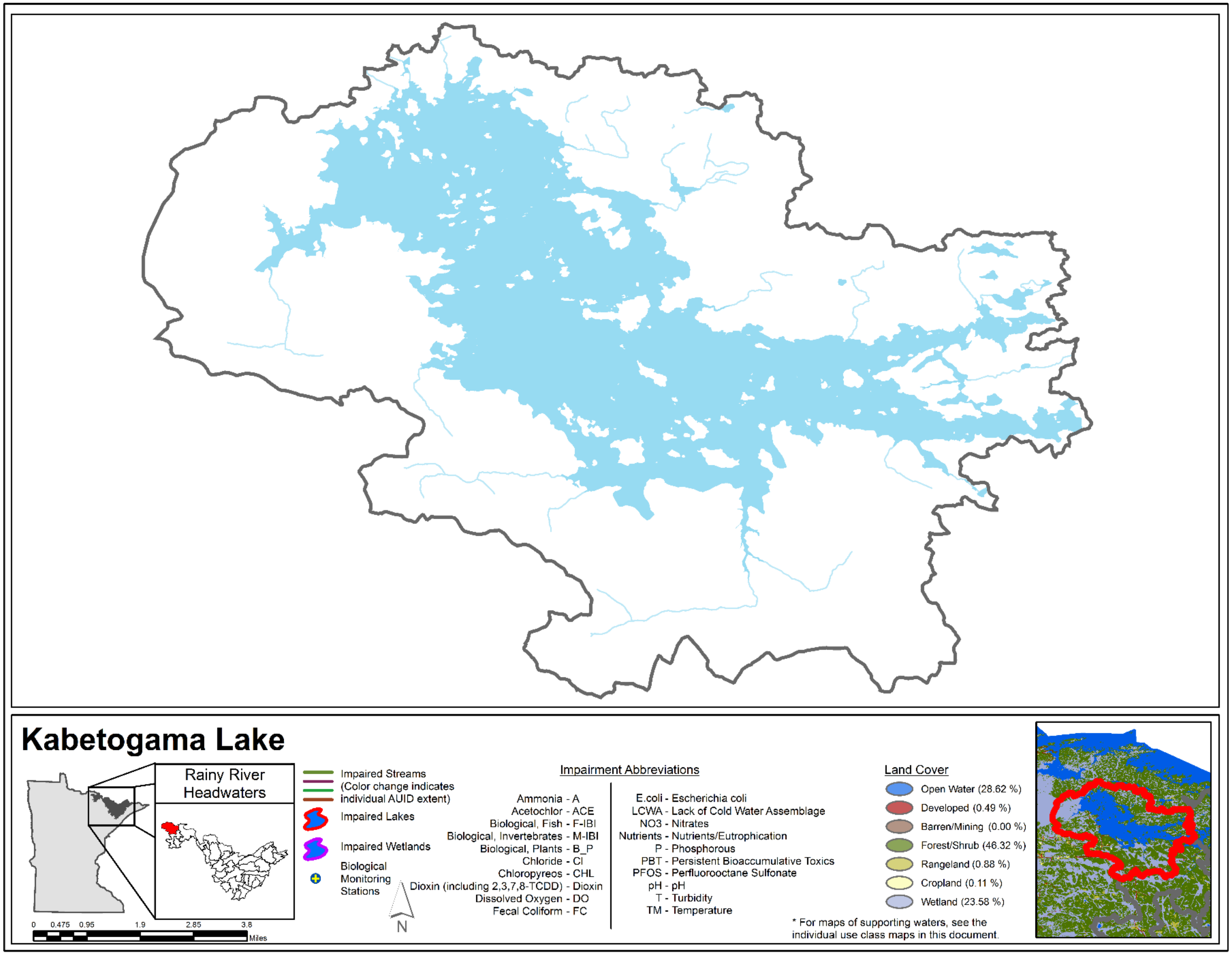

Figure 68. Currently listed impaired waters by parameter and land use characteristics in the Kabetogama Lake Aggregated 12-HUC.

Namakan Lake Aggregated 12-HUC HUC 0903000125-01

The Namakan Lake Subwatershed drains 164.92 square miles of St. Louis County and is the second largest subwatershed within the Rainy River-Headwaters Watershed. This subwatershed lies along the international border between the United States and Canada, with additional drainage on the Canadian side. Both the Loon River Subwatershed and Vermilion River Major Watershed enter this subwatershed on the southwest shoreline of Sand Point Lake (69-0617-00). Namakan Lake (69-0693-00) receives its waters from Sand Point and Kabetogama Lake, along with other tributary streams and lakes. The largest stream to enter Namakan Lake is the Moose River that enters it from the northeast shoreline after flowing 12.7 miles and draining 37.3 square miles. Namakan Lake is considered the outlet of the Rainy River-Headwaters Watershed. There are a total of 66 lakes greater than 10 acres, with the most prominent being Namakan, Sand Point, Johnson, Mukooda, Little Johnson, Long, and Little Trout. This subwatershed is dominated by forest (59.11%), open water (22.44%), and wetland (17.87%). Only 0.44% is rangeland, 0.13% is developed, 0.01% is row-crop agriculture, and there is no barren/mining. The majority (63.3%) of this subwatershed lies within the VNP, with a smaller portion (36.6%) in the Superior National Forest. An even smaller portion (0.2%) of this land lies within the BWCAW. Much of the land within this subwatershed is owned and managed by local, state, and federal entities (USGS, 2008). As a result of overall remoteness, short tributary streams and many large bodies of water; there was no biological or intensive water chemistry sampling conducted within this subwatershed.

Table 53. Lake assessments: Namakan Lake Aggregated 12-HUC.

Lake Name	DNR ID	Area (acres)	Max Depth (ft)	Assessment Method	Ecoregion	Secchi Trend	Aquatic Life Indicators:			Aquatic Recreation Indicators:			Aquatic Life Use	Aquatic Recreation Use
							Fish IBI	Chloride	Pesticides	Total Phosphorus	Chlorophyll-a	Secchi		
Spring	69-0761-00	218.1	60	Deep Lake	NLF	- -	- -	- -	- -	MTS	MTS	MTS	IF	SUP
Johnson	69-0691-00	1664.2	88	Deep Lake	NLF	- -	- -	- -	- -	MTS	MTS	MTS	IF	SUP
Namakan	69-0693-00	11919.9	150	Deep Lake	NLF	I	- -	- -	- -	MTS	MTS	MTS	IF	SUP
Little Johnson	69-0760-00	560.6	28	Deep Lake	NLF	NT	- -	- -	- -	MTS	MTS	MTS	IF	SUP
Sand Point	69-0617-00	4716	184	Deep Lake	NLF	NT	- -	- -	- -	MTS	MTS	MTS	IF	SUP

Abbreviations for Ecoregion: DA = Driftless Area, NCHF = North Central Hardwood Forest, NGP = Northern Glaciated Plains, NLF = Northern Lakes and Forests, NMW = Northern Minnesota Wetlands, RRV = Red River Valley, WCBP = Western Corn Belt Plains
Abbreviations for Secchi Trend: D = decreasing/declining trend, I = increasing/improving trend, NT = no detectable trend, -- = not enough data
Abbreviations for Indicator Evaluations: -- = No Data, **MTS** = Meets Standard; **EXS** = Exceeds Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Not Support (Impaired, exceeds standard)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.

Summary

The Namakan Lake Subwatershed had no assessable stream segments and five lakes assessed for aquatic recreation (Table 53). All of the lakes met the applicable standards or criteria and fully support aquatic recreation (Figure 70). The National Park Service and the USGS have long monitored the larger lakes within the VNP. These organizations have provided their data for Namakan (69-0693-00) and Sand Point Lakes (69-0617-00; Figure 69). Koochiching and North St. Louis County SWCD monitored three remote lakes (Johnson, Little Johnson, and Spring) within the Superior National Forest. All of the lakes monitored were mesotrophic, with the exception of Spring Lake (69-0761-00). Johnson (69-0691-00), Little Johnson (69-0760-00), and Spring were all high quality lakes. Spring Lake is classified as a lake trout lake, and is meeting standards to protect this designated use; transparency here averaged 5.3 meters (17 feet; Figure 69).

Voyageurs National Park's larger lakes have seen an improvement in water quality (a reduction in Chl-a concentrations) since about 2000, following a change in water level management that allowed a more natural water regime (Christensen et. al). Water levels in these lakes are controlled by a dam at the Namakan Lake outlet at Kettle Falls on the Minnesota/Ontario border; lake levels are regulated by the International Joint Commission.

Sand Point, Little Vermilion, and Namakan are meeting standards to protect aquatic recreation. These lakes are also close to, but not attaining, the Class 2B Secchi transparency standard (2.0 meters), due natural bog staining from the surrounding forests and wetlands. Namakan Lake have a statistically significant improvement in transparency in recent years. The lakes of the Namakan Reservoir (Namakan, Kabetogama, Sand Point, and Crane) have a rapid residence time, estimated at 0.6 years (Kallemeyn et al., 2003), which is a likely a key factor in their response to changes in water level management.

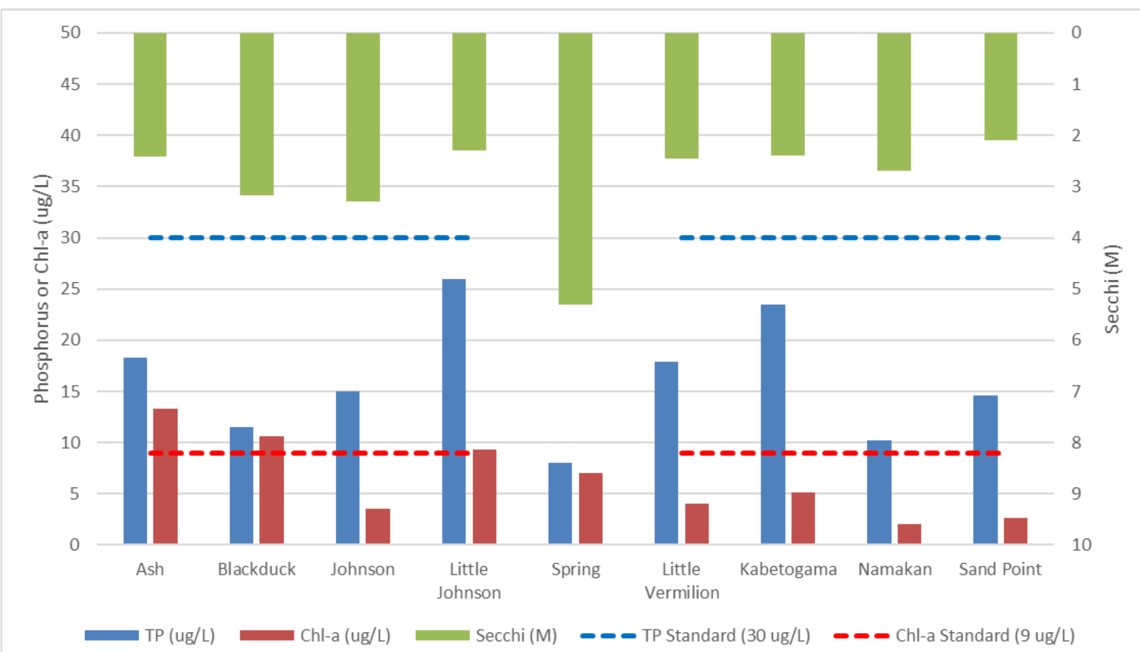

Figure 69. Water quality summary for assessed lakes in the Ash River, Black Duck River, Loon River, Kabetogama Lake, and Namakan Lake Subwatersheds.

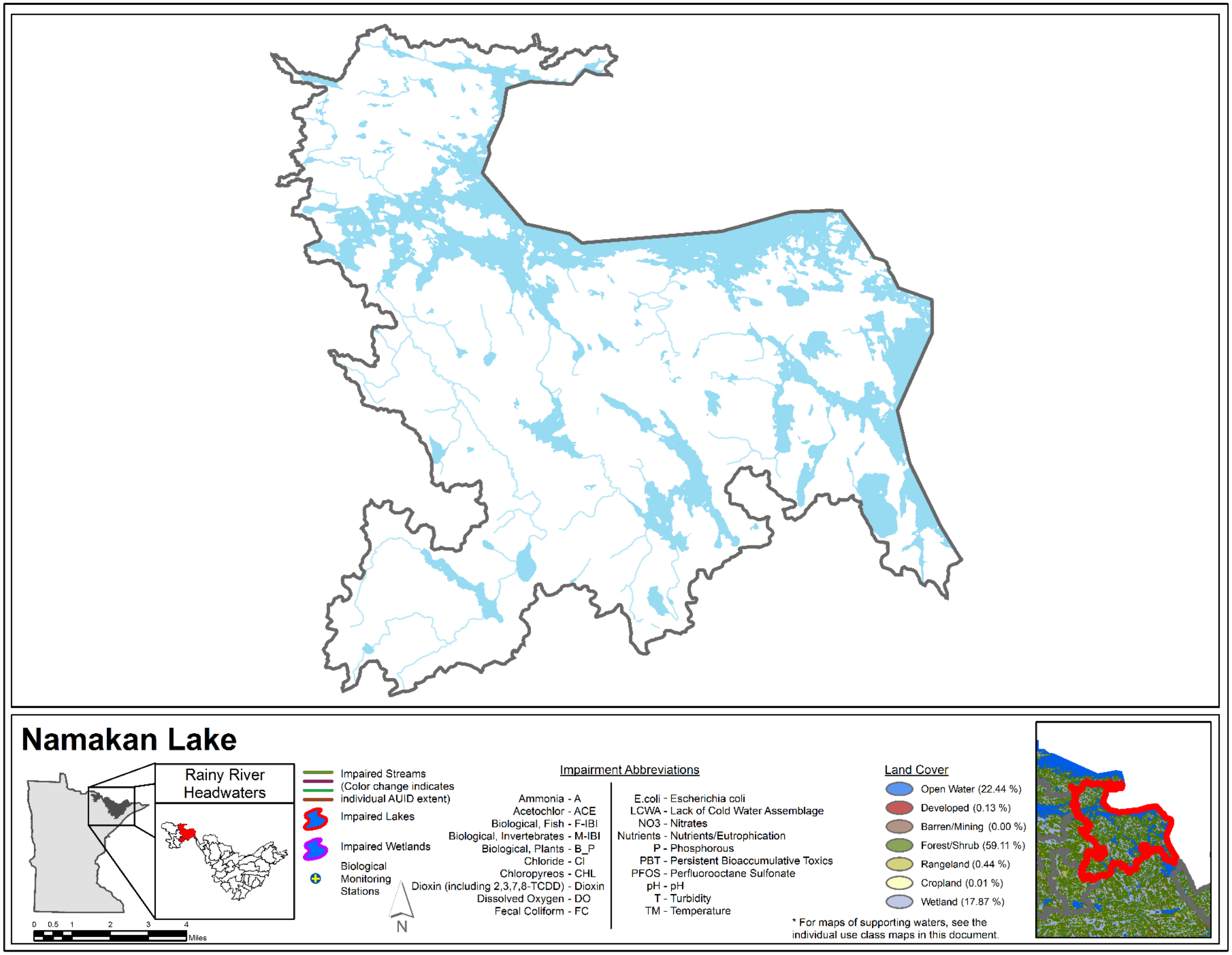

Figure 70. Currently listed impaired waters by parameter and land use characteristics in the Kabetogama Lake Aggregated 12-HUC.

Watershed-wide results and discussion

Assessment results and data summaries are included below for the entire HUC-8 watershed unit of the Rainy River-Headwaters Watershed, grouped by sample type. Summaries are provided for lakes, streams, and rivers in the watershed for the following: aquatic life and recreation uses, aquatic consumption results, load monitoring data results, transparency trends, and remote sensed lake transparency. Additionally, groundwater and wetland monitoring results are included where applicable.

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 Rainy River-Headwaters Watershed.

Stream water quality

Sixty-four of the 408 stream reaches were assessed for aquatic life, with 12 of those assessed for aquatic recreation (Table 54). Of the assessed streams, 62 streams reaches fully supported aquatic life and 11 streams reaches fully supported aquatic recreation. None of the stream reaches were classified as limited resource waters. Only two stream reaches did not support aquatic life and one stream reach did not support aquatic recreation.

Overall, water quality conditions are good, and reflect the forests and wetlands that dominate the land cover within the Rainy River-Headwaters Watershed. Problem areas do occur and persist throughout this watershed but are limited to the lower reaches where stressors from land use practices and natural processes may accumulate. Total suspended solids are elevated in the lower reaches of the Black Duck and Ash River. Sources of the sediment are likely a function of the watershed's geologic setting, the river's geomorphology and current/historical land use practices. Bio-accumulation of mercury in fish tissue and mercury within the water column may also be linked to overland runoff and land use practices. Dissolved oxygen and pH often exceeded standards in portions of this watershed. The area has very little disturbance; the exceedances are likely attributed to the high proportion of wetlands in the watershed and the geology of the area. Bacteria levels were elevated in one subwatershed that had a relatively large agricultural operation and may be attributed to stressors associated with this type of land use. Additional sampling of vicinity tributaries through the stressor identification process may provide more insight on anthropogenic and wildlife contributions of bacteria to the stream. A mixture of exceptional cold-water and warm-water aquatic resources occur throughout the Rainy River-Headwaters Watershed. Additional protections should be considered for streams that display exceptional biological, chemical, and physical qualities.

Table 54. Assessment summary for stream water quality in the Rainy River-Headwaters Watershed.

			Assessed AUIDs		Supporting		Non-supporting		
Watershed	**Area (acres)**	**# Total AUIDs ***	**# Aquatic Life**	**# Aquatic Recreation**	**# Aquatic Life**	**# Aquatic Recreation**	**# Aquatic Life**	**# Aquatic Recreation**	**# Delistings**
Rainy River-Headwaters HUC 8	**1,890,689**	**408**	**64**	**12**	**62**	**11**	**2**	**1**	0
Granite River	30,597	8	1	0	1	0	0	0	0
Cross River	40,498	1	1	1	1	1	0	0	0
Saganaga Lake	20,869	1	0	0	0	0	0	0	0
Sea Gull River	98,194	2	0	0	0	0	0	0	0
Knife Lake	42,719	0	0	0	0	0	0	0	0
Moose Lake	68,632	0	0	0	0	0	0	0	0
Lower Stony River	73,618	22	6	1	6	1	0	0	0
Upper Stony River	47,819	7	2	0	2	0	0	0	0
Greenwood River	31,141	8	1	0	1	0	0	0	0
Isabella River	61,880	19	1	0	1	0	0	0	0
Little Isabella River	32,952	16	3	1	3	1	0	0	0
Mitawan Creek	26,917	25	5	0	5	0	0	0	0
Island River	63,871	17	6	1	6	1	0	0	0
Dumbbell River	32,331	34	5	1	5	1	0	0	0
South Kawishiwi River	129,368	19	6	1	6	1	0	0	0
Dunka River	37,227	4	2	1	2	1	0	0	0
Lower Kawishiwi River	86,930	4	0	0	0	0	0	0	0
Upper Kawishiwi River	83,577	6	2	0	2	0	0	0	0
Shagawa River	66,713	8	4	1	4	1	0	0	0
Kawishiwi River (Fall Lake)	46,859	2	0	0	0	0	0	0	0
Bear Island River	42,795	12	4	1	4	1	0	0	0
Basswood Lake	80,543	7	0	0	0	0	0	0	0
Crooked Lake	61,938	1	0	0	0	0	0	0	0

Horse River	33,163	7	1	0	1	0	0	0	0
Boulder River	99,237	37	7	0	7	0	0	0	0
Lac La Croix	59,301	0	0	0	0	0	0	0	0
Loon River	43,743	6	0	0	0	0	0	0	0
Little Indian Sioux River	64,377	12	1	1	1	1	0	0	0
Ash River	69,221	65	4	1	3	1	1	0	0
Black Duck River	32,043	56	2	1	1	0	1	1	0
Kabetogama Lake	76,069	0	0	0	0	0	0	0	0
Namakan Lake	105,547	6	0	0	0	0	0	0	0

* This number only includes stream reaches that have been delineated for assessments and excludes all defined lakes.

Lake water quality

The Rainy River-Headwaters Watershed contains 1,273 lakes greater than 10 acres in size (Table 55). A total of 60 of the watershed's larger and notable lakes were monitored from 2012 to 2015 by a mix of MPCA staff, VNP, USGS, citizen volunteers, and SWAGs. These lakes included Gunflint, Saganaga, Silver Island, Namakan, Kabetogama, Shagawa, Cedar, Big, Jeanette, and many others. High quality lakes abound in the Rainy River-Headwaters Watershed. All monitored lakes, except for Blueberry Lake near Ely, met eutrophication standards for protecting cool and warm-water or lake trout lakes in the Northern Lakes and Forest ecoregion, and had good to excellent water quality that indicated mesotrophic to oligotrophic conditions. The impairment on Blueberry Lake was determined to be a result of natural conditions. Lake Kabetogama, also shallow, is susceptible to algal blooms and is nearing eutrophic conditions, but still supports recreation use. Concentrations of phosphorus and Chl-a and Secchi transparencies, were at expected levels given the area's dominant forest and wetland land use, limited amounts of lakeshore development, and high percentage of protected lands. Some lakes had naturally low transparency due to 'bog staining' from the surrounding wetlands. Several other Rainy River-Headwaters subwatersheds deep within the BWCAW had many lakes (185) that fully support aquatic recreation based on satellite estimated Secchi transparency (Figure 83).

Table 55. Assessment summary for lake water chemistry in the Rainy River-Headwaters Watershed.

			Assessed AUIDs		Supporting		Non-supporting		
Watershed	**Area (acres)**	**Lakes >10 Acres**	**# Aquatic Life**	**# Aquatic Recreation**	**# Aquatic Life**	**# Aquatic Recreation**	**# Aquatic Life**	**# Aquatic Recreation**	**# Delistings**
Rainy River-Headwaters HUC 8	**1,890,689**	**1,273**	**0**	**245**	**0**	**244**	**0**	**1**	**0**
Granite River	30,597	36	0	8	0	8	0	0	0
Cross River	40,498	58	0	5	0	5	0	0	0
Saganaga Lake	20,869	11	0	3	0	3	0	0	0
Sea Gull River	98,194	171	0	33	0	33	0	0	0
Knife Lake	42,719	72	0	32	0	32	0	0	0
Moose Lake	68,632	89	0	32	0	32	0	0	0
Lower Stony River	73,618	41	0	1	0	1	0	0	0
Upper Stony River	47,819	14	0	1	0	1	0	0	0
Greenwood River	31,141	2	0	1	0	1	0	0	0
Isabella River	61,880	44	0	1	0	1	0	0	0
Little Isabella River	32,952	14	0	2	0	2	0	0	0
Mitawan Creek	26,917	10	0	0	0	0	0	0	0
Island River	63,871	47	0	6	0	6	0	0	0
Dumbbell River	32,331	19	0	1	0	1	0	0	0
South Kawishiwi River	129,368	47	0	4	0	4	0	0	0
Dunka River	37,227	4	0	0	0	0	0	0	0
Lower Kawishiwi River	86,930	80	0	12	0	12	0	0	0
Upper Kawishiwi River	83,577	105	0	18	0	18	0	0	0
Shagawa River	66,713	38	0	7	0	7	0	0	0

Kawishiwi River (Fall Lake)	46,859	15	0	6	0	6	0	0	0
Bear Island River	42,795	13	0	4	0	3	0	1	0
Basswood Lake	80,543	40	0	9	0	9	0	0	0
Crooked Lake	61,938	36	0	14	0	14	0	0	0
Horse River	33,163	27	0	9	0	9	0	0	0
Boulder River	99,237	42	0	7	0	7	0	0	0
Lac La Croix	59,301	53	0	13	0	13	0	0	0
Loon River	43,743	28	0	5	0	5	0	0	0
Little Indian Sioux River	64,377	30	0	3	0	3	0	0	0
Ash River	69,221	10	0	1	0	1	0	0	0
Black Duck River	32,043	4	0	1	0	1	0	0	0
Kabetogama Lake	76,069	7	0	1	0	1	0	0	0
Namakan Lake	105,547	66	0	5	0	5	0	0	0

Biological monitoring

Fish

The Rainy River Basin spans a total of 26,882.4 square miles, encompassing one state (Minnesota) and two provinces (Ontario and Manitoba). Seventy-four different species of fish can be found within this basin. Although the Rainy River-Headwaters Watershed encompasses only a small percentage (11%; Minnesota Only) of the entire basin, 38 species were sampled during this monitoring (Appendix 4.1). Historically, fisheries management activities have focused on the stocking of brook trout within cold-water (trout) streams.

The Rainy River Basin does not have any endangered or threatened species under federal law but the watershed does have six fish species listed by the state of Minnesota as being of special concern (DNR, August 2013). These speciesies include; *Ichthyomyzon fossor* (northern brook lamprey), *Acipenser fulvescens* (lake sturgeon), *Coregonus zenithicus* (shortjaw cisco), *Couesius plumbeus* (lake chub), *Lepomis gulosus* (warmouth), and *Lepomis peltastes* (northern longear sunfish). In addition, many introduced and invasive species are known to exist within the watershed, including curly-leaf pondweed, Heterosporis, purple loosestrife, spiny water flea (*Bythotrephes longimanus*) and numerous fish species (*Osmerus mordax*: rainbow smelt, *salmo trutta*: brown trout, *salvelinus fontinalis*: brook trout, *Lepomis gulosus*: warmouth, and *Micropterus dolomieu*: smallmouth bass). Many of the fish species were either introduced during historical stocking efforts or likely transported by recreational users. Streams and lakes near population centers and other heavily used recreational areas are the most vulnerable to aquatic invasive species. Only two introduced species were encountered during sampling for this assessment, including brook trout and smallmouth bass.

Some fish species occurred in high densities while others had a more limited distribution and low numbers of individuals. The most ubiquitous fish species within this watershed was the *Catostomus commersoni* (white sucker), which occurred at 65 of the 72 stations (Appendix 4.1). Although the white sucker was the most frequently captured, it was not the most abundant fish species. While only encountered at 51 stations throughout the watershed, the *Luxilus cornutus* (common shiner) was the most abundant fish species with 3,387 individuals collected. Numerous other species of fish were encountered at the majority of the stations, including *Umbra limi* (central mudminnow), *Semotilus atromaculatus* (creek chub), *Rhinichthys cataractae* (longnose dace), *Rhinichthys atratulus* (blacknose dace), and *Cottus bairdii* (mottled sculpin). Fish that were encountered during sampling consisted of both warm-water riverine and cold-water obligate species. This is likely due to the diversity of water temperature, habitat, and overall channel morphology found throughout the Rainy River-Headwaters Watershed.

Certain attributes of the fish community, such as pollution tolerance, trophic (feeding) habits, reproductive traits, habitat preferences, species richness, and life history strategies can provide insight into the quality of the streams in which they inhabit. These attributes cannot only be beneficial in identifying a streams status but also in identifying environmental stressors that may be contributing to aquatic life impairments. Fish species that are known to be intolerant or sensitive of disturbances are almost always a good indication of quality stream habitat, water chemistry, and connectivity. On the contrary, a fish assemblage that is dominated by tolerant species is likely an indication of poor water quality, habitat, or other natural or anthropogenic factors. Though there were some tolerant fish species captured throughout the watershed, most streams had a robust population of sensitive fish species. Anthropogenic stressors were few throughout this watershed and resulted in sufficient habitat and water chemistry to support these assemblages. The most frequently captured sensitive species was the longnose dace, which was found at 38 of the 72 stations. Overall, the presence of relatively sensitive species and a limited number of tolerant species indicates exceptional water quality. Problem areas do persist and are likely attributed to natural and anthropogenic stressors that can be found in select drainages.

Macroinvertebrates

Between 2010 and 2015 there were a total of 76 macroinvertebrate monitoring visits (representing 61 stations) within the Rainy River-Headwaters Watershed. Of the 398 unique taxonomic groupings observed within this watershed, approximately 30% of these represent sensitive individuals. The most numerous taxonomic groupings observed were *Chimarra* (finger-net caddisflies), *Simulium* (blackflies), *Hydrobiidae* (gastropods), *Hydropsychidae* (net-spinning caddisflies), *Rheotanytarsus* (midges). Many of these taxa represent ubiquitous species found across Minnesota. The macroinvertebrate surveys did not identify species that are considered to be endangered or threatened but one species of special concern (*Boyeria grafinana*; Odonata) were observed at five monitoring location throughout this watershed. However, many of the specimens collected during these surveys could be representative of species on this list, based on their known range, distribution, and habitat requirements. Many of the macroinvertebrate communities in the Rainy River-Headwaters Watershed are representative of excellent/exceptional water quality. These catchments should be managed to maintain their valuable aquatic resources.

Watershed-wide condition

Fish and macroinvertebrate communities throughout the Rainy River-Headwaters Watershed are in generally excellent condition. The relatively low amount of anthropogenic stressors within the Rainy River-Headwaters Watershed likely contributes to the exceptional quality of its waterways. Most F-IBI and M-IBI scores are very near, or actually attain an exceptional use designation. Good habitat, water chemistry, and flow conditions may all play a role in the high overall diversity of species and the relatively high frequency of sensitive species. Fish communities in particular tend to perform relatively well, perhaps due to fairly diverse and abundant habitat found in most Rainy River-Headwaters streams. Some of the most noteworthy waterways according to the F-IBI and M-IBI scores, include Bezhik Creek, Denley Creek, MItawan Creek, Jack Pine Creek, Snake River, Little Isabella River, and the Cross River (Table 59).

Fish contaminant results

Mercury was analyzed in fish tissue samples collected from the 213 lakes in the watershed. Polychlorinated biphenyls (PCBs) were measured in at least one fish species from most of the lakes. Twenty-one species were tested for contaminants, including crayfish. A total of 13,023 fish were collected for contaminant analysis between 1970 and 2015.

Contaminant concentrations are summarized by waterway, fish species, and year (Appendix 6). “Total Fish” indicates the total number of fish analyzed and “N” indicates the number of samples. The number of fish exceeds the number of samples when fish are combined into a composite sample. This was typically done for panfish, such as bluegill sunfish and yellow perch. “Anatomy” refers to the type of sample; since 1989, most of the samples have been skin-on fillets (FILSK) or for fish without scales (catfish and bullheads), skin-off fillets (FILET). Occasionally, whole fish (WHORG) were analyzed and there were a few other types of sample with codes identified in the footnote of the table.

Most of the lakes (188) were listed as impaired for mercury in fish tissue in MPCA’s 2016 Draft Impaired Waters List. Of those impaired lakes, 98 were included in the Statewide Mercury TMDL. The other impaired lakes had mercury concentrations high enough to not qualify for the Statewide TMDL.

None of the waters in this watershed are listed as impaired for PCBs in fish tissue. PCB concentrations in fish tissue were near or below the reporting limit (0.01 - 0.03 mg/kg). Fish consumption advice, developed by the Minnesota Department of Health, has meal advice of "unrestricted" for PCBs in fish less than or equal to 0.05 mg/kg.

Overall, mercury concentrations in fish remain a concern for this watershed. The Fish Contaminant Monitoring Program will continue to retest the fish from impaired waters to assess if mercury levels are changing.

Pollutant load monitoring

The WPLMN has two stations within the Rainy River-Headwaters Watershed as shown in Table 56. Average annual FWMCs of TSS, TP, and NO_3+NO_2-N for major watershed stations statewide are presented below, with the Rainy River-Headwaters Watershed highlighted. Water runoff, a significant factor in pollutant loading, is also shown. Water runoff is the portion of annual precipitation that makes it to a river or stream; this it can be expressed in inches.

Table 56. WPLMN stream monitoring stations for the Watonwan River watershed

Station Type	Stream Name	USGS/DNR ID	EQuIS ID
Major Watershed	Kawishwi River near Winton, MN	E72061001	S006-522
Subwatershed	Stony River near Babbitt, Tomahawk Rd	H72045001	S002-811

As a general rule, elevated levels of TSS and NO_3+NO_2-N are regarded as "non-point" source derived pollutants originating from many small diffuse sources such as urban or agricultural runoff. Excess TP can be attributed to both non-point as well as point sources such as industrial or wastewater treatment plants. Major "non-point" sources of phosphorus include dissolved phosphorus from fertilizers and phosphorus adsorbed to and transported with sediment during runoff. Excessive TSS, TP, and NO_3+NO_2-N in surface waters impacts fish and other aquatic life, as well as fishing, swimming and other recreational uses. High levels of NO_3+NO_2-N is a concern for drinking water.

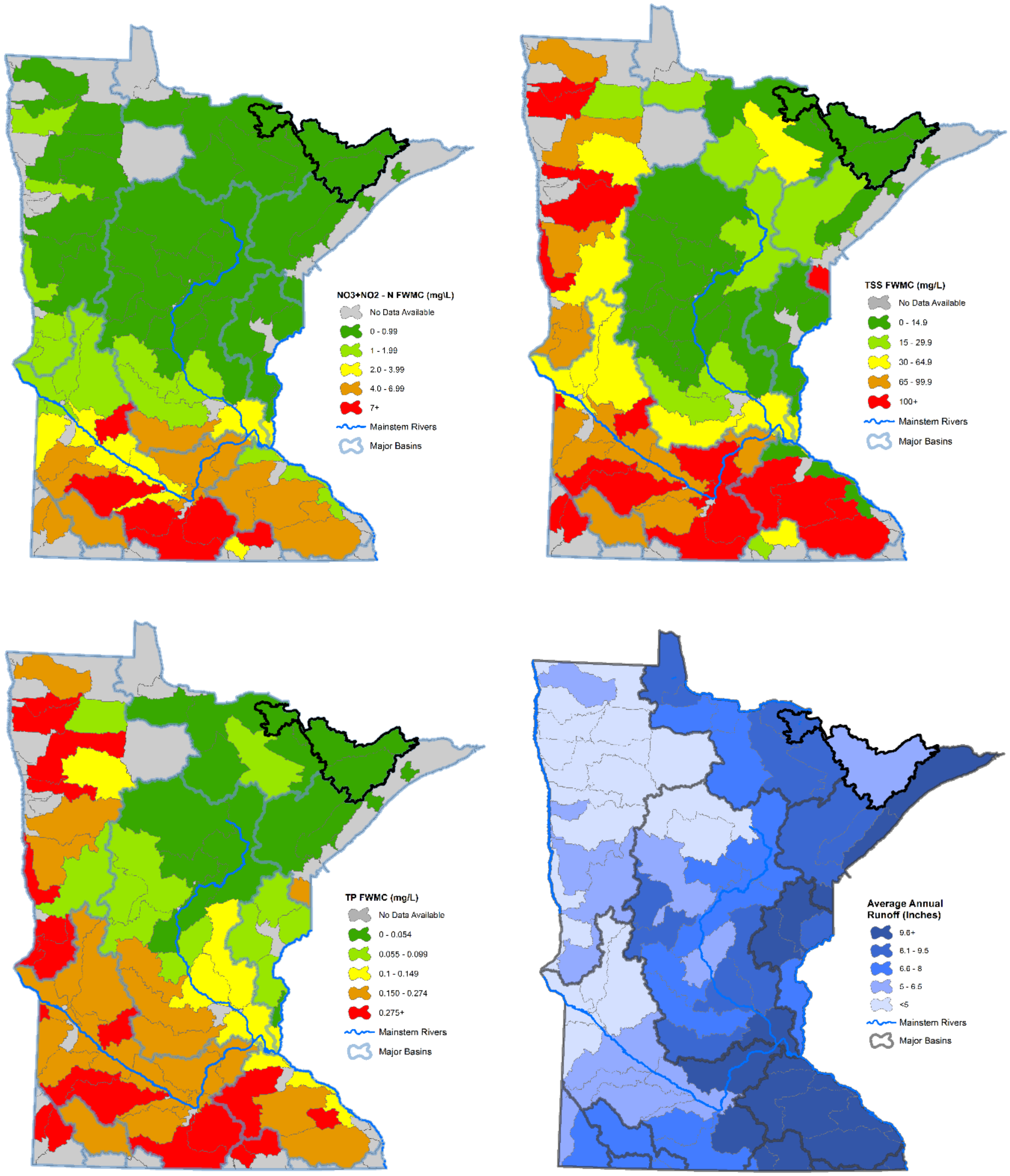

Figure 71. 2007-2014 Average annual TSS, TP, and NO_3-NO_2-N flow weighted mean concentrations, and runoff by major watershed.

Figure 71 shows the average annual TSS, TP, and NO_3+NO_2-N FWMCs for the Rainy River-Headwaters Watershed to be very low, similar to other watersheds in northeast and north central Minnesota. A large proportion of the Kawishiwi River drainage is located within the BWCAW. There is some logging activity and mining exploration in the region but for the most part, the drainage is relatively pristine.

More information, including results for subwatershed stations, can be found at the WPLMN website.

Substantial year-to-year variability in water quality occurs for most rivers and streams, including the Kawishiwi River. Results for individual years are shown in the charts below (Figure 72).

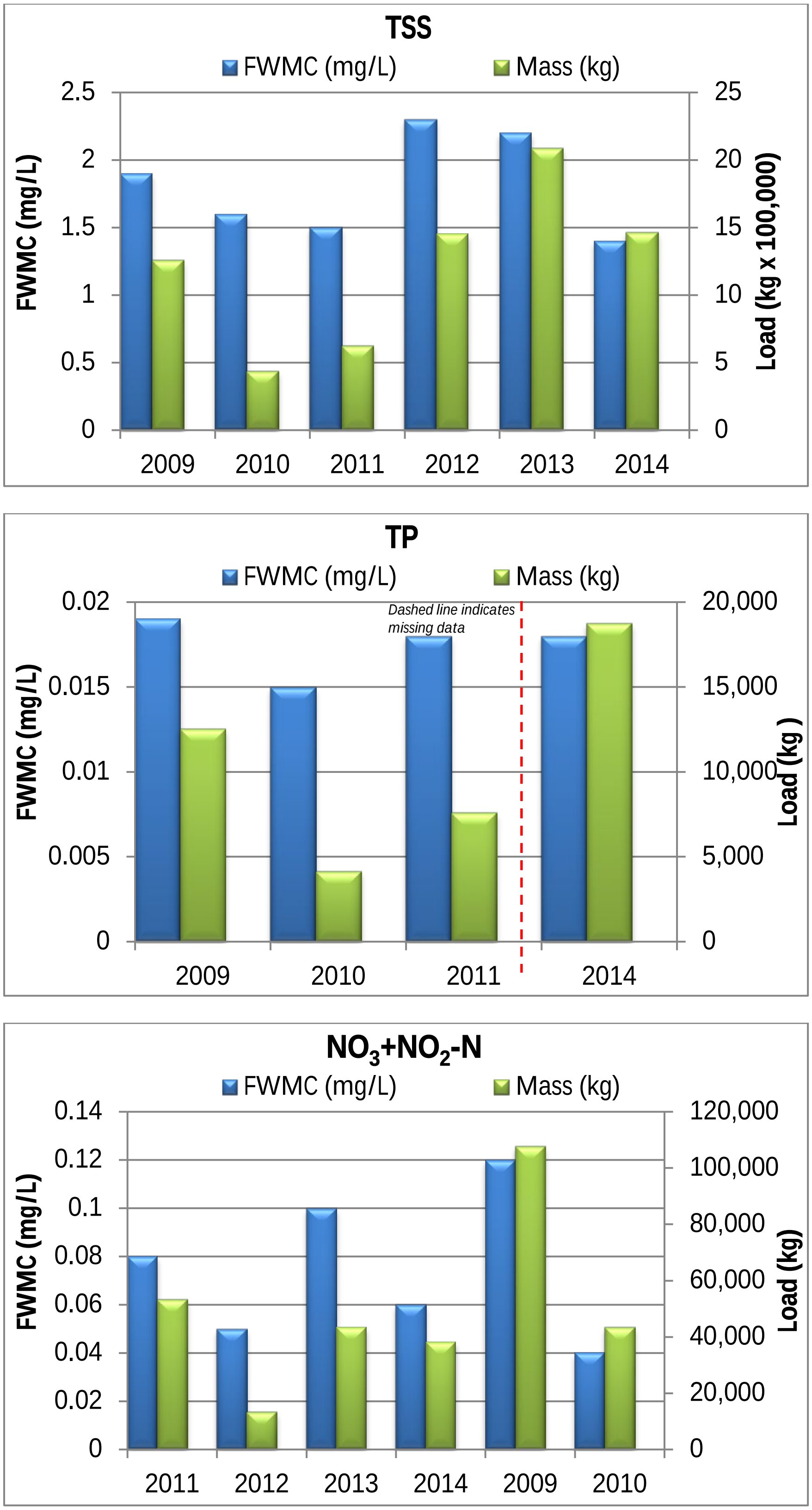

Figure 72. TSS, TP, and NO_3+NO_2-N flow weighted mean concentrations and loads for the Kawishiwi River near Winton, MN.

Groundwater monitoring

Groundwater quality

A 1999 MPCA statewide baseline study determined that the groundwater quality in northeast Minnesota is considered good when compared to other areas with similar aquifers. Concentrations of major cations and anions were lower in the surficial and buried drift aquifers when compared to similar aquifers statewide (MPCA, 1999). Exceedances of drinking water criteria in arsenic, beryllium, boron, manganese and selenium did occur, and were contributed to geology, but some trace inorganic chemicals could be of concern locally. Volatile organic compounds were also detected in this region, with the most commonly detected compounds associated with well disinfection, atmospheric deposition and fuel oils (MPCA, 1999).

The MPCA currently monitors three shallow groundwater wells within the watershed. These stations have not been monitored long enough to calculate trends in groundwater quality, but results to date reflect the description of background surficial water quality outlined in the baseline study.

Mandatory MDH testing of new drinking water wells for arsenic, a naturally occurring but potentially harmful contaminant for humans, found that in this area of the state, the majority of new wells are within the water quality standards for arsenic levels, but there are some exceedances of the maximum contaminant level (MCL) of 10 μg/L. The percentages of wells identified with concentrations exceeding the MCL by county in the Rainy River-Headwaters Watershed are as follows: St. Louis (27.4%) Cook (12.6%) and Lake (3.8%) (MDH, 2017).

Groundwater/surface water withdrawals

The DNR requires permits for users withdrawing more than 10,000 gallons of water per day or 1 million gallons per year. Annual reports are entered into and stored in the DNR Permitting and Reporting System. Figure 73 and Figure 74 display, respectively, total active permitted groundwater and surface water withdrawals within the watershed for the past 20 years (DNR, 2016b). Neither exhibits a statistically significant trend over this time period.

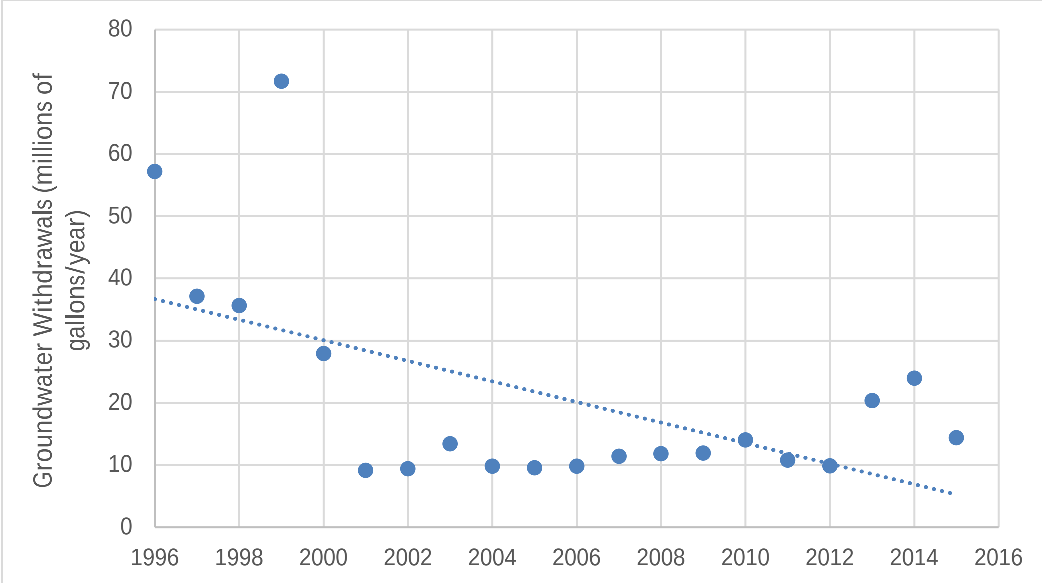

Figure 73. Total annual permitted groundwater withdrawals, Rainy River-Headwaters Watershed (1996-2015).

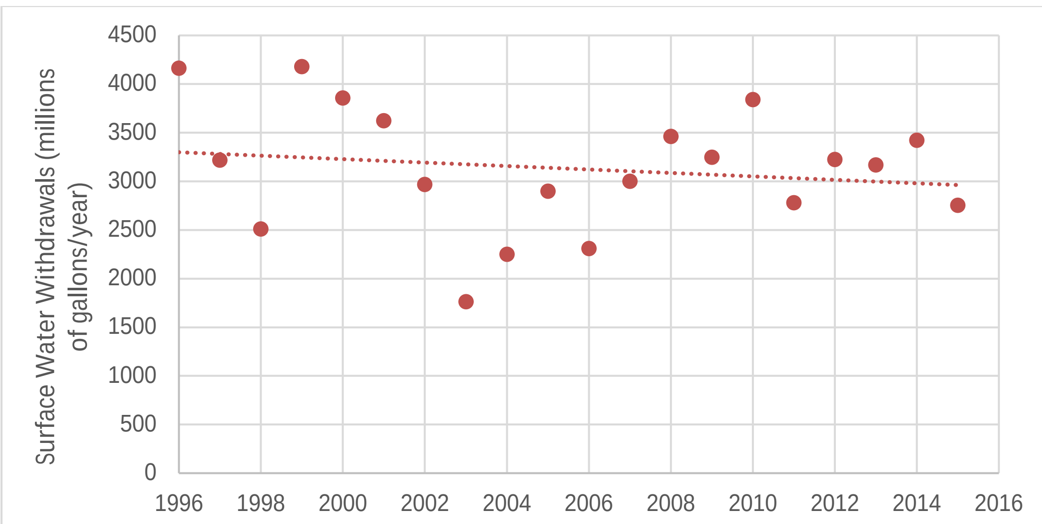

Figure 74. Total annual permitted surface water withdrawals, Rainy River-Headwaters Watershed (1996-2015).

Stream flow

Groundwater/surface water interactions are common and the impacts of groundwater use on surface water quantity have been documented in places like Little Rock Creek and White Bear Lake. Discharge is one measure of the volume of water in a stream. Figure 75 and Figure 76 depicts mean annual and mean summer monthly discharge on the South Kawishiwi River. Continuous measurements were available for the time period 2004-2015. The data appear to indicate an increasing flow trend, but the increase is not at a statistically significant rate. (USGS, 2016)

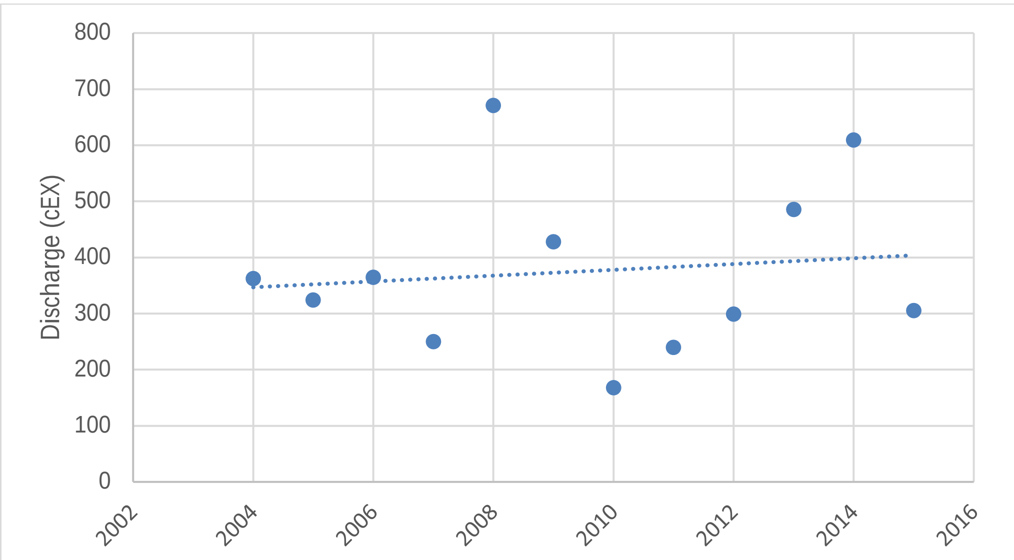

Figure 75. Mean annual discharge measurements for the South Kawishiwi River (2004-2015).

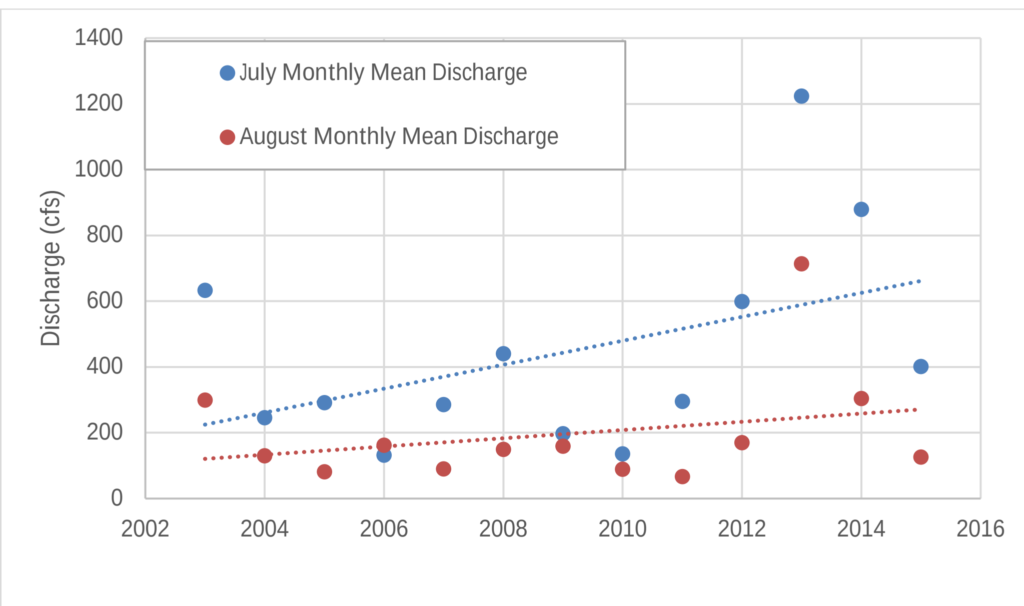

Figure 76. Mean July/August discharge measurements for the South Kawishiwi River (2004-2015).

Wetland condition

The Rainy River-Headwaters Watershed occurs entirely within the Mixed Wood Shield Ecoregion. Wetland condition, in this ecoregion is very good, especially when compared to other ecoregions in the state. Based on plant community floristic quality, 84% of the wetlands in the Mixed Wood Shield Ecoregion are estimated to be in Exceptional or Good condition and an estimated 0% are in Poor condition (Table 57). In the other two ecoregions of the state wetland condition results are essentially opposite. In these locations significant extents of wetland area is dominated by invasive plants, particularly narrow-leaf cattail (Typha angustifolia), hybrid cattail (Typha X glauca), and reed canary grass (Phalaris arundinacea). These invasive plants often outcompete native species due to their tolerance of nutrient enrichment, hydrologic alterations and toxic pollutants such as chlorides (Galatowisch 2012) and thus strongly influence the composition and structure of the wetland plant community. In the Rainy River-Headwaters Watershed and other HUC8 watersheds located within the Mixed Wood Shield ecoregion water quality efforts should focus on protecting the quality wetland resource that is present including efforts to limit hydrologic alternations and the spread of invasive species which are known to rapidly and dramatically impact wetland quality.

Table 57. Wetland biological condition by major ecoregions based on floristic quality. Results are expressed as an extent (i.e., percentage of wetland acres) and include essentially all wetland types (MPCA 2015).

Condition Category	Mixed Wood Shield	Mixed Wood Plains	Temperate Prairies
Exceptional	64%	6%	7%
Good	20%	12%	11%
Fair	16%	42%	40%
Poor	0%	40%	42%

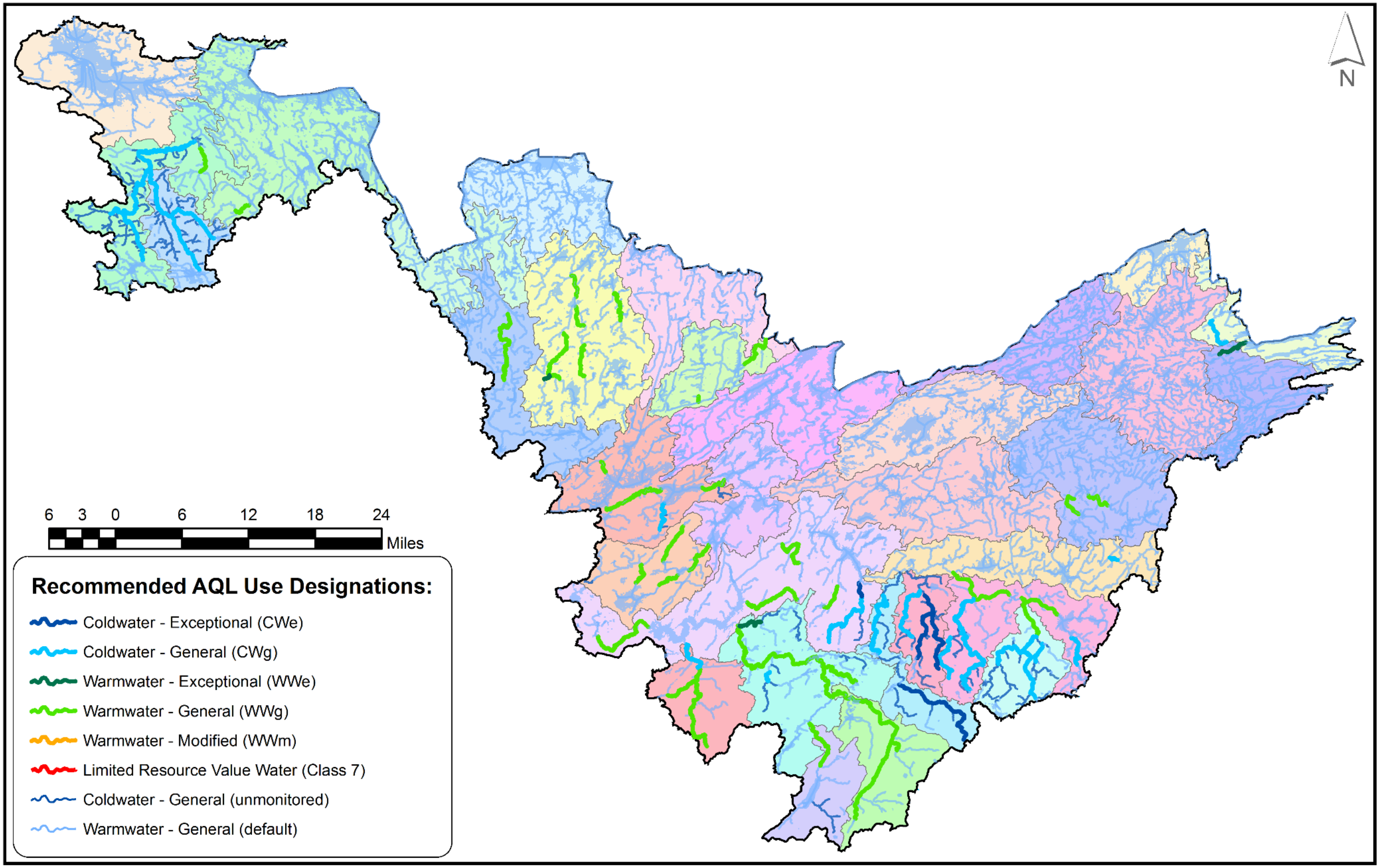

Figure 77. Stream tiered aquatic life use designations in the Rainy River-Headwaters Watershed.

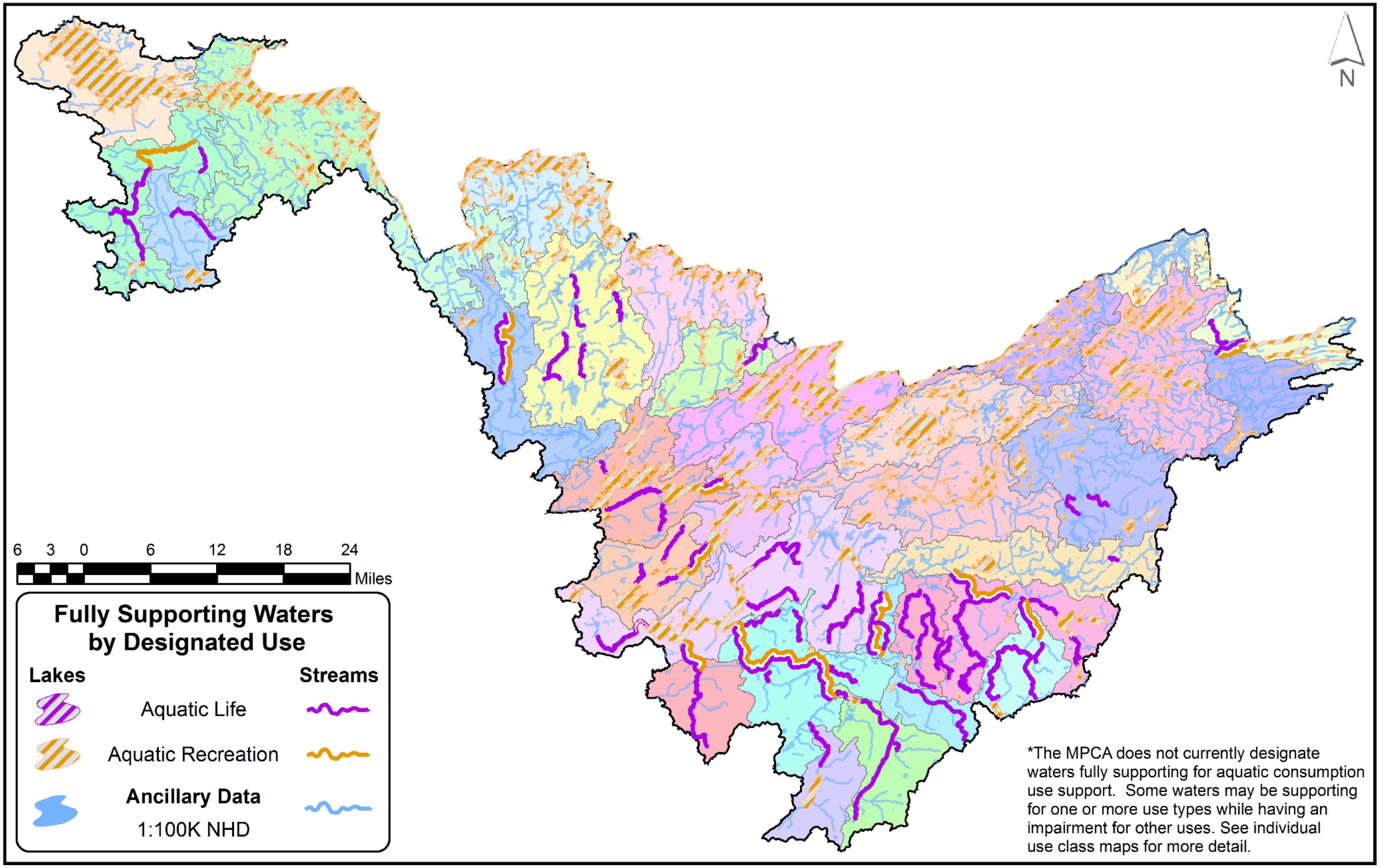

Figure 78. Fully supporting waters by designated use in the Rainy River-Headwaters Watershed.

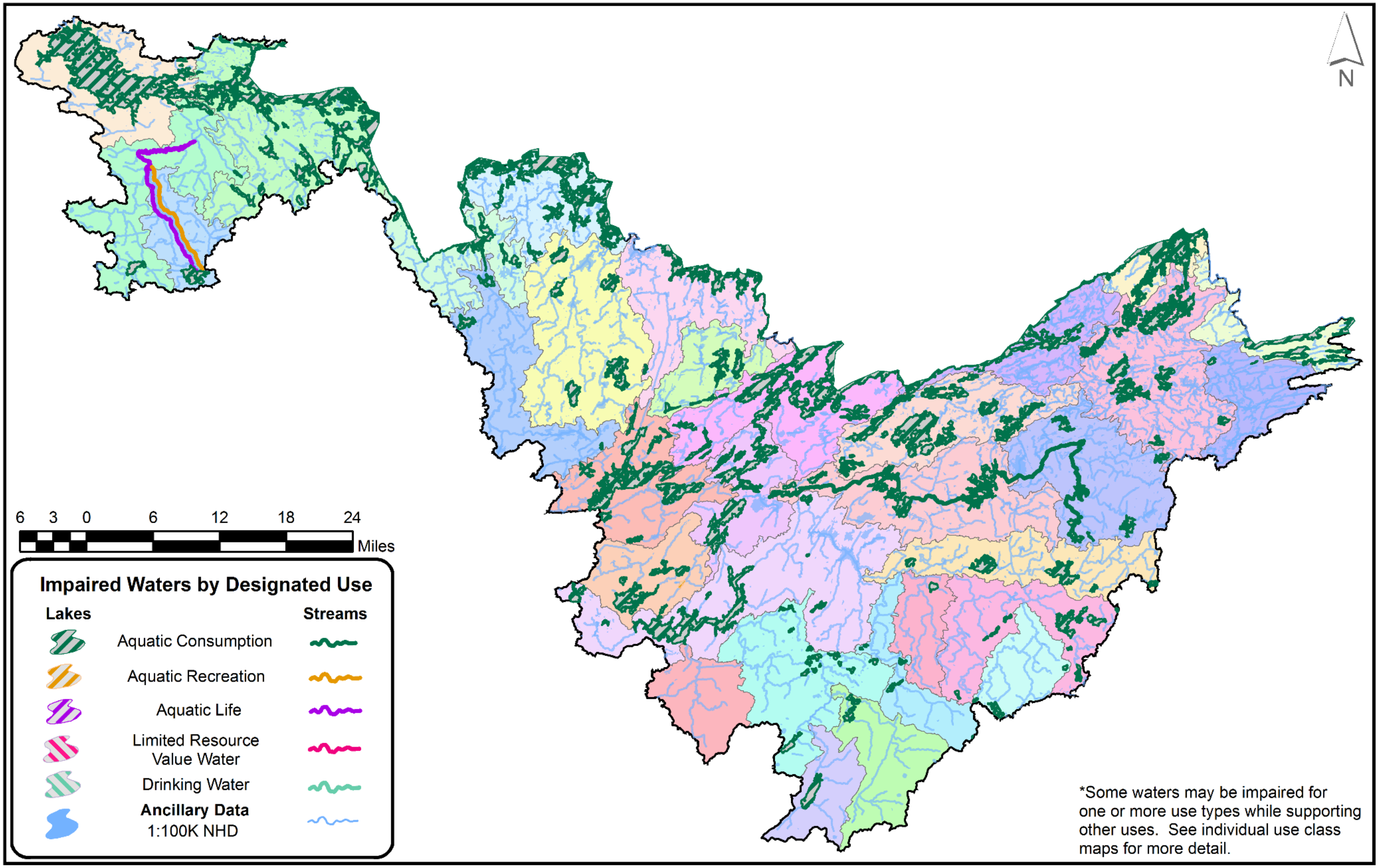

Figure 79. Impaired waters by designated use in the Rainy River-Headwaters Watershed.

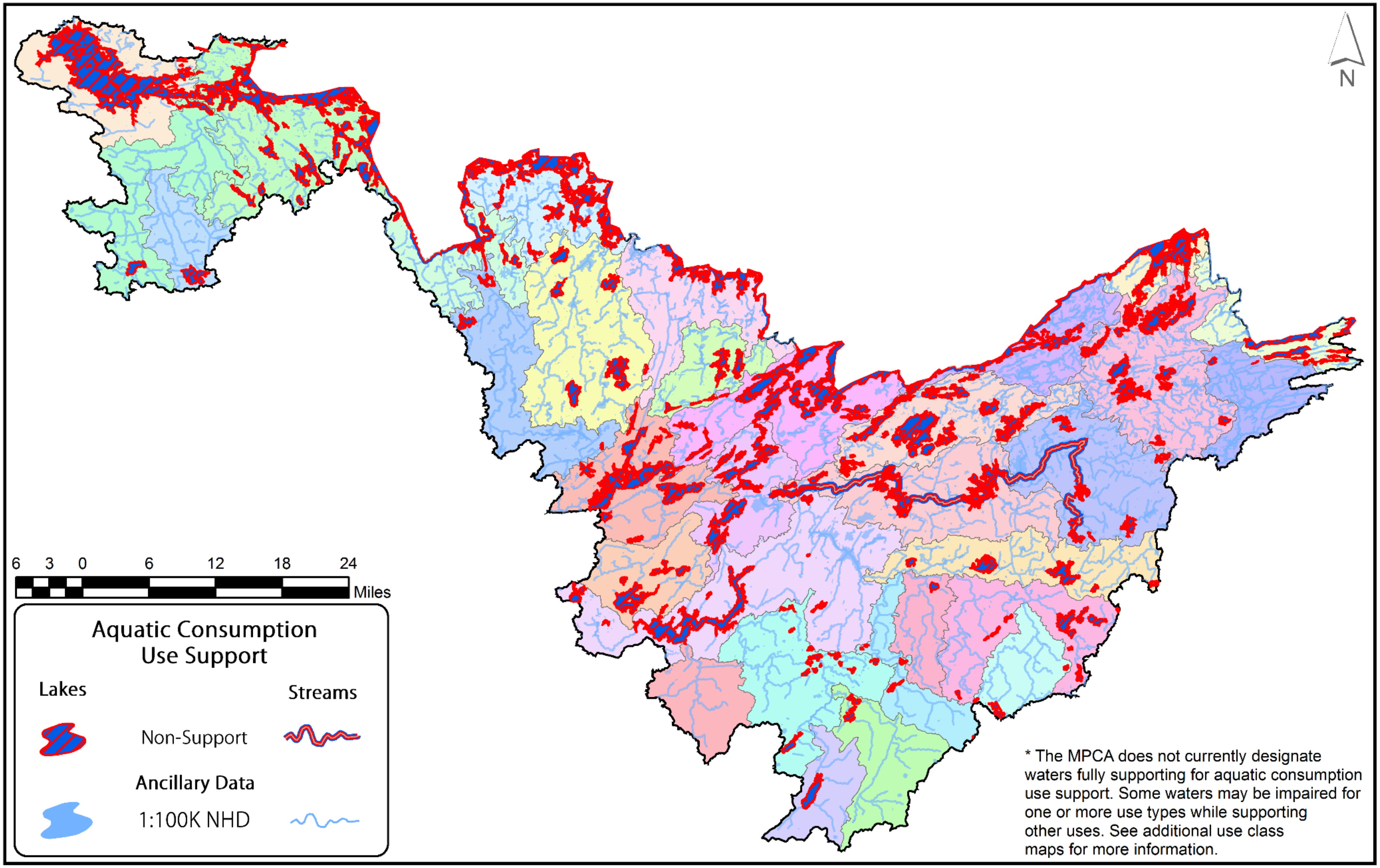

Figure 80. Aquatic consumption use support in the Rainy River-Headwaters Watershed.

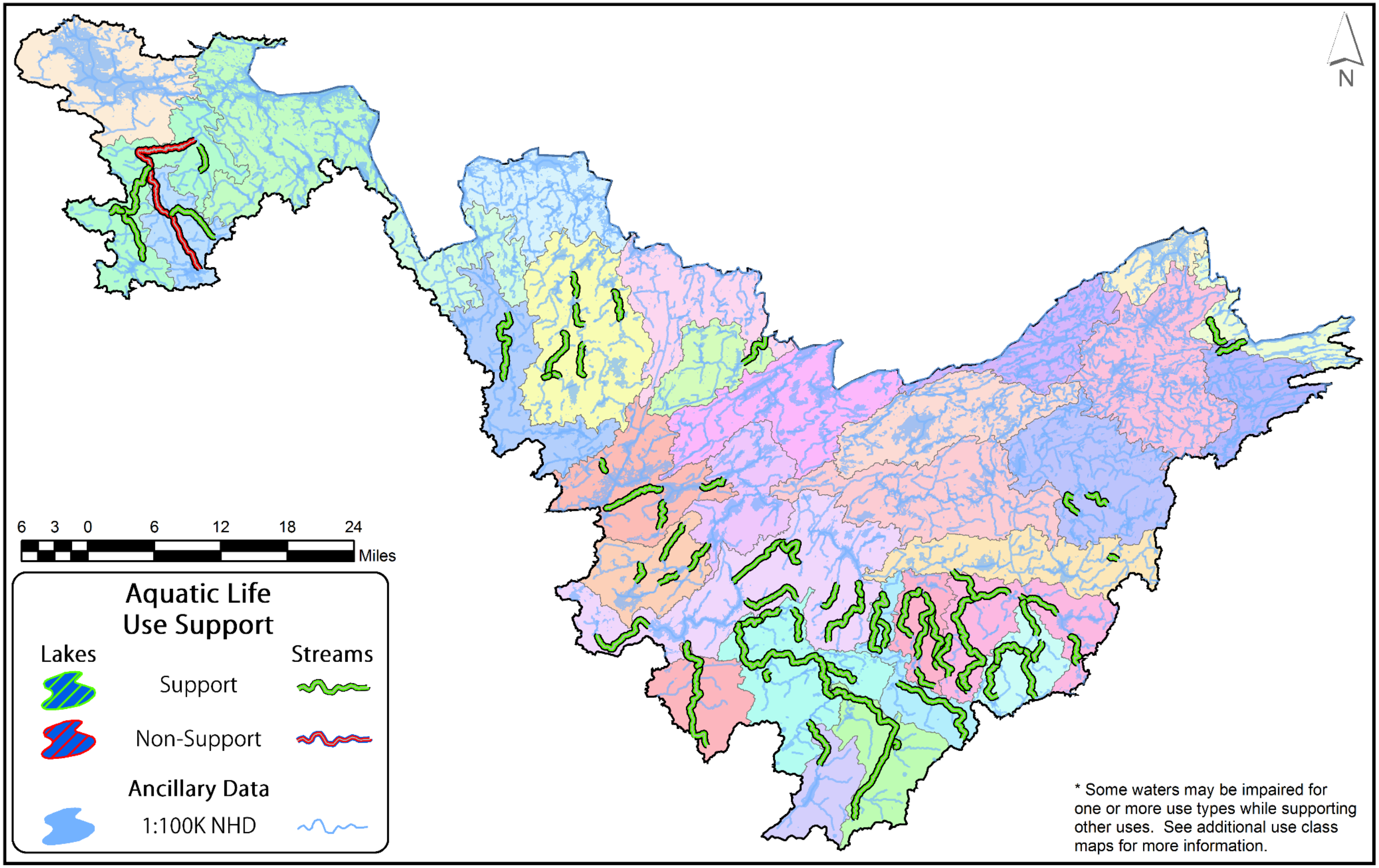

Figure 81. Aquatic life use support in the Rainy River-Headwaters Watershed.

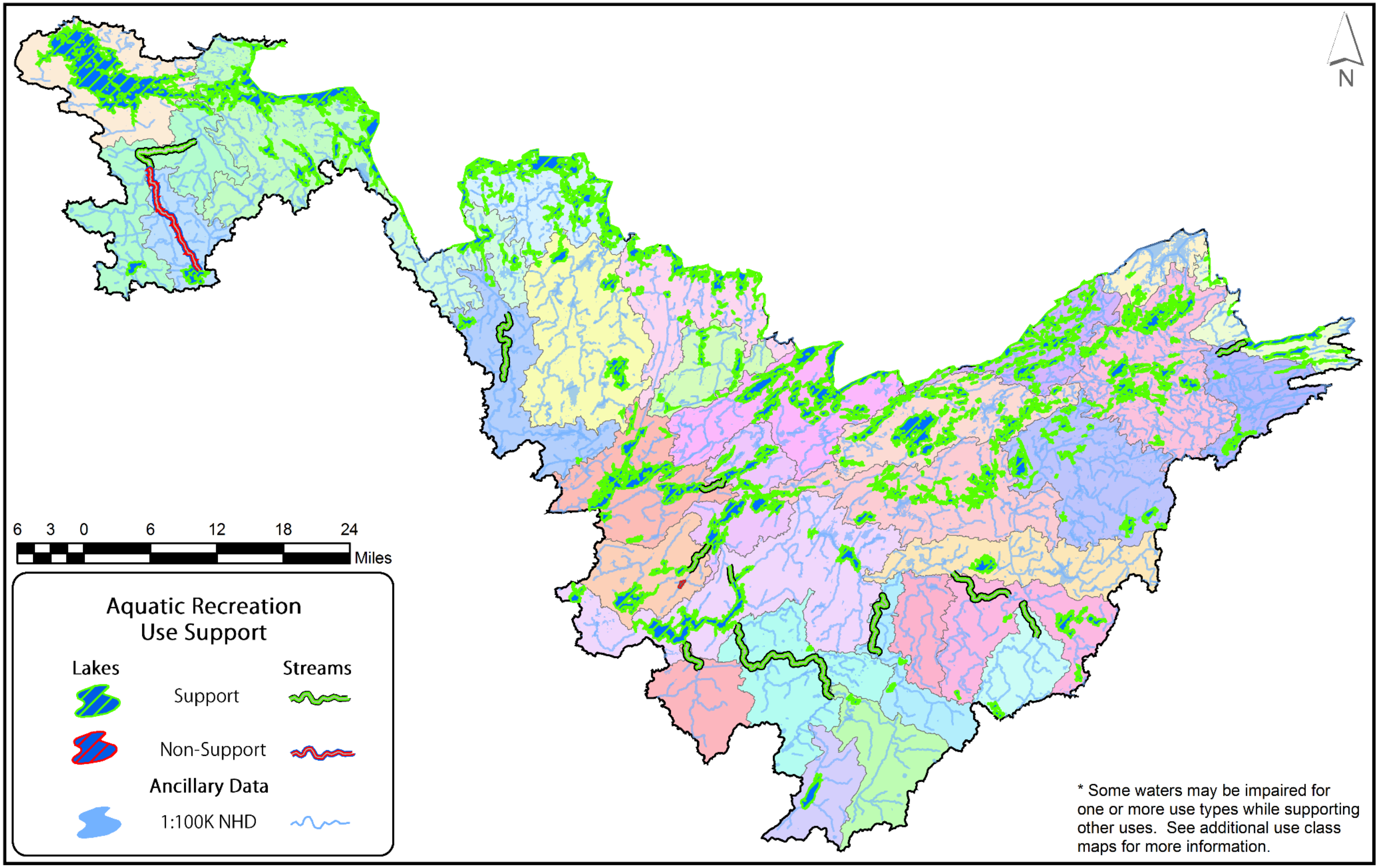

Figure 82. Aquatic recreation use support in the Rainy River-Headwaters Watershed.

Transparency trends for the rainy river-headwaters watershed

The MPCA completes annual trend analysis on lakes and streams across the state based on long-term transparency measurements. The data collection for this work relies heavily on volunteers across the state and also incorporates any agency and partner data submitted to EQuIS.

The trends are calculated using a Seasonal Kendall statistical test for waters with a minimum of eight years of transparency data; Secchi disk measurements in lakes and Secchi tube measurements in streams.

Citizen volunteer monitoring occurs at 1 stream and 185 lakes in the watershed (Table 58). Most lakes had no trend in transparency. Six lakes had declines in clarity: notably Burntside, Farm, and Garden Lakes. Improving Secchi transparency was detected on 7 lakes such as Shagawa, Vermilion, Namakan, Kabetogama, and Ban.

Table 58. Water clarity trends at citizen stream monitoring stations.

Rainy River-Headwaters HUC 09030001	Citizen Stream Monitoring Program	Citizen Lake Monitoring Program
Number of stations w/ increasing trend	0	7
Number of stations w/ decreasing trend	0	6
Number of stations w/ no trend	1	172

In June 2014, the MPCA published its final trend analysis of river monitoring data located statewide based on the historical Milestones Network. The network is a collection of 80 monitoring locations on rivers and streams across the state with good, long-term water quality data. The period of record is generally more than 30 years, through 2010, with monitoring at some stations going back to the 1950s. While the network of stations is not necessarily representative of Minnesota's rivers and streams as a whole, they do provide a valuable and widespread historical record for many of the state's waters. Starting in 2017, the MPCA will be switching to the Pollutant Load Monitoring Network for long-term trend analysis on rivers and streams. Data from this program has much more robust sampling and will cover over 100 stations across the state.

Remote sensing for lakes in the rainy river-headwaters watershed

The University of Minnesota, in partnership with MPCA, conducts remote sensing of lake clarity. The information provides a snapshot of water transparency during late summer over a span of 30 years. Secchi disk transparency data is paired with satellite imagery to come up with estimates of water clarity across the state. While there are limitations to the data, such as cloud cover, vegetation, or stained water altering the estimated Secchi transparency, it does provide information to help prioritize monitoring and protection efforts on lakes which do not have water quality data.

Several other Rainy River-Headwaters subwatersheds deep within the BWCAW had many lakes that were fully support aquatic recreation based on satellite estimated Secchi transparency. Examples of these lake-dominated watersheds include Basswood Lake, Upper Kawishiwi, Lower Kawishiwi, Crooked Lake, Horse River, Knife Lake, Boulder River, and Lac La Croix. As expected, high quality lakes abound in the BWCAW and throughout the Rainy-Headwaters watershed. In many individual lakes, lake transparency data collected from BWCAW volunteers (such as the Boy Scouts of America at the Northern Tier High Adventure Base near Ely) corroborated these assessment decisions. A summary of remotely-sensed Secchi transparency for larger lakes in the Rainy River-Headwaters Watershed is shown in Figure 83. Subwatershed maps of remote-sensed Secchi transparency, circa 2005, can be found in this MPCA report https://www.pca.state.mn.us/sites/default/files/wq-ws3-09030001.pdf.

Lake transparency is generally the clearest (greater than 4 meters or 14 feet) in the northern and northeast portions of the watershed, corresponding with the area's deep, clear bedrock basins, then gradually declines east to west due to variations in geology and wetlands and forest. Watersheds with naturally low transparency due to bog staining are most pronounced in the South Kawishiwi, Island, and Greenwood River Subwatersheds.

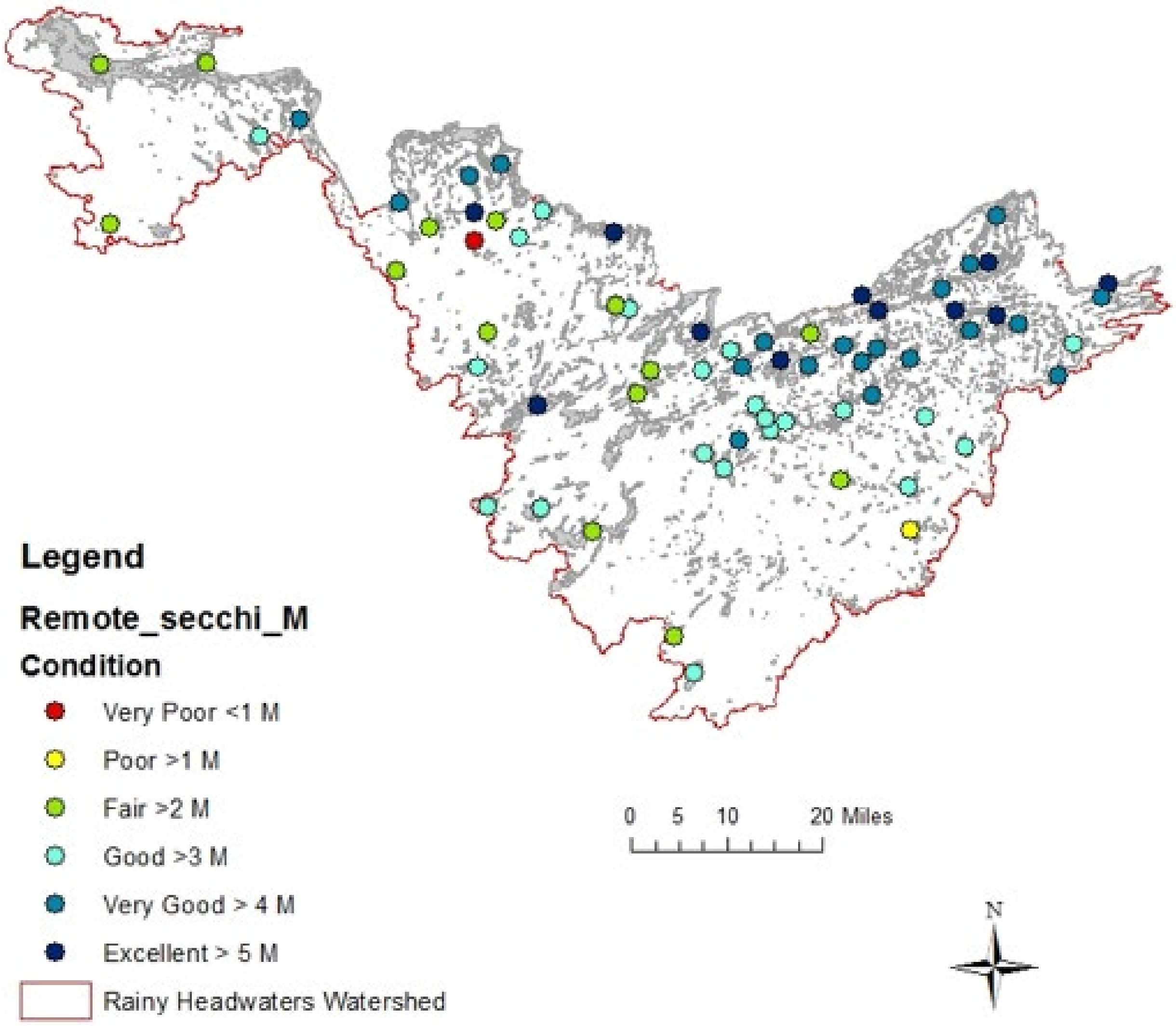

Figure 83. Remotely sensed Secchi transparency on lakes in the Rainy River-Headwaters watershed.

Summaries and recommendations

The Rainy River-Headwaters Watershed contains a large portion of the BWCAW, which is best known for its scenic views, towering pines, and magnificent cascades that connect large bodies of water. This entire watershed, including much of northeastern Minnesota, is comprised of vast tracts of upland and lowland forest. Recreational opportunities are abundant throughout this forested landscape with its streams and lakes as major focal points. This scenic watershed is only 11.4% privately owned leaving the majority of the land undeveloped and open to the public (NRCS, 2007). The undeveloped nature of this watershed is undoubtedly a key reason for the high water quality found in the majority of the Rainy River-Headwaters Watershed.

Biological monitoring results identified numerous sensitive fish species within the Rainy River-Headwaters Watershed. All of the stream reaches that were assessable met biological criteria for both fish and macroinvertebrates, and at times significantly exceeded the biological impairment thresholds. Though many of the reaches were found to be in good biological standing, some chemical aquatic life indicators exceeded state standards. The chemical impairments, although not reflected in some fish and macroinvertebrate Index of Biological Integrity scores, may have a negative effect on biological composition, diversity, and overall health. In-stream habitat, as indicated by Minnesota Stream Habitat Assessment (MSHA) scores, ranged from poor to good, with a relatively high amount of quality habitat accessible for biological communities. Many stations had a variety of habitat that allowed a diversity of species to persist and therefore to be collected during sampling for this report. In some cases, high quality in-stream habitat may be mitigating the negative consequences of point or non-point pollutants at the few locations were these stressors exist.

Lake water quality is in good to excellent conditions throughout the watershed. Fifty nine of the 60 lakes sampled meet the eutrophication standards. Natural background conditions from the surrounding drainage were determined to be the cause of high nutrients and algae in shallow Blueberry Lake near Ely, the one lake that did not meet standards. Over 185 lakes within the BWCAW met the eutrophication standards, based on satellite-estimated Secchi transparency. Sand, Kabetogama, Johnson, and Onagon lakes were closest to being designated as impaired. While these lakes do meet standards, they would benefit from additional monitoring even though these relatively productive waters are likely heavily influenced by natural conditions.

Groundwater within the Rainy River-Headwaters Watershed is generally of good quality. Chemical and mineral content of groundwater is heavily influenced by residence time and contact with bedrock. Recharge to these aquifers is limited due to the surficial geology. Shallow aquifers provide sufficient quantities of groundwater for domestic use and the existing rate of high-capacity groundwater use does not appear to be negatively impacting surface water flow.

Impairments found on stream segments within the Rainy River-Headwaters Watershed are likely a function of both natural and anthropogenic stressors. Streams with more erosive soils tend to have higher suspended sediment in lower reaches. These conditions likely have a natural component, but the suspended sediment can result in stressful conditions for biological communities and may be amplified by poor land use practices. Aquatic consumption impairments, caused primarily by atmospheric deposition of mercury from the global burning of fossils fuels, are one of the widest spread impairments lakes and rivers throughout the watershed. Both DO and pH met standards, reflecting the undeveloped nature of the watershed. Bacteria levels (*E. coli*) were good for most subwatersheds. The Black Duck River Subwatershed had an *E. coli* impairment that may be tied to current land use within that specific drainage.

Overall, lakes and streams within the Rainy River-Headwaters Watershed have benefited from little developmental pressure. However, these systems are highly sensitivity to anthropogenic stressors like most waterbodies in northern Minnesota. A continued vigilance is necessary to monitor areas where developmental pressures are or will be expected to occur. Point and non-point pollutants are affecting water quality and quantity in select drainages, and will be addressed in future TMDLs. A combination of stressors, including urban/industrial development, forest cover change, draining of wetlands/lakes, and the damming of streams, are likely contributing to the reduction of sensitive species in some stream reaches. The Shagawa and Dunka River Subwatersheds appeared to be the most impacted by urban/industrial development. An emphasis should be given to maintaining natural vegetative buffer areas along shorelines to prevent overland runoff and reduce erosion potential in these more developed watersheds to maintain the existing high quality of the lakes and streams. Some of the top aquatic resources found in this watershed include Bezhik Creek, Denley Creek, and Little Isabella River. A complete list of the top 10 highest quality stream resources within this watershed as indicated by biological (F-IBI and M-IBI) and physical (MSHA) parameters are displayed in Table 59. Those streams that have exceptional biological, chemical, and physical parameters are worthy of additional protections in order to preserve their valuable aquatic resources.

Table 59. Top 10 stream resources in the Rainy River-Headwaters Watershed as indicated by biological and physical parameters.

Rank	Stream Name	Biological Station	Reach Description
1	Bezhik Creek	14RN036	BWCAW Boundary to Moose River
2	Denley Creek	14RN067	Nira Creek to Stony River
3	Little Isabella River	14RN079	Headwaters to Flat Horn Lake
4	Mitawan Creek	05RN073, 06RN014, 05RN190	Kitigan Lake to BWCAW Boundary
5	Snake River	14RN064	BWCAW Boundary to T61 R10W S12, North Line
6	Jack Pine Creek	14RN081	Headwaters to Mitawan Creek
7	Cross River	14RN011	Ham Lake to Gunflint Lake
8	Moose River	14RN035, 05RN076, 14RN034	BWCAW Boundary to BWCAW Boundary
9	Stony River	14RN073, 14RN072, 05RN074, 14RN007	Headwaters to Birch Lake
10	Arrowhead Creek	10RN070, 14RN086, 14RN085	Spear Lake to Island River

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Appendix 1 – Water chemistry 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.

Orthophosphate - Orthophosphate (OP) is a water soluble form of phosphorus that is readily available to algae (bioavailable). 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.

Total Kjeldahl 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. Increasing the amount of phosphorus entering the system therefore increases the growth of aquatic plants and other organisms. Excessive levels of Phosphorous over stimulate aquatic growth and resulting in the progressive deterioration of water quality from overstimulation of nutrients, called eutrophication. Elevated levels of phosphorus 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.

Total Suspended Solids (TSS) – TSS and turbidity are highly correlated. 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. The greater the level of TSS, the murkier the water appears and the higher the measured turbidity.

Higher turbidity results in less light penetration which may harm beneficial aquatic species and may favor undesirable algae species. An overabundance of algae can lead to increases in turbidity, further compounding the problem.

Unionized 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 2.1 – Intensive watershed monitoring water chemistry stations in the Rainy River-Headwaters Watershed

EQuIS ID	Biological Station	AUID	Waterbody Name	Location	Aggregated 12-digit HUC
S007-902	14RN001	09030001-818	Ash River	At Ash River Recreational Trail, 10 mi. N of Ash Lake	0903000123-01
S008-618	- -	09030001-820	Black Duck River	At Sheep Ranch Road, 5 mi. NE of Ash Lake	0903000123-03
S007-903	14RN003	09030001-557	Little Indian Sioux River	At Tomahawk Road (FR-377), 12 mi. N of Isabella	0903000120-02
S007-905	14RN004	09030001-535	Shagawa River	At Snowmobile Trail off of CSAH-88, 1 mi. SW of Winton	0903000110-01
S000-912	14RN005	09030001-608	Bear Island River	At Highway 1, 3 mi. S of Ely	0903000111-02
S000-108	- -	09030001-536	Kawishiwi River	At Highway 1, 8 mi. SE of Ely	0903000108-01
S007-766	14RN006	09030001-987	Dunka River	At Scott Road (CR-623), 3.5 mi. E of Babbitt	0903000108-02
S002-811	14RN007	09030001-985	Stony River	At New Tomahawk Trail (FR-424), 8.5 mi. E of Babbitt	0903000106-01
S007-910	14RN072	09030001-984	Stony River	At FH 7 Spur (FR-933), 10.5 mi. NW of Isabella	0903000106-02
S007-899	14RN008	09030001-561	Little Isabella River	At the end of Sand River Rd (FR-381), 13 mi. NW of Isabella	0903000107-02
S007-779	14RN009	09030001-563	Island River	At Tomahawk Road (FR-377), 12 mi. N of Isabella	0903000107-04
S007-898	14RN010	09030001-634	Dumbbell River	At Lake 29 E Road (FR-356), 11.5 mi. NE of Isabella	0903000107-05
S007-912	14RN011	09030001-966	Cross River	At County Road 12 (Gunflint Trail), 6.5 mi. SE of Trail End	0903000103-02

Appendix 2.2 – Intensive watershed monitoring biological stations in the Rainy River-Headwaters Watershed

AUID	Biological Station	Waterbody Name	Biological Station Location	County	Aggregated 12-digit HUC
09030001-974	14RN098	Larch Creek	Downstream of Gunflint Trl (CR 12), 3.5 mi. SE of Trails End	Cook	0903000103-01
09030001-966	14RN011	Cross River	Downstream of Gunflint Trl (CR 12), 6.5 mi. SE of Trails End	Cook	0903000103-02
09030001-627	14RN067	Denley Creek	Downstream of Keeley Creek Rd (FR 428), 9 mi. NE of Babbitt	Lake	0903000106-01
09030001-804	14RN069	Nip Creek	Upstream of Private Drive off Stony River Rd (FR 178), 11 mi. SE of Babbitt	Lake	0903000106-01
09030001-978	14RN070	Unnamed Creek (Trib. to Stony R)	Downstream of Clover Lake Spur B (FR 1491B), 12.5 mi. W of Isabella	Lake	0903000106-01
09030001-985	14RN007	Stony River	Upstream of New Tomahawk Rd (FR 424), 8.5 mi. E of Babbitt	Lake	0903000106-01
09030001-985	05RN074	Stony River	Upstream of Hwy 1, 9 mi. NW of Isabella	Lake	0903000106-01
09030001-693	14RN075	Wilbar Creek	Adjacent to Stony River Grade (FR 913), 6 mi. SW of Isabella	Lake	0903000106-02
09030001-984	14RN072	Stony River	Downstream of FH 7 Spur 933 (FR 933), 10.5 mi. NW of Isabella	Lake	0903000106-02
09030001-984	14RN073	Stony River	Upstream of South Stony Rd (FR 393), 6 mi. SW of Isabella	Lake	0903000106-02
09030001-602	14RN077	Greenwood River	Upstream of Private Drive off of Hwy 2, 12 mi. W of Isabella	Lake	0903000106-03
09030001-676	14RN100	Hog Creek	Adjacent to Hog Creek Rd (FR 349), 20 mi. NE of Isabella	Lake	0903000107-01
09030001-530	14RN079	Little Isabella River	Adjacent to Little Isabella River Rd (FR 558), 6.5 mi. NW of Isabella	Lake	0903000107-02
09030001-561	14RN008	Little Isabella River	End of Sand River Rd (FR 381), 13 mi. NW of Isabella	Lake	0903000107-02
09030001-560	14RN082	Inga Creek	Upstream of Closed Trl off of Edward Lake RD (FR 1471), 11.5 mi. NW of Isabella	Lake	0903000107-03
09030001-564	14RN081	Jack Pine Creek	Adjacent to Northwest Rd (FR 373), 9.5 mi. NW of Isabella	Lake	0903000107-03
09030001-568	05RN190	Mitawan Creek	Upstream of Tomahawk Rd (FR 377), 9.5 mi. NW of Isabella	Lake	0903000107-03
09030001-529	14RN083	Island River	Upstream of Lake 29 E (FR 356), 12.5 mi. NE of Isabella	Lake	0903000107-04
09030001-550	14RN086	Arrowhead Creek	Upstream of Sawbill Landing Rd (FR 369), 6 mi. N of Isabella	Lake	0903000107-04
09030001-550	14RN085	Arrowhead Creek	Upstream of Missable Rd (FR 379), 10.5 mi. N of Isabella	Lake	0903000107-04
09030001-563	14RN009	Island River	Upstream of Tomahawk Rd (FR 377), 12 mi. N of Isabella	Lake	0903000107-04
09030001-586	14RN087	Camp Creek, West Branch	Downstream of Northwest Rd (FR 373), 5.5 mi. N of Isabella	Lake	0903000107-04
09030001-979	14RN084	Harriet Creek	Upstream of CR 705, 13 mi. NE of Isabella	Lake	0903000107-04
09030001-574	14RN091	Scott Creek	Adjacent to Plum Lake Rd (FR 364), 8.5 mi. NE of Isabella	Lake	0903000107-05
09030001-632	14RN089	Dumbbell River	Downstream of Dumbbell River Rd (FR 174), 6.5 mi. NE of Isabella	Lake	0903000107-05

AUID	Biological Station	Waterbody Name	Biological Station Location	County	Aggregated 12-digit HUC
09030001-634	14RN010	Dumbbell River	Upstream of Lake 29 E Rd (FR 356), 11.5 mi. NE of Isabella	Lake	0903000107-05
09030001-773	14RN090	Folly Creek	Upstream of Folly Creek Rd (FR 920), 10 mi. NE of Isabella	Lake	0903000107-05
09030001-519	14RN061	Birch River	1 mi. upstream of CSAH 21, 1.5 mi. NW of Babbitt	St. Louis	0903000108-01
09030001-520	14RN062	Keely Creek	End of Birch Lake Access Spur A (FR 1436A), 10.5 mi. NE of Babbit	Lake	0903000108-01
09030001-542	14RN064	Snake River	End of Snake River Rd (FR 381E), 14 mi. NW of Isabella	Lake	0903000108-01
09030001-605	14RN063	Filson Creek	Downstream of Spruce Rd (CR 23), 22 mi. NE of Babbitt	Lake	0903000108-01
09030001-674	05RN065	August Creek	Upstream of Snowmobile Trl off August Cr Rd (FR 388), 15 mi. SE of Winton	Lake	0903000108-01
09030001-986	14RN065	Dunka River	End of Nineteen Proof Rd (FR 423), 6.5 mi. SE of Babbitt	St. Louis	0903000108-02
09030001-987	14RN006	Dunka River	Adjacent to Scott Rd (CR 623), 3.5 mi. E of Babbitt	St. Louis	0903000108-02
09030001-982	14RN095	Phoebe River	7 mi. downstream of Kawishiwi Lake Rd (FR 354), 23 mi. NE of Isabella	Lake	0903000109-02
09030001-990	14RN094	Kawishiwi River	5 mi. downstream of Kawishiwi Lake Rd (FR 354), 21.5 mi. NE of Isabella	Lake	0903000109-02
09030001-535	14RN004	Shagawa River	Downstream of Snowmobile Trl off of CSAH 88, 1 mi. SW of Winton	St. Louis	0903000110-01
09030001-565	14RN055	Longstorff Creek	Downstream of Longstorff Creek Rd, 3 mi. W of Ely	St. Louis	0903000110-01
09030001-808	14RN051	Burntside River	Upstream of CSAH 88, 3 mi. NW of Ely	St. Louis	0903000110-01
09030001-976	14RN052	Crab Creek	3.5 mi. upstream of Van-Vac Rd (CR 404), 8.5 mi. NW of Ely	St. Louis	0903000110-01
09030001-608	14RN005	Bear Island River	Upstream of Hwy 1, 3.5 mi. S of Ely	St. Louis	0903000111-02
09030001-663	14RN059	Beaver River	Downstream of Muckawa Rd (FR 434), 6 mi. NW of Babbitt	St. Louis	0903000111-02
09030001-665	14RN058	Bear Island River	0.5 mi. upstream of CSAH 21, 7 mi. SW of Ely	St. Louis	0903000111-02
09030001-708	14RN060	Johnson Creek	Downstream of CSAH 21, 5 mi. SW of Ely	St. Louis	0903000111-02
09030001-719	14RN002	Horse River	Downstream of Low Lake Rd (FR 457), 11.5 mi. N of Winton	Lake	0903000113-02
09030001-521	14RN034	Moose River	Downstream of Echo Trl (CR 116), 18.5 mi. NW of Ely	St. Louis	0903000118-01
09030001-521	14RN035	Moose River	0.5 mi. upstream of Moose Loop (FR 464), 17 mi. NW of Ely	St. Louis	0903000118-01
09030001-601	14RN044	Portage River	2.5 mi. downstream of Echo Trl (CR 116), 19.5 mi. NW of Ely	St. Louis	0903000118-01
09030001-650	14RN043	Nina Moose River	6 mi. downstream of Echo Trl (CR 116), 22.5 mi. NW of Ely	St. Louis	0903000118-01
09030001-744	14RN047	Duck Creek	Upstream of Echo Trl (CR 116), 17 mi. NW of Ely	St. Louis	0903000118-01
09030001-788	14RN045	Portage River	Upstream of Echo Trl (CR 116), 17 mi. NW of Ely	St. Louis	0903000118-01
09030001-975	14RN036	Bezhik Creek	0.5 mi. upstream of Moose Loop (FR 464), 17 mi. NW of Ely	St. Louis	0903000118-01
09030001-733	14RN071	Stuart River	5 mi. downstream of Echo Trl (CR 116), 19 mi. NW of Ely	St. Louis	0903000118-01
09030001-557	14RN003	Little Indian Sioux River	Downstream of Echo Trl (CR 116), 15.5 mi. SE of Crane Lake	St. Louis	0903000120-02

AUID	Biological Station	Waterbody Name	Biological Station Location	County	Aggregated 12-digit HUC
09030001-818	14RN001	Ash River	Upstream of Ash River Recreational Trl, 10 mi. N of Ash Lake	St. Louis	0903000123-01
09030001-819	14RN099	Ash River	Upstream of Hwy 53, 4 mi. NW of Ash Lake	St. Louis	0903000123-01
09030001-819	14RN012	Ash River	Upstream of Gary Rd (FR 961), 8 mi. N of Ash Lake	St. Louis	0903000123-01
09030001-823	14RN014	Kinmount Creek	Downstream of Hwy 53, 5 mi. NW of Ash Lake	St. Louis	0903000123-01
09030001-868	14RN015	Camp Ninety Creek	Upstream of Camp 90 FR, 11 mi. NE of Ash Lake	St. Louis	0903000123-01
09030001-820	14RN017	Black Duck River	Adjacent to Adams Hill Rd (FR 961), 7 mi. N of Ash Lake	St. Louis	0903000123-03
09030001-820	14RN018	Black Duck River	Upstream of Sarah Rd (FR 623), 5 mi. NE of Ash Lake	St. Louis	0903000123-03
09030001-827	14RN021	Ninemile Creek	Upstream of Sarah Rd (FR 623), 5 mi. NE of Ash Lake	St. Louis	0903000123-03

Appendix 2.3 – Other biological stations in the Rainy River-Headwaters Watershed

AUID	Biological Station	Waterbody Name	Biological Station Location	County	Aggregated 12-digit HUC
09030001-555	06RN009	Harris Creek	Downstream of FH 7 Spur 1464 (FR 1464), 14.5 mi. SE of Ely	Lake	0903000106-01
09030001-555	10RN075	Harris Creek	Downstream of FR 1464, 14 mi. E of Babbitt	Lake	0903000106-01
09030001-573	11RN003	Nira Creek	Adjacent to Keeley Creek Rd (FR 428), 11 mi. NE of Babbitt	Lake	0903000106-01
09030001-984	05RN024	Stony River	0.5 mi. downstream of FH 7 Spur 933 (FR 933), 10.5 mi. NW of Isabella	Lake	0903000106-02
09030001-676	05RN071	Hog Creek	Adjacent to Hog Creek Rd (FR 349), 20 mi. NE of Isabella	Lake	0903000107-01
09030001-530	06RN012	Little Isabella River	Adjacent to Grouse Lake Spur A (FR 177A), 5 mi. NW of Isabella	Lake	0903000107-02
09030001-561	05RN072	Little Isabella River	Upstream of Tomahawk Rd (FR 377), 10.5 mi. NW of Isabella	Lake	0903000107-02
09030001-561	06RN011	Little Isabella River	Adjacent to Kelly Lake Rd (FR 386), 10.5 mi. NW of Isabella	Lake	0903000107-02
09030001-577	06RN016	Sphagnum Creek	Upstream of Tomahawk Snowmobile Trl (FR 1472), 10 mi. NW of Isabella	Lake	0903000107-02
09030001-577	10RN073	Sphagnum Creek	Downstream of Tomahawk Snowmobile Trl, 11 mi. NW of Isabella	Lake	0903000107-02
09030001-556	06RN010	Hill Creek	Upstream of Victor Lake Spur D (FR 912D), 5 mi. NW of Isabella	Lake	0903000107-03
09030001-558	15RN082	Inga Creek	Downstream of Tomahawk Rd (FR 377), 9 mi. NW of Isabella	Lake	0903000107-03
09030001-568	05RN073	Mitawan Creek	Upstream of Jackpine Rd (FR 173), 7.5 mi. NW of Isabella	Lake	0903000107-03
09030001-568	06RN014	Mitawan Creek	Adjacent to Tomahawk Rd (FR 377), 10 mi. NW of Isabella	Lake	0903000107-03
09030001-912	05RN119	Unnamed trib. to Mitawan Creek	Upstream of Jackpine Rd (FR 173), 7.5 mi. NW of Isabella	Lake	0903000107-03
09030001-529	15EM097	Island River	Downstream of Lake 29 E (FR 356), 12.5 mi. NE of Isabella	Lake	0903000107-04
09030001-550	10RN070	Arrowhead Creek	Downstream of Tomlinson Lake Rd (FR 367), 4 mi. N of Isabella	Lake	0903000107-04
09030001-801	06RN017	Trappers Creek	Upstream of Trappers Lake Rd (FR 369), 2.5 mi. NE of Isabella	Lake	0903000107-04
09030001-801	10RN076	Trappers Creek	Upstream of Trappers Lake Rd (FR 369), 2.5 mi. NE of Isabella	Lake	0903000107-04
09030001-979	10RN071	Harriet Creek	Upstream of Two Moose Trl (FR 1287), 12 mi. NE of Isabella	Lake	0903000107-04
09030001-979	10RN072	Harriet Creek	Downstream of CR 705, 13 mi. NE of Isabella	Lake	0903000107-04
09030001-578	14RN101	Tomlinson Creek	Adjacent to FR 174HA, 5 mi. NE of Isabella	Lake	0903000107-05
09030001-583	85RN001	Dumbbell River	Upstream of Dumbbell River Rd (FR 174), 5.5 mi. NE of Isabella	Lake	0903000107-05
09030001-583	85RN002	Dumbbell River	Downstream of Dumbbell Lake Spur (FR 902), 5.5 mi. NE of Isabella	Lake	0903000107-05
09030001-583	85RN003	Dumbbell River	Upstream of Dumbbell River Rd (FR 174), 6 mi. NE of Isabella	Lake	0903000107-05
09030001-633	05RN042	Dumbbell River	0.5 mi. downstream of Trappers Lake Rd (FR 369), 10 mi. NE of Isabella	Lake	0903000107-05

AUID	Biological Station	Waterbody Name	Biological Station Location	County	Aggregated 12-digit HUC
09030001-806	10RN074	Tributary to Scott Creek	Upstream of Wanless Rd (FR 172), 6.5 mi. NE of Isabella	Lake	0903000107-05
09030001-520	11RN002	Keely Creek	End of Birch Lake Access Spur A (FR 1436A), 10.5 mi. SE of Ely	Lake	0903000108-01
09030001-531	06RN015	Snake River	Upstream of Snake River Spur D (FR 387D), 12.5 mi. NW of Isabella	Lake	0903000108-01
09030001-531	98NF197	Snake River	Adjacent to Sand River Spur E (FR 381E), 13.5 mi. NW of Isabella	Lake	0903000108-01
09030001-604	98RN001	Trib. to Birch Lake	End of Private Drive (LTV Steel Rd), 6 mi. E of Babbitt	St. Louis	0903000108-01
09030001-605	11RN005	Filson Creek	Downstream of Spruce Rd (CR 23), 22 mi. NE of Babbitt	Lake	0903000108-01
09030001-674	11RN001	August Creek	Downstream of August Creek Rd (FR 388), 15 mi. SE of Ely	Lake	0903000108-01
09030001-603	05RN075	Trib. to Dunka River	Downstream of Dunka Mine Rd, 4.5 mi. SE of Babbitt	St. Louis	0903000108-02
09030001-986	15RN037	Dunka River	Upstream of Headwaters Rd (FR 113), 6.5 mi. SE of Babbitt	St. Louis	0903000108-02
09030001-986	15RN036	Dunka River	Downstream of Scott Rd (CR 623), 4.5 mi. E of Babbitt	St. Louis	0903000108-02
09030001-987	15RN035	Dunka River	Adjacent to Scott Rd (CR 623), 4 mi. E of Babbitt	St. Louis	0903000108-02
09030001-565	15RN055	Longstorff Creek	Upstream of Taconite Trl, 3 mi. SW of Ely	St. Louis	0903000110-01
09030001-665	05RN058	Bear Island River	Downstream of CSAH 21, 6.5 mi. NE of Babbitt	St. Louis	0903000111-02
09030001-671	05RN183	Trib. to Picket Lake	Upstream of Low Lake Rd (FR 457), 9 mi. N of Ely	St. Louis	0903000113-02
09030001-727	06RN018	Trib. to Mudro Lake	Downstream of Low Lake Rd (FR 457), 9 mi. N of Ely	St. Louis	0903000113-02
09030001-521	05RN076	Moose River	Downstream of Moose Loop Rd (FR 464), 17 mi. NW of Ely	St. Louis	0903000118-01
09030001-601	10EM109	Portage River	3 mi. downstream of Echo Trl (CR 116), 19.5 mi. NW of Ely	St. Louis	0903000118-01
09030001-557	15RN033	Little Indian Sioux River	Upstream of Echo Trl (CR 116), 15.5 mi. SE of Crane Lake	St. Louis	0903000120-02
09030001-667	05RN069	Trib. to Range Line Creek	Upstream of Meander Lake Spur B (FR 467B), 22 mi. NW of Ely	St. Louis	0903000120-02
09030001-818	05RN043	Ash River	0.75 mi. upstream of Camp 90 FR, 8 mi. N of Ash Lake	St. Louis	0903000123-01
09030001-819	98NF199	Ash River	Downstream of Hwy 53, 3.5 mi. NW of Ash Lake	St. Louis	0903000123-01
09030001-860	05RN030	Trib. to Long Lake	0.5 mi. upstream of Forest Capital Partnership 160 RD, 10 mi. NE of Ash Lake	St. Louis	0903000125-01

Appendix 3.1 – Minnesota statewide IBI thresholds and confidence limits

Class #	Class Name	Use Class	Exceptional Use Threshold	General Use Threshold	Modified Use Threshold	Confidence Limit
Fish						
1	Southern Rivers	2B, 2C	71	49	NA	±11
2	Southern Streams	2B, 2C	66	50	35	±9
3	Southern Headwaters	2B, 2C	74	55	33	±7
10	Southern Coldwater	2A	82	50	NA	±9
4	Northern Rivers	2B, 2C	67	38	NA	±9
5	Northern Streams	2B, 2C	61	47	35	±9
6	Northern Headwaters	2B, 2C	68	42	23	±16
7	Low Gradient	2B, 2C	70	42	15	±10
11	Northern Coldwater	2A	60	35	NA	±10
Invertebrates						
1	Northern Forest Rivers	2B, 2C	77	49	NA	±10.8
2	Prairie Forest Rivers	2B, 2C	63	31	NA	±10.8
3	Northern Forest Streams RR	2B, 2C	82	53	NA	±12.6
4	Northern Forest Streams GP	2B, 2C	76	51	37	±13.6
5	Southern Streams RR	2B, 2C	62	37	24	±12.6
6	Southern Forest Streams GP	2B, 2C	66	43	30	±13.6
7	Prairie Streams GP	2B, 2C	69	41	22	±13.6
8	Northern Coldwater	2A	52	32	NA	±12.4
9	Southern Coldwater	2A	72	43	NA	±13.8

Appendix 3.2 – Biological monitoring results – Fish IBI (assessable reaches)

National Hydrography Dataset (NHD) Assessment Segment AUID	Biological Station	Stream Segment Name	Drainage Area Mi²	Fish Class	Threshold	F-IBI	Visit Date
Aggregated 12-HUC: 0903000103-01 (Granite River)							
09030001-974	14RN098	Larch Creek	5.16	11	35	50.46	23-Jul-14
09030001-974	14RN098	Larch Creek	5.16	11	35	50.04	12-Aug-14
Aggregated 12-HUC: 0903000103-02 (Cross River)							
09030001-966	14RN011	Cross River	61.88	5*	61	62.81	22-Jul-15
Aggregated 12-HUC: 0903000106-01 (Lower Stony River)							
09030001-555	06RN009	Harris Creek	3.30	11	35	49.61	15-Sep-06
09030001-555	06RN009	Harris Creek	3.30	11	35	51.85	23-Sep-09
09030001-555	06RN009	Harris Creek	3.30	11	35	49.19	16-Jul-13
09030001-978	14RN070	Unnamed creek (Trib. To Stony River)	8.02	7	42	59.36	30-Jun-14
09030001-573	11RN003	Nira Creek	9.45	11	35	44.16	27-Sep-11
09030001-627	14RN067	Denley Creek	15.69	7*	70	75.45	20-Aug-14
09030001-804	14RN069	Nip Creek	21.18	11	35	37.21	24-Jul-14
09030001-985	05RN074	Stony River	150.76	5	47	74.24	07-Sep-05
09030001-985	05RN074	Stony River	150.76	5	47	62.49	28-Aug-14
09030001-985	14RN007	Stony River	210.41	5	47	87.61	20-Aug-14
Aggregated 12-HUC: 0903000106-02 (Upper Stony River)							
09030001-693	14RN075	Wilbar Creek	14.27	6	42	79.57	24-Jun-14
09030001-984	14RN073	Stony River	50.63	5	47	83.13	18-Aug-15
09030001-984	14RN072	Stony River	73.48	5	47	87.32	19-Aug-14
09030001-984	05RN024	Stony River	73.55	5	47	78.61	19-Jul-05
Aggregated 12-HUC: 0903000106-03 (Greenwood River)							
09030001-602	14RN077	Greenwood River	45.13	6	42	78.30	18-Aug-14
Aggregated 12-HUC: 0903000107-01 (Isabella River)							
09030001-676	05RN071	Hog Creek	12.51	11	35	48.42	20-Jul-05
09030001-676	14RN100	Hog Creek	13.90	11	35	55.92	22-Jul-14
09030001-676	14RN100	Hog Creek	13.90	11	35	52.95	18-Aug-15

National Hydrography Dataset (NHD) Assessment Segment AUID	Biological Station	Stream Segment Name	Drainage Area Mi²	Fish Class	Threshold	F-IBI	Visit Date
Aggregated 12-HUC: 0903000107-02 (Little Isabella River)							
09030001-577	06RN016	Sphagnum Creek	3.37	11	35	79.79	15-Sep-06
09030001-577	06RN016	Sphagnum Creek	3.37	11	35	75.88	10-Sep-08
09030001-530	14RN079	Little Isabella River	18.95	11*	60	73.31	22-Jul-14
09030001-561	05RN072	Little Isabella River	39.74	11	35	44.21	18-Jul-05
09030001-561	14RN008	Little Isabella River	48.20	11	35	55.45	05-Aug-14
Aggregated 12-HUC: 0903000107-03 (Mitawan Creek)							
09030001-912	05RN119	Unnamed trib. to Mitawan Creek	0.66	11	35	58.60	17-Aug-05
09030001-556	06RN010	Hill Creek	3.39	11	35	45.26	14-Sep-06
09030001-556	06RN010	Hill Creek	3.39	11	35	78.39	10-Sep-08
09030001-556	06RN010	Hill Creek	3.39	11	35	69.57	16-Jul-13
09030001-556	06RN010	Hill Creek	3.39	11	35	80.11	29-Sep-15
09030001-564	14RN081	Jack Pine Creek	6.41	11*	60	60.20	01-Jul-14
09030001-558	15RN082	Inga Creek	7.10	11	60	78.12	08-Jul-15
09030001-568	05RN073	Mitawan Creek	8.97	11*	60	70.62	08-Jul-05
09030001-568	05RN073	Mitawan Creek	8.97	11*	60	61.25	16-Jul-13
09030001-568	05RN073	Mitawan Creek	8.97	11*	60	68.55	24-Jun-15
09030001-560	14RN082	Inga Creek	10.76	11	35	54.39	10-Jul-14
09030001-560	14RN082	Inga Creek	10.76	11	35	64.22	15-Sep-15
09030001-568	06RN014	Mitawan Creek	11.58	11*	60	70.38	15-Sep-06
09030001-568	06RN014	Mitawan Creek	11.58	11*	60	77.37	22-Sep-09
09030001-568	06RN014	Mitawan Creek	11.58	11*	60	72.05	04-Sep-13
09030001-568	05RN190	Mitawan Creek	18.56	11*	60	81.21	23-Jun-15
Aggregated 12-HUC: 0903000107-04 (Island River)							
09030001-801	06RN017	Trappers Creek	0.36	11	35	52.69	14-Sep-06
09030001-801	06RN017	Trappers Creek	0.36	11	35	49.99	09-Sep-08
09030001-586	14RN087	Camp Creek, West Branch	6.78	11	35	50.35	01-Jul-14
09030001-550	14RN086	Arrowhead Creek	7.04	11	35	53.28	01-Jul-14
09030001-979	14RN084	Harriet Creek	9.86	11	35	42.73	21-Jul-14
09030001-979	14RN084	Harriet Creek	9.86	11	35	79.34	23-Jun-15

National Hydrography Dataset (NHD) Assessment Segment AUID	Biological Station	Stream Segment Name	Drainage Area Mi²	Fish Class	Threshold	F-IBI	Visit Date
Aggregated 12-HUC: 0903000107-04 (Island River) Cont.							
09030001-550	14RN085	Arrowhead Creek	26.93	11	35	60.02	21-Jul-14
09030001-529	14RN083	Island River	34.90	6	42	73.96	29-Jul-14
09030001-529	15EM097	Island River	34.93	6	42	86.29	06-Oct-15
09030001-563	14RN009	Island River	148.35	5	47	59.48	22-Jul-14
Aggregated 12-HUC: 0903000107-05 (Dumbbell River)							
09030001-578	14RN101	Tomlinson Creek	5.27	11	35	55.78	27-Aug-14
09030001-773	14RN090	Folly Creek	6.12	11	35	50.77	21-Jul-14
09030001-574	14RN091	Scott Creek	8.57	11	35	61.78	23-Jul-14
09030001-632	14RN089	Dumbbell River	14.51	11	35	46.14	29-Jul-14
09030001-633	05RN042	Dumbbell River	31.94	11	35	50.26	18-Aug-05
09030001-634	14RN010	Dumbbell River	49.13	6	42	72.53	22-Jul-14
09030001-634	14RN010	Dumbbell River	49.13	6	42	74.24	26-Jul-16
Aggregated 12-HUC: 0903000108-01 (South Kawishiwi River)							
09030001-604	98RN001	Trib. to Birch Lake	1.99	6	42	64.38	21-Jul-98
09030001-674	05RN065	August Creek	7.94	7	42	66.70	06-Aug-14
09030001-520	14RN062	Keely Creek	10.67	6	42	88.61	06-Aug-14
09030001-531	06RN015	Snake River	11.86	11	35	77.13	22-Sep-09
09030001-531	98NF197	Snake River	18.01	11	35	40.66	01-Oct-98
09030001-542	14RN064	Snake River	19.07	11*	60	83.71	22-Jul-14
09030001-519	14RN061	Birch River	24.63	7	42	37.74	13-Jul-15
Aggregated 12-HUC: 0903000108-02 (Dunka River)							
09030001-603	05RN075	Trib. to Dunka River	6.85	7	42	64.71	29-Jun-05
09030001-603	05RN075	Trib. to Dunka River	6.85	7	42	72.92	17-Aug-05
09030001-986	15RN037	Dunka River	7.98	6	42	51.26	21-Sep-15
09030001-986	14RN065	Dunka River	30.56	6	42	82.83	07-Aug-14
09030001-986	15RN036	Dunka River	43.97	7	42	51.46	05-Oct-15
09030001-987	15RN035	Dunka River	50.95	11	35	49.71	24-Jun-15
09030001-987	14RN006	Dunka River	57.07	11	35	41.93	01-Jul-14
09030001-987	14RN006	Dunka River	57.07	11	35	40.58	19-Aug-14

National Hydrography Dataset (NHD) Assessment Segment AUID	Biological Station	Stream Segment Name	Drainage Area Mi²	Fish Class	Threshold	F-IBI	Visit Date
Aggregated 12-HUC: 0903000108-02 (Dunka River) Cont.							
09030001-987	14RN006	Dunka River	57.07	11	35	55.37	22-Sep-15
Aggregated 12-HUC: 0903000109-02 (Upper Kawishiwi River)							
09030001-990	14RN094	Kawishiwi River	13.51	6	42	56.30	09-Sep-14
09030001-982	14RN095	Phoebe River	27.13	6	42	54.95	10-Sep-14
Aggregated 12-HUC: 0903000110-01 (Shagawa River)							
09030001-565	15RN055	Longstorff Creek	5.81	11	35	43.91	22-Jun-15
09030001-976	14RN052	Crab Creek	8.91	6	42	64.61	24-Jul-14
09030001-976	14RN052	Crab Creek	8.91	6	42	69.05	11-Sep-14
09030001-808	14RN051	Burntside River	68.69	5	47	51.55	21-Jul-14
09030001-535	14RN004	Shagawa River	100.68	5	47	78.93	20-Aug-14
Aggregated 12-HUC: 0903000111-02 (Bear Island River)							
09030001-708	14RN060	Johnson Creek	5.82	6	42	30.62	23-Jul-14
09030001-663	14RN059	Beaver River	20.23	7	42	44.90	14-Jul-15
09030001-665	14RN058	Bear Island River	37.29	7	42	64.05	04-Aug-14
09030001-665	05RN058	Bear Island River	37.66	7	42	63.08	17-Aug-05
09030001-608	14RN005	Bear Island River	65.81	5	47	84.42	28-Jul-14
Aggregated 12-HUC: 0903000113-02 (Horse River)							
09030001-719	14RN002	Horse River	47.73	6	42	67.45	24-Sep-14
Aggregated 12-HUC: 0903000118-01 (Boulder River)							
09030001-744	14RN047	Duck Creek	6.94	6	42	68.43	30-Jul-14
09030001-975	14RN036	Bezhik Creek	10.09	7*	70	72.81	23-Jul-14
09030001-521	14RN035	Moose River	12.63	7	42	75.98	23-Jul-14
09030001-521	05RN076	Moose River	23.03	7	42	66.33	08-Sep-05
09030001-521	05RN076	Moose River	23.03	7	42	68.90	21-Aug-13
09030001-521	05RN076	Moose River	23.03	7	42	72.77	14-Jul-15
09030001-521	14RN034	Moose River	32.10	7	42	65.21	23-Jul-14
09030001-788	14RN045	Portage River	27.81	6	42	60.14	21-Aug-14
09030001-601	14RN044	Portage River	40.80	6	42	81.57	16-Sep-14
09030001-601	10EM109	Portage River	40.87	6	42	68.16	14-Sep-10

National Hydrography Dataset (NHD) Assessment Segment AUID	Biological Station	Stream Segment Name	Drainage Area Mi²	Fish Class	Threshold	F-IBI	Visit Date
Aggregated 12-HUC: 0903000118-01 (Boulder River) Cont.							
09030001-650	14RN043	Nina Moose River	84.88	5	47	76.77	16-Sep-14
Aggregated 12-HUC: 0903000120-02 (Little Indian Sioux River)							
09030001-667	05RN069	Trib. to Range Line Creek	0.39	7	42	51.20	21-Jun-05
09030001-557	15RN033	Little Indian Sioux River	72.75	5	47	45.81	15-Jul-15
Aggregated 12-HUC: 0903000123-01 (Ash River)							
09030001-823	14RN014	Kinmount Creek	12.60	11	35	41.85	30-Jul-14
09030001-868	14RN015	Camp Ninety Creek	13.99	7	42	62.93	09-Sep-14
09030001-819	98NF199	Ash River	29.69	11	35	35.34	08-Jul-98
09030001-819	14RN099	Ash River	30.13	11	35	50.26	08-Sep-14
09030001-819	14RN012	Ash River	53.82	11	35	35.65	09-Sep-14
09030001-818	05RN043	Ash River	106.34	11	35	36.80	09-Aug-05
09030001-818	14RN001	Ash River	118.61	11	35	34.97	22-Jul-15
Aggregated 12-HUC: 0903000123-03 (Black Duck River)							
09030001-827	14RN021	Ninemile Creek	12.77	11	35	29.24	06-Jul-15
09030001-820	14RN018	Black Duck River	17.31	11	35	32.75	06-Jul-15
09030001-820	14RN017	Black Duck River	46.11	11	35	35.85	09-Sep-14
Aggregated 12-HUC: 0903000125-01 (Namakan Lake)							
09030001-860	05RN030	Trib. to Long Lake	3.66	6	42	73.54	22-Jun-05

*** Exceptional Use Threshold applies to this reach**

Appendix 3.3 – Biological monitoring results – Macroinvertebrate IBI (assessable reaches)

National Hydrography Dataset (NHD) Assessment Segment AUID	Biological Station	Stream Segment Name	Drainage Area Mi²	Invert Class	Threshold	M-IBI	Visit Date
Aggregated 12-HUC: 0903000103-01 (Granite River)							
09030001-974	14RN098	Larch Creek	5.16	8	32	44.33	12-Aug-14
Aggregated 12-HUC: 0903000103-02 (Cross River)							
09030001-966	14RN011	Cross River	61.88	3*	82	79.73	12-Aug-14
Aggregated 12-HUC: 0903000106-01 (Lower Stony River)							
09030001-978	14RN070	Unnamed creek (Trib. To Stony River)	8.02	4	51	72.51	10-Sep-14
09030001-573	11RN003	Nira Creek	9.45	8	32	56.91	27-Sep-11
09030001-573	11RN003	Nira Creek	9.45	8	32	61.04	08-Oct-14
09030001-627	14RN067	Denley Creek	15.69	4*	76	83.82	20-Aug-14
09030001-804	14RN069	Nip Creek	21.18	8	32	55.28	16-Sep-14
09030001-985	05RN074	Stony River	150.76	3	53	67.66	09-Aug-05
09030001-985	14RN007	Stony River	210.41	3	53	72.85	20-Aug-14
Aggregated 12-HUC: 0903000106-02 (Upper Stony River)							
09030001-693	14RN075	Wilbar Creek	14.27	3	53	81.04	19-Aug-14
09030001-693	14RN075	Wilbar Creek	14.27	3	53	51.87	25-Aug-15
09030001-984	14RN073	Stony River	50.63	3	53	70.56	19-Aug-14
09030001-984	14RN073	Stony River	50.63	3	53	64.00	17-Aug-15
09030001-984	14RN072	Stony River	73.48	3	53	79.80	19-Aug-14
09030001-984	05RN024	Stony River	73.55	3	53	68.47	09-Aug-05
Aggregated 12-HUC: 0903000106-03 (Greenwood River)							
09030001-602	14RN077	Greenwood River	45.13	3	53	67.88	18-Aug-14
09030001-602	14RN077	Greenwood River	45.13	3	53	70.36	25-Aug-15
Aggregated 12-HUC: 0903000107-01 (Isabella River)							
09030001-676	05RN071	Hog Creek	12.51	8	32	73.38	09-Aug-05
09030001-676	14RN100	Hog Creek	13.90	8	32	55.75	13-Aug-14
09030001-676	14RN100	Hog Creek	13.90	8	32	58.30	12-Aug-15
Aggregated 12-HUC: 0903000107-02 (Little Isabella River)							
09030001-530	14RN079	Little Isabella River	18.95	8*	52	51.74	09-Aug-14

National Hydrography Dataset (NHD) Assessment Segment AUID	Biological Station	Stream Segment Name	Drainage Area Mi²	Invert Class	Threshold	M-IBI	Visit Date
Aggregated 12-HUC: 0903000107-02 (Little Isabella River) Cont.							
09030001-561	05RN072	Little Isabella River	39.74	8	32	64.32	10-Aug-05
09030001-561	14RN008	Little Isabella River	48.20	8	32	54.66	05-Aug-14
Aggregated 12-HUC: 0903000107-03 (Mitawan Creek)							
09030001-564	14RN081	Jack Pine Creek	6.41	8*	52	60.49	14-Aug-14
09030001-558	15RN082	Inga Creek	7.10	8	32	27.40	26-Aug-15
09030001-568	05RN073	Mitawan Creek	8.97	8*	52	54.24	10-Aug-05
09030001-568	05RN073	Mitawan Creek	8.97	8*	52	63.81	09-Sep-13
09030001-568	05RN073	Mitawan Creek	8.97	8*	52	63.89	25-Aug-15
09030001-560	14RN082	Inga Creek	10.76	8	32	46.03	15-Sep-15
09030001-564	14RN081	Jack Pine Creek	6.41	8*	52	60.49	14-Aug-14
Aggregated 12-HUC: 0903000107-04 (Island River)							
09030001-979	14RN084	Harriet Creek	9.86	8	32	53.97	13-Aug-14
09030001-979	14RN084	Harriet Creek	9.86	8	32	66.35	13-Aug-15
09030001-550	14RN085	Arrowhead Creek	26.93	8	32	73.59	18-Sep-14
09030001-529	14RN083	Island River	34.90	3	53	57.18	13-Aug-14
09030001-529	15EM097	Island River	34.93	3	53	87.00	12-Aug-15
Aggregated 12-HUC: 0903000107-05 (Dumbbell River)							
09030001-773	14RN090	Folly Creek	6.12	8	32	60.57	13-Aug-14
09030001-574	14RN091	Scott Creek	8.57	8	32	47.41	13-Aug-14
09030001-633	05RN042	Dumbbell River	31.94	8	32	32.86	09-Aug-05
09030001-634	14RN010	Dumbbell River	49.13	3	53	77.73	13-Aug-14
09030001-634	14RN010	Dumbbell River	49.13	3	53	88.16	12-Sep-16
Aggregated 12-HUC: 0903000108-01 (South Kawishiwi River)							
09030001-674	11RN001	August Creek	7.33	3	53	66.24	28-Sep-11
09030001-674	11RN001	August Creek	7.33	3	53	63.43	07-Oct-14
09030001-674	05RN065	August Creek	7.94	4	51	46.49	06-Aug-14
09030001-605	11RN005	Filson Creek	9.46	3	53	82.13	27-Sep-11
09030001-605	11RN005	Filson Creek	9.46	3	53	84.10	15-Sep-14
09030001-605	14RN063	Filson Creek	9.47	4	51	88.08	08-Aug-14

National Hydrography Dataset (NHD) Assessment Segment AUID	Biological Station	Stream Segment Name	Drainage Area Mi²	Invert Class	Threshold	M-IBI	Visit Date
Aggregated 12-HUC: 0903000108-01 (South Kawishiwi River) Cont.							
09030001-520	11RN002	Keely Creek	10.73	3	53	51.46	22-Sep-11
09030001-520	11RN002	Keely Creek	10.73	3	53	75.36	16-Sep-14
09030001-531	06RN015	Snake River	11.86	8	32	61.13	07-Oct-14
09030001-542	14RN064	Snake River	19.07	8*	52	69.65	17-Sep-14
Aggregated 12-HUC: 0903000108-02 (Dunka River)							
09030001-986	15RN037	Dunka River	7.98	3	53	66.34	26-Aug-15
09030001-986	15RN036	Dunka River	43.97	4	51	62.51	18-Aug-15
09030001-987	15RN035	Dunka River	50.95	8	32	31.57	18-Aug-15
09030001-987	14RN006	Dunka River	57.07	8	32	33.50	19-Aug-14
09030001-987	14RN006	Dunka River	57.07	8	32	40.82	18-Aug-15
Aggregated 12-HUC: 0903000109-02 (Upper Kawishiwi River)							
09030001-990	14RN094	Kawishiwi River	13.51	3	53	61.05	09-Sep-14
09030001-982	14RN095	Phoebe River	27.13	3	53	59.37	10-Sep-14
Aggregated 12-HUC: 0903000110-01 (Shagawa River)							
09030001-565	15RN055	Longstorff Creek	5.81	8	32	58.08	18-Aug-15
09030001-565	14RN055	Longstorff Creek	8.61	8	32	51.76	18-Sep-14
09030001-976	14RN052	Crab Creek	8.91	3	53	72.22	11-Sep-14
09030001-535	14RN004	Shagawa River	100.68	3	53	48.61	20-Aug-14
09030001-535	14RN004	Shagawa River	100.68	3	53	38.00	18-Aug-15
Aggregated 12-HUC: 0903000111-02 (Bear Island River)							
09030001-708	14RN060	Johnson Creek	5.82	4	51	52.15	22-Sep-14
09030001-708	14RN060	Johnson Creek	5.82	4	51	74.62	18-Aug-15
09030001-665	14RN058	Bear Island River	37.29	4	51	81.79	04-Aug-14
09030001-665	05RN058	Bear Island River	37.66	4	51	64.55	09-Aug-05
09030001-608	14RN005	Bear Island River	65.81	3	53	63.87	29-Jul-14
Aggregated 12-HUC: 0903000113-02 (Horse River)							
09030001-671	05RN183	Trib. to Picket Lake	2.12	3	53	52.38	22-Aug-05
09030001-719	14RN002	Horse River	47.73	3	53	66.67	24-Sep-14

National Hydrography Dataset (NHD) Assessment Segment AUID	Biological Station	Stream Segment Name	Drainage Area Mi^2	Invert Class	Threshold	M-IBI	Visit Date
Aggregated 12-HUC: 0903000118-01 (Boulder River)							
09030001-744	14RN047	Duck Creek	6.94	3	53	65.42	30-Jul-14
09030001-975	14RN036	Bezhik Creek	10.09	4*	76	84.00	21-Aug-14
09030001-733	14RN041	Stuart River	17.06	3	53	80.97	23-Sep-14
09030001-521	05RN076	Moose River	23.03	4	51	84.88	10-Aug-05
09030001-788	14RN045	Portage River	27.81	3	53	73.45	30-Jul-14
09030001-601	14RN044	Portage River	40.80	3	53	75.30	16-Sep-14
09030001-601	10EM109	Portage River	40.87	4	51	72.81	14-Sep-10
09030001-650	14RN043	Nina Moose River	84.88	3	53	62.27	16-Sep-14
Aggregated 12-HUC: 0903000120-02 (Little Indian Sioux River)							
09030001-557	14RN003	Little Indian Sioux River	72.83	3	53	51.28	30-Jul-14
09030001-557	14RN003	Little Indian Sioux River	72.83	3	53	58.00	29-Jul-15
Aggregated 12-HUC: 0903000123-01 (Ash River)							
09030001-823	14RN014	Kinmount Creek	12.60	8	32	20.00	30-Jul-14
09030001-823	14RN014	Kinmount Creek	12.60	8	32	39.00	18-Aug-15
09030001-868	14RN015	Camp Ninety Creek	13.99	4	51	52.99	09-Sep-14
09030001-819	14RN099	Ash River	30.13	8	32	31.19	30-Jul-14
09030001-819	14RN012	Ash River	53.82	8	32	43.62	09-Sep-14
09030001-818	05RN043	Ash River	106.34	8	32	31.18	17-Aug-05
Aggregated 12-HUC: 0903000123-03 (Black Duck River)							
09030001-827	14RN021	Ninemile Creek	12.77	8	32	46.66	31-Jul-14
09030001-820	14RN018	Black Duck River	17.31	8	32	49.62	31-Jul-14
09030001-820	14RN017	Black Duck River	46.11	8	32	39.21	09-Sep-14
Aggregated 12-HUC: 0903000125-01 (Namakan Lake)							
09030001-860	05RN030	Trib. to Long Lake	3.66	3	53	51.68	11-Aug-05

*** Exceptional Use Threshold applies to this reach**

Appendix 4.1 – Fish species found during biological monitoring surveys

Common Name	Scientific Name	Quantity of Stations Where Present	Quantity of Individuals Collected
white sucker	*Catostomus commersonii*	65	1730
central mudminnow	*Umbra limi*	56	722
common shiner	*Luxilus cornutus*	51	3387
creek chub	*Semotilus atromaculatus*	46	2268
longnose dace	*Rhinichthys cataractae*	38	1213
blacknose dace	*Rhinichthys atratulus*	37	1009
mottled sculpin	*Cottus bairdii*	37	193
johnny darter	*Etheostoma nigrum*	32	383
blacknose shiner	*Notropis heterolepis*	31	436
brook stickleback	*Culaea inconstans*	31	422
northern redbelly dace	*Phoxinus eos*	28	844
burbot	*Lota lota*	28	407
northern pike	*Esox lucius*	28	65
pearl dace	*Margariscus margarita*	26	312
yellow perch	*Perca flavescens*	25	484
tadpole madtom	*Noturus gyrinus*	24	301
rock bass	*Ambloplites rupestris*	20	107
finescale dace	*Phoxinus neogaeus*	17	200
golden shiner	*Notemigonus crysoleucas*	16	192
logperch	*Percina caprodes*	15	224
fathead minnow	*Pimephales promelas*	14	133
brook trout	*Salvelinus fontinalis*	14	115
smallmouth bass	*Micropterus dolomieu*	13	199
hornyhead chub	*Nocomis biguttatus*	10	555
brassy minnow	*Hybognathus hankinsoni*	9	120
iowa darter	*Etheostoma exile*	9	25
walleye	*Sander vitreus*	6	9
largemouth bass	*Micropterus salmoides*	4	59
bluegill	*Lepomis macrochirus*	4	16
pumpkinseed	*Lepomis gibbosus*	4	5
yellow bullhead	*Ameiurus natalis*	3	22
bigmouth shiner	*Notropis dorsalis*	3	6
blackchin shiner	*Notropis heterodon*	2	19
black crappie	*Pomoxis nigromaculatus*	2	10
longear sunfish	*Lepomis megalotis*	2	3
green sunfish	*Lepomis cyanellus*	2	2
spottail shiner	*Notropis hudsonius*	1	2
shorthead redhorse	*Moxostoma macrolepidotum*	1	1

Fish collected by the MPCA during the 10 year assessment window (>2005) for the Intensive Watershed Monitoring of the Rainy River-Headwaters Watershed

Appendix 4.2 – Macroinvertebrate species found during biological monitoring surveys

Taxonomic Name	Quantity of Stations Where Present	Quantity of Individuals Collected
Ablabesmyia	34	84
Acari	60	366
Acentrella	5	6
Acentrella nadineae	3	9
Acentrella parvula	3	6
Acentrella turbida	7	34
Acentria	1	1
Acerpenna	16	59
Acerpenna pygmaea	14	123
Acroneuria	30	126
Acroneuria abnormis	16	64
Acroneuria lycorias	10	26
Aeshna	6	4
Aeshna umbrosa	2	2
Aeshnidae	14	37
Agarodes distinctus	8	10
Agnetina	1	13
Agrypnia	1	1
Allocladius	1	1
Amnicola	8	291
Amphinemura	5	31
Amphipoda	2	2
Anacaena	1	2
Anafroptilum	5	14
Anax	1	1
Ancyronyx variegatus	3	4
Anisoptera	3	7
Anopheles	3	8
Antocha	19	81
Aquarius	6	12
Argia	4	5
Atherix	12	45
Atrichopogon	2	6
Attenella attenuata	1	7
Aulodrilus	2	5
Baetidae	28	129
Baetis	27	148
Baetis brunneicolor	9	38
Baetis flavistriga	31	285
Baetis intercalaris	4	6

Taxonomic Name	Quantity of Stations Where Present	Quantity of Individuals Collected
Baetis tricaudatus	1	11
Baetisca	3	3
Baetisca laurentina	1	2
Basiaeschna janata	2	1
Belostoma	6	9
Belostoma flumineum	6	6
Bezzia	3	13
Bezzia/Palpomyia	1	1
Bittacomorpha	1	1
Boyeria	14	26
Boyeria grafiana	6	10
Boyeria vinosa	25	48
Brachycentridae	2	3
Brachycentrus	2	8
Brachycentrus numerosus	9	55
Brillia	17	26
Caenis	14	75
Caenis diminuta	18	345
Caenis hilaris	10	68
Callibaetis	4	8
Calopterygidae	24	201
Calopteryx	30	149
Calopteryx aequabilis	13	80
Calopteryx maculata	3	13
Cambaridae	5	1
Capniidae	4	18
Cardiocladius	5	9
Centroptilum	1	2
Ceraclea	32	179
Ceratopogonidae	3	3
Ceratopogoninae	32	71
Ceratopsyche	35	472
Ceratopsyche alhedra	5	32
Ceratopsyche bronta	4	9
Ceratopsyche morosa	6	100
Ceratopsyche slossonae	5	10
Ceratopsyche sparna	28	300
Cheumatopsyche	46	421
Chimarra	54	1264
Chironomini	10	17
Chironomus	6	10
Choroterpes	1	3
Chromagrion conditum	1	2

Taxonomic Name	Quantity of Stations Where Present	Quantity of Individuals Collected
Chrysops	3	3
Cladopelma	3	4
Cladotanytarsus	5	25
Coenagrionidae	17	73
Conchapelopia	10	14
Cordulegaster	3	5
Cordulegaster maculata	1	2
Cordulia	1	2
Corduliidae	11	19
Corixidae	9	43
Corydalidae	4	9
Corynoneura	16	28
Crambidae	3	6
Crangonyx	4	6
Crenitis	1	1
Cricotopus	57	499
Cryptochironomus	11	28
Cryptotendipes	2	2
Culicoides	1	1
Cymatia	1	1
Cymbiodyta	1	1
Dasyhelea	2	3
Dicranota	3	4
Dicrotendipes	11	55
Didymops transversa	1	1
Dineutus	1	2
Diphetor hageni	1	1
Diplectrona	1	1
Diplectrona modesta	1	1
Diplocladius cultriger	1	1
Dixa	2	3
Dixella	6	16
Dolichopodidae	2	2
Dolophilodes	1	7
Dolophilodes distinctus	3	13
Doncricotopus bicaudatus	1	1
Dubiraphia	31	220
Dytiscidae	7	12
Ectopria	1	1
Elmidae	3	15
Empididae	14	22
Enallagma	2	6
Enchytraeus	4	4

Taxonomic Name	Quantity of Stations Where Present	Quantity of Individuals Collected
Endochironomus	4	18
Enochrus	1	1
Ephemera	2	2
Ephemera simulans	1	4
Ephemera varia	1	1
Ephemerella	18	335
Ephemerella subvaria	1	103
Ephemerellidae	15	42
Ephydridae	7	15
Epitheca canis	2	2
Epoicocladius	2	2
Eukiefferiella	24	100
Eurylophella	53	429
Eurylophella temporalis	2	2
Fabria inornatus	1	1
Ferrissia	40	305
Gammaridae	1	1
Gammarus	2	15
Gerridae	7	6
Glossosoma	7	27
Glossosoma intermedium	1	3
Glossosoma nigrior	9	29
Glossosomatidae	10	19
Glyphopsyche irrorata	1	3
Glyptotendipes	4	47
Gomphidae	20	53
Gomphus	2	2
Gomphus lividus	1	2
Guttipelopia	1	11
Gymnochthebius	1	1
Gyraulus	19	131
Gyrinidae	1	1
Gyrinus	12	21
Hagenius	3	1
Hagenius brevistylus	6	8
Haliplus	3	9
Helichus	1	1
Helicopsyche	2	8
Helicopsyche borealis	20	92
Helisoma	2	6
Helisoma anceps	5	10
Hemerodromia	64	339
Heptagenia	1	2

Taxonomic Name	Quantity of Stations Where Present	Quantity of Individuals Collected
Heptageniidae	31	78
Hesperocorixa	1	1
Hetaerina	3	8
Hetaerina americana	1	9
Heterocloeon	1	1
Heterotrissocladius	2	3
Hexagenia	4	28
Hexagenia bilineata	1	1
Hexatoma	1	1
Hirudinea	24	61
Hyalella	43	608
Hydatophylax	4	11
Hydatophylax argus	5	13
Hydraena	12	23
Hydrobiidae	32	1037
Hydrophilidae	4	5
Hydropsyche	31	278
Hydropsyche betteni	28	234
Hydropsyche dicantha	9	287
Hydropsychidae	51	1020
Hydroptila	31	141
Hydroptilidae	17	75
Hydrozoa	1	1
Hyporhygma	1	1
Ilybius	2	3
Isonychia	3	5
Isoperla	6	17
Iswaeon	12	111
Ithytrichia clavata	1	1
Labiobaetis	1	1
Labiobaetis frondalis	1	5
Labiobaetis propinquus	27	178
Labrundinia	18	37
Larsia	3	6
Lauterborniella agrayloides	4	9
Lepidostoma	42	246
Leptoceridae	17	70
Leptophlebia	3	89
Leptophlebia cupida	1	5
Leptophlebiidae	57	471
Lestes	1	1
Lethocerus	5	5
Leucorrhinia	2	1

Taxonomic Name	Quantity of Stations Where Present	Quantity of Individuals Collected
Leucrocuta	7	13
Leuctra	6	14
Leuctridae	6	7
Libellulidae	3	3
Limnephilidae	46	179
Limnephilus	2	2
Limnophila	1	1
Limnophyes	5	7
Liodessus	4	6
Lopescladius	1	1
Lumbriculidae	3	5
Lymnaeidae	4	4
Lype	1	1
Lype diversa	9	13
Maccaffertium	50	331
Maccaffertium modestum	1	2
Maccaffertium vicarium	15	29
Macromia illinoiensis	2	4
Macromiinae	1	1
Macronychus	4	31
Macronychus glabratus	25	135
Macrostemum zebratum	1	6
Mallochohelea	1	3
Mayatrichia ayama	7	22
Micrasema	5	29
Micrasema rusticum	24	199
Micromenetus	1	7
Micropsectra	30	285
Microtendipes	54	597
Molanna	2	10
Mystacides	22	89
Naididae	1	1
Nais	3	3
Nanocladius	13	23
Natarsia	2	2
Nectopsyche	1	4
Nehalennia	1	1
Nemata	7	12
Nematoda	2	2
Nemotaulius hostilis	7	9
Neophylax	3	2
Neophylax oligius	1	2
Neoplasta	5	7

Taxonomic Name	Quantity of Stations Where Present	Quantity of Individuals Collected
Neoplea striola	2	5
Neureclipsis	20	166
Neurocordulia	1	1
Neurocordulia xanthosoma	1	1
Nigronia	44	148
Nilotanypus	2	3
Nilothauma	7	15
Nixe	1	2
Notonecta	3	15
Notonectidae	2	3
Nyctiophylax	14	30
Odontoceridae	1	1
Oecetis	15	36
Oecetis avara	9	18
Oecetis furva	2	3
Oecetis nocturna	3	13
Oecetis persimilis	2	2
Oecetis testacea	32	181
Oligochaeta	40	229
Ophiogomphus	5	2
Ophiogomphus rupinsulensis	5	2
Optioservus	42	371
Orconectes	17	9
Orthocladiinae	18	83
Orthocladius	38	176
Orthocladius (Symposiocladius)	9	19
Oxyethira	36	378
Pagastia	1	1
Paracapnia	2	4
Parachironomus	3	3
Paracladopelma	1	1
Paracymus	1	1
Paragnetina	1	2
Paragnetina media	31	139
Parakiefferiella	17	40
Paralauterborniella nigrohalterale	2	3
Paraleptophlebia	8	90
Paramerina	8	11
Parametriocnemus	49	308
Paraponyx	3	3
Parapoynx	9	26
Paratanytarsus	19	74
Paratendipes	3	28

Taxonomic Name	Quantity of Stations Where Present	Quantity of Individuals Collected
Peltodytes	1	1
Pentaneura	5	9
Pericoma	1	1
Perlesta	2	3
Perlidae	26	86
Perlodidae	7	19
Phaenopsectra	30	70
Philopotamidae	3	10
Phryganea	2	2
Phryganeidae	13	46
Phylocentropus	5	8
Physa	9	57
Physella	21	94
Pilaria	2	2
Pisidiidae	73	789
Planorbella	5	20
Planorbidae	14	80
Platycentropus	1	3
Plauditus	12	61
Polycentropodidae	16	36
Polycentropus	17	42
Polypedilum	70	488
Potamyia flava	1	1
Potthastia	7	10
Probezzia	4	11
Procladius	21	70
Procloeon	18	70
Promenetus exacuous	2	6
Protoptila	8	130
Psectrocladius	18	69
Pseudochironomus	5	12
Pseudolimnophila	1	1
Psychodidae	1	1
Psychomyia flavida	5	13
Psychomyiidae	1	1
Pteronarcys	3	3
Ptilostomis	11	30
Pycnopsyche	8	13
Pyralidae	1	1
Ranatra	1	1
Rhagovelia	8	44
Rheocricotopus	28	94
Rheotanytarsus	63	976

Taxonomic Name	Quantity of Stations Where Present	Quantity of Individuals Collected
Rhyacophila	4	7
Rhyacophila minor	2	8
Robackia	1	1
Roederiodes	2	4
Saetheria	1	4
Scirtidae	1	1
Serratella	1	1
Serratella serrata	5	10
Serromyia	1	1
Sialis	9	18
Sigara	3	5
Simuliidae	2	2
Simulium	62	1165
Siphloplecton	2	13
Sisyra	2	5
Slavina appendiculata	1	1
Somatochlora	2	3
Somatochlora minor	3	3
Somatochlora walshii	1	1
Stempellina	3	5
Stempellinella	41	184
Stenacron	19	62
Stenelmis	53	360
Stenochironomus	39	120
Stenonema	7	36
Stictochironomus	2	2
Stylaria	1	1
Synorthocladius	5	9
Tabanidae	5	5
Tabanus	1	2
Taeniopteryx	11	106
Tanypodinae	25	82
Tanytarsini	21	62
Tanytarsus	59	498
Teloganopsis deficiens	2	14
Thienemanniella	22	40
Thienemannimyia	49	434
Thienemannimyia Gr.	32	249
Tipula	13	19
Tipulidae	4	4
Trepaxonemata	2	3
Triaenodes	10	28
Tribelos	20	159

Taxonomic Name	Quantity of Stations Where Present	Quantity of Individuals Collected
Trichoptera	6	9
Tricorythodes	13	50
Trissopelopia ogemawi	4	8
Tubificinae	2	2
Turbellaria	5	11
Tvetenia	48	379
Uenoidae	3	14
Unionidae	1	1
Valvata	1	1
Xenochironomus	2	12
Xenochironomus xenolabis	15	21
Xylotopus par	17	32
Zavreliella marmorata	1	1
Zavrelimyia	9	32

Macroinvertebrates collected during the 10 year assessment window (>2005) in the Rainy River-Headwaters Watershed

Appendix 5 – Minnesota stream habitat assessment results

Habitat information documented during each fish sampling visit is provided. This table convey the results of the Minnesota Stream Habitat Assessment (MSHA) survey, which evaluates the section of stream sampled for biology and can provide an indication of potential stressors (e.g., siltation, eutrophication) impacting fish and macroinvertebrate communities. The MSHA score is comprised of five scoring categories including adjacent land use, riparian zone, substrate, fish cover and channel morphology, which are summed for a total possible score of 100 points. Scores for each category, a summation of the total MSHA score, and a narrative habitat condition rating are provided in the tables for each biological monitoring station. Where multiple visits occur at the same station, the scores from each visit have been averaged. The final row in each table displays average MSHA scores and a rating for the aggregated 12-HUC subwatershed.

# Visits	Biological Station ID	Reach 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
3	14RN098	Larch Creek	5.00	11.33	16.97	12.00	17.00	62.30	Fair
		Average Habitat Results: *Granite River Aggregated 12 HUC*	**5.00**	**11.33**	**16.97**	**12.00**	**17.00**	**62.30**	**Fair**
3	14RN011	Cross River	3.75	11.83	22.50	15.67	23.67	77.42	Good
		Average Habitat Results: *Cross River Aggregated 12 HUC*	**3.75**	**11.83**	**22.50**	**15.67**	**23.67**	**77.42**	**Good**
2	17RN070	Unnamed Creek (Trib to Stony R)	5.00	11.50	3.00	10.50	7.00	37.00	Poor
2	14RN069	Nip Creek	5.00	12.00	22.28	13.00	26.00	78.28	Good
2	14RN067	Denley Creek	5.00	11.00	17.00	14.00	21.00	68.00	Good
2	05RN074	Stony River	5.00	12.00	19.75	10.50	16.00	63.25	Fair
2	14RN007	Stony River	5.00	11.00	19.00	9.00	17.00	61.00	Fair
		Average Habitat Results: *Lower Stony River Aggregated 12 HUC*	**5.00**	**11.50**	**16.21**	**11.40**	**17.40**	**61.51**	**Fair**
3	14RN075	Wilbar Creek	5.00	13.33	21.43	14.00	21.33	75.09	Good
3	14RN073	Stony River	5.00	13.67	25.27	11.67	26.33	81.94	Good
2	14RN072	Stony River	5.00	13.00	25.50	14.00	26.00	83.50	Good
		Average Habitat Results: *Upper Stony River Aggregated 12 HUC*	**5.00**	**13.33**	**24.07**	**13.22**	**24.55**	**80.17**	**Good**
2	14RN077	Greenwood River	5.00	12.50	23.70	13.50	24.00	78.70	Good
		Average Habitat Results: *Greenwood River Aggregated 12 HUC*	**5.00**	**12.50**	**23.70**	**13.50**	**24.00**	**78.70**	**Good**
4	14RN100	Hog Creek	5.00	12.00	20.10	11.00	24.75	72.85	Good
		Average Habitat Results: *Isabella Aggregated 12 HUC*	**5.00**	**12.00**	**20.10**	**11.00**	**24.75**	**72.85**	**Good**
2	14RN079	Little Isabella River	5.00	12.50	24.40	15.00	28.50	85.40	Good
1	14RN008	Little Isabella River	5.00	12.00	21.75	15.00	29.00	82.75	Good
		Average Habitat Results: *Little Isabella Aggregated 12 HUC*	**5.00**	**12.25**	**23.08**	**15.00**	**28.75**	**84.08**	**Good**

# Visits	Biological Station ID	Reach 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	14RN081	Jack Pine Creek	5.00	13.00	16.50	14.50	11.00	60.00	Fair
2	15RN082	Inga Creek	5.00	12.00	18.80	13.00	22.50	71.30	Good
2	14RN082	Inga Creek	5.00	13.25	18.10	14.00	22.50	72.85	Good
1	06RN010	Hill Creek	5.00	13.00	22.90	15.00	29.00	84.90	Good
4	05RN073	Mitawan Creek	5.00	14.25	19.50	15.00	24.00	77.75	Good
2	05RN190	Mitawan Creek	5.00	14.00	19.00	14.00	21.00	73.00	Good
Average Habitat Results: *Mitawan Creek Aggregated 12 HUC*			**5.00**	**13.25**	**19.13**	**14.25**	**21.67**	**73.30**	**Good**
1	14RN087	Camp Creek, West Branch	5.00	13.00	17.20	13.00	17.00	65.20	Fair
1	14RN086	Arrowhead Creek	5.00	14.00	27.00	14.00	20.00	80.00	Good
2	14RN085	Arrowhead Creek	5.00	13.00	24.50	13.50	24.00	80.00	Good
4	14RN084	Harriet Creek	5.00	12.88	23.93	13.25	28.50	83.56	Good
2	14RN083	Island River	5.00	11.50	22.70	13.00	28.50	80.70	Good
3	15EM097	Island River	5.00	11.67	23.60	14.00	25.33	79.60	Good
1	14RN009	Island River	5.00	11.00	13.00	10.00	21.00	60.00	Fair
Average Habitat Results: *Island River Aggregated 12 HUC*			**5.00**	**12.39**	**22.72**	**13.21**	**25.21**	**78.53**	**Good**
1	14RN101	Tomlinson Creek	5.00	14.00	22.80	14.00	26.00	81.80	Good
2	14RN091	Scott Creek	5.00	12.50	22.50	12.00	24.00	76.00	Good
2	14RN090	Folly Creek	5.00	14.00	24.00	13.00	24.00	80.00	Good
1	14RN089	Dumbbell River	5.00	11.00	12.00	11.00	12.00	51.00	Fair
4	14RN010	Dumbbell River	5.00	11.50	25.00	13.00	23.75	78.25	Good
Average Habitat Results: *Dumbbell River Aggregated 12 HUC*			**5.00**	**12.60**	**21.26**	**12.60**	**21.95**	**73.41**	**Good**
2	14RN064	Snake River	5.00	12.50	23.00	11.00	25.00	76.50	Good
1	11RN001	August Creek	5.00	14.00	22.40	16.00	31.00	88.40	Good
2	05RN065	August Creek	5.00	11.00	7.50	11.00	10.00	44.50	Poor
1	14RN063	Filson Creek	5.00	11.50	17.20	16.00	23.00	72.70	Good
1	11RN005	Filson Creek	5.00	11.00	21.25	16.00	28.00	81.25	Good
1	14RN062	Keely Creek	5.00	12.00	20.60	11.00	26.00	74.60	Good
1	11RN002	Keely Creek	5.00	11.00	20.20	13.00	31.00	80.20	Good

Continued On Next Page

# Visits	Biological Station ID	Reach 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
		Continued From Previous Page							
1	14RN061	Birch River	5.00	13.00	18.60	13.00	17.00	66.60	Good
		Average Habitat Results: *South Kawishiwi Aggregated 12 HUC*	**5.00**	**12.00**	**18.84**	**13.38**	**23.88**	**73.10**	**Good**
2	15RN037	Dunka River	5.00	14.00	22.95	11.50	18.50	71.95	Good
1	14RN065	Dunka River	5.00	13.00	21.60	11.00	30.00	80.60	Good
2	15RN036	Dunka River	5.00	11.50	18.00	11.00	16.00	61.50	Fair
2	15RN035	Dunka River	5.00	12.75	24.35	11.00	28.00	81.10	Good
5	14RN006	Dunka River	2.75	10.80	20.12	14.00	22.20	69.87	Good
		Average Habitat Results: *Dunka River Aggregated 12 HUC*	**4.55**	**12.41**	**21.40**	**11.70**	**22.94**	**73.00**	**Good**
1	14RN095	Phoebe River	5.00	13.00	27.00	14.00	26.00	85.00	Good
2	14RN094	Kawishiwi River	5.00	12.00	21.05	11.00	24.00	73.05	Good
		Average Habitat Results: *Upper Kawishiwi Aggregated 12 HUC*	**5.00**	**12.33**	**23.03**	**12.00**	**24.67**	**77.03**	**Good**
2	15RN055	Longstorff Creek	5.00	14.00	23.60	13.00	28.50	74.10	Good
2	14RN055	Longstorff Creek	5.00	13.75	26.30	12.00	20.00	77.05	Good
2	14RN052	Crab Creek	5.00	13.50	23.48	13.00	25.50	80.48	Good
1	14RN051	Burntside River	5.00	11.00	11.00	13.00	21.00	61.00	Fair
2	14RN004	Shagawa River	5.00	12.50	22.08	13.50	26.50	79.58	Good
		Average Habitat Results: *Shagawa River Aggregated 12 HUC*	**5.00**	**13.17**	**22.48**	**12.89**	**24.67**	**78.21**	**Good**
4	14RN060	Johnson Creek	5.00	12.00	21.63	11.75	18.75	69.13	Good
1	14RN059	Beaver River	5.00	12.00	24.45	15.00	28.00	84.45	Good
1	14RN058	Bear Island River	5.00	11.00	18.50	12.00	24.00	70.50	Good
1	14RN005	Bear Island River	3.00	9.50	20.50	14.00	16.00	63.00	Fair
		Average Habitat Results: *Bear Island River Aggregated 12 HUC*	**4.71**	**11.50**	**21.42**	**12.57**	**20.43**	**70.63**	**Good**
1	14RN002	Horse River	5.00	13.00	24.00	11.00	24.00	77.00	Good
		Average Habitat Results: *Horse River Aggregated 12 HUC*	**5.00**	**13.00**	**24.00**	**11.00**	**24.00**	**77.00**	**Good**
1	14RN047	Duck Creek	5.00	11.00	15.30	14.00	22.00	67.30	Good
2	14RN045	Portage River	5.00	13.00	22.75	14.00	24.00	78.75	Good
1	14RN044	Portage River	5.00	11.00	24.00	11.00	25.00	76.00	Good

Continued On Next Page

# Visits	Biological Station ID	Reach 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
Continued From Previous Page									
1	14RN061	Birch River	5.00	13.00	18.60	13.00	17.00	66.60	Good
1	10EM109	Portage River	5.00	15.00	22.00	12.00	19.00	73.00	Good
1	14RN043	Nina Moose River	5.00	13.00	24.00	9.00	22.00	73.00	Good
1	14RN041	Stuart River	5.00	13.00	24.20	13.00	24.00	79.20	Good
2	14RN036	Bezhik Creek	5.00	12.75	9.50	11.50	18.50	57.25	Fair
1	14RN035	Moose River	5.00	11.50	11.00	9.00	18.00	54.50	Fair
3	05RN076	Moose River	5.00	11.17	6.87	13.33	13.00	49.37	Fair
1	14RN034	Moose River	5.00	11.00	6.50	15.00	15.00	52.50	Fair
Average Habitat Results: *Boulder River Aggregated 12 HUC*			**5.00**	**12.18**	**15.15**	**12.43**	**19.21**	**63.97**	**Fair**
1	15RN033	Little Indian Sioux River	5.00	11.50	23.00	15.00	18.00	72.50	Good
2	14RN003	Little Indian Sioux River	5.00	13.50	23.50	10.00	17.00	69.00	Good
Average Habitat Results: *Little Indian Sioux Aggregated 12 HUC*			**5.00**	**12.50**	**23.25**	**12.50**	**17.50**	**70.75**	**Good**
2	14RN015	Camp Ninety Creek	5.00	10.00	13.50	13.00	16.00	57.50	Fair
3	14RN014	Kinmount Creek	4.17	10.33	14.67	14.67	12.67	56.51	Fair
2	14RN099	Ash River	5.00	11.25	12.55	13.50	16.00	58.30	Fair
1	14RN012	Ash River	5.00	9.00	14.00	16.00	6.00	50.00	Fair
1	14RN001	Ash River	5.00	11.50	6.00	12.00	12.00	46.50	Fair
Average Habitat Results: *Ash River Aggregated 12 HUC*			**4.83**	**10.42**	**12.14**	**13.83**	**12.53**	**53.75**	**Fair**
3	14RN021	Ninemile Creek	0.83	5.00	11.15	11.67	15.00	43.65	Poor
3	14RN018	Black Duck River	0.00	2.50	17.07	11.67	18.67	49.91	Fair
2	14RN017	Black Duck River	5.00	11.00	13.50	13.00	9.00	51.50	Fair
Average Habitat Results: *Black Duck River Aggregated 12 HUC*			**1.94**	**6.17**	**13.91**	**12.11**	**14.22**	**48.35**	**Fair**

Qualitative habitat ratings

- = Good: MSHA score above the median of the least-disturbed sites (MSHA>66)
- = Fair: MSHA score between the median of the least-disturbed sites and the median of the most-disturbed sites (45 < MSHA < 66)
- = Poor: MSHA score below the median of the most-disturbed sites (MSHA<45)

Appendix 6 – Fish contaminant results

Fish contaminant information is summarized by waterway, species, and years. See "Watershed-Wide Results and Discussion: Fish Contaminant Results" for further information.

							Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
16032700	PORTAGE	Splake	1993	FILSK	8	1	11.5	11.5	11.5	0.04	0.04	0.04	1	0.01	0.01	Y
			2005	FILSK	5	5	12.7	10.1	18.4	0.10	0.05	0.18	1	0.01	0.01	Y
		White sucker	1993	FILSK	4	1	16.6	16.6	16.6	0.10	0.10	0.10				
16032800	IRON*	Northern pike	1997	FILSK	9	9	19.9	14.3	30.9	0.32	0.13	0.76	2	0.01	0.01	Y
		White sucker	1997	FILSK	5	1	18.1	18.1	18.1	0.17	0.17	0.17	1	0.01	0.01	Y
16033100	NORTH*	Lake trout	1995	FILSK	11	5	19.1	11.5	26.2	0.22	0.11	0.34	2	0.01	0.01	Y
		Northern pike	1995	FILSK	9	3	26.1	22.4	31.5	0.28	0.15	0.47				
		Walleye	1995	FILSK	7	4	21.1	14.3	28.6	0.35	0.08	0.88	1	0.01	0.01	Y
		White sucker	1995	FILSK	3	1	20	20	20	0.09	0.09	0.09				
		Yellow perch	1995	FILSK	4	1	7.7	7.7	7.7	0.11	0.11	0.11				
16033700	MAYHEW*	Lake trout	1994	FILSK	13	4	14.8	10.5	22.9	0.09	0.04	0.21	1	0.023	0.023	Y
			2004	FILSK	3	3	14.4	12.3	16.4	0.06	0.05	0.09				
		White sucker	1994	FILSK	4	1	17.6	17.6	17.6	0.08	0.08	0.08				
		Yellow perch	1994	NOHV	10	1	6.3	6.3	6.3	0.13	0.13	0.13				
			2004	FILSK	8	1	7	7	7	0.14	0.14	0.14				
16034100	WEST POPE*	Bluegill sunfish	2000	FILSK	1	1	10.1	10.1	10.1	0.10	0.10	0.10				
		Northern pike	2000	FILSK	5	5	18.1	14.4	21	0.20	0.11	0.28				
		Walleye	2000	FILSK	7	7	17.6	12.8	21.8	0.38	0.13	0.68				
		White sucker	2000	FILSK	5	1	19.5	19.5	19.5	0.17	0.17	0.17				
		Yellow perch	2000	FILSK	2	2	12.1	11.4	12.7	0.18	0.16	0.20				
16034200	EAST POPE**	Northern pike	2008	FILSK	8	8	20.7	16.8	34.5	0.57	0.16	1.47				
		Smallmouth bass	2008	FILSK	1	1	13.3	13.3	13.3	0.13	0.13	0.13				
		Walleye	2008	FILSK	4	4	17.8	13.7	19.5	0.51	0.31	0.67				
16035500	LITTLE IRON*	Northern pike	1997	FILSK	8	8	19.2	14.1	21.5	0.29	0.12	0.65	1	0.01	0.01	Y
		Walleye	1997	FILSK	4	4	15.9	13.1	18.4	0.32	0.19	0.47	1	0.01	0.01	Y
		White sucker	1997	FILSK	8	1	18.6	18.6	18.6	0.14	0.14	0.14				

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
							Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
16035600	GUNFLINT**	Lake trout	1991	FILSK	25	10	19.9	14.6	26.3	0.39	0.19	0.60	10	0.059	0.11	
			2007	FILSK	3	3	24.4	23.7	25.2	0.67	0.53	0.85				
			2015	FILSK	4	4	20.2	13.5	28.2	0.49	0.09	0.98				
		Northern pike	1977	PLUG	18	18	20.1	14	28	0.29	0.12	0.56				
			1982	FILSK	2	1	18	18	18	0.12	0.12	0.12				
			1986	FILSK	5	3	27.4	23.4	32	0.58	0.41	0.70				
			1996	FILSK	10	10	20.2	14.2	25.4	0.21	0.08	0.40				
			2000	FILSK	9	9	22	14.5	28.3	0.21	0.10	0.27				
			2003	FILSK	1	1	26	26	26	0.37	0.37	0.37				
			2007	FILSK	1	1	26.3	26.3	26.3	0.27	0.27	0.27				
			2015	FILSK	5	5	24.3	14.2	34.8	0.36	0.15	0.89				
		Smallmouth bass	1991	FILSK	1	1	10.3	10.3	10.3	0.12	0.12	0.12	1	0.01	0.01	Y
			2007	FILSK	1	1	17.3	17.3	17.3	0.46	0.46	0.46				
		Walleye	1977	PLUG	24	24	16.9	10	26	0.53	0.20	1.23				
			1982	FILSK	8	3	17.2	13.5	22.2	0.28	0.18	0.48				
			1991	FILSK	23	6	20.3	10.5	28.3	0.54	0.11	1.10	5	0.021	0.05	
			1996	FILSK	5	5	15	8.4	22.2	0.31	0.13	0.48				
			2000	FILSK	6	6	19.7	13.7	28.6	0.48	0.18	1.08				
			2003	FILSK	8	8	16.5	8.9	29	0.40	0.11	1.33				
			2007	FILSK	6	6	23.6	20.6	27.6	0.69	0.51	1.16				
			2015	FILSK	5	5	17.5	14.5	22.6	0.22	0.17	0.33				
		White sucker	1991	FILSK	14	4	16.7	10.8	19.6	0.12	0.07	0.14	3	0.015	0.024	
		Yellow perch	1991	FILSK	8	1	8.1	8.1	8.1	0.18	0.18	0.18				
			2000	WHORG	9	9	6.31	5.8	7.3	0.06	0.05	0.08				
			2003	WHORG	3	1	6.9	6.9	6.9	0.16	0.16	0.16				
			2007	WHORG	3	1	7	7	7	0.13	0.13	0.13				
16035700	CRAB	Northern pike	1997	FILSK	4	4	16.2	14.9	17.8	0.16	0.13	0.17	1	0.01	0.01	Y
			2007	FILSK	4	4	22.6	19.4	27.4	0.26	0.19	0.38				
		Walleye	1997	FILSK	4	4	15.6	11.9	21.2	0.21	0.17	0.30	1	0.01	0.01	Y
			2007	FILSK	1	1	15.2	15.2	15.2	0.21	0.21	0.21				

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in) Mean	Length (in) Min	Length (in) Max	Mercury (mg/kg) Mean	Mercury (mg/kg) Min	Mercury (mg/kg) Max	PCBs (mg/kg) N	PCBs (mg/kg) Mean	PCBs (mg/kg) Max	< RL
		Yellow perch	1997	FILSK	3	1	6.3	6.3	6.3	0.09	0.09	0.09				
			2007	WHORG	4	1	6	6	6	0.06	0.06	0.06				
16044800	LOON**	Cisco (Lake herring)	2011	FILSK	5	1	11.7	11.7	11.7	0.12	0.12	0.12				
		Lake trout	1985	FILSK	8	3	18.2	15.1	21.5	0.30	0.10	0.50				
			1990	FILSK	6	3	16.3	9.6	22.3	0.17	0.08	0.28	3	0.058	0.14	
			2007	FILSK	8	8	15.5	13.5	16.9	0.16	0.12	0.22				
			2011	FILSK	8	8	15.2	14	16.6	0.13	0.08	0.20				
		Northern pike	1985	FILSK	10	3	27.3	23.8	32	0.66	0.36	1.15				
			1990	FILSK	3	2	21.2	19.8	22.6	0.25	0.20	0.29	2	0.01	0.01	Y
			1996	FILSK	9	9	28.1	25.2	30.9	0.63	0.38	1.08				
			2007	FILSK	4	4	29.4	26.2	35.3	1.01	0.78	1.20				
			2011	FILSK	3	3	29.6	23.2	34.5	0.96	0.13	1.70				
		Rock bass	2011	FILSK	7	2	6.4	6.3	6.5	0.15	0.15	0.16				
		Smallmouth bass	2007	FILSK	3	3	9.1	8.7	9.6	0.14	0.13	0.14				
			2011	FILSK	1	1	11.2	11.2	11.2	0.21	0.21	0.21				
		Walleye	1990	FILSK	3	1	19.1	19.1	19.1	0.22	0.22	0.22	1	0.01	0.01	Y
			2011	FILSK	1	1	22.5	22.5	22.5	0.39	0.39	0.39				
		Yellow perch	2007	WHORG	1	1	6.1	6.1	6.1	0.07	0.07	0.07				
16045000	EXTORTION*	Splake	2000	FILSK	5	5	12.5	10.6	14.1	0.26	0.21	0.34				
16057100	FROST*	Lake trout	1982	FILSK	13	3	17.2	13.2	20.9	0.25	0.21	0.27				
			1998	FILSK	5	5	18.2	16.7	19.5	0.15	0.08	0.21	5	0.011	0.013	
		Northern pike	1982	FILSK	6	2	19.9	17.2	22.5	0.23	0.21	0.25				
16058200	LARCH	Smallmouth bass	2003	WHORG	13	13	1.42	1.2	1.8	0.08	0.03	0.21				
16058300	MEDITATION*	Brook trout	1998	FILSK	7	7	12.2	9.8	13.8	0.28	0.10	0.50	4	0.01	0.01	Y
16060600	ROUND*	Northern pike	1983	FILSK	3	1	19.9	19.9	19.9	0.27	0.27	0.27				
			1993	FILSK	16	4	22.7	18.5	27.1	0.28	0.13	0.45	1	0.01	0.01	Y
			2005	FILSK	6	6	21.1	19	26	0.20	0.12	0.30				
			2008	FILSK	7	7	23.6	15.6	27.2	0.13	0.08	0.25				
			2015	FILSK	6	6	23.1	18.7	27.5	0.25	0.15	0.38				

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
							Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
		Smallmouth bass	1993	FILSK	7	2	14.1	12.4	15.7	0.22	0.12	0.32	1	0.01	0.01	Y
			2005	FILSK	5	5	14.4	12.9	16.6	0.15	0.10	0.23				
		Walleye	1983	FILSK	4	1	19.2	19.2	19.2	0.30	0.30	0.30				
			1993	FILSK	21	5	15.9	10.1	21.3	0.18	0.09	0.34	1	0.01	0.01	Y
			2005	FILSK	8	8	16.7	11.7	26	0.26	0.11	0.60				
		White sucker	1993	FILSK	8	1	19.4	19.4	19.4	0.09	0.09	0.09	1	0.01	0.01	Y
		Yellow perch	1993	FILSK	5	1	9.5	9.5	9.5	0.07	0.07	0.07				
			2005	WHORG	5	1	5.9	5.9	5.9	0.05	0.05	0.05				
			2008	WHORG	10	2	6.6	6	7.2	0.16	0.04	0.27				
16062300	TUSCARORA	Lake trout	1989	FILSK	9	3	17.8	13.9	22.1	0.11	0.07	0.18	3	0.05	0.05	Y
16062700	BINGSHICK	Brook trout	2007	FILSK	2	2	18.8	18.4	19.1	0.55	0.55	0.56				
16062900	SEA GULL**	Cisco (Lake herring)	1991	FILSK	16	2	12.9	9.5	16.2	0.14	0.14	0.14	1	0.023	0.023	Y
		Lake trout	1983	FILSK	2	1	28	28	28	0.65	0.65	0.65				
			1991	FILSK	21	5	16.7	7.4	23	0.38	0.01	0.62	3	0.059	0.073	
		Northern pike	1983	FILSK	11	3	28	24.6	32.5	0.31	0.23	0.42				
			1991	FILSK	7	4	23.6	17.4	30	0.53	0.23	1.00	1	0.048	0.048	Y
			1996	FILSK	10	10	18.8	12.4	32.1	0.41	0.09	1.89				
			2003	FILSK	7	7	25.5	22.4	29.1	0.66	0.45	0.91				
			2009	FILSK	15	15	23.5	14.1	38.5	0.49	0.28	0.66				
		Walleye	1983	FILSK	2	1	22.1	22.1	22.1	0.62	0.62	0.62				
			1991	FILSK	15	3	19.8	14.1	26.9	0.72	0.35	1.40	1	0.07	0.07	
			1996	FILSK	5	5	18.7	9.9	26.9	0.44	0.15	1.11				
			2003	FILSK	4	4	22.7	19.1	26	0.89	0.54	1.30				
16063200	GULL**	Lake whitefish	1998	FILSK	4	1	20	20	20	0.12	0.12	0.12				
		Northern pike	1998	FILSK	7	7	26.5	19.3	32.8	0.99	0.38	2.00				
		Smallmouth bass	1998	FILSK	2	2	11.8	11.6	11.9	0.20	0.17	0.22				
		Walleye	1998	FILSK	4	4	19.3	12.8	27.5	0.58	0.25	1.25				
16063300	SAGANAGA*	Lake trout	1985	FILSK	2	1	21.5	21.5	21.5	0.87	0.87	0.87				
			1995	FILSK	4	3	20.8	14.5	30.3	0.20	0.11	0.35	3	0.05	0.12	

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
							Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
		Lake whitefish	1995	FILSK	15	4	18.4	14.4	22.8	0.09	0.03	0.16	4	0.045	0.11	
		Northern pike	1985	FILSK	13	4	22.7	17.9	27.8	0.78	0.33	1.80				
			1995	FILSK	26	12	21.5	14.3	29.3	0.38	0.22	1.18	1	0.01	0.01	Y
			2001	FILSK	6	6	22.5	19	27.6	0.28	0.15	0.39				
			2004	FILSK	7	7	26.8	19.4	37.4	0.72	0.22	1.25				
			2008	FILSK	20	20	22.5	17.3	31.2	0.23	0.11	0.62				
			2014	FILSK	15	15	22.3	18.1	26.5	0.42	0.24	0.71				
		Smallmouth bass	1995	FILSK	8	1	14.4	14.4	14.4	0.27	0.27	0.27				
		Walleye	1971	PLUG	15	15	17.1	12.5	25.3	0.60	0.28	0.88				
			1982	FILSK	15	4	21.5	12.8	29	0.88	0.22	2.00				
			1985	FILSK	4	1	16.3	16.3	16.3	0.55	0.55	0.55				
			1995	FILSK	32	17	15.7	9.3	26.8	0.28	0.08	0.75	1	0.02	0.02	Y
		White sucker	1995	FILSK	6	1	19.6	19.6	19.6	0.14	0.14	0.14				
		Yellow perch	2001	FILSK	3	1	7.5	7.5	7.5	0.23	0.23	0.23				
			2004	WHORG	1	1	5.9	5.9	5.9	0.18	0.18	0.18				
			2008	WHORG	10	2	5.35	4	6.7	0.06	0.05	0.06				
16065300	HOG**	Northern pike	1994	FILSK	18	5	19.7	14.4	28	0.43	0.21	0.70	1	0.01	0.01	Y
		White sucker	1994	FILSK	8	1	20.2	20.2	20.2	0.19	0.19	0.19				
		Yellow perch	1994	WHORG	11	1	5.8	5.8	5.8	0.03	0.03	0.03				
16067300	MESABA**	Lake trout	1993	FILSK	1	1	29.7	29.7	29.7	0.37	0.37	0.37	1	0.039	0.039	
		Northern pike	1993	FILSK	10	3	23.7	21.5	26	0.57	0.49	0.62	1	0.01	0.01	Y
16068600	WINE**	Lake trout	1993	FILSK	11	4	25.3	19	31.2	0.45	0.31	0.64	3	0.025	0.04	
16072300	CROOKED*	Lake trout	1992	FILSK	16	3	17.7	13.4	22	0.13	0.09	0.20	2	0.039	0.065	
		White sucker	1992	FILSK	7	2	19.5	18.1	20.9	0.20	0.16	0.24	1	0.013	0.013	
16075300	GILLIS*	Lake trout	1992	FILSK	13	2	14.5	11.7	17.2	0.15	0.05	0.26	2	0.041	0.062	
		White sucker	1992	FILSK	4	1	17.8	17.8	17.8	0.18	0.18	0.18	1	0.014	0.014	
16075900	ALPINE**	Lake whitefish	2002	FILSK	4	1	16	16	16	0.14	0.14	0.14				
		Walleye	1984	FILSK	5	1	17.9	17.9	17.9	0.38	0.38	0.38				
			2002	FILSK	5	5	22.4	20.3	27	1.01	0.66	1.77				
16076800	JASPER*	Lake trout	1992	FILSK	4	2	19.3	17.2	21.3	0.60	0.32	0.87	2	0.039	0.047	

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
							Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
		Lake whitefish	1992	FILSK	12	2	19.8	18.5	21	0.35	0.31	0.38	1	0.11	0.11	
		Smallmouth bass	1992	FILSK	2	1	10.9	10.9	10.9	0.21	0.21	0.21				
		Walleye	1992	FILSK	2	1	12.8	12.8	12.8	0.30	0.30	0.30	1	0.011	0.011	
16079300	RED ROCK*	Lake whitefish	1998	FILSK	5	1	21.7	21.7	21.7	0.15	0.15	0.15				
		Northern pike	1998	FILSK	8	8	21.6	18.7	29.7	0.47	0.18	1.10				
		Smallmouth bass	1998	FILSK	4	4	13.7	11.6	15.8	0.30	0.21	0.46				
		Walleye	1984	FILSK	5	1	20.8	20.8	20.8	0.32	0.32	0.32				
			1998	FILSK	5	5	17.5	16	19.1	0.35	0.28	0.40				
16080800	PHOEBE**	Northern pike	1998	FILSK	10	10	23.6	14.3	29.8	0.51	0.16	0.74				
		Smallmouth bass	1998	FILSK	5	5	12.2	11	13	0.26	0.19	0.32				
		Walleye	1998	FILSK	10	10	16.5	14	17.9	0.43	0.25	0.61				
16080900	LITTLE SAGANAGA*	Lake trout	1987	FILSK	12	4	16	12.8	19.7	0.20	0.12	0.32	4	0.01	0.01	Y
			2011	FILSK	5	5	21.3	20	22.6	0.29	0.25	0.38				
		Northern pike	1987	FILSK	12	4	25.1	20.3	30.7	0.58	0.36	0.82	4	0.01	0.01	Y
			1995	FILSK	11	11	21.1	12.6	31.9	0.27	0.12	0.61				
			2011	FILSK	11	11	28.2	25.3	36.2	0.63	0.36	0.90				
16081100	GABIMICHIGAMI*	Lake trout	1993	FILSK	12	3	20.4	14.5	25.5	0.30	0.16	0.41	2	0.034	0.035	
			2005	FILSK	12	12	17.2	12.5	21.7	0.24	0.09	0.60	1	0.01	0.01	Y
			2015	FILSK	2	2	17.7	15.3	20	0.21	0.13	0.30				
		Northern pike	1982	FILSK	16	4	24.5	16.9	30.4	0.46	0.23	0.87				
			1995	FILSK	11	11	22.1	14.3	30.9	0.27	0.12	0.88				
			2005	FILSK	6	6	24	16.9	30.4	0.32	0.21	0.58				
			2015	FILSK	6					0.32	0.22	0.43				
		White sucker	1993	FILSK	4	1	17.2	17.2	17.2	0.18	0.18	0.18				
		Yellow perch	2005	WHORG	8	2	6.25	6	6.5	0.08	0.06	0.11				
38000400	COOK	Northern pike	2015	FILSK	8	8	24.2	18.6	37.4	0.37	0.26	0.54				
		White sucker	2015	FILSK	5	1	17.7	17.7	17.7	0.09	0.09	0.09				
		Yellow perch	2015	FILSK	8	1	6.14	6.14	6.14	0.08	0.08	0.08				
38004200	WYE*	Northern pike	2010	FILSK	6	6	16.8	14.7	22.7	0.32	0.20	0.53				
		Walleye	2010	FILSK	8	8	14	12.1	17.1	0.24	0.18	0.32				

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
							Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
		White sucker	2010	FILSK	3	1	16.5	16.5	16.5	0.06	0.06	0.06				
		Yellow perch	2010	FILSK	5	1	7.6	7.6	7.6	0.09	0.09	0.09				
38004800	HARRIET*	Northern pike	1994	FILSK	23	5	18.6	11.9	25.7	0.20	0.12	0.26				
			2009	FILSK	15	15	19.2	14.1	26.3	0.37	0.20	0.61				
		Walleye	1994	FILSK	20	5	17.5	13.2	22.6	0.23	0.13	0.35	1	0.01	0.01	Y
		White sucker	1994	FILSK	8	1	17.6	17.6	17.6	0.05	0.05	0.05				
		Yellow perch	1994	FILSK	9	1	7.3	7.3	7.3	0.07	0.07	0.07				
38004900	WANLESS*	Northern pike	1995	FILSK	19	3	19.8	14.3	25.2	0.41	0.21	0.61	1	0.01	0.01	Y
		White sucker	1995	FILSK	5	1	21.4	21.4	21.4	0.27	0.27	0.27				
38005700	HOGBACK	Rainbow trout	2006	FILSK	5	5	12.6	10.2	16	0.03	0.02	0.06				
		Splake	2006	FILSK	4	4	14.9	12	18	0.17	0.15	0.20				
38006400	COFFEE*	Northern pike	1981	FILSK	5	1	23.1	23.1	23.1	0.55	0.55	0.55	1	0.025	0.025	Y
				WHORG	5	1	23.1	23.1	23.1	0.47	0.47	0.47				
			1995	FILSK	15	3	20.8	16.4	24.6	0.23	0.01	0.37	1	0.01	0.01	Y
			2007	FILSK	6	6	20.4	19.3	22.6	0.60	0.25	0.75				
		Walleye	1981	FILSK	5	1	15.1	15.1	15.1	0.29	0.29	0.29	1	0.025	0.025	Y
				WHORG	5	1	15.1	15.1	15.1	0.27	0.27	0.27				
			1995	FILSK	2	2	14.7	13.6	15.7	0.37	0.35	0.39				
			2007	FILSK	6	6	16.2	13.2	19.5	0.45	0.25	0.69				
			2015	FILSK	13	13	16.3	11.8	24.9	1.07	0.65	2.41				
		White sucker	1995	FILSK	7	1	20.5	20.5	20.5	0.23	0.23	0.23				
			2015	FILSK	5	1	18.1	18.1	18.1	0.36	0.36	0.36				
		Yellow perch	1995	FILSK	10	1	6.9	6.9	6.9	0.09	0.09	0.09				
			2007	WHORG	10	1	7	7	7	0.12	0.12	0.12				
			2015	FILSK	10	1	5.58	5.58	5.58	0.21	0.21	0.21				
38006600	T*	Black crappie	2011	FILSK	10	2	12	11.1	12.9	0.17	0.11	0.22				
		Northern pike	1995	FILSK	8	2	17.7	16.5	18.9	0.33	0.32	0.34				
			2011	FILSK	4	4	21.3	17.7	25.2	0.37	0.26	0.49				
		Walleye	1995	FILSK	11	2	16.5	14.7	18.3	0.42	0.32	0.52	1	0.01	0.01	Y
			2011	FILSK	8	8	15.4	13.6	21	0.35	0.24	0.59				

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
							Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
38006700	ORGAN**	Northern pike	1997	FILSK	10	10	21.8	17.4	26.1	0.63	0.41	1.10	2	0.01	0.01	Y
			2013	FILSK	5	5	21	19.4	24.3	1.52	1.06	2.31				
		White sucker	1997	FILSK	1	1	17.4	17.4	17.4	0.12	0.12	0.12	1	0.01	0.01	Y
		Yellow perch	1997	FILSK	2	1	6.6	6.6	6.6	0.19	0.19	0.19				
38006800	WINDY**	Lake whitefish	1991	FILSK	8	1	10.2	10.2	10.2	0.29	0.29	0.29				
			2012	FILSK	5	1	13.4	13.4	13.4	0.22	0.22	0.22				
		Northern pike	1982	FILSK	9	4	28.3	17.2	36.2	1.02	0.46	1.61				
			1991	FILSK	3	1	18.3	18.3	18.3	0.57	0.57	0.57	1	0.01	0.01	Y
			1995	FILSK	15	15	21.3	12.5	31.9	0.57	0.30	1.10				
			1999	FILSK	15	15	22.1	15.4	30.1	0.75	0.42	1.27	1	0.01	0.01	Y
			2009	FILSK	11	11	23.5	16.6	33.3	0.77	0.39	1.34				
		Rock bass	1991	FILSK	10	1	8.5	8.5	8.5	0.34	0.34	0.34				
		Walleye	1991	FILSK	11	2	14.4	12.7	16.1	0.55	0.52	0.57	1	0.01	0.01	Y
			1999	FILSK	8	8	16.9	14.4	20.4	1.39	1.02	1.58				
			2009	FILSK	10	10	15	12.8	18.2	0.65	0.48	0.83				
			2012	FILSK	6	6	13.9	12	15.3	0.51	0.35	0.63				
		White sucker	1991	FILSK	17	3	16.6	13	20.1	0.18	0.07	0.31	1	0.013	0.013	
			2012	FILSK	4	1	17.3	17.3	17.3	0.14	0.14	0.14				
		Yellow perch	1992	WHORG	99	5	3.08	3	3.1	0.10	0.06	0.13				
			1999	WHORG	10	10	4.55	4.3	5	0.12	0.09	0.15				
			2012	FILSK	4	1	8.3	8.3	8.3	0.19	0.19	0.19				
38007400	SQUARE*	Northern pike	1995	FILSK	16	5	22.9	15.9	32.6	0.33	0.14	0.57	1	0.01	0.01	Y
		Walleye	1995	FILSK	15	4	15.5	11.4	19.6	0.23	0.12	0.45				
38007900	WATONWAN**	Northern pike	1995	FILSK	13	4	23.1	17.8	28.9	0.51	0.34	0.73	1	0.01	0.01	Y
		Walleye	1995	FILSK	11	4	17.5	13.5	21.7	0.63	0.30	0.83				
38008000	KAWISHIWI*	Northern pike	1983	FILSK	10	2	19.8	17.7	21.9	0.31	0.30	0.32				
			1989	FILSK	2	1	26.9	26.9	26.9	0.86	0.86	0.86				
			1996	FILSK	10	10	19.5	12.3	27.8	0.19	0.08	0.33				
			2003	FILSK	23	23	16.9	12.2	20.7	0.32	0.10	0.61				
			2010	FILSK	15	15	18.3	14.9	23	0.28	0.13	0.57				

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
							Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
		Walleye	1983	FILSK	3	1	15.3	15.3	15.3	0.18	0.18	0.18				
			1989	FILSK	3	1	12.9	12.9	12.9	0.19	0.19	0.19				
			1996	FILSK	5	5	14.4	9.1	20.4	0.20	0.09	0.36				
			2010	FILSK	15	15	16.7	13.3	27	0.33	0.16	0.94				
		Yellow perch	2003	WHORG	8	2	6.55	5.4	7.7	0.06	0.04	0.09				
38010400	POLLY**	Northern pike	2002	FILSK	3	3	18.6	15.6	20.6	0.41	0.23	0.51				
		Walleye	2002	FILSK	5	5	15.7	13	21	0.63	0.31	1.20				
38015300	ADAMS*	Northern pike	1982	FILSK	36	4	24.4	18.3	30	0.34	0.26	0.44				
			1996	FILSK	11	11	25.7	17.2	33.4	0.50	0.20	0.93				
		Walleye	1982	FILSK	8	3	21.8	17.7	26.8	0.57	0.39	0.92				
38018000	OGISHKEMUNCIE*	Lake trout	2001	FILSK	2	2	21.5	21	21.9	0.33	0.31	0.34	2	0.01	0.01	Y
		Northern pike	2001	FILSK	5	5	19.9	16.4	21.8	0.35	0.25	0.43				
		Walleye	2001	FILSK	8	8	18.8	14.1	23.7	0.45	0.28	0.73				
38021100	OTTERTRACK**	Lake trout	1993	FILSK	4	3	28	24.7	31.5	0.52	0.24	0.86	3	0.031	0.064	
		Lake whitefish	1993	FILSK	17	3	16.9	13.1	20.5	0.08	0.05	0.13	1	0.01	0.01	Y
		Northern pike	1993	FILSK	14	5	27.6	18.7	38.6	0.59	0.20	0.94	1	0.013	0.013	
		Walleye	1993	FILSK	17	3	17.3	13.1	22.2	0.36	0.20	0.62	1	0.01	0.01	Y
38021900	SILVER ISLAND*	Black crappie	1998	FILSK	5	1	10.2	10.2	10.2	0.24	0.24	0.24				
			2003	FILSK	8	1	10.3	10.3	10.3	0.30	0.30	0.30				
			2008	FILSK	10	1	10.4	10.4	10.4	0.34	0.34	0.34				
			2012	FILSK	10	2	11.6	10.8	12.4	0.20	0.12	0.29				
		Lake whitefish	1998	FILSK	8	1	15.4	15.4	15.4	0.09	0.09	0.09	1	0.11	0.11	
			2008	FILSK	3	1	18.1	18.1	18.1	0.11	0.11	0.11				
			2012	FILSK	5	1	15.7	15.7	15.7	0.10	0.10	0.10				
		Northern pike	1989	FILSK	6	2	19.8	18.9	20.6	0.24	0.16	0.31				
			1998	FILSK	10	10	21.5	17.6	29.2	0.33	0.17	0.42				
			2008	FILSK	5	5	22	18.7	24.7	0.29	0.22	0.46				
			2012	FILSK	6	6	19.7	18.1	23.7	0.24	0.22	0.28				
		Walleye	1989	FILSK	6	2	14	12.6	15.3	0.20	0.18	0.22				
			1998	FILSK	10	10	14.6	12.6	18.5	0.24	0.14	0.61				

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
							Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
			2008	FILSK	5	5	15.6	13.7	18.4	0.25	0.19	0.33				
			2012	FILSK	6	6	15.7	12.5	23	0.20	0.12	0.32				
		Yellow perch	2008	FILSK	10	1	10.5	10.5	10.5	0.20	0.20	0.20				
			2012	FILSK	10	2	9.2	8.9	9.5	0.15	0.14	0.16				
38022000	PERENT*	Walleye	1990	FILSK	6	2	14.6	13	16.1	0.41	0.37	0.44	2	0.01	0.01	Y
38022900	LITTLE KNIFE*	Lake trout	1993	FILSK	6	3	22.8	18.9	27	0.46	0.30	0.57	3	0.035	0.056	
		Lake whitefish	1993	FILSK	15	3	16.7	11.4	20.6	0.08	0.06	0.10	1	0.011	0.011	
		Northern pike	1993	FILSK	2	1	29.4	29.4	29.4	0.65	0.65	0.65	1	0.015	0.015	
38029000	COMFORT	Black crappie	2015	FILSK	7	1	9.6	9.6	9.6	0.34	0.34	0.34				
		Northern pike	2015	FILSK	7	7	20.9	15.5	27.1	0.62	0.49	0.73				
		Walleye	2015	FILSK	4	4	16.7	11.2	24.2	0.58	0.47	0.65				
		White sucker	2015	FILSK	5	1	17.6	17.6	17.6	0.19	0.19	0.19				
		Yellow perch	2015	FILSK	9	1	7.13	7.13	7.13	0.15	0.15	0.15				
38029200	SECTION 29*	Northern pike	1994	FILSK	9	3	20.5	17.4	23.6	0.41	0.37	0.49	1	0.01	0.01	Y
			2012	FILSK	6	6	19.3	13.6	28.1	0.40	0.17	0.84				
		Walleye	1994	FILSK	9	3	15.3	13.5	17.6	0.32	0.27	0.36				
			2012	FILSK	6	6	15.9	11.8	19.4	0.27	0.19	0.41				
		White sucker	1994	FILSK	8	1	19.5	19.5	19.5	0.14	0.14	0.14				
			2012	FILSK	5	1	15.6	15.6	15.6	0.10	0.10	0.10				
		Yellow perch	1994	FILSK	2	1	8.7	8.7	8.7	0.14	0.14	0.14				
				WHORG	7	1	5.9	5.9	5.9	0.10	0.10	0.10				
			2012	FILSK	5	1	7.1	7.1	7.1	0.18	0.18	0.18				
38029300	BUNNY**	Northern pike	1997	FILSK	10	10	19.4	15.1	25.7	0.55	0.28	0.90	2	0.01	0.01	Y
		White sucker	1997	FILSK	10	1	18.7	18.7	18.7	0.23	0.23	0.23	1	0.01	0.01	Y
		Yellow perch	1997	FILSK	10	1	9.8	9.8	9.8	0.16	0.16	0.16				
38033600	AMBER	Northern pike	1982	FILSK	10	5	27.5	19	38	0.82	0.32	1.51				
		Walleye	1982	FILSK	9	2	15.4	13.5	17.3	0.64	0.46	0.81				
38035100	THOMAS*	Cisco (Lake herring)	1992	FILSK	10	1	9.3	9.3	9.3	0.21	0.21	0.21				
		Lake trout	1992	FILSK	13	3	19	12.3	27.7	0.25	0.13	0.46	2	0.035	0.05	

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
							Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
		Northern pike	1992	FILSK	9	4	24.8	18.2	31	0.34	0.14	0.58	1	0.01	0.01	Y
		Walleye	1992	FILSK	20	3	17.7	13.2	21.5	0.34	0.21	0.48	1	0.023	0.023	
		White sucker	1992	FILSK	7	1	17.8	17.8	17.8	0.06	0.06	0.06	1	0.014	0.014	
38037200	FRASER*	Lake trout	1992	FILSK	13	4	18.7	13.3	25.6	0.32	0.22	0.41	2	0.03	0.046	
		Northern pike	1992	FILSK	3	2	29.7	28.1	31.2	0.58	0.54	0.61	1	0.01	0.01	Y
		Walleye	1992	FILSK	22	3	17.7	12.2	22.3	0.46	0.23	0.68	1	0.041	0.041	
		White sucker	1992	FILSK	15	2	15.9	13.5	18.3	0.08	0.02	0.14	1	0.01	0.01	Y
38039300	DUMBBELL*	Muskellunge	1983	FILSK	3	1	23.8	23.8	23.8	0.64	0.64	0.64				
			2009	FILSK	13	13	29.9	24.1	36.5	0.50	0.23	1.11				
		Walleye	1983	FILSK	16	3	17.1	12.4	22.4	0.28	0.19	0.45				
			1996	FILSK	24	18	15.4	7.3	24	0.21	0.06	0.53	1	0.01	0.01	Y
			2000	FILSK	24	24	15.7	11.4	24.7	0.20	0.06	0.56				
			2006	FILSK	7	7	16.1	11.8	23	0.25	0.14	0.38				
		White sucker	1996	FILSK	1	1	17.8	17.8	17.8	0.08	0.08	0.08				
		Yellow perch	1996	FILSK	10	1	6.3	6.3	6.3	0.06	0.06	0.06				
			2000	WHORG	10	10	6.03	5.5	6.4	0.04	0.03	0.05				
			2006	WHORG	10	2	6.3	6.2	6.4	0.07	0.06	0.08				
38039500	SYLVANIA**	Northern pike	1997	FILSK	10	10	18.8	14.3	26.2	0.36	0.16	0.62	2	0.01	0.01	Y
		White sucker	1997	FILSK	8	1	17.6	17.6	17.6	0.15	0.15	0.15	1	0.01	0.01	Y
		Yellow perch	1997	FILSK	10	1	10.4	10.4	10.4	0.12	0.12	0.12				
38039600	ISABELLA*	Lake whitefish	1992	FILSK	9	2	14.6	13.1	16	0.07	0.06	0.08	1	0.034	0.034	
		Northern pike	1983	FILSK	11	4	25.1	17.6	35	0.68	0.39	1.28				
			1989	FILSK	3	1	27.4	27.4	27.4	0.54	0.54	0.54				
			1996	FILSK	9	9	21	15.1	27.8	0.39	0.21	0.69				
			2006	FILSK	24	24	24.1	17	36.2	0.60	0.31	1.27				
		Walleye	1983	FILSK	4	1	13.7	13.7	13.7	0.50	0.50	0.50				
			1989	FILSK	4	2	19	16.4	21.5	0.95	0.59	1.30				
			1992	FILSK	15	2	14	12.1	15.9	0.35	0.25	0.44	1	0.035	0.035	
		Yellow perch	1992	FILSK	8	1	8.8	8.8	8.8	0.20	0.20	0.20				
			2006	WHORG	10	3	6.13	5.7	6.6	0.15	0.14	0.15				

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
							Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
38039700	INSULA**	Northern pike	2001	FILSK	10	10	28.3	23.4	37.6	0.57	0.39	0.74				
		Walleye	2001	FILSK	9	9	17.5	13	29.7	0.52	0.31	1.12	1	0.01	0.01	Y
		White sucker	2001	FILSK	4	1	19.6	19.6	19.6	0.10	0.10	0.10				
38040000	IMA*	Bluegill sunfish	1998	FILSK	4	1	7.5	7.5	7.5	0.14	0.14	0.14				
		Cisco (Lake herring)	1998	FILSK	5	1	12	12	12	0.24	0.24	0.24				
		Lake trout	1998	FILSK	10	10	19.7	15.2	24.5	0.35	0.17	0.52	4	0.031	0.062	
		Northern pike	1998	FILSK	10	10	21.9	17	26.2	0.26	0.16	0.41				
		Walleye	1998	FILSK	10	10	21.3	16.2	25.6	0.57	0.18	0.99				
38040400	KNIFE*	Lake trout	1993	FILSK	26	5	23	14.3	31.6	0.43	0.14	0.76	4	0.036	0.052	
		Lake whitefish	1993	FILSK	19	3	17.2	12.6	21.2	0.07	0.06	0.09	1	0.018	0.018	
		Northern pike	1993	FILSK	8	3	29.1	23.7	36.2	0.55	0.28	0.84	3	0.018	0.035	
		Walleye	1993	FILSK	20	3	17	13	21.2	0.29	0.13	0.46	1	0.021	0.021	
38042000	OSIER	Yellow perch	2001	FILSK	10	1	9.8	9.8	9.8	0.17	0.17	0.17				
38043200	EIGHTEEN*	Smallmouth bass	1991	FILSK	9	2	13.6	11.8	15.3	0.27	0.18	0.36	1	0.01	0.01	Y
		Walleye	1991	FILSK	18	3	16.1	10.3	20.8	0.29	0.18	0.45	2	0.01	0.01	Y
		White sucker	1991	FILSK	9	2	19.9	18.9	20.8	0.07	0.07	0.07	1	0.01	0.01	Y
		Yellow perch	1991	FILSK	10	1	8.9	8.9	8.9	0.10	0.10	0.10				
38044000	REDSKIN*	Brook trout	2007	FILSK	5	5	9.72	6.7	14	0.16	0.06	0.26				
		White sucker	2007	FILSK	6	1	15.3	15.3	15.3	0.10	0.10	0.10				
38044100	JACK*	Northern pike	1997	FILSK	4	4	19	15.9	23.9	0.49	0.38	0.61	1	0.01	0.01	Y
		White sucker	1997	FILSK	7	1	17	17	17	0.35	0.35	0.35	1	0.01	0.01	Y
		Yellow perch	1997	FILSK	10	1	9.6	9.6	9.6	0.25	0.25	0.25				
38044300	BOG*	Walleye	2010	FILSK	8	8	13.4	12	17.4	0.41	0.29	0.57				
		White sucker	2010	FILSK	3	1	14.4	14.4	14.4	0.08	0.08	0.08				
		Yellow perch	2010	FILSK	5	1	10.1	10.1	10.1	0.13	0.13	0.13				
38048800	DISAPPOINTMENT*	Cisco (Lake herring)	1999	FILSK	6	1	14.5	14.5	14.5	0.11	0.11	0.11	1	0.013	0.013	
		Northern pike	1984	FILSK	10	3	22.1	18.3	27.1	0.35	0.17	0.57				
			1999	FILSK	8	8	26.6	22.3	30.9	0.40	0.19	0.65				

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
							Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
		Walleye	1984	FILSK	15	3	17.6	13.6	23.2	0.31	0.18	0.53				
			1999	FILSK	8	8	19.2	13.1	23	0.35	0.15	0.71				
38049100	VERA*	Walleye	1995	FILSK	15	3	18.3	12	24	0.34	0.17	0.55	1	0.01	0.01	Y
		White sucker	1995	FILSK	5	1	20.6	20.6	20.6	0.05	0.05	0.05				
			2015	FILSK	13	9	18.8	15.1	23	0.50	0.17	0.92				
38049800	ENSIGN**	Cisco (Lake herring)	2002	FILSK	4	1	14.8	14.8	14.8	0.11	0.11	0.11				
		Northern pike	2002	FILSK	5	5	27.4	20.6	36.7	0.41	0.24	0.63				
		Walleye	2002	FILSK	5	5	17	12.5	21.5	0.18	0.11	0.28				
38052600	PARENT*	Cisco (Lake herring)	1994	FILSK	6	1	8.6	8.6	8.6	0.16	0.16	0.16				
		Northern pike	1982	FILSK	8	2	30.2	27.1	33.3	1.78	0.84	2.72				
			2012	FILSK	6	6	27.3	24	30.6	0.43	0.30	0.54				
		Smallmouth bass	1982	FILSK	7	2	14	11	16.9	0.57	0.25	0.88				
		Walleye	1982	FILSK	6	3	23.8	19.4	27.5	0.76	0.50	0.94				
			1994	FILSK	10	3	18	14.1	20.9	0.30	0.15	0.43	1	0.01	0.01	Y
			1996	FILSK	6	6	20.8	9.3	26.2	0.52	0.08	0.87				
			2002	FILSK	22	22	20.9	11.5	28	0.51	0.12	1.28				
		White sucker	1994	FILSK	5	1	20.6	20.6	20.6	0.12	0.12	0.12				
38052900	SNOWBANK*	Burbot (Eelpout)	1992	FILET	16	7	18.7	13.5	24.2	0.40	0.14	0.61	2	0.01	0.01	Y
		Lake trout	1983	FILSK	10	3	21.7	17.1	25.8	0.24	0.19	0.33				
			1992	FILSK	14	7	19.4	13.6	26.4	0.29	0.16	0.54	5	0.072	0.18	
		Northern pike	1983	FILSK	13	3	27.3	23	31.5	0.51	0.33	0.62				
			1992	FILSK	1	1	31.5	31.5	31.5	0.39	0.39	0.39	1	0.01	0.01	Y
			1996	FILSK	10	10	17.7	9.8	24.2	0.17	0.08	0.30				
			2000	FILSK	10	10	25.6	19.1	33.3	0.36	0.20	0.68				
			2010	FILSK	15	15	21.4	17	27.3	0.29	0.13	0.76				
		Smallmouth bass	1992	FILSK	9	4	11.9	9.4	17	0.22	0.16	0.38	1	0.032	0.032	
		Walleye	1983	FILSK	10	2	20	17.1	22.9	0.36	0.21	0.51				
			1992	FILSK	2	2	18.4	18	18.7	0.23	0.21	0.25	1	0.01	0.01	Y

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
							Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
		White sucker	1992	FILSK	2	2	20.5	19.4	21.6	0.14	0.13	0.14	1	0.017	0.017	
		Yellow perch	2000	WHORG	10	10	6.23	5.9	6.5	0.07	0.03	0.15				
38053000	SUCKER**	Cisco (Lake herring)	1993	FILSK	8	1	11.2	11.2	11.2	0.06	0.06	0.06				
			2000	FILSK	8	1	11.2	11.2	11.2	0.09	0.09	0.09				
		Northern pike	1993	FILSK	9	4	21.6	14.6	26	0.30	0.10	0.64	1	0.01	0.01	Y
			2000	FILSK	6	6	26	20.1	33.7	0.26	0.12	0.59				
		Walleye	1993	FILSK	20	5	18.9	11.7	28.3	0.31	0.10	0.59	1	0.015	0.015	
			2000	FILSK	6	6	18	14	29.1	0.25	0.09	0.79				
		Yellow perch	1993	FILSK	5	1	8.5	8.5	8.5	0.13	0.13	0.13				
38053200	BIRCH*	Bluegill sunfish	2005	FILSK	5	1	6.8	6.8	6.8	0.05	0.05	0.05				
		Cisco (Lake herring)	2005	FILSK	6	1	14.3	14.3	14.3	0.13	0.13	0.13				
		Largemouth bass	2005	FILSK	1	1	14.3	14.3	14.3	0.25	0.25	0.25				
		Northern pike	1991	FILSK	17	4	25.5	18.8	34.3	0.30	0.15	0.46	3	0.01	0.01	Y
			2005	FILSK	6	6	28.5	20	36.2	0.35	0.15	0.55				
			2010	FILSK	15	15	24.7	16.8	41.9	0.21	0.06	0.49				
		Smallmouth bass	2005	FILSK	5	5	13.8	11.1	16	0.18	0.12	0.30				
		Walleye	1991	FILSK	15	2	14.8	12	17.6	0.17	0.10	0.24	1	0.01	0.01	Y
			2005	FILSK	6	6	18.6	14.8	24.6	0.19	0.12	0.37				
		White sucker	2000	FILSK	3	1	19.4	19.4	19.4	0.05	0.05	0.05				
38055000	SURPRISE*	Northern pike	2000	FILSK	7	7	21	18.1	31.4	0.23	0.11	0.45				
		White sucker	2000	FILSK	4	1	19.5	19.5	19.5	0.09	0.09	0.09				
38055100	BEETLE	Brook trout	2014	FILSK	4	4	12	9.1	16	0.09	0.06	0.14				
38055200	DRAGON	Northern pike	1989	FILSK	5	2	21.2	18	24.3	0.41	0.32	0.50				
		Walleye	1989	FILSK	6	2	14.9	13.5	16.3	0.33	0.18	0.47				
38055400	GANDER**	Northern pike	1994	FILSK	27	5	21.8	12.1	30	0.67	0.41	0.94	1	0.01	0.01	Y
		White sucker	1994	FILSK	6	1	17.6	17.6	17.6	0.13	0.13	0.13				
		Yellow perch	1994	FILSK	8	1	7.7	7.7	7.7	0.20	0.20	0.20				
38055700	GROUSE**	Bluegill sunfish	2004	FILSK	1	1	8.5	8.5	8.5	0.14	0.14	0.14				

						No.	Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	Samples	Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
		Northern pike	1989	FILSK	5	2	18.6	16.2	21	0.32	0.06	0.57				
			1992	FILSK	21	3	17.6	13.5	22.2	0.46	0.30	0.70				
			2004	FILSK	5	5	18.6	16.1	20	0.30	0.23	0.44				
		Walleye	1989	FILSK	6	2	15.7	13.2	18.2	0.53	0.30	0.76				
			2004	FILSK	5	5	16.1	12.5	22.3	0.41	0.20	0.77				
		Yellow perch	1992	WHORG	92	4	2.85	2.5	3.1	0.09	0.08	0.10				
			2004	FILSK	3	1	9.1	9.1	9.1	0.14	0.14	0.14				
38055900	KITIGAN	Northern pike	1989	FILSK	8	3	21.1	17.1	25.9	0.17	0.15	0.21				
		Walleye	1989	FILSK	1	1	14.8	14.8	14.8	0.13	0.13	0.13				
38056100	MITAWAN	Northern pike	1989	FILSK	8	4	22.1	18.9	25.9	0.25	0.17	0.38				
		Walleye	1989	FILSK	9	4	18.9	12.6	24	0.24	0.07	0.37				
38056800	FLAT HORN*	Northern pike	1992	FILSK	18	4	22.7	13.2	31.6	0.41	0.18	0.61	1	0.01	0.01	Y
		Walleye	1992	FILSK	9	2	15.2	12.7	17.6	0.30	0.23	0.36	1	0.01	0.01	Y
		White sucker	1992	FILSK	19	3	16.9	12.8	20.7	0.18	0.06	0.31	1	0.01	0.01	Y
		Yellow perch	1992	NOHV	9	1	6.5	6.5	6.5	0.1	0.1	0.1				
38057300	GEGOKA**	Northern pike	1989	FILSK	3	1	18.9	18.9	18.9	0.28	0.28	0.28				
			2008	FILSK	5	5	17.1	15.1	19.3	0.46	0.33	0.58				
			2011	FILSK	5	5	24.4	18.6	33.5	0.52	0.38	0.68				
		Walleye	1989	FILSK	6	2	21.8	18.8	24.8	0.55	0.30	0.80				
		White sucker	2011	FILSK	5	1	18.1	18.1	18.1	0.24	0.24	0.24				
		Yellow perch	2011	FILSK	8	2	8.5	8.2	8.8	0.17	0.16	0.18				
38059600	QUADGA*	Northern pike	1994	FILSK	14	4	21.2	17.8	25.4	0.43	0.34	0.59				
		Walleye	1994	FILSK	7	3	20.6	18	23.1	0.50	0.31	0.62	1	0.01	0.01	Y
38060000	THREE**	Northern pike	1992	FILSK	18	3	22	17.1	26.5	0.53	0.36	0.69	1	0.01	0.01	
		Walleye	1992	FILSK	16	4	20.4	11.6	30	0.83	0.46	1.40	1	0.013	0.013	
38060500	ONE*	Northern pike	1984	FILSK	10	2	20.7	18.2	23.1	0.30	0.27	0.32				
			1996	FILSK	10	10	23.4	14.6	36.6	0.43	0.18	0.82				
		Walleye	1984	FILSK	8	2	15	12.9	17	0.31	0.25	0.36				
			1996	FILSK	5	5	12.7	7.2	19.5	0.31	0.24	0.44				
38060800	TWO*	Northern pike	1996	FILSK	28	6	21.8	13.4	31.4	0.38	0.17	0.68	1	0.01	0.01	Y

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
							Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
		Walleye	1996	FILSK	8	2	15.7	13.6	17.8	0.48	0.41	0.54				
		White sucker	1996	FILSK	2	1	18.7	18.7	18.7	0.15	0.15	0.15				
38061900	NEWFOUND*	Bluegill sunfish	1993	FILSK	8	1	6.7	6.7	6.7	0.05	0.05	0.05				
			2010	FILSK	5	1	7.3	7.3	7.3	0.05	0.05	0.05				
		Cisco (Lake herring)	1993	FILSK	8	1	11.5	11.5	11.5	0.05	0.05	0.05				
			2000	FILSK	6	1	12.3	12.3	12.3	0.10	0.10	0.10				
		Northern pike	1993	FILSK	23	6	21	12.8	28.7	0.17	0.08	0.26	1	0.01	0.01	Y
			2000	FILSK	9	9	24.4	18.4	35.5	0.31	0.16	0.92				
			2010	FILSK	8	8	26.8	19	38.1	0.33	0.24	0.47				
		Walleye	1993	FILSK	29	6	18.9	11.8	25.6	0.30	0.13	0.66	1	0.015	0.015	
			2000	FILSK	7	7	19	12.5	27.4	0.29	0.10	0.66				
			2010	FILSK	5	5	17.5	13.4	21.4	0.22	0.17	0.27				
38062000	FOUND	Brook trout	1996	FILSK	14	3	13.4	8.5	16.8	0.08	0.06	0.11	1	0.01	0.01	Y
38063000	FLASH*	Northern pike	1993	FILSK	14	3	23.1	17.5	27.4	0.31	0.20	0.39	1	0.01	0.01	Y
		Walleye	1993	FILSK	19	3	16.1	11.4	20.1	0.26	0.17	0.33	1	0.01	0.01	Y
38063500	GRASS*	Black crappie	1996	FILSK	5	1	13.1	13.1	13.1	0.37	0.37	0.37				
		Northern pike	1996	FILSK	6	3	28.4	23.2	34.9	0.47	0.30	0.76	2	0.01	0.01	Y
		White sucker	1996	FILSK	5	1	17.6	17.6	17.6	0.09	0.09	0.09				
38064000	OJIBWAY**	Bluegill sunfish	1992	FILSK	8	1	6.1	6.1	6.1	0.13	0.13	0.13				
			2005	FILSK	10	1	6.5	6.5	6.5	0.13	0.13	0.13				
		Cisco (Lake herring)	1992	FILSK	8	1	10.5	10.5	10.5	0.20	0.20	0.20	1	0.025	0.025	Y
			2005	FILSK	4	1	12.5	12.5	12.5	0.18	0.18	0.18				
		Lake trout	1992	FILSK	15	4	18.8	9.3	27.3	0.38	0.12	0.86	2	0.205	0.22	
			2005	FILSK	2	2	21	20.5	21.4	0.24	0.23	0.24	2	0.015	0.02	
		Northern pike	1992	FILSK	8	4	25.4	19.5	33.3	0.47	0.25	0.93	1	0.12	0.12	
			2005	FILSK	5	5	26.5	24.4	30	0.49	0.35	0.67				
		Smallmouth bass	2005	FILSK	5	5	14.2	10.8	18.1	0.51	0.34	0.89				
38064200	WIND*	Bluegill sunfish	2011	FILSK	8	2	6.65	6	7.3	0.03	0.03	0.03				

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
							Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
		Northern pike	2011	FILSK	8	8	23.5	15.6	30.7	0.16	0.06	0.28				
		White sucker	2011	FILSK	5	1	15.3	15.3	15.3	0.02	0.02	0.02				
		Yellow perch	2011	FILSK	3	1	8.1	8.1	8.1	0.14	0.14	0.14				
38064400	MOOSE*	Bluegill sunfish	2005	FILSK	10	1	5.3	5.3	5.3	0.06	0.06	0.06				
		Cisco (Lake herring)	2005	FILSK	1	1	14	14	14	0.08	0.08	0.08				
		Largemouth bass	2005	FILSK	1	1	12.4	12.4	12.4	0.26	0.26	0.26				
		Northern pike	1991	FILSK	18	3	21.9	17.2	26.4	0.30	0.16	0.44	2	0.01	0.01	Y
			2005	FILSK	8	8	25.8	16.7	38.5	0.62	0.14	1.44				
			2010	FILSK	16	16	22.9	16.5	35.6	0.43	0.12	0.97				
		Smallmouth bass	2005	FILSK	5	5	13.8	10.5	17.3	0.27	0.14	0.41				
		Walleye	1991	FILSK	22	4	19.2	11.3	26.4	0.59	0.16	1.40	3	0.01	0.01	Y
			2005	FILSK	8	8	18.1	12.6	26.5	0.25	0.13	0.63				
38064500	BASSWOOD*	Northern pike	1977	PLUG	25	25	20.4	15.5	25.5	0.46	0.23	0.86				
			1985	FILSK	15	3	21.6	17.3	26.3	0.55	0.34	0.72				
			1996	FILSK	13	13	24.2	17	32.5	0.47	0.07	1.15				
			2005	FILSK	41	41	22.9	17.8	38.6	0.33	0.12	1.01				
			2015	FILSK	15	15	26	19	41.3	0.64	0.26	1.63				
		Walleye	1977	PLUG	28	28	16.7	12.5	29	0.61	0.24	1.95				
			1985	FILSK	12	3	17.4	13.2	21.9	0.70	0.30	1.40				
		Yellow perch	2005	WHORG	22	4	6.1	5.5	6.7	0.06	0.03	0.11				
38065600	GREENWOOD**	Northern pike	1977	PLUG	25	25	18.6	14.9	27.7	0.45	0.31	0.75				
			1994	FILSK	23	6	18.5	11.7	25.7	0.46	0.25	0.70				
			2000	FILSK	6	6	18.5	15	22.9	0.50	0.31	0.82				
			2009	FILSK	15	15	21.4	14.7	30.1	0.69	0.30	1.19				
		Walleye	1984	FILSK	4	1	18.8	18.8	18.8	1.10	1.10	1.10				
			1994	FILSK	15	5	18	11.6	28	0.98	0.43	2.10	1	0.01	0.01	Y
			2000	FILSK	6	6	16.6	11.8	22.4	0.68	0.42	1.30				
		White sucker	1977	PLUG	25	25	14.9	8.5	18.8	0.17	0.07	0.56				
			1994	FILSK	8	1	19.1	19.1	19.1	0.40	0.40	0.40				

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
							Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
			2000	FILSK	3	1	18.3	18.3	18.3	0.26	0.26	0.26				
		Yellow perch	1977	PLUG	25	25	7.58	5.4	10.9	0.26	0.08	0.68				
			1994	FILSK	4	1	9.3	9.3	9.3	0.30	0.30	0.30				
			2000	FILSK	10	1	8.5	8.5	8.5	0.18	0.18	0.18				
38065800	MIDDLE MCDOUGAL*	Northern pike	1996	FILSK	8	2	17.7	16.4	18.9	0.29	0.20	0.37				
		Walleye	1996	FILSK	5	2	12.8	10.7	14.9	0.27	0.21	0.33				
		White sucker	1996	FILSK	7	1	20.3	20.3	20.3	0.29	0.29	0.29	1	0.01	0.01	Y
		Yellow perch	1996	FILSK	10	1	6.2	6.2	6.2	0.07	0.07	0.07				
38065900	SOUTH MCDOUGAL**	Northern pike	1991	FILSK	16	3	17.3	13.9	20.8	0.43	0.23	0.55	1	0.01	0.01	Y
			2015	FILSK	8	8	18.1	14.3	25.2	0.46	0.29	0.70				
		Smallmouth bass	2015	FILSK	1	1	19	19	19	0.83	0.83	0.83				
		Walleye	1991	FILSK	11	3	17.2	12.5	22.2	0.58	0.38	0.78	1	0.01	0.01	Y
			2015	FILSK	8	8	15.9	12.8	18.1	0.57	0.35	0.83				
		White sucker	1991	FILSK	14	2	14.9	12.3	17.5	0.17	0.08	0.25	1	0.01	0.01	Y
			2015	FILSK	5	1	17.1	17.1	17.1	0.16	0.16	0.16				
		Yellow perch	1991	FILSK	10	1	8.4	8.4	8.4	0.19	0.19	0.19				
			2015	FILSK	10	1	7.93	7.93	7.93	0.17	0.17	0.17				
38066400	DUNNIGAN**	Bluegill sunfish	1996	FILSK	4	1	5.5	5.5	5.5	0.09	0.09	0.09				
			2015	FILSK	3	1	5.33	5.33	5.33	0.09	0.09	0.09				
		Smallmouth bass	1981	FILSK	5	1	13.1	13.1	13.1	0.28	0.28	0.28	1	0.025	0.025	Y
				WHORG	5	1	13.1	13.1	13.1	0.19	0.19	0.19				
			1982	FILSK	6	1	11.4	11.4	11.4	0.30	0.30	0.30				
			1984	FILSK	5	1	11.1	11.1	11.1	0.11	0.11	0.11				
			1987	FILSK	14	3	10.7	10.4	10.9	0.25	0.21	0.31				
			1993	FILSK	3	1	13.2	13.2	13.2	0.26	0.26	0.26				
			1996	FILSK	8	2	8.85	7.9	9.8	0.15	0.14	0.16				
			2011	FILSK	14	14	11.9	10.8	13.8	0.29	0.20	0.44				
			2015	FILSK	8	8	11.6	9.6	15.5	0.37	0.22	0.81				

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in) Mean	Length (in) Min	Length (in) Max	Mercury (mg/kg) Mean	Mercury (mg/kg) Min	Mercury (mg/kg) Max	PCBs (mg/kg) N	PCBs (mg/kg) Mean	PCBs (mg/kg) Max	< RL
		Walleye	1981	FILSK	5	1	17.9	17.9	17.9	0.75	0.75	0.75	1	0.025	0.025	Y
				WHORG	5	1	17.9	17.9	17.9	0.53	0.53	0.53				
			1982	FILSK	5	2	17.6	14	21.2	0.80	0.50	1.10				
			1984	FILSK	5	1	16.2	16.2	16.2	0.48	0.48	0.48				
			1987	FILSK	9	9	16.5	12	19.8	0.88	0.20	1.50				
			1993	FILSK	8	2	18.1	16.2	19.9	0.62	0.51	0.72	1	0.01	0.01	Y
			1996	FILSK	15	9	16.4	13.7	21.4	0.55	0.33	1.02	1	0.01	0.01	Y
			1999	FILSK	10	10	17.6	11.9	23.9	0.62	0.25	1.06	1	0.01	0.01	Y
			2011	FILSK	7	7	17.7	11.4	20.3	0.53	0.30	0.68				
			2015	FILSK	8	8	15.5	11.2	21	0.43	0.28	0.53				
38066500	GYPSY	Brook trout	2013	FILSK	3	3	11.5	8.5	13.4	0.23	0.16	0.28				
38066600	SLATE**	Northern pike	1987	FILSK	3	3	24.4	19.8	30.1	0.62	0.52	0.74				
			2005	FILSK	4	4	20.6	17	24.5	0.39	0.22	0.75				
			2014	FILSK	7	7	24.4	14.2	33.2	0.59	0.18	0.87				
		Smallmouth bass	2014	FILSK	7	7	15.4	12.2	17.8	0.51	0.30	0.76				
		Walleye	1987	FILSK	9	9	17.9	12.4	23.5	0.96	0.25	1.50				
			1999	FILSK	8	8	17	13.7	26.1	0.58	0.16	1.68	1	0.03	0.03	
			2005	FILSK	5	5	15.2	11.7	18.6	0.36	0.15	0.61				
			2014	FILSK	10	10	13.3	11.1	16.2	0.33	0.19	0.55				
		White sucker	1999	FILSK	7	1	19.1	19.1	19.1	0.30	0.30	0.30				
			2005	FILSK	4	1	17.6	17.6	17.6	0.28	0.28	0.28				
		Yellow perch	1999	FILSK	10	1	9.9	9.9	9.9	0.17	0.17	0.17				
			2005	FILSK	8	1	8.9	8.9	8.9	0.21	0.21	0.21				
38066800	DEEP**	Northern pike	1991	FILSK	20	3	22.4	18.7	26.5	0.31	0.21	0.49	2	0.01	0.01	Y
		Rock bass	1991	FILSK	4	1	7.3	7.3	7.3	0.24	0.24	0.24				
		Walleye	1991	FILSK	20	3	17.1	12.1	22	0.64	0.36	0.86				
		White sucker	1991	FILSK	8	1	18	18	18	0.14	0.14	0.14	1	0.01	0.01	Y
		Yellow perch	1991	WHORG	18	1	6.5	6.5	6.5	0.13	0.13	0.13				
38067000	PIKE*	Largemouth bass	1993	FILSK	1	1	12.9	12.9	12.9	0.28	0.28	0.28				
		Northern pike	1993	FILSK	13	3	23.1	19.4	26.1	0.36	0.29	0.43	1	0.01	0.01	Y

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
							Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
		White sucker	1993	FILSK	8	1	18.1	18.1	18.1	0.13	0.13	0.13	1	0.01	0.01	Y
		Yellow perch	1993	WHORG	14	1	5.9	5.9	5.9	0.11	0.11	0.11				
38067100	TWO DEER*	Largemouth bass	2011	FILSK	3	3	15.5	9.3	18.9	0.53	0.24	0.77				
		Northern pike	2011	FILSK	8	8	24.6	22.1	27.7	0.28	0.25	0.30				
		White sucker	2011	FILSK	5	1	19	19	19	0.21	0.21	0.21				
		Yellow perch	2011	FILSK	10	2	7.2	7	7.4	0.17	0.16	0.18				
38067300	HIGHLIFE*	Bluegill sunfish	1983	WHORG	3	1	7.5	7.5	7.5	0.02	0.02	0.02				
			1986	FILSK	9	1	7	7	7	0.17	0.17	0.17				
			2004	FILSK	10	1	6.2	6.2	6.2	0.08	0.08	0.08				
		Brook trout	2004	FILSK	5	5	12.5	11.5	13.5	0.09	0.07	0.11				
		Largemouth bass	1986	FILSK	1	1	14.5	14.5	14.5	0.57	0.57	0.57				
		Yellow perch	1983	WHORG	5	1	7.6	7.6	7.6	0.12	0.12	0.12				
			1986	WHORG	9	1	7	7	7	0.17	0.17	0.17				
38067400	EAST CHUB*	Bluegill sunfish	1985	FILSK	4	1	6.3	6.3	6.3	0.04	0.04	0.04	1	0.02	0.02	Y
			1988	FILSK	3	1	6.3	6.3	6.3	0.04	0.04	0.04	1	0.01	0.01	Y
			2000	FILSK	10	1	8.3	8.3	8.3	0.15	0.15	0.15				
			2003	FILSK	10	1	7.2	7.2	7.2	0.11	0.11	0.11				
		Northern pike	1982	FILSK	14	3	21.9	17.5	25.8	0.19	0.17	0.21				
			1985	FILSK	8	2	21.1	19.2	22.9	0.32	0.28	0.36	1	0.02	0.02	Y
			1988	FILSK	12	4	26.9	19.2	37.3	0.31	0.26	0.38	4	0.01	0.01	Y
			2000	FILSK	6	6	24.1	22.5	27.1	0.30	0.21	0.37				
			2003	FILSK	5	5	23.2	20.8	25.8	0.47	0.28	0.79				
			2006	FILSK	9	9	19.9	15.2	24.1	0.29	0.14	0.47				
			2012	FILSK	12	12	22.3	17.9	26.1	0.33	0.14	0.56				
		Walleye	1982	FILSK	3	1	19.8	19.8	19.8	0.55	0.55	0.55				
			1985	FILSK	4	3	17	14.2	19.2	0.25	0.19	0.33	1	0.02	0.02	Y
			1988	FILSK	6	2	17.6	15.9	19.2	0.24	0.22	0.25	2	0.01	0.01	Y
		White sucker	2000	FILSK	4	1	18.2	18.2	18.2	0.09	0.09	0.09				
		Yellow perch	2006	WHORG	10	4	6.08	5.7	6.4	0.10	0.07	0.14				
			2012	FILSK	5	1	8.5	8.5	8.5	0.16	0.16	0.16				

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
							Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
38067500	WEST CHUB*	Northern pike	1994	FILSK	22	5	22.7	14.2	30.5	0.18	0.11	0.25	2	0.01	0.01	Y
		White sucker	1994	FILSK	14	2	16.3	13.3	19.2	0.06	0.03	0.10				
		Yellow perch	1994	FILSK	8	1	7.3	7.3	7.3	0.03	0.03	0.03				
38068600	NORTH MCDOUGAL**	Northern pike	1991	FILSK	3	1	16.4	16.4	16.4	0.33	0.33	0.33				
			2006	FILSK	6	6	18.4	14.5	25.5	0.46	0.29	0.76				
			2009	FILSK	14	14	19.3	16.7	24.2	0.40	0.26	0.52				
		Walleye	1991	FILSK	12	2	14.4	11.8	17	0.53	0.28	0.78	1	0.01	0.01	Y
			2000	FILSK	5	5	14.9	13	16.7	0.71	0.39	1.17				
			2006	FILSK	4	4	13.7	12	15.6	0.38	0.33	0.49				
		White sucker	1991	FILSK	15	2	14.8	12.4	17.2	0.12	0.06	0.18	1	0.01	0.01	Y
			2000	FILSK	4	1	18.1	18.1	18.1	0.15	0.15	0.15				
		Yellow perch	1991	FILSK	8	1	9.5	9.5	9.5	0.10	0.10	0.10				
			2000	FILSK	10	1	9.4	9.4	9.4	0.20	0.20	0.20				
			2006	FILSK	10	1	8.8	8.8	8.8	0.19	0.19	0.19				
38068800	NORWAY	Splake	2011	FILSK	8	8	14.8	14	16.5	0.13	0.09	0.15				
38069100	AUGUST**	Northern pike	1992	FILSK	14	3	22.8	17.5	30	0.63	0.40	0.79	1	0.01	0.01	Y
			1996	FILSK	6	6	18.3	15.9	20.3	0.38	0.19	0.56				
			2002	FILSK	10	10	18.5	16	21.2	0.64	0.38	0.90				
			2007	FILSK	1	1	26	26	26	0.84	0.84	0.84				
			2013	FILSK	13	13	20.3	13.6	32.1	0.48	0.30	0.70				
		Walleye	1992	FILSK	17	3	16.5	11.5	21.2	0.64	0.28	1.10	1	0.01	0.01	Y
			1996	FILSK	8	8	12.5	8.5	19	0.28	0.17	0.56				
			2002	FILSK	9	9	15.2	10.5	27	0.66	0.30	1.57				
			2007	FILSK	19	19	13.3	11.5	16.9	0.34	0.28	0.53				
			2013	FILSK	12	12	14.6	11	21.7	0.41	0.31	1.02				
		White sucker	1992	FILSK	20	3	17.1	12.4	21.1	0.11	0.04	0.22	1	0.01	0.01	Y
		Yellow perch	1992	WHORG	11	1	5.8	5.8	5.8	0.10	0.10	0.10				
			2002	WHORG	8	2	6.6	5.9	7.3	0.11	0.10	0.11				
			2007	WHORG	10	2	5.95	5.9	6	0.14	0.12	0.16				

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in) Mean	Min	Max	Mercury (mg/kg) Mean	Min	Max	PCBs (mg/kg) N	Mean	Max	< RL
38070100	GABBRO	Northern pike	1977	PLUG	21	21	21.7	12.2	34.5	0.50	0.22	0.95				
		White sucker	1977	PLUG	25	25	14.3	8.8	22	0.09	0.03	0.20				
		Yellow perch	1977	PLUG	25	25	7.82	5.7	9.6	0.34	0.08	0.88				
38070500	NICKEL**	Walleye	2000	FILSK	8	8	14.6	13.4	15.9	0.50	0.32	0.61				
		White sucker	2000	FILSK	9	1	22.1	22.1	22.1	0.27	0.27	0.27				
38071400	SECTION TWELVE*	Bluegill sunfish	2000	FILSK	10	1	5.7	5.7	5.7	0.16	0.16	0.16				
		Cisco (Lake herring)	2000	FILSK	10	1	15.5	15.5	15.5	0.07	0.07	0.07				
		Walleye	2000	FILSK	8	8	16	12.4	22.4	0.32	0.20	0.66				
38071500	TRIANGLE*	Northern pike	1991	FILSK	16	4	20.5	13.8	27.1	0.28	0.15	0.42	2	0.01	0.01	Y
			1996	FILSK	10	10	22.7	15.2	28.5	0.41	0.17	0.81				
			2008	FILSK	19	19	22.8	11.7	40.5	0.30	0.22	0.74				
			2014	FILET	11	11	28.3	20.3	37.1	0.54	0.24	0.85				
		Walleye	1991	FILSK	16	4	18.9	9.3	25.4	0.34	0.13	0.56	3	0.01	0.01	Y
			1996	FILSK	5	5	21.7	18.5	23.7	0.62	0.36	0.91				
		Yellow perch	2008	WHORG	5	1	7.7	7.7	7.7	0.09	0.09	0.09				
38071800	GREENSTONE*	Northern pike	1992	FILSK	13	4	24.3	17.7	30.5	0.48	0.16	0.89	1	0.01	0.01	Y
			1996	FILSK	10	10	22.3	17	30.1	0.26	0.13	0.59				
			2001	FILSK	9	9	24.4	16.9	32.9	0.43	0.14	0.72				
			2009	FILSK	15	15	22.9	18	26.7	0.48	0.26	0.78				
			2014	FILET	15	15	24.6	19.9	32.4	0.43	0.22	0.83				
		Walleye	1992	FILSK	19	3	16.7	11.8	21.1	0.27	0.18	0.42	1	0.01	0.01	Y
			1996	FILSK	5	5	16.8	9.7	25.6	0.36	0.09	0.93				
			2001	FILSK	10	10	19.2	15.2	23.8	0.44	0.36	0.62				
		White sucker	1992	FILSK	2	1	22.9	22.9	22.9	0.19	0.19	0.19	1	0.01	0.01	Y
		Yellow perch	1992	FILSK	7	1	6.4	6.4	6.4	0.07	0.07	0.07				
38072000	CONCHU	Brook trout	1994	FILSK	11	3	15.3	13.1	18.2	0.11	0.10	0.15	1	0.01	0.01	Y
38072200	CLEAR*	Bluegill sunfish	1998	FILSK	2	1	7.1	7.1	7.1	0.06	0.06	0.06				
		Northern pike	1998	FILSK	10	10	21.1	17	25.3	0.18	0.11	0.28				
		Walleye	1998	FILSK	10	10	15.2	12.8	18.5	0.19	0.09	0.34				

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
							Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
		White sucker	1998	FILSK	7	1	16.6	16.6	16.6	0.08	0.08	0.08				
38073500	SAND**	Bluegill sunfish	2005	FILSK	6	2	8.3	7	9.6	0.11	0.08	0.15				
		Northern pike	1985	FILSK	1	1	18.8	18.8	18.8	0.77	0.77	0.77				
			1989	FILSK	3	1	21.6	21.6	21.6	0.44	0.44	0.44				
			1998	FILSK	9	9	19.4	15	28.9	0.38	0.22	0.52				
			2005	FILSK	8	8	17.8	14.4	25.5	0.35	0.11	0.66				
			2008	FILSK	24	24	18.4	14.7	28.5	0.33	0.20	0.54				
			2014	FILSK	3	3	17.7	16.2	19.5	0.62	0.59	0.65				
		Walleye	1985	FILSK	12	3	17.1	13.4	20.8	0.88	0.59	1.20				
			1998	FILSK	10	10	14.3	12.6	19.2	0.39	0.21	0.66				
			2005	FILSK	8	8	16.2	13.3	20	0.44	0.22	0.83				
			2014	FILSK	15	15	14	11.5	24.5	0.56	0.42	0.90				
		White sucker	1998	FILSK	8	1	17.9	17.9	17.9	0.18	0.18	0.18				
		Yellow perch	1998	FILSK	10	1	9.3	9.3	9.3	0.15	0.15	0.15				
			2005	FILSK	8	1	10.3	10.3	10.3	0.21	0.21	0.21				
			2008	WHORG	10	2	7.5	7.2	7.8	0.08	0.06	0.09				
38073600	HARRIS**	Walleye	1993	FILSK	20	3	17.2	12	21.4	0.65	0.36	0.97	1	0.01	0.01	Y
			2013	FILSK	8	8	15.8	14	18.5	0.74	0.55	0.97				
		Yellow perch	1993	WHORG	15	1	5.9	5.9	5.9	0.18	0.18	0.18				
38073700	BEAVER HUT**	Brook trout	1996		2	1	12.3	12.3	12.3	0.38	0.38	0.38	1	0.01	0.01	Y
		White sucker	1996	FILSK	5	1	15.4	15.4	15.4	0.18	0.18	0.18				
		Yellow perch	1996	FILSK	6	1	10.3	10.3	10.3	0.60	0.60	0.60				
38073800	GARDEN LAKE RES.**	Northern pike	1970	PLUG	2	2	21.9	17.3	26.4	0.35	0.28	0.41				
			1983	FILSK	20	5	28.3	18.6	41.5	0.61	0.36	0.90				
			1996	FILSK	10	10	25.1	12.7	40.7	0.51	0.16	0.88				
			2004	FILSK	23	23	23.5	13.1	42.3	0.44	0.13	1.17				
		Walleye	1983	FILSK	10	3	18.2	14.5	23	0.37	0.35	0.40				
		White sucker	1970	PLUG	2	2	17.2	16.3	18	0.31	0.21	0.40				
		Yellow perch	2004	WHORG	10	2	5.4	5.1	5.7	0.04	0.04	0.05				

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in) Mean	Length (in) Min	Length (in) Max	Mercury (mg/kg) Mean	Mercury (mg/kg) Min	Mercury (mg/kg) Max	PCBs (mg/kg) N	PCBs (mg/kg) Mean	PCBs (mg/kg) Max	< RL
38074100	PICKEREL*	Northern pike	1998	FILSK	10	10	20.9	16.9	23.9	0.27	0.12	0.41				
		Walleye	1998	FILSK	9	9	22.1	18.3	26.9	0.52	0.16	1.20				
		White sucker	1998	FILSK	5	1	20.3	20.3	20.3	0.06	0.06	0.06				
38078000	BROWNS*	Northern pike	1991	FILSK	18	5	21.7	13.7	30.6	0.19	0.06	0.35	3	0.01	0.01	Y
			1996	FILSK	10	10	19.7	10.6	28.5	0.21	0.06	0.46				
			2011	FILSK	15	15	20.8	15.4	27.9	0.21	0.07	0.42				
		Walleye	1991	FILSK	18	4	19.6	12.7	26.7	0.24	0.06	0.50	3	0.01	0.01	Y
			1996	FILSK	5	5	16.1	8.3	23.7	0.18	0.07	0.44				
38078200	GARDEN**	Bluegill sunfish	1994	FILSK	9	1	7.9	7.9	7.9	0.14	0.14	0.14				
			2008	FILSK	10	1	7.1	7.1	7.1	0.18	0.18	0.18				
		Black crappie	2008	FILSK	10	1	9.2	9.2	9.2	0.18	0.18	0.18				
		Cisco (Lake herring)	1994	FILSK	8	2	11.5	10.6	12.4	0.23	0.21	0.26	1	0.01	0.01	Y
		Northern pike	1994	FILSK	8	4	21.7	16.8	27.7	0.45	0.32	0.73	1	0.01	0.01	Y
			2008	FILSK	8	8	20.9	17.1	25.2	0.39	0.28	0.52				
		Walleye	1994	FILSK	10	3	15.4	12.6	18	0.35	0.23	0.43				
			2008	FILSK	6	6	16.8	10.5	28.3	0.45	0.18	0.92				
38078400	NEWTON*	Northern pike	1991	FILSK	11	3	23.5	17.2	31.5	0.71	0.33	1.30	2	0.01	0.01	Y
			1995	FILSK	9	9	22.8	12.2	42.9	0.58	0.30	1.31				
			2007	FILSK	6	6	17.4	15	22.3	0.31	0.23	0.39				
		Walleye	1991	FILSK	11	3	18.6	11.1	26.8	0.87	0.29	2.00	2	0.01	0.01	Y
			2007	FILSK	6	6	13.6	12.2	14.9	0.28	0.20	0.36				
		Yellow perch	2007	FILSK	10	1	9.9	9.9	9.9	0.31	0.31	0.31				
38078600	SANDPIT**	Northern pike	1981	FILSK	5	1	22.1	22.1	22.1	0.70	0.70	0.70	1	0.025	0.025	Y
				WHORG	5	1	22.1	22.1	22.1	0.57	0.57	0.57				
			1984	FILSK	15	3	22.4	18.8	26	0.84	0.40	1.19				
			1996	FILSK	10	10	21.4	12.5	35.2	0.65	0.31	1.27				
		Smallmouth bass	1981	WHORG	2	1	12.1	12.1	12.1	0.25	0.25	0.25				
		Walleye	1981	FILSK	1	1	20.6	20.6	20.6	1.10	1.10	1.10	1	0.025	0.025	Y
				WHORG	4	1	13.3	13.3	13.3	0.54	0.54	0.54				

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
							Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
			1984	FILSK	2	1	17.9	17.9	17.9	0.76	0.76	0.76				
38079200	HORSE**	Northern pike	1991	FILSK	13	4	24.3	18.4	30	0.58	0.41	0.81	2	0.01	0.01	Y
		Walleye	1991	FILSK	10	3	17.5	13.1	21.7	0.59	0.39	0.78	2	0.01	0.01	Y
38081000	CEDAR*	Northern pike	1994	FILSK	16	5	24.4	18.3	33.6	0.24	0.12	0.49				
		Walleye	1994	FILSK	15	4	16.8	11	24.2	0.20	0.08	0.40	1	0.01	0.01	Y
		White sucker	1994	FILSK	8	1	19.5	19.5	19.5	0.10	0.10	0.10				
		Yellow perch	1994	FILSK	6	1	9.9	9.9	9.9	0.11	0.11	0.11				
38081100	FALL**	Bluegill sunfish	2007	FILSK	10	1	8.9	8.9	8.9	0.23	0.23	0.23				
		Black crappie	2007	FILSK	7	1	9.7	9.7	9.7	0.20	0.20	0.20				
		Cisco (Lake herring)	1993	FILSK	8	2	13.4	12.1	14.6	0.15	0.12	0.17	1	0.01	0.01	Y
		Northern pike	1977	PLUG	25	25	21.2	14	40.7	0.42	0.15	1.29				
			1982	FILSK	7	2	20.4	18.7	22	0.39	0.34	0.43				
			1993	FILSK	15	4	24.1	17.4	30.1	0.44	0.30	0.60	1	0.01	0.01	Y
			1995	FILSK	8	8	18.5	13.8	25.7	0.30	0.20	0.41				
			2003	FILSK	24	24	20.1	14.3	27.7	0.39	0.16	0.87				
			2007	FILSK	24	24	20.1	15.3	33.3	0.33	0.18	0.88				
			2012	FILSK	12	12	20.1	18	28.5	0.34	0.22	0.52				
		Smallmouth bass	2007	FILSK	5	5	12.5	9.6	14.5	0.22	0.18	0.29				
		Walleye	1977	PLUG	24	24	13.3	9.3	18.8	0.34	0.21	0.53				
			1982	FILSK	20	2	14.4	13.1	15.7	0.42	0.39	0.44				
			1993	FILSK	14	3	15.7	13	18.6	0.43	0.36	0.49				
			1995	FILSK	10	10	16	9.1	23.2	0.35	0.11	0.61				
		White sucker	1977	PLUG	24	24	15.9	8.8	22.1	0.14	0.04	0.38				
		Yellow perch	1977	PLUG	25	25	7.87	5.2	11.1	0.20	0.08	0.50				
			1993	FILSK	7	1	10.1	10.1	10.1	0.25	0.25	0.25				
			2003	WHORG	10	2	5.5	5.3	5.7	0.06	0.05	0.07				
			2007	WHORG	9	2	7	7	7	0.07	0.06	0.08				
38081300	FOURTOWN**	Northern pike	1991	FILSK	22	5	22.1	10.8	34.3	0.67	0.46	1.00	1	0.012	0.012	
		Walleye	1991	FILSK	5	1	11.1	11.1	11.1	0.52	0.52	0.52				

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
							Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
38081700	CROOKED**	Lake whitefish	1995	FILSK	3	1	18.8	18.8	18.8	0.17	0.17	0.17	1	0.01	0.01	Y
		Northern pike	1995	FILSK	31	7	25.5	14.8	37.7	0.83	0.27	1.80	1	0.01	0.01	Y
		Walleye	1995	FILSK	23	5	18.7	12.8	25.5	0.67	0.43	1.00				
		Yellow perch	1995	FILSK	10	1	7.7	7.7	7.7	0.20	0.20	0.20				
38090900	JOUPPI*	Brook trout	2007	FILSK	6	6	11.6	10.6	14.6	0.16	0.12	0.25				
			2014	FILSK	3	3	11.1	10.1	11.9	0.40	0.38	0.41				
69000300	BIRCH**	Bluegill sunfish	1976	LIVER	4	4	7.7	7.1	8.2							
				PLUSK	6	6	7.3	4.4	8.6	0.11	0.01	0.23				
			1990	FILSK	10	1	7	7	7	0.14	0.14	0.14	1	0.01	0.01	Y
			2012	FILSK	10	2	7.85	7.4	8.3	0.11	0.09	0.12				
		Black crappie	1976	LIVER	14	14	10.3	7.9	11.6							
				PLUSK	14	14	10.3	7.9	11.6	0.30	0.14	0.46				
			1990	FILSK	45	5	8.2	7.1	9.5	0.14	0.08	0.20	5	0.01	0.01	Y
			2012	FILSK	10	2	9.9	9.4	10.4	0.17	0.16	0.18				
			2015	FILSK	5	1	9.66	9.66	9.66	0.19	0.19	0.19				
		Cisco (Lake herring)	2015	FILSK	5	1	14.8	14.8	14.8	0.09	0.09	0.09				
		Muskellunge	1976	LIVER	1	1	30.6	30.6	30.6							
				PLUSK	1	1	30.6	30.6	30.6	0.64	0.64	0.64				
		Northern pike	1976	LIVER	22	22	17.3	11.5	27.7							
				PLUSK	22	22	17.3	11.5	27.7	0.25	0.13	0.61				
			1984	FILSK	13	3	21.9	17.3	26.8	0.31	0.21	0.50				
			1990	FILSK	38	18	23.5	14	34.7	0.39	0.13	1.10	18	0.012	0.043	
			1996	FILSK	10	10	23.9	13.6	39.4	0.50	0.20	0.93				
			2003	FILSK	24	24	21.3	16.8	26.1	0.36	0.14	0.81				
			2012	FILSK	11	11	23.4	12.9	39.1	0.34	0.17	0.55				
		Rock bass	1976	LIVER	2	2	7.1	6.5	7.7							
				PLUSK	3	3	6.37	4.9	7.7	0.26	0.14	0.33				
		Walleye	1976	LIVER	2	2	12.5	10.6	14.3							
				PLUSK	4	4	11.3	8.8	14.3	0.30	0.16	0.39				

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
							Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
			1984	FILSK	10	2	15	13.9	16	0.26	0.25	0.27				
			1990	FILSK	57	14	15.9	10.2	25.4	0.46	0.21	0.73	14	0.01	0.01	Y
			2015	FILSK	8	8	19.6	14.6	28.3	0.53	0.23	1.00				
		White sucker	1976	LIVER	15	15	16.1	12.4	20.1							
				PLUSK	21	21	14.2	6.7	20.1	0.13	0.04	0.34				
			1990	FILSK	53	11	14	9.9	17.7	0.11	0.02	0.38	11	0.01	0.01	Y
		Yellow perch	2003	WHORG	10	3	6.87	5.7	8	0.11	0.07	0.17				
69000400	WHITE IRON**	Black crappie	1994	FILSK	9	1	10.4	10.4	10.4	0.23	0.23	0.23				
		Cisco (Lake herring)	1994	FILSK	4	1	13.7	13.7	13.7	0.19	0.19	0.19				
			2010	FILSK	3	1	10.6	10.6	10.6	0.12	0.12	0.12				
		Northern pike	1971	PLUG	8	8	18.8	16.8	20.8	0.66	0.38	0.95				
			1977	PLUG	25	25	19.6	15.2	23.7	0.34	0.21	0.58				
			1982	FILSK	11	4	24.3	17.2	31	0.74	0.44	0.91				
			1994	FILSK	20	6	24.9	16.9	36.7	0.54	0.26	0.84	1	0.01	0.01	Y
			1996	FILSK	10	10	20.4	10.6	30.5	0.45	0.12	0.82				
			2001	FILSK	24	24	21.2	16.1	27.5	0.51	0.33	0.78				
			2004	FILSK	24	24	23.4	17.7	31.4	0.56	0.27	1.59				
			2008	FILSK	19	19	21.6	15.2	38.1	0.53	0.33	0.95				
			2010	FILSK	8	8	22.3	18.5	26.8	0.36	0.22	0.87				
		Rock bass	2008	FILSK	7	7	8.64	7.3	10.1	0.35	0.18	0.71				
		Smallmouth bass	2008	FILSK	6	6	13.5	8.7	18.1	0.41	0.19	0.78				
		Walleye	1971	PLUG	8	8	13.5	12	15.4	0.76	0.43	1.80				
			1977	PLUG	26	26	14.4	11	21.5	0.46	0.26	0.78				
			1982	FILSK	15	2	18.2	12.8	23.5	0.98	0.44	1.51				
			1994	FILSK	22	5	16	10.2	21.4	0.56	0.27	0.78				
			1996	FILSK	5	5	13.2	10.3	16.1	0.32	0.21	0.41				
			2008	FILSK	5	5	21.1	18.9	23.6	0.97	0.76	1.14				
			2010	FILSK	6	6	19.9	13.8	29.4	0.70	0.33	1.09				
		White sucker	1977	PLUG	20	20	15.3	12.8	20	0.11	0.03	0.27				

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
							Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
			1994	FILSK	7	1	18.4	18.4	18.4	0.21	0.21	0.21				
		Yellow perch	1977	PLUG	25	25	7.48	5.2	10.6	0.27	0.10	0.68				
			2001	WHORG	24	1	2.2	2.2	2.2	0.08	0.08	0.08				
			2004	WHORG	10	2	5.45	5.3	5.6	0.07	0.07	0.08				
			2008	FILSK	7	1	8.4	8.4	8.4	0.30	0.30	0.30				
				WHORG	17	3	6.13	5.7	6.4	0.19	0.12	0.32				
69005600	LITTLE**	Northern pike	1994	FILSK	6	2	16.1	14.7	17.4	0.60	0.52	0.68				
			2005	FILSK	3	3	24.6	19.4	30	0.98	0.41	1.74				
		Walleye	1994	FILSK	6	3	18.4	15.8	21.6	0.94	0.62	1.25	1	0.01	0.01	Y
			2005	FILSK	5	5	15.6	13.1	18	0.72	0.25	1.49				
		White sucker	1994	FILSK	3	1	18.9	18.9	18.9	0.16	0.16	0.16				
69005800	PERCH**	Bluegill sunfish	1996	FILSK	10	1	7	7	7	0.12	0.12	0.12				
		Walleye	1996	FILSK	15	3	15.5	12.8	18.2	0.34	0.18	0.58	1	0.01	0.01	Y
69005900	WHISPER*	Bluegill sunfish	1996	FILSK	8	1	8.5	8.5	8.5	0.11	0.11	0.11				
		Largemouth bass	1996	FILSK	4	1	10	10	10	0.12	0.12	0.12				
		Walleye	1996	FILSK	15	3	16.1	11.8	19.8	0.36	0.12	0.54	1	0.01	0.01	Y
		White sucker	1996	FILSK	8	1	18	18	18	0.12	0.12	0.12				
69006100	ONE PINE**	Bluegill sunfish	1991	FILSK	10	1	7.2	7.2	7.2	0.14	0.14	0.14				
		Black crappie	1991	FILSK	10	1	8.2	8.2	8.2	0.14	0.14	0.14				
		Northern pike	1991	FILSK	18	4	21.1	13.6	31.4	0.39	0.27	0.49	2	0.01	0.01	Y
			2007	FILSK	23	23	18.3	12.6	33.3	0.21	0.08	0.42				
		Walleye	1991	FILSK	9	2	13.8	11	16.6	0.54	0.47	0.60	1	0.01	0.01	Y
		Yellow perch	2007	WHORG	10	2	5.7	5.6	5.8	0.06	0.06	0.06				
69006200	HOBO*	Black crappie	2001	FILSK	5	1	9.4	9.4	9.4	0.09	0.09	0.09				
		Northern pike	2001	FILSK	6	6	27.4	24.2	31.7	0.43	0.34	0.71				
69006300	BASS*	Bluegill sunfish	1997	FILSK	10	1	7.8	7.8	7.8	0.10	0.10	0.10	1	0.01	0.01	Y
		Northern pike	1997	FILSK	9	9	21.9	20.4	24.1	0.28	0.12	0.38	1	0.01	0.01	Y
		White sucker	1997	FILSK	7	1	18.9	18.9	18.9	0.08	0.08	0.08	1	0.01	0.01	Y
69006400	DRY	Brown trout	1996	FILSK	7	2	15	13.9	16	0.08	0.07	0.09	1	0.01	0.01	Y

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
							Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
		Cisco (Lake herring)	1996	FILSK	8	1	10.5	10.5	10.5	0.16	0.16	0.16				
		Splake	1996	FILSK	5	1	15.5	15.5	15.5	0.06	0.06	0.06	1	0.01	0.01	Y
69006500	MINISTER**	Bluegill sunfish	1996	FILSK	10	1	6.4	6.4	6.4	0.12	0.12	0.12				
		Northern pike	1996	FILSK	10	3	17.7	15	20.9	0.39	0.22	0.59				
		Walleye	1996	FILSK	8	3	17.3	15	20	0.49	0.25	0.86	1	0.01	0.01	Y
		White sucker	1996	FILSK	3	1	18.4	18.4	18.4	0.07	0.07	0.07				
69006600	LITTLE LONG*	Bluegill sunfish	1994	FILSK	10	1	6.5	6.5	6.5	0.05	0.05	0.05				
		Northern pike	1994	FILSK	17	6	24	13.1	39	0.47	0.08	1.80				
			2010	FILSK	9	9	16.9	14.1	19.3	0.07	0.04	0.11				
		Smallmouth bass	1994	FILSK	7	3	12.9	10.4	15.9	0.17	0.10	0.31				
		Walleye	1994	FILSK	24	5	19.6	9.9	26.6	0.30	0.06	0.48	1	0.01	0.01	Y
		White sucker	1994	FILSK	3	1	15.8	15.8	15.8	0.02	0.02	0.02				
69006900	SHAGAWA*	Northern pike	1983	FILSK	6	2	19.6	18.1	21.1	0.17	0.16	0.17				
			2004	FILSK	24	24	23.8	19.6	30	0.21	0.11	0.50				
		Walleye	1983	FILSK	20	4	20.5	13.6	27.2	0.33	0.08	0.53				
			1993	FILSK	15	3	14.4	11.1	17.6	0.15	0.08	0.26	1	0.017	0.017	
			1995	FILSK	13	13	14.1	9.1	19.5	0.18	0.07	0.36				
		White sucker	1993	FILSK	7	1	19.5	19.5	19.5	0.05	0.05	0.05	1	0.092	0.092	
		Yellow perch	1993	FILSK	6	1	9	9	9	0.08	0.08	0.08				
			2004	WHORG	10	2	5.25	5	5.5	0.03	0.03	0.03				
69007000	LOW*	Bluegill sunfish	2000	FILSK	7	1	8	8	8	0.12	0.12	0.12				
			2005	FILSK	10	1	7	7	7	0.08	0.08	0.08				
		Black crappie	1991	FILSK	10	1	8.8	8.8	8.8	0.10	0.10	0.10				
			2005	FILSK	9	1	9	9	9	0.11	0.11	0.11				
		Northern pike	1991	FILSK	21	5	22.6	11.3	34.7	0.40	0.15	0.89	3	0.01	0.01	Y
			2000	FILSK	7	7	22.4	15.2	31.3	0.44	0.24	0.71				
			2005	FILSK	8	8	24.2	17.2	31.4	0.50	0.21	0.94				
			2010	FILSK	15	15	23.7	15.3	33.2	0.47	0.24	0.82				
		Smallmouth bass	2005	FILSK	4	4	13.7	10.7	16.1	0.27	0.17	0.36				

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
							Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
		Walleye	1991	FILSK	16	3	17.2	12.7	20.2	0.34	0.15	0.48	2	0.01	0.01	Y
			2000	FILSK	7	7	17.3	15.4	19.5	0.32	0.26	0.40				
			2005	FILSK	9	9	16.2	13.7	19.6	0.32	0.17	0.61				
		White sucker	2000	FILSK	10	1	20.1	20.1	20.1	0.21	0.21	0.21				
69007100	HIGH	Splake	1984	FILSK	10	2	12.6	12.2	12.9	0.10	0.07	0.12				
69007800	MUDRO**	Burbot (Eelpout)	2014	FILSK	3	1	20	20	20	1.18	1.18	1.18				
		Cisco (Lake herring)	2014	FILSK	5	1	6.74	6.74	6.74	0.41	0.41	0.41				
		Northern pike	2014	FILSK	8	8	23.9	18.9	30.2	1.69	0.87	2.41				
69007900	PICKET**	Bluegill sunfish	1997	FILSK	6	1	8.3	8.3	8.3	0.23	0.23	0.23				
			2014	FILSK	10	1	6.68	6.68	6.68	0.19	0.19	0.19				
		Northern pike	1997	FILSK	6	6	19.6	15.2	26.6	0.77	0.51	1.40	1	0.01	0.01	Y
			2014	FILSK	8	8	18.7	15.5	22.6	0.74	0.42	1.21				
		Walleye	1997	FILSK	2	2	20.1	15.6	24.5	0.71	0.45	0.96	1	0.01	0.01	Y
			2014	FILSK	5	5	17.1	15.5	18.7	1.04	0.81	1.32				
		White sucker	1997	FILSK	8	1	19.6	19.6	19.6	0.34	0.34	0.34	1	0.01	0.01	Y
			2014	FILSK	4	1	18.8	18.8	18.8	0.23	0.23	0.23				
69008000	NELS**	Bluegill sunfish	1991	FILSK	4	1	7.8	7.8	7.8	0.22	0.22	0.22				
		Northern pike	1991	FILSK	6	1	17.2	17.2	17.2	0.71	0.71	0.71				
			2006	FILSK	22	22	20.3	14.3	36.8	0.75	0.45	2.28				
		Walleye	1991	FILSK	8	3	17.3	12.6	21.7	0.72	0.51	0.95	2	0.01	0.01	Y
			1996	FILSK	10	10	15.7	7.6	27.2	0.70	0.23	1.75				
		Yellow perch	2006	WHORG	10	3	5.63	5.5	5.8	0.23	0.22	0.23				
69008200	GRASSY**	Bluegill sunfish	1997	FILSK	9	1	6.2	6.2	6.2	0.15	0.15	0.15				
		Northern pike	1997	FILSK	10	10	20.5	17.6	24	0.68	0.51	0.83	1	0.01	0.01	Y
			2007	FILSK	24	24	20.5	11	36	0.64	0.31	1.05				
		Yellow perch	2007	WHORG	6	2	6.45	6.3	6.6	0.19	0.17	0.21				
69008300	TEE*	Yellow perch	1997	FILSK	13	1	6.4	6.4	6.4	0.34	0.34	0.34	1	0.01	0.01	Y
69008400	SLETTEN	Largemouth bass	1981	FILSK	1	1	15.9	15.9	15.9	0.49	0.49	0.49	1	0.025	0.025	
				WHORG	5	1	12.7	12.7	12.7	0.35	0.35	0.35				

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
							Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
			1984	FILSK	7	1	11.8	11.8	11.8	0.31	0.31	0.31				
		Yellow perch	1981	WHORG	5	1	11.3	11.3	11.3	0.15	0.15	0.15				
69008500	FENSKE**	Bluegill sunfish	1997	FILSK	10	1	6.7	6.7	6.7	0.18	0.18	0.18				
		Cisco (Lake herring)	1997	FILSK	1	1	15.7	15.7	15.7	0.34	0.34	0.34				
		Northern pike	1997	FILSK	10	10	26.9	20	34	0.62	0.41	1.00	2	0.01	0.01	Y
			2007	FILSK	14	14	22.7	15.5	27.2	0.61	0.31	1.10				
		Yellow perch	2007	WHORG	6	2	6.3	5.3	7.3	0.19	0.16	0.23				
69011500	BEAR ISLAND**	Bluegill sunfish	1993	FILSK	6	1	7.3	7.3	7.3	0.07	0.07	0.07				
		Northern pike	1983	FILSK	20	5	26.3	17.3	35	0.72	0.21	1.06				
			1993	FILSK	12	4	24.6	16.2	36.6	0.53	0.19	0.89	1	0.01	0.01	Y
			1996	FILSK	10	10	23.8	11.4	33.5	0.69	0.10	1.24				
			2003	FILSK	24	24	24.3	18.9	32	0.55	0.24	1.12				
			2008	FILSK	24	24	22.8	16.3	40.2	0.35	0.20	0.95				
			2013	FILSK	12	12	21.2	14.5	33.6	0.32	0.18	0.58				
		Walleye	1983	FILSK	10	2	15.5	13.8	17.2	0.44	0.30	0.57				
			1985	FILSK	2	1	20.4	20.4	20.4	0.97	0.97	0.97				
			1993	FILSK	16	4	15.7	10.6	20	0.51	0.24	0.74	1	0.016	0.016	
		White sucker	1993	FILSK	6	1	17.1	17.1	17.1	0.10	0.10	0.10	1	0.01	0.01	Y
		Yellow perch	2003	WHORG	11	2	6	5.7	6.3	0.10	0.09	0.10				
			2008	WHORG	10	2	6.85	6	7.7	0.08	0.07	0.09				
69011700	JOHNSON*	Bluegill sunfish	1991	FILSK	7	1	6	6	6	0.10	0.10	0.10				
			2012	FILSK	10	2	7.4	6.8	8	0.12	0.09	0.14				
		Black crappie	1991	FILSK	10	1	8.7	8.7	8.7	0.22	0.22	0.22				
			2002	FILSK	8	1	10.2	10.2	10.2	0.28	0.28	0.28				
		Northern pike	1991	FILSK	18	3	22.4	17.6	27.5	0.49	0.42	0.54	2	0.01	0.01	Y
			2012	FILSK	6	6	18.3	16.6	20.7	0.21	0.17	0.30				
		Walleye	1991	FILSK	15	4	19.3	10.1	27.2	0.71	0.24	1.10	3	0.011	0.014	
		White sucker	2012	FILSK	5	1	18.7	18.7	18.7	0.18	0.18	0.18				
69011800	BURNTSIDE**	Lake trout	1977	PLUG	4	4	24.1	21	28	0.56	0.37	0.76				

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
							Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
			1985	FILSK	9	2	20.2	17.5	22.8	0.49	0.46	0.52	2	0.08	0.106	
			1990	FILSK	4	4	23.6	21.6	25.3	0.64	0.56	0.72	4	0.148	0.18	
			1999	FILSK	8	8	20.5	14.2	28	0.41	0.24	0.70	5	0.074	0.116	
		Lake whitefish	1990	FILSK	4	3	18.9	17	20.2	0.12	0.07	0.18	3	0.074	0.085	
			1999	FILSK	8	1	22.9	22.9	22.9	0.19	0.19	0.19	1	0.135	0.135	
		Northern pike	1977	PLUG	34	34	25.6	19.5	32	0.42	0.19	1.01				
			1982	FILSK	20	4	24.8	19.2	30.6	0.44	0.30	0.62				
			1990	FILSK	1	1	20.8	20.8	20.8	0.25	0.25	0.25	1	0.01	0.01	Y
			1995	FILSK	15	15	22.6	11	33.1	0.44	0.16	0.81				
			2003	FILSK	26	26	25.8	17	35	0.71	0.30	1.75				
			2007	FILSK	24	24	22.6	16.2	29.1	0.45	0.23	1.00				
		Smallmouth bass	1977	PLUG	9	9	13.7	9	18	0.45	0.27	0.65				
		Walleye	1977	PLUG	6	6	16	11.2	24	0.42	0.18	0.95				
			1982	FILSK	15	3	17.6	14.3	21.8	0.79	0.27	1.67				
			1990	FILSK	6	3	15.4	13.5	18	0.40	0.31	0.53	3	0.01	0.01	Y
			1995	FILSK	10	10	16.6	7.1	27.4	0.60	0.19	1.43				
		White sucker	1990	FILSK	2	2	19	17.5	20.4	0.09	0.06	0.12	2	0.01	0.01	Y
		Yellow perch	2003	WHORG	10	3	8.47	6.5	10.4	0.15	0.10	0.19				
			2007	WHORG	6	2	7.1	6.5	7.7	0.11	0.10	0.12				
69012000	EVERETT**	Bluegill sunfish	1996	FILSK	10	1	7.4	7.4	7.4	0.13	0.13	0.13				
			2011	FILSK	7	2	5.8	5.4	6.2	0.15	0.11	0.20				
		Northern pike	1996	FILSK	17	4	19.4	15.5	23.7	0.42	0.16	0.76				
			2007	FILSK	24	24	20.3	16.2	29.1	0.64	0.28	1.14				
			2011	FILSK	8	8	19.6	15.8	22.5	0.45	0.34	0.80				
		Walleye	1996	FILSK	7	3	17.1	12	21.2	0.69	0.23	1.00	1	0.01	0.01	Y
			2011	FILSK	4	4	16.9	13.2	19.2	0.65	0.43	0.78				
		White sucker	1996	FILSK	7	1	18.9	18.9	18.9	0.15	0.15	0.15				
		Yellow perch	2007	WHORG	11	2	5.35	4.9	5.8	0.15	0.15	0.15				
69015700	JOSEPH*	Bluegill sunfish	2011	FILSK	10	2	7.05	6.4	7.7	0.04	0.03	0.05				
		Largemouth bass	2011	FILSK	5	5	14.5	14	15	0.20	0.15	0.26				

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
							Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
		Northern pike	2011	FILSK	2	2	24.4	19.8	28.9	0.17	0.12	0.22				
		Walleye	2011	FILSK	8	8	17.3	13.4	26.5	0.18	0.05	0.55				
		White sucker	2011	FILSK	5	1	17.2	17.2	17.2	0.05	0.05	0.05				
69015900	MUCKWA*	Walleye	1995	FILSK	15	3	15.2	13.4	17.2	0.25	0.16	0.38	1	0.01	0.01	Y
		White sucker	1995	FILSK	8	1	20.4	20.4	20.4	0.08	0.08	0.08				
		Yellow perch	1995	FILSK	10	1	8.6	8.6	8.6	0.19	0.19	0.19				
69016100	WOLF**	Bluegill sunfish	1994	FILSK	10	1	8.2	8.2	8.2	0.12	0.12	0.12				
		Northern pike	1994	FILSK	19	6	21.1	14.3	28.4	0.42	0.25	0.64	1	0.01	0.01	Y
			2014	FILET	1	1	38.7	38.7	38.7	0.63	0.63	0.63				
				FILSK	14	14	22.1	17.9	28.8	0.28	0.15	0.47				
		Walleye	1994	FILSK	17	4	14.9	11.1	18.8	0.46	0.22	1.00				
		White sucker	1994	FILSK	3	1	19.8	19.8	19.8	0.08	0.08	0.08				
69016300	TWIN*	Northern pike	1995	FILSK	16	3	19.3	17.3	21.4	0.36	0.30	0.48	1	0.01	0.01	Y
		White sucker	1995	FILSK	6	1	19.9	19.9	19.9	0.10	0.10	0.10				
69016800	SHIPMAN BASS	Bluegill sunfish	2011	FILSK	3	1	6.9	6.9	6.9	0.29	0.29	0.29				
		Northern pike	2011	FILSK	3	3	20.4	19	22.4	0.90	0.85	0.96				
69017400	EAST TWIN**	Bluegill sunfish	1992	FILSK	8	1	6.3	6.3	6.3	0.16	0.16	0.16				
			2011	FILSK	10	2	6.35	5.8	6.9	0.14	0.14	0.14				
		Black crappie	2011	FILSK	6	2	8.05	7.2	8.9	0.16	0.16	0.17				
		Northern pike	1992	FILSK	17	3	22	18.2	26.6	0.45	0.35	0.59	1	0.01	0.01	Y
			2000	FILSK	5	5	19.4	17.9	21.5	0.44	0.28	0.68				
			2007	FILSK	23	23	22.2	15.6	37.8	0.70	0.34	2.34				
			2011	FILSK	8	8	24.6	18.1	29.7	0.81	0.34	1.12				
		Walleye	1992	FILSK	16	2	13.6	10	17.2	0.61	0.42	0.80	1	0.01	0.01	Y
			2000	FILSK	3	3	16.9	12.8	20.4	0.42	0.26	0.54				
			2011	FILSK	5	5	16.2	13.6	19	0.48	0.32	0.79				
		White sucker	1992	FILSK	5	2	20.1	19	21.2	0.13	0.07	0.19	1	0.01	0.01	Y
		Yellow perch	2007	WHORG	10	2	6.15	5.8	6.5	0.18	0.18	0.19				
69017500	OLE**	Bluegill sunfish	2001	FILSK	2	1	7.7	7.7	7.7	0.25	0.25	0.25				
		Walleye	2001	FILSK	3	3	26	24.9	26.7	2.23	2.09	2.37				

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
							Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
		Yellow perch	2001	FILSK	7	1	7.8	7.8	7.8	0.75	0.75	0.75				
69018100	SLIM**	Northern pike	2006	FILSK	6	6	20.8	16.3	26.3	0.89	0.55	1.14				
		Walleye	1982	FILSK	20	3	17.9	12.5	22	0.60	0.25	0.91				
			1996	FILSK	10	10	15.9	9.1	21.7	0.54	0.21	1.02				
			2006	FILSK	7	7	15.6	11.5	19.5	0.66	0.30	1.17				
		Yellow perch	2006	WHORG	2	1	5.5	5.5	5.5	0.21	0.21	0.21				
69019000	BIG*	Northern pike	1982	FILSK	17	3	21.9	16.3	26.5	0.38	0.22	0.56				
			1994	FILSK	9	3	21.6	18.1	26.9	0.29	0.21	0.34	1	0.01	0.01	Y
			1996	FILSK	10	10	15.9	9.5	26	0.15	0.05	0.31				
			2004	FILSK	24	24	21	15.6	33	0.28	0.11	0.75				
			2009	FILSK	13	13	19.6	17.4	21.6	0.32	0.24	0.41				
			2014	FILET	6	6	22.1	17.7	26.3	0.33	0.30	0.39				
		Smallmouth bass	1982	FILSK	4	1	12.1	12.1	12.1	0.22	0.22	0.22				
		Walleye	1982	FILSK	18	3	17	12.3	20.4	0.39	0.32	0.49				
			1994	FILSK	13	3	15.6	13.8	17.7	0.25	0.16	0.38				
			1996	FILSK	8	8	16.1	8.4	22.4	0.24	0.07	0.39				
		White sucker	1994	FILSK	8	1	20.6	20.6	20.6	0.19	0.19	0.19				
		Yellow perch	1994	FILSK	4	1	11.4	11.4	11.4	0.18	0.18	0.18				
			2004	WHORG	10	3	7.27	7.1	7.4	0.07	0.06	0.07				
69019900	ED SHAVE**	Northern pike	1995	FILSK	5	3	22.8	15.9	31.6	0.52	0.25	0.76	1	0.01	0.01	Y
		Walleye	1995	FILSK	7	2	17.5	15.3	19.6	0.74	0.64	0.84				
		Yellow perch	1995	FILSK	8	1	10.6	10.6	10.6	0.34	0.34	0.34				
69020500	STUART**	Northern pike	1985	FILSK	2	1	23.5	23.5	23.5	1.06	1.06	1.06				
			1996	FILSK	8	4	22.5	17	28.4	0.71	0.25	1.20				
			2006	FILSK	16	16	24.2	15.7	33.3	0.65	0.29	1.61				
		Walleye	1985	FILSK	9	2	14.9	13.7	16	0.41	0.15	0.67				
			1996	FILSK	14	4	18.8	14	28.3	0.67	0.23	1.35	1	0.01	0.01	Y
		White sucker	1996	FILSK	8	1	21.1	21.1	21.1	0.45	0.45	0.45				
		Yellow perch	1996	FILSK	9	1	9.7	9.7	9.7	0.59	0.59	0.59				
			2006	WHORG	11	5	8.44	7	9.8	0.19	0.13	0.26				

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
							Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
69022000	CRAB**	Northern pike	2001	FILSK	6	6	28.6	23.1	33.6	2.08	1.27	2.95	1	0.01	0.01	Y
		Smallmouth bass	2001	FILSK	7	7	14.4	12.2	16.7	0.98	0.87	1.07	1	0.01	0.01	Y
69022400	LAC LA CROIX**	Lake trout	1994	FILSK	19	7	21.2	14.1	29.5	0.31	0.10	0.85	4	0.032	0.051	
			2004	FILSK	5	5	23	20.2	25.1	0.24	0.22	0.27				
		Lake whitefish	1994	FILSK	22	6	16.9	11.1	20.9	0.09	0.04	0.13	4	0.018	0.033	
			2004	FILSK	8	1	21	21	21	0.15	0.15	0.15				
		Northern pike	1984	FILSK	15	3	22.6	18.2	27.2	0.48	0.32	0.80				
			1994	FILSK	31	10	25.5	15.3	35.9	0.57	0.17	0.96				
			2004	FILSK	6	6	27.1	21.3	31.5	0.67	0.42	0.88				
			2014	FILSK	13	13	21	16.9	30.3	0.51	0.26	1.13				
		Walleye	1984	FILSK	12	3	17.3	13.3	22	0.63	0.25	1.30				
			1994	FILSK	25	8	17.3	12.1	22.9	0.40	0.17	0.68				
			2004	FILSK	5	5	18.6	13.5	23.5	0.58	0.25	0.87				
69025400	BEARHEAD*	Bluegill sunfish	2008	FILSK	12	2	7.6	7.2	8	0.06	0.06	0.07				
		Largemouth bass	2008	FILSK	5	5	14.6	13.5	16.8	0.25	0.17	0.31				
		Northern pike	1983	FILSK	7	2	25.5	22.4	28.5	0.32	0.23	0.41				
			1995	FILSK	6	6	17.4	14	22.4	0.19	0.12	0.35				
			2004	FILSK	24	24	20.7	16.2	31.5	0.19	0.11	0.29				
			2008	BIOPSY	15	15	22.2	17.3	32.2	0.21	0.10	0.48				
				FILSK	24	24	22.7	17.3	32.2	0.19	0.11	0.40				
		Walleye	1983	FILSK	13	2	20.3	17.5	23	0.56	0.28	0.84				
			1995	FILSK	10	10	16.3	9.7	24.5	0.33	0.05	0.65				
			2008	FILSK	48	48	14.2	10.9	21.3	0.16	0.07	0.37				
		Yellow perch	2004	WHORG	10	2	5.8	5.6	6	0.05	0.05	0.05				
			2008	WHORG	5	1	6	6	6	0.07	0.07	0.07				
69031600	BIG MOOSE**	Northern pike	1982	FILSK	20	5	26.5	16.5	37	0.46	0.14	0.82				
			2009	FILSK	6	6	20.1	19.1	20.7	0.36	0.33	0.42				
		Smallmouth bass	2009	FILSK	6	6	13.2	11.3	15.7	0.42	0.31	0.59				
		Walleye	1991	FILSK	15	2	14.3	12.2	16.4	0.48	0.29	0.66	1	0.01	0.01	Y
			2009	FILSK	8	8	16.2	11.8	19.3	0.59	0.23	1.18				

							Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
DOWID	**Waterway**	**Species**	**Year**	**Anatomy[1]**	**Total Fish**	**No. Samples**	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**	**N**	**Mean**	**Max**	**< RL**
69032900	MEANDER	Smallmouth bass	1988	FILSK	28	7	8.44	5.6	11.6	0.32	0.23	0.51				
			2014	FILET	11	11	12.6	10.1	17	0.45	0.29	0.68				
69033000	OYSTER**	Northern pike	1982	FILSK	18	4	24.5	16.8	31.2	1.16	0.61	2.07				
			1996	FILSK	10	10	24.4	17.1	31.3	0.88	0.29	2.39				
69033900	RAMSHEAD*	Northern pike	1991	FILSK	15	4	25.6	18.6	33.9	0.27	0.12	0.42	3	0.01	0.01	Y
69034300	HUSTLER**	Northern pike	1981	FILSK	5	1	25.4	25.4	25.4	1.10	1.10	1.10	1	0.025	0.025	
				WHORG	5	1	25.4	25.4	25.4	0.82	0.82	0.82				
			1984	FILSK	20	4	25	18.8	32.2	1.01	0.58	1.64				
			1996	FILSK	5	5	20.7	19.1	24.5	0.67	0.50	0.95				
		White sucker	1981	WHORG	2	1	17.8	17.8	17.8	0.10	0.10	0.10				
69035000	GE-BE-ON-EQUAT**	Lake whitefish	1999	FILSK	6	1	20.4	20.4	20.4	0.19	0.19	0.19	1	0.013	0.013	
		Northern pike	1985	FILSK	9	9	23.1	18.1	29.9	0.66	0.38	1.50				
			1999	FILSK	6	6	25.6	20.5	28.9	0.74	0.30	1.21	1	0.012	0.012	
			2009	FILSK	4	4	21.2	17	25.2	0.64	0.55	0.82				
		Walleye	1985	FILSK	14	14	17.4	12.4	21.6	0.92	0.49	1.60				
			1999	FILSK	8	8	20.8	18.5	26.4	0.93	0.56	2.04	1	0.011	0.011	
			2009	FILSK	8	8	21.2	16.5	25.5	1.30	0.50	2.07				
69036900	TAKUCMICH*	Cisco (Lake herring)	1999	FILSK	5	1	11.7	11.7	11.7	0.33	0.33	0.33				
			2013	FILSK	5	1	10.6	10.6	10.6	0.33	0.33	0.33				
		Lake trout	1999	FILSK	7	7	20.2	14	29	0.38	0.19	1.00	6	0.026	0.076	
			2013	FILSK	7	7	22.6	18	29.9	0.98	0.37	1.61				
		Northern pike	2013	FILSK	7	7	27.8	23.4	35.5	1.18	0.63	2.14				
69038300	LYNX**	Smallmouth bass	2002	FILSK	5	5	11.1	8.2	15.5	0.61	0.37	0.91				
		Walleye	2002	FILSK	4	4	19.6	17.7	22.6	1.03	0.60	1.30				
69045600	JEANETTE*	Northern pike	1982	FILSK	6	2	24.7	22.2	27.2	0.29	0.22	0.36				
			1986	FILSK	6	6	20.9	19.5	23	0.66	0.31	1.00				
			1996	FILSK	10	10	21.9	11.9	33.4	0.36	0.12	0.56				
			2004	FILSK	20	20	20.9	13.1	31.9	0.39	0.08	0.89				

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
							Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
			2009	FILSK	12	12	20.4	16.7	23	0.40	0.20	0.56				
			2014	FILET	13	13	21.4	16.6	34.1	0.42	0.22	0.68				
		Walleye	1982	FILSK	17	3	17.4	12.4	22.1	0.47	0.26	0.59				
			1986	FILSK	12	12	16	12	22.9	0.45	0.27	0.72				
			1996	FILSK	5	5	15.4	6.8	23	0.35	0.11	0.71				
		Yellow perch	2004	WHORG	9	2	5.95	5.6	6.3	0.06	0.05	0.06				
69046100	SHELL	Walleye	2015	FILSK	8	8	10.8	7.4	16.7	0.21	0.09	0.40				
		Yellow perch	2015	FILSK	7	1	6.43	6.43	6.43	0.14	0.14	0.14				
69046400	LOWER PAUNESS*	Walleye	2005	FILSK	3	3	12.2	9.6	13.6	0.65	0.50	0.72				
		Yellow perch	2005	FILSK	5	1	7.9	7.9	7.9	0.31	0.31	0.31				
69046500	UPPER PAUNESS**	Walleye	2005	FILSK	5	5	13.1	10.3	17.9	0.57	0.43	0.76				
		Yellow perch	2005	FILSK	8	1	7.9	7.9	7.9	0.46	0.46	0.46				
69046900	HERITAGE**	Cisco (Lake herring)	2003	FILSK	5	1	11.7	11.7	11.7	0.16	0.16	0.16				
		Northern pike	2003	FILSK	6	6	22	17	35.5	0.92	0.52	1.69				
69047000	LOON**	Black crappie	2015	FILSK	13	9	12.1	9.98	16.1	0.44	0.19	0.64				
		Cisco (Lake herring)	2008	FILSK	8	1	9.4	9.4	9.4	0.14	0.14	0.14				
		Northern pike	1982	FILSK	14	3	22.1	17.4	28.1	0.94	0.56	1.54				
			1996	FILSK	10	10	20.4	16.9	24.3	0.61	0.30	0.88				
			2001	FILSK	3	3	25.1	24	25.9	0.89	0.73	1.12				
		Walleye	1982	FILSK	11	2	15.5	13.2	17.7	0.84	0.79	0.89				
			2008	FILSK	8	8	16	13.6	18.5	0.66	0.54	0.81				
69047300	EUGENE**	Lake whitefish	2001	FILSK	6	1	17.9	17.9	17.9	0.28	0.28	0.28	1	0.01	0.01	Y
		Northern pike	2001	FILSK	7	7	18.5	14.2	25.1	0.77	0.35	1.80				
		White sucker	2001	FILSK	5	1	18.8	18.8	18.8	0.11	0.11	0.11				
69048100	FAT*	Lake trout	1983	FILSK	8	1	18.4	18.4	18.4	0.46	0.46	0.46				
			1986	FILSK	10	2	17.6	17	18.1	0.72	0.33	1.10				
			1996	FILSK	14	3	15.5	13.8	17.5	0.30	0.15	0.50	1	0.01	0.01	Y
			2007	FILSK	7	7	17.5	16.6	18.4	0.48	0.38	0.73				

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
							Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
69048400	LITTLE LOON**	Walleye	2009	FILSK	8	8	16.7	13.8	18.3	0.70	0.62	0.86				
69048700	GUN**	Lake trout	1996	FILSK	16	6	20.9	12.6	28.9	0.81	0.28	1.60	2	0.04	0.05	
			2008	FILSK	4	4	20.4	12.9	27.2	1.04	0.39	1.42				
		Lake whitefish	2008	FILSK	8	1	9	9	9	0.40	0.40	0.40				
69060400	DOVRE**	Northern pike	1996	FILSK	17	4	22.8	18	27.9	0.93	0.34	1.60	1	0.01	0.01	Y
			2011	FILSK	8	8	20.7	17.5	23.4	0.70	0.43	1.02				
		Yellow perch	1996	FILSK	10	1	6.9	6.9	6.9	0.28	0.28	0.28				
			2011	FILSK	8	2	8.65	8.2	9.1	0.38	0.37	0.39				
69060800	LITTLE VERMILION**	Black crappie	1991	FILSK	10	1	9.3	9.3	9.3	0.20	0.20	0.20				
		Cisco (Lake herring)	1991	FILSK	8	1	11.4	11.4	11.4	0.27	0.27	0.27	1	0.01	0.01	Y
		Northern pike	1991	FILSK	14	3	27.1	22	32.7	1.44	0.85	2.50	3	0.01	0.01	Y
			1996	FILSK	10	10	25.5	14.4	33.9	0.94	0.23	1.68				
			2001	FILSK	12	12	24.3	20.9	33.1	0.71	0.42	1.20	1	0.01	0.01	Y
			2006	FILSK	7	7	25.1	20.7	28.3	1.04	0.74	1.53				
			2011	FILSK	16	16	20.2	14.8	27.2	0.55	0.30	1.00				
		Sauger	1991	FILSK	3	1	13.7	13.7	13.7	1.20	1.20	1.20				
			2001	FILSK	2	2	12.4	12.2	12.5	0.79	0.68	0.89				
		Smallmouth bass	1991	FILSK	1	1	12.3	12.3	12.3	0.63	0.63	0.63				
		Walleye	1991	FILSK	20	4	19	11.9	25	1.26	0.42	2.00	3	0.01	0.01	Y
			1996	FILSK	5	5	17.7	10.2	29.3	1.02	0.31	2.21				
			2001	FILSK	8	8	17.3	11.2	29	1.11	0.49	2.63	1	0.01	0.01	Y
		Yellow perch	1991	FILSK	6	1	7.9	7.9	7.9	0.37	0.37	0.37				
			2001	WHORG	10	2	6.1	5.6	6.6	0.15	0.12	0.18				
			2006	WHORG	9	3	5.87	5.7	6	0.22	0.18	0.30				
69061700	SAND POINT**	Black crappie	1990	FILSK	8	1	8.6	8.6	8.6	0.20	0.20	0.20	1	0.01	0.01	Y
			1995	FILSK	5	1	9.6	9.6	9.6	0.22	0.22	0.22				
			2002	FILSK	8	1	9.9	9.9	9.9	0.28	0.28	0.28				
			2013	FILSK	5	1	9.7	9.7	9.7	0.27	0.27	0.27				

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
							Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
		Crayfish	2011	WHORG	30	30	2.5	1.9	3.2	0.05	0.02	0.11				
		Cisco (Lake herring)	1990	FILSK	3	1	14.7	14.7	14.7	0.09	0.09	0.09	1	0.01	0.01	Y
			1995	FILSK	4	1	14.8	14.8	14.8	0.28	0.28	0.28	1	0.01	0.01	Y
		Northern pike	1977	PLUG	7	7	21.3	19.2	24.5	0.43	0.21	0.83				
			1982	FILSK	24	4	24.7	18.9	30.9	1.07	0.41	2.20				
			1990	FILSK	26	16	26.6	21.2	36.4	1.12	0.39	2.40	3	0.015	0.026	
			1995	FILSK	12	12	24.4	20.2	31.7	0.60	0.24	1.51				
			1996	FILSK	9	9	27.7	19.9	40.9	0.89	0.29	1.73				
			1997	FILSK	22	22	23.7	17.5	30.8	0.69	0.25	1.80	2	0.01	0.01	Y
				WHORG	22	22	23.7	17.5	30.8	0.57	0.21	1.50				
			2001	FILSK	19	19	26.4	21	34.6	0.90	0.42	2.00				
			2004	FILSK	20	20	23.8	16.7	33	0.90	0.21	2.12				
			2007	FILSK	17	17	23.4	18.2	32.7	0.99	0.44	2.06				
			2013	FILSK	6	6	21.5	17.5	27.1	0.95	0.44	1.67				
		Rusty crayfish	2011	WHORG	30	30	3.17	2.7	3.6	0.05	0.03	0.09				
		Sauger	1990	FILSK	7	1	11.2	11.2	11.2	0.91	0.91	0.91	1	0.01	0.01	Y
		Smallmouth bass	1990	FILSK	6	1	10.9	10.9	10.9	0.46	0.46	0.46	1	0.01	0.01	Y
		Walleye	1977	PLUG	8	8	16.8	11.8	21	1.21	0.25	2.67				
			1982	FILSK	17	3	17.6	12.5	22.5	1.07	0.46	1.92				
			1986	FILSK	1	1	25	25	25	4.50	4.50	4.50				
			1990	FILSK	32	20	17.9	11.7	23.8	1.01	0.49	2.00	3	0.01	0.01	Y
			1995	FILSK	12	4	16.4	11.5	20.6	0.63	0.30	1.00	1	0.01	0.01	Y
			1996	FILSK	5	5	18	10.7	28.7	1.06	0.38	2.36				
			2013	FILSK	8	8	15.4	12.5	20.5	0.72	0.47	1.22				
		Yellow perch	1990	FILSK	2	1	9.4	9.4	9.4	0.51	0.51	0.51	1	0.01	0.01	Y
			1997	WHORG	10	10	4.77	3.8	5.4	0.19	0.12	0.30				
			2001	WHORG	9	2	6.25	5.9	6.6	0.21	0.17	0.26				
			2004	WHORG	5	1	5.4	5.4	5.4	0.16	0.16	0.16				
			2007	WHORG	10	2	6.35	5.7	7	0.18	0.14	0.22				

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
							Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
69068200	LITTLE TROUT*	Lake Trout	1991	FILSK	11	3	16.2	8.8	26.5	0.22	0.09	0.38	3	0.02	0.027	
			1999	FILSK	8	8	20.5	14.3	31.4	0.33	0.15	1.02	4	0.034	0.073	
		Northern Pike	1991	FILSK	5	2	24	21.2	26.7	0.33	0.24	0.42	2	0.011	0.011	
			1999	FILSK	1	1	30.4	30.4	30.4	0.53	0.53	0.53	1	0.01	0.01	Y
			2009	FILSK	4	4	20.9	19.5	24.7	0.51	0.24	1.28				
			2014	FILSK	1	1	31	31	31	0.94	0.94	0.94				
		Smallmouth Bass	1991	FILSK	9	2	14.3	12.9	15.7	0.32	0.28	0.35	1	0.01	0.01	Y
			2014	FILSK	1	1	16.7	16.7	16.7	1.05	1.05	1.05				
		Walleye	1991	FILSK	14	3	17.2	10.6	22.9	0.47	0.19	0.78	2	0.047	0.084	
			1995	FILSK	14	14	15	6.6	24.8	0.34	0.13	1.22				
			1999	FILSK	21	21	20.2	11.8	27.8	0.54	0.13	1.09	1	0.019	0.019	
			2004	FILSK	11	11	22.5	18.4	28.2	0.71	0.32	1.30				
			2014	FILSK	9	9	21.8	19.3	23.6	1.08	0.66	1.46				
		White Sucker	1991	FILSK	3	2	16.3	13.3	19.2	0.09	0.05	0.12				
		Yellow Perch	1999	WHORG	10	10	6.61	6	7.5	0.12	0.06	0.17				
69068400	MUKOODA*	Black Crappie	1994	FILSK	9	1	10	10	10	0.10	0.10	0.10				
		Cisco	1994	FILSK	5	1	11.7	11.7	11.7	0.08	0.08	0.08				
		Lake Trout	1994	FILSK	10	2	16.4	13.5	19.3	0.15	0.10	0.20	1	0.016	0.016	
		Northern Pike	1995	FILSK	4	4	30.9	22.8	42.8	0.40	0.17	0.82				
			2002	FILSK	15	15	22.4	17.6	25.6	0.22	0.13	0.27				
			2007	FILSK	16	16	22.8	18.5	26	0.31	0.18	0.49				
			2012	FILSK	12	12	22	18	29.2	0.31	0.10	0.62				
		Walleye	1987	FILSK	8	8	19.1	12	25.1	0.61	0.14	1.30				
			1995	FILSK	10	10	22.8	19.7	26.2	0.76	0.34	1.27				
		Yellow Perch	2002	WHORG	5	1	6.8	6.8	6.8	0.10	0.10	0.10				
			2007	WHORG	8	1	7.9	7.9	7.9	0.15	0.15	0.15				
69068500	O'LEARY*	Crayfish	2003	WHORG	22	22				0.03	0.02	0.05				
		Northern Pike	1986	FILSK	10	10	22.4	20.7	24	0.52	0.33	0.63				
			2001	FILSK	14	14	18.8	15.4	22.3	0.24	0.13	0.52				

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
							Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
		Smallmouth Bass	2001	FILSK	5	5	14.9	11.9	17.4	0.28	0.22	0.35				
		Walleye	1986	FILSK	2	2	21.4	20.9	21.9	0.52	0.48	0.56				
		White Sucker	2001	FILSK	2	1	21.1	21.1	21.1	0.18	0.18	0.18				
		Yellow Perch	2001	FILSK	10	1	5.9	5.9	5.9	0.13	0.13	0.13				
69069100	JOHNSON**	Northern Pike	1984	FILSK	9	4	25.4	17.3	33.5	0.50	0.29	0.69				
			1996	FILSK	10	10	24.3	14.9	34.1	0.44	0.11	0.95				
			2004	FILSK	18	18	22.8	15.7	28.3	0.38	0.10	0.65				
			2011	FILSK	14	14	26.2	21.8	30.8	0.64	0.31	0.97				
		Rusty Crayfish	2006	WHORG	35	35				0.03	0.01	0.08				
		Walleye	1984	FILSK	5	2	19	17.2	20.8	0.38	0.34	0.41				
		Yellow Perch	2004	WHORG	12	2	6.75	6	7.5	0.09	0.09	0.10				
69069300	NAMAKAN**	Black Crappie	1990	FILSK	4	1	8.6	8.6	8.6	0.16	0.16	0.16	1	0.015	0.015	
		Cisco	1990	FILSK	8	1	14.2	14.2	14.2	0.05	0.05	0.05	1	0.01	0.01	Y
			1995	FILSK	5	1	15.3	15.3	15.3	0.12	0.12	0.12	1	0.01	0.01	Y
		Lake Whitefish	1990	FILSK	1	1	20.8	20.8	20.8	0.14	0.14	0.14	1	0.12	0.12	
		Northern Pike	1971	PLUG	9	9	18.2	15.5	21	0.27	0.10	0.53				
			1977	FILSK	11	4	24.6	18.1	31.9	0.43	0.31	0.54				
				PLUG	4	4	18.8	15.5	23.3	0.19	0.09	0.28				
			1990	FILSK	32	19	24.8	19.7	33	0.62	0.20	1.30	3	0.01	0.01	Y
			1995	FILSK	10	10	24.7	19.9	32.4	0.46	0.17	0.98				
			1996	FILSK	10	10	25.9	20.8	36	0.62	0.24	1.25				
			1997	FILSK	12	12	22.8	19	27.9	0.44	0.21	0.80	2	0.01	0.01	Y
				WHORG	12	12	22.8	19	27.9	0.35	0.17	0.63				
			2001	FILSK	19	19	25.4	18.6	31.1	0.61	0.27	1.14				
			2004	FILSK	16	16	23.1	17.6	34	0.56	0.18	2.00				
			2007	FILSK	14	14	22.8	18	27	0.46	0.17	0.85				
			2012	FILSK	8	8	22.2	19.5	26.1	0.50	0.30	0.94				
			2015	FILSK	6	6	22.6	18.8	26.2	0.84	0.22	1.33				
		Rock Bass	1990	FILSK	3	1	7.8	7.8	7.8	0.34	0.34	0.34	1	0.01	0.01	Y
		Sauger	1990	FILSK	9	1	11.5	11.5	11.5	1.20	1.20	1.20	1	0.015	0.015	

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in) Mean	Length (in) Min	Length (in) Max	Mercury (mg/kg) Mean	Mercury (mg/kg) Min	Mercury (mg/kg) Max	PCBs (mg/kg) N	PCBs (mg/kg) Mean	PCBs (mg/kg) Max	< RL
			2001	FILSK	8	8	12.1	10.8	13.1	0.83	0.33	1.26				
		Smallmouth Bass	1990	FILSK	7	1	11	11	11	0.22	0.22	0.22	1	0.01	0.01	Y
		Walleye	1971	PLUG	17	17	13.5	10	17.4	0.33	0.14	0.73				
			1977	FILSK	3	1	19.3	19.3	19.3	0.40	0.40	0.40				
				PLUG	10	10	14.7	11.5	17.5	0.31	0.13	0.58				
			1990	FILSK	41	22	17.5	11	24	0.50	0.27	1.00	2	0.01	0.01	Y
			1995	FILSK	20	6	16.2	11.6	22.2	0.46	0.22	0.86	1	0.01	0.01	Y
			1996	FILSK	5	5	17.9	11.4	25.2	0.53	0.25	0.91				
			2015	FILSK	7	7	16	12.2	20.5	0.46	0.13	0.83				
		Yellow Perch	1990	FILSK	8	1	7.8	7.8	7.8	0.10	0.10	0.10	1	0.01	0.01	Y
			1995	FILSK	10	1	8.6	8.6	8.6	0.28	0.28	0.28				
			1997	WHORG	10	10	5.67	5.2	5.9	0.14	0.06	0.26				
			2001	WHORG	10	3	6.87	6.1	7.7	0.14	0.08	0.18				
			2004	WHORG	10	2	5.65	5.5	5.8	0.07	0.07	0.08				
			2007	WHORG	10	2	6.2	6.2	6.2	0.07	0.06	0.09				
			2015	FILSK	8	1	7.34	7.34	7.34	0.18	0.18	0.18				
69075000	MOOSE*	Bluegill Sunfish	2011	FILSK	7	2	8.15	7.6	8.7	0.04	0.04	0.04				
		Northern Pike	2011	FILSK	8	8	22	15.3	35.2	0.30	0.15	0.57				
		Walleye	1994	FILSK	11	3	19.7	17.3	22.2	0.49	0.27	0.81	1	0.01	0.01	Y
		White Sucker	1994	FILSK	4	1	17.9	17.9	17.9	0.11	0.11	0.11				
			2011	FILSK	2	1	16.3	16.3	16.3	0.08	0.08	0.08				
		Yellow Perch	1994	FILSK	7	1	11.1	11.1	11.1	0.14	0.14	0.14				
69075400	FRANKLIN**	Northern Pike	1989	FILSK	9	3	22.2	18.6	25.3	0.27	0.19	0.37				
		Walleye	1989	FILSK	8	3	17.6	13	22	0.41	0.11	0.83				
			2006	FILSK	6	6	18	14.7	23.2	0.38	0.19	0.72				
			2013	FILSK	6	6	17.6	15.1	20.7	0.42	0.22	0.69				
		Yellow Perch	2006	WHORG	6	5	7.96	7.2	9	0.07	0.06	0.09				
			2013	FILSK	10	2	8.3	7.5	9.1	0.16	0.13	0.18				
69075600	TOOTH**	Northern Pike	1987	FILSK	7	7	20.9	16.7	35.1	1.58	0.83	4.40				
			1995	FILSK	10	10	18.8	13.5	21.3	1.18	0.26	1.75				

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
							Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
			2001	FILSK	10	10	19.8	8.3	26.7	1.20	0.39	2.03				
			2008	FILSK	5	5	21.6	20.2	23.3	0.89	0.70	1.13				
69075700	NET**	Northern Pike	1997	FILSK	7	7	18.9	15.1	24.3	0.45	0.31	0.63				
			2006	FILSK	11	11	18.3	12.2	24.3	0.55	0.25	1.02				
		Yellow Perch	2006	WHORG	6	3	6.9	5.5	9	0.16	0.11	0.25				
69076000	LITTLE JOHNSON*	Crayfish	2006	WHORG	35	35				0.03	0.02	0.04				
		Lake Whitefish	2003	FILSK	1	1	22.3	22.3	22.3	0.12	0.12	0.12				
		Northern Pike	1989	FILSK	6	2	20.7	19.5	21.9	0.25	0.22	0.28				
			1998	FILSK	7	7	18.9	13.8	21.5	0.19	0.10	0.26				
			2003	FILSK	3	3	18.3	16.9	20.5	0.26	0.18	0.36				
		Smallmouth Bass	1998	FILSK	7	7	13.6	11.5	16.5	0.18	0.11	0.23				
		Walleye	1989	FILSK	9	3	17.8	14.4	21.1	0.28	0.17	0.40				
			1998	FILSK	8	8	16.6	13	20.9	0.24	0.11	0.57				
			2003	FILSK	6	6	16.4	12.7	21	0.38	0.12	0.82				
			2010	FILSK	8	8	18.2	12.5	24.1	0.32	0.12	0.70				
		White Sucker	2010	FILSK	1	1	17.3	17.3	17.3	0.06	0.06	0.06				
		Yellow Perch	1998	FILSK	6	1	10.4	10.4	10.4	0.11	0.11	0.11				
			2003	FILSK	4	1	11.3	11.3	11.3	0.13	0.13	0.13				
			2010	FILSK	4	1	8.1	8.1	8.1	0.06	0.06	0.06				
69076500	LONG*	Walleye	1999	FILSK	8	8	19.4	14.7	25.3	0.31	0.17	0.72	1	0.01	0.01	Y
			2013	FILSK	6	6	15.2	12.6	20.8	0.17	0.11	0.22				
		White Sucker	1999	FILSK	4	1	19	19	19	0.09	0.09	0.09				
			2013	FILSK	5	1	17	17	17	0.05	0.05	0.05				
		Yellow Perch	1999	FILSK	10	1	10.2	10.2	10.2	0.24	0.24	0.24				
			2013	FILSK	9	2	9.6	8.1	11.1	0.15	0.08	0.21				
69081900	GANNON**	Northern Pike	2007	FILSK	6	6	19.5	15.6	27.2	0.68	0.27	1.36				
		Yellow Perch	2007	FILSK	8	1	7.8	7.8	7.8	0.18	0.18	0.18				
69083000	AGNES**	Northern Pike	1997	FILSK	5	5	16.5	10.8	20.9	0.49	0.27	0.97				
			1999	FILSK	8	8	22.6	16.8	30.8	0.58	0.32	0.99	1	0.01	0.01	Y
		Yellow Perch	1999	FILSK	10	1	8.4	8.4	8.4	0.16	0.16	0.16				

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
							Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
69083200	CRUISER*	Brown Trout	1988	FILSK	1	1	25.5	25.5	25.5	0.56	0.56	0.56	1	0.027	0.027	
		Lake Trout	1995	FILSK	12	3	15.5	13.1	17.9	0.17	0.16	0.18	1	0.01	0.01	Y
			2005	FILSK	18	18	17.2	10.4	33.5	0.23	0.11	0.45	1	0.01	0.01	Y
			2015	FILSK	15	15	15	12.2	19.6	0.23	0.14	0.49				
69083700	BEAST**	Northern Pike	2001	FILSK	7	7	24.8	19.7	33.2	1.11	0.69	2.62	1	0.01	0.01	Y
		Smallmouth Bass	2006	FILSK	5	5	13.4	10.9	17	0.53	0.46	0.70				
		White Sucker	2001	FILSK	2	1	20.7	20.7	20.7	0.39	0.39	0.39				
69084200	BLACK DUCK*	Bluegill Sunfish	1992	FILSK	10	1	5.9	5.9	5.9	0.03	0.03	0.03				
			2012	FILSK	8	2	7.65	7.4	7.9	0.03	0.03	0.03				
		Black Crappie	2002	FILSK	10	1	9.5	9.5	9.5	0.09	0.09	0.09				
		Northern Pike	1982	FILSK	5	1	28.1	28.1	28.1	0.28	0.28	0.28				
			1992	FILSK	4	2	25.1	23.2	27	0.15	0.09	0.21	1	0.024	0.024	
		Walleye	1982	FILSK	18	3	17.9	12.5	22.1	0.29	0.14	0.45				
			1992	FILSK	8	3	17.4	14.6	20.1	0.14	0.10	0.19	1	0.016	0.016	
			1995	FILSK	11	11	14	7.2	18.7	0.12	0.07	0.20				
			2002	FILSK	5	5	16.6	14	19.9	0.14	0.11	0.18				
			2012	FILSK	6	6	17.4	12	24.4	0.16	0.08	0.33				
		White Sucker	1992	FILSK	11	2	19.2	17.6	20.8	0.07	0.04	0.10	1	0.026	0.026	
			2002	FILSK	4	1	18.8	18.8	18.8	0.06	0.06	0.06				
69084300	EK*	Northern Pike	1986	FILSK	17	17	22	16.5	29.4	0.67	0.28	2.30				
			2001	FILSK	10	10	18.1	8.4	30.3	0.33	0.10	1.09				
			2006	FILSK	8	8	20.5	18.2	22.6	0.48	0.34	0.78				
		Yellow Perch	2006	WHORG	5	2	5.55	5.2	5.9	0.09	0.09	0.10				
69084500	KABETOGAMA*	Black Crappie	1990	FILSK	2	1	9.9	9.9	9.9	0.16	0.16	0.16	1	0.01	0.01	Y
			2002	FILSK	5	1	9.4	9.4	9.4	0.25	0.25	0.25				
		Cisco	1995	FILSK	8	1	15.5	15.5	15.5	0.07	0.07	0.07	1	0.01	0.01	Y
			2002	FILSK	5	1	15.3	15.3	15.3	0.07	0.07	0.07				
		Northern Pike	1977	PLUG	10	10	21.8	15.8	30.5	0.16	0.09	0.24				
			1983	FILSK	16	4	24.6	17.5	33	0.14	0.08	0.23				
			1986	FILSK	16	6	26.5	19.9	32.3	0.37	0.20	0.54				

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
							Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
			1990	FILSK	27	17	26.3	18.2	37.5	0.27	0.16	0.44	3	0.01	0.01	Y
			1995	FILSK	10	10	26.6	21.2	34.1	0.37	0.19	0.74				
			1996	FILSK	10	10	25.1	17.5	38.3	0.18	0.07	0.50				
			1997	FILSK	22	22	21.7	14.9	33.3	0.18	0.08	0.43	1	0.01	0.01	Y
				WHORG	23	23	22	14.9	33.3	0.14	0.06	0.35				
			2002	FILSK	5	5	25.7	20.5	32.3	0.30	0.23	0.36				
			2004	FILSK	22	22	22.8	17.5	36.5	0.21	0.07	0.55				
			2006	FILSK	7	7	22.2	19	28.1	0.15	0.08	0.20				
			2009	FILSK	13	13	24.6	20.6	35.2	0.30	0.15	0.47				
		Sauger	1990	FILSK	11	2	14.1	12.5	15.7	0.24	0.12	0.36	2	0.01	0.01	Y
			1995	FILSK	12	3	16	13.5	19	0.26	0.11	0.41				
			2002	FILSK	5	5	10.6	9.3	12.5	0.24	0.20	0.30				
		Smallmouth Bass	1990	FILSK	2	1	10.7	10.7	10.7	0.05	0.05	0.05	1	0.01	0.01	Y
			1995	FILSK	6	1	11.9	11.9	11.9	0.08	0.08	0.08				
			2002	FILSK	5	5	13.2	10.5	14.5	0.25	0.20	0.37				
		Walleye	1977	PLUG	26	26	16.2	9.4	21.3	0.16	0.03	0.40				
			1983	FILSK	4	2	19.7	18.4	21	0.16	0.15	0.17				
			1986	FILSK	23	8	19.1	12.6	26.6	0.63	0.44	1.40				
			1990	FILSK	41	20	19.3	11.3	25.6	0.27	0.10	0.58	4	0.011	0.013	
			1995	FILSK	16	4	16.3	12.9	20.1	0.13	0.09	0.22	1	0.01	0.01	Y
			1996	FILSK	5	5	18.4	11.6	24.2	0.22	0.10	0.52				
			2002	FILSK	5	5	19	15.6	22.5	0.23	0.17	0.32				
			2012	FILSK	6	6	17.3	13.9	23.3	0.17	0.04	0.36				
		White Sucker	1995	FILSK	5	1	17.1	17.1	17.1	0.03	0.03	0.03				
		Yellow Perch	1990	FILSK	9	1	10.4	10.4	10.4	0.09	0.09	0.09	1	0.011	0.011	
			1995	FILSK	10	1	9.8	9.8	9.8	0.06	0.06	0.06				
			1997	WHORG	10	10	5.31	4.9	5.7	0.02	0.02	0.02				
			2002	FILSK	5	1	9.7	9.7	9.7	0.10	0.10	0.10				
			2004	WHORG	21	3	4.57	3.7	5.8	0.02	0.01	0.04				
			2006	WHORG	5	1	5.4	5.4	5.4	0.03	0.03	0.03				

DOWID	Waterway	Species	Year	Anatomy[1]	Total Fish	No. Samples	Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
							Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
69086400	ASH*	Northern Pike	1983	FILSK	12	4	24.9	18.5	33	0.29	0.21	0.47				
			1995	FILSK	10	10	20.6	16	28.2	0.26	0.15	0.43				
			2002	FILSK	18	18	22.1	15.2	26.2	0.27	0.09	0.74				
			2008	FILSK	14	14	27	21.2	34.4	0.20	0.13	0.25				
			2013	FILSK	6	6	26.5	24.4	28.4	0.63	0.34	0.90				
		Walleye	1983	FILSK	1	1	26.5	26.5	26.5	0.68	0.68	0.68				
		Yellow Perch	2002	WHORG	10	2	5.7	5.7	5.7	0.04	0.03	0.04				
			2008	WHORG	10	2	5.75	5.4	6.1	0.05	0.04	0.05				
69086700	JORGENS**	Crayfish	2003	WHORG	10	10				0.04	0.02	0.08				
		Northern Pike	1997	FILSK	5	5	22.8	18.1	27.6	0.43	0.29	0.72				
			2001	FILSK	8	8	23.2	21.1	24.3	0.51	0.34	1.11				
			2005	FILSK	8	8	23.2	20.3	25.1	0.54	0.24	0.67				
		Yellow Perch	2005	WHORG	2	1	5.7	5.7	5.7	0.07	0.07	0.07				
69086900	QUARTERLINE**	Northern Pike	1997	FILSK	5	5	18.9	17.2	20.4	0.62	0.37	0.78				
			2001	FILSK	15	15	15.9	7.5	21.5	0.54	0.16	1.36				
			2007	FILSK	12	12	17.6	14.9	19.9	0.55	0.35	0.82				
		Yellow Perch	2007	WHORG	11	2	5.75	3.5	8	0.16	0.12	0.19				

* Impaired for mercury in fish tissue as of 2016 Draft Impaired Waters List; categorized as EPA Class 4a for waters covered by the Statewide Mercury TMDL.

** Impaired for mercury in fish tissue as of 2014 Draft Impaired Waters List; categorized as EPA Class 5 for waters needing a TMDL.

Anatomy codes: FILSK – edible fillet, skin-on; FILET—edible fillet, skin-off; BIOPSY or PLUG—dorsal muscle piece, without skin; WHORG—whole organism; NOHV-organism without head or viscera; PLUSK-dorsal muscle with skin