Mississippi River-Twin Cities Watershed Monitoring and Assessment Report

Minnesota Pollution Control Agency

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List of acronyms

AUID Assessment Unit Identification
CCSI Channel Condition and Stability Index
CD County Ditch
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
CWLA Clean Water Legacy Act
DO Dissolved oxygen
DOP Dissolved Orthophosphate
E Eutrophic
E. coli Escherichia coli
EQuIS Environmental Quality Information System
EX Exceeds Criteria (Bacteria)
EXP Exceeds Criteria, Potential Impairment
EXS Exceeds Criteria, Potential Severe Impairment
FS Full Support
Fish IBI Fish Index of Biological Integrity
H Hypereutrophic
Hg Mercury
HUC Hydrologic Unit Code
IBI Index of Biotic Integrity
IF Insufficient Information
Invert IBI Macroinvertebrate Index of Biological Integrity
IWM Intensive Watershed Monitoring
K Potassium
LRVW Limited Resource Value Water
M Mesotrophic
MCES Metropolitan Council Environmental Services
MDA Minnesota Department of Agriculture
MDH Minnesota Department of Health
MDNR Minnesota Department of Natural Resources
MINLEAP Minnesota Lake Eutrophication Analysis Procedure
MPCA Minnesota Pollution Control Agency
MSHA Minnesota Stream Habitat Assessment
MTS Meets standard or biological criterion
N Nitrogen
NH_3 un-ionized ammonia
Nitrate-N Nitrate Plus Nitrite Nitrogen
NA Not Assessed
NHD National Hydrologic Dataset
NS Not Supporting
NT No Trend
NWI National Wetlands Inventory
OP Orthophosphate
P Phosphorous
PCB Poly Chlorinated Biphenyls
PFCs Perfluorochemicals
PFOS Perfluorooctane Sulfonate
PWI Protected Waters Inventory
RNR River Nutrient Region
SMCL Secondary Maximum Contaminant Level
SWAG Surface Water Assessment Grant
SWCD Soil and Water Conservation District
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
WPLMN Water Pollutant Load Monitoring Network
WRAPS Watershed Restoration and Protection Strategy/ies

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Executive summary

The Mississippi River-Twin Cities Watershed (07010206) lies in East-Central Minnesota and encompasses a large portion of the seven county metropolitan area of Minneapolis and St Paul. The watershed is home to more than 1.8 million people across ninety-nine cities, over four hundred species of wildlife, over one hundred fish species, and numerous aquatic invertebrate species. Drinking water quality and the recreational enjoyment of lakes and streams are valuable assets to the health of its citizens and the wealth of local economies throughout the watershed.

Historically, the watershed was mostly maple-basswood forest, with a fringe of prairie along the west and southern region of the watershed. The banks of the Mississippi River were home to many historical native American villages. Fur trading, logging, and rich tillable soil brought European settlers to the region and transformed the landscape to a largely urban and agricultural corridor. Thankfully, urban planners saw the value of retaining land for recreational enjoyment and developed a vast network of parks that enrich the quality of life of residents and visitors to this day.

Although densely urbanized at the center, the Mississippi River-Twin Cities Watershed is lake-rich, with over 250 basins greater than ten acres. Quality-of-life amenities in the watershed include plentiful parks and natural areas which are associated with lakes as well as streams. A mix of deep and shallow lakes provides recreational opportunities such as fishing, swimming, sailing, canoeing and kayaking. The outer fringes of the watershed that are less densely urbanized contain a mix of low-gradient wetland habitat for hunting and birdwatching, and agricultural land for grazing and cropland.

In 2010 the Minnesota Pollution Control Agency (MPCA) undertook an intensive watershed monitoring effort of the Mississippi River-Twin Cities Watershed's surface waters. Forty-eight stream stations were sampled for biology at the outlets of variable sized sub-watersheds. These locations included the outlets of tributaries such as Rice Creek, Elm Creek, Coon Creek, Bassett Creek, Shingle Creek, and Minnehaha Creek, and the outlets of many smaller headwater streams. As part of this effort, MPCA staff joined with local partners to complete stream water chemistry sampling at the outlets of six of the subwatersheds. In 2012, a holistic approach was taken to assess all of the watersheds' surface waterbodies for support of aquatic life, recreation, and fish consumption where sufficient data were available. During this process, 180 lakes and 46 stream reaches were assessed for aquatic recreation and/or aquatic life. (Not all lake and stream reaches were able to be assessed due to insufficient data and modified channel condition).

Eighty-four lakes are considered to be fully supporting recreation uses, while an additional 87 are not supporting. Eight lakes that were previously listed as impaired for aquatic recreation use are now meeting standards and are proposed to be removed from the Impaired Waters List in 2014. During the 2012 assessment, seven lakes were identified as impaired for aquatic life use due to chloride toxicity; however, additional lakes are being assessed in 2013 with the potential for more impaired lakes. Biological sampling is not yet done on lakes and it is anticipated that additional aquatic life impairments will be found based on those indices. Fifty-one lakes are impaired for aquatic consumption use, with high levels of mercury, Poly Chlorinated Biphenyls (PCBs), and Perfluorooctane Sulfonate (PFOS) found in fish tissue; fish consumption advisories have been recommended for lakes across the watershed.

Only one stream was assessed as fully supporting aquatic recreation while 17 are not supporting due to elevated bacteria levels. For aquatic life use, two stream reaches were determined to be fully supporting and 21 stream reaches were found to be non-supporting. In addition, 34 stream segments were not assessed for aquatic biology because the stream at the biological station is greater than 50% channelized. (Channelized reaches are currently not being assessed until new biological standards are developed.) The majority of channelized streams in the watershed had fair or poor condition ratings based on their fish and macroinvertebrate assemblages.

Land use changes in vegetation, urban development, and application of fertilizers and deicers have all likely contributed to reduced water clarity, algal blooms, potentially unsafe swimming conditions, and loss of sensitive aquatic species. Increased bacteria levels, chloride, nutrients, and flashy stream flows are threats to the quality of the water resources in much of the watershed today. A number of Total Maximum Daily Load (TMDLs) and Watershed Restoration and Protection Strategies (WRAPS) have been implemented or are in development that target reductions in nutrients, bacteria, and chloride. Additional measures are needed in order to improve and protect water quality throughout the Mississippi River-Twin Cities Watershed.

Varying geology leads to diverse conditions for groundwater within the Mississippi River-Twin Cities Watershed. Years of industrialization and urbanization have created areas of much localized concern for groundwater quality and quantity. Urban expansion into rural/agricultural areas has created areas of concern for groundwater contamination by nitrates. Chloride impacts to groundwater are a watershed-wide concern due to the application of deicers in this heavily urbanized watershed. The concept of groundwater-surface water interaction and potential effects on waterbodies is an area of new and growing concern for municipalities within the watershed.

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. The 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 water bodies 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 water body 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 (CWLA) 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 Clean Water Act (CWA) goal of protecting and restoring the quality of Minnesota's water resources.

This watershed-wide monitoring approach was implemented in the Mississippi River-Twin Cities Watershed beginning in the summer of 2010. Streams and lakes were assessed in 2012. At that time, the Mississippi River was assessed for drinking water but the results are excluded from this report. A large river report that includes the section of the Mississippi River upstream of St. Anthony Falls (Lock and Dam #1) in Minneapolis and a Great River report that captures all the assessment decisions along the length of the Mississippi River are being planned. Therefore, this watershed report provides a summary of all water quality assessment results in the Mississippi River-Twin Cities subwatersheds that drain to the Mississippi River and incorporates all data available for the assessment process, including watershed monitoring, volunteer monitoring and monitoring conducted by local government units if it was reported to the MPCA.

I. The watershed monitoring approach

The watershed approach is a ten year rotation for monitoring and assessing waters of the state on the level of Minnesota's 81 major watersheds (Figure 1). 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).

Pollutant load monitoring network

The Watershed Pollutant Load Monitoring Network (WPLMN) is a long-term monitoring approach designed to measure levels of key pollutants in the state's watersheds, 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. Since the network's inception in 2007, the WPLMN has adopted a multi-agency monitoring design that combines site specific stream flow data from United States Geological Survey (USGS) and Minnesota Department of Natural Resources (MDNR) flow gaging stations, with water quality data collected by the Metropolitan Council Environmental Services (MCES), local monitoring organizations and Minnesota Pollution Control Agency WPLMN staff to compute annual pollutant loads at 79 river monitoring sites across Minnesota. Intensive water quality sampling occurs year round at all WPLMN sites. Data will also be used to assist with TMDL studies and implementation plans, watershed modeling efforts and watershed research projects.

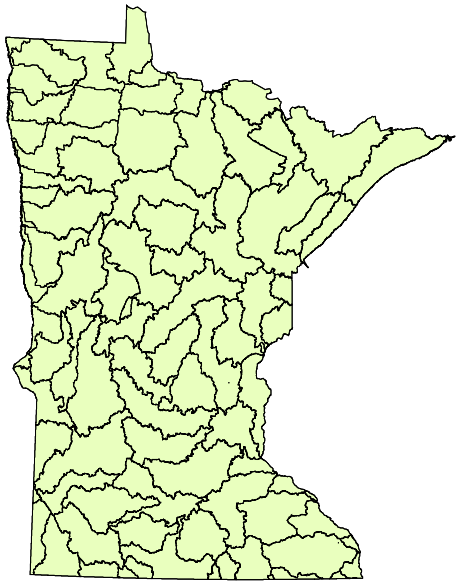

Figure 1. Major watersheds within Minnesota (8-Digit HUC).

Intensive watershed monitoring

The Intensive Watershed Monitoring (IWM) strategy utilizes a nested watershed design allowing the sampling of streams within watersheds from a coarse to a fine scale. Each watershed scale is defined by a hydrologic unit code (HUC). These HUCs define watershed boundaries for water bodies within a similar geographic and hydrologic extent. The foundation of this approach is the 81 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 ten-year cycle.

River and stream sites are selected near the outlet of each of three watershed scales, 8-HUC, 11-HUC and 14-HUC. 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 watershed 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. (Since the Mississippi River-Twin Cities Watershed does not have a discrete outlet and is comprised instead of multiple tributaries that feed into the Mississippi River, there was no fish contaminants station. The Mississippi River itself does have fish contaminant impairments that are not included in this report but will be in a report on the Mississippi River at a later date). A recently issued report on the condition of the Mississippi River by the National

Park Service and Friends of the Mississippi River can be found at: http://stateoftheriver.com/. The 11-HUC subwatershed is the next smallest watershed scale which generally consists of major tributary streams with drainage areas ranging from 75 to 150 mi^2. Each subwatershed 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 subwatershed, smaller watersheds (14 HUC, typically 10 to 20 mi^2), are sampled at each outlet that flows into the major subwatershed tributaries. Each of these minor subwatershed outlets is sampled for biology to assess aquatic life use support (red dots in Figure 2).

Within the intensive watershed monitoring strategy, lakes are selected to represent the range of conditions and lake type (size and depth) found within the watershed. Lakes most heavily used for recreation (all those greater than five hundred acres and at least 25% of lakes 100 to 499 acres) are monitored for water chemistry to determine if recreational uses, such as swimming and wading, are being supported. Lakes are sampled monthly from May through September for a two-year period. Currently lakes are assessed for aquatic life uses solely on levels of chloride; a method that includes monitoring fish and aquatic plant communities is under development with MPCA and MDNR staff.

Specific locations for sites sampled as part of the intensive monitoring effort in the Mississippi River-Twin Cities Watershed are shown in Figure 2 and are listed in Appendix 2, Appendix 3.1, Appendix 3.2, Appendix 4.2, Appendix 4.3, Appendix 5.2 and Appendix 5.3.

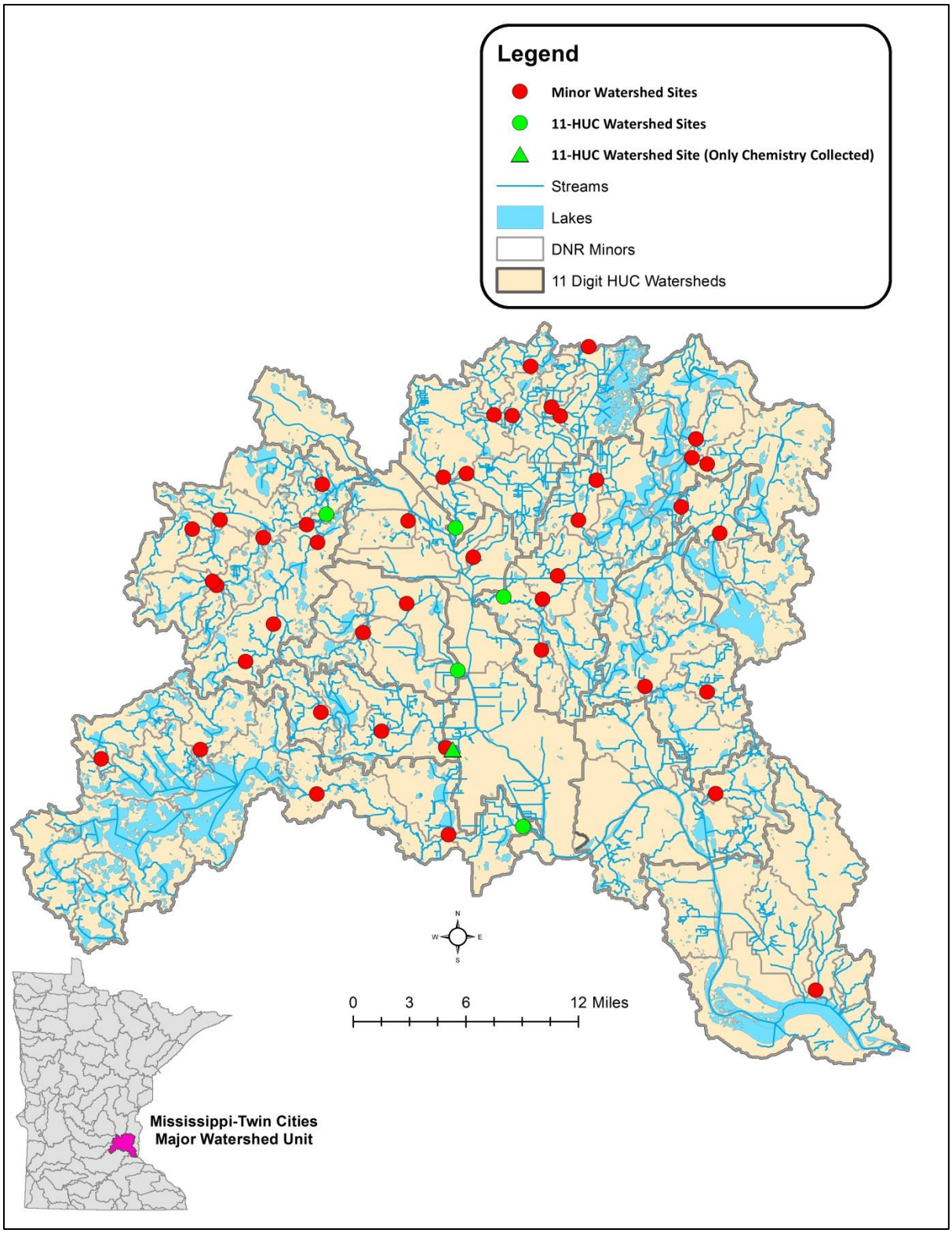

Figure 2. Intensive Watershed Monitoring (IWM) sites for streams in the Mississippi River-Twin Cities Watershed.

Local watershed organizations

There are fifteen watershed management organizations and watershed districts that have jurisdiction within the area of the Mississippi River-Twin Cities Watershed (Figure 3, Table 1). The intensive watershed design is based on the land area that drains each 11-HUC subwatershed. The subwatershed boundaries do not always align with the jurisdictional boundaries of respective watershed organizations that are sometimes based on individual watersheds while others are based on political boundaries. Consequently, there may be more than one watershed organization active within each subwatershed. The following figure and table are presented for cross-referencing between the subwatersheds and the watershed management organizations referenced in this report.

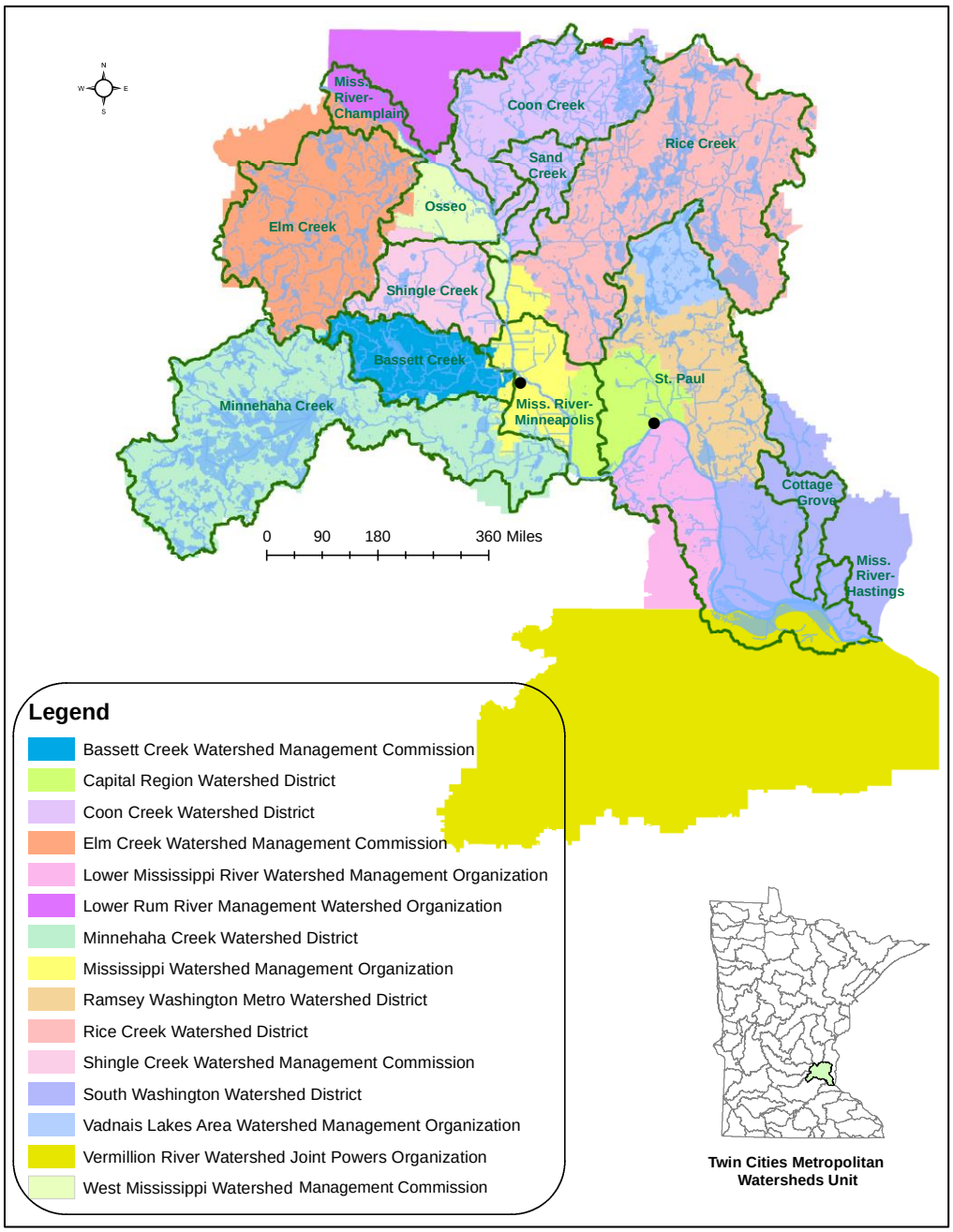

Figure 3. The 11-HUC subwatersheds (green outline) and local watershed groups (in color) within the Mississippi River-Twin Cities Watershed.

Table 1. Local watershed groups and 11-HUC subwatersheds within their jurisdiction.

Local Watershed Group	Group Acronym	HUC 11 Name*
Bassett Creek Watershed Management Commission	BCWMC	Bassett Creek
Capital Region Watershed District	CRWD	St Paul
Coon Creek Watershed District	CCWD	Osseo, Sand Creek, Coon Creek, Rice Creek
Elm Creek Watershed Management Commission	ECWMC	Elm Creek Rice Creek
Lower Mississippi River Watershed Management Organization	LMRWMO	St Paul
Lower Rum River Management Watershed Organization	LRRMWO	Mississippi (Direct)-Champlain
Minnehaha Creek Watershed District	MCWD	Mississippi (Direct)–Hastings, Bassett Creek, Minnehaha Creek
Mississippi Watershed Management Organization	MWMO	Rice Creek
Ramsey Washington Metro Watershed District	RWMWD	St Paul
Rice Creek Watershed District	RCWD	Rice Creek, St Paul
Shingle Creek Watershed Management Commission	SCWMC	Shingle Creek
South Washington Watershed District	SWWD	St Paul, Cottage Grove
Vadnais Lakes Area Watershed Management Organization	VLAWMO	Rice Creek, St Paul
Vermillion River Watershed Joint Powers Organization	VRWJPO	St Paul
West Mississippi Watershed Management Commission	WMWMC	Mississippi (Direct)-Champlain, Rice Creek, Osseo

*11-HUC names that are underlined indicate subwatersheds where respective watershed groups have assessment results included in this report.

New watershed delineations were recently completed by the MDNR. This coverage will be incorporated into the intensive watershed monitoring design in 2013. Future watershed assessment and monitoring reports will incorporate these new delineations which may align better with some but not all of the jurisdictional boundaries of the local watershed groups listed in Table 1.

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 sites and lakes to be included in the intensive watershed monitoring process. Funding passes from MPCA through Surface Water Assessment Grants (SWAGs) to local groups such as counties, soil and water conservation districts (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 site 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.

Water chemistry data from the Mississippi River-Twin Cities Watershed comes primarily from external parties and volunteers (Figure 4). Very little sampling by MPCA staff occurs in this watershed due to the local jurisdiction coverage of watershed districts and water management organizations. The Metropolitan Council coordinates the Citizen Assisted Lake Monitoring Program, which utilizes volunteers to collect transparency and water chemistry data on lakes throughout the metropolitan area. In contrast, the biological monitoring data in this report came primarily from the MPCA.

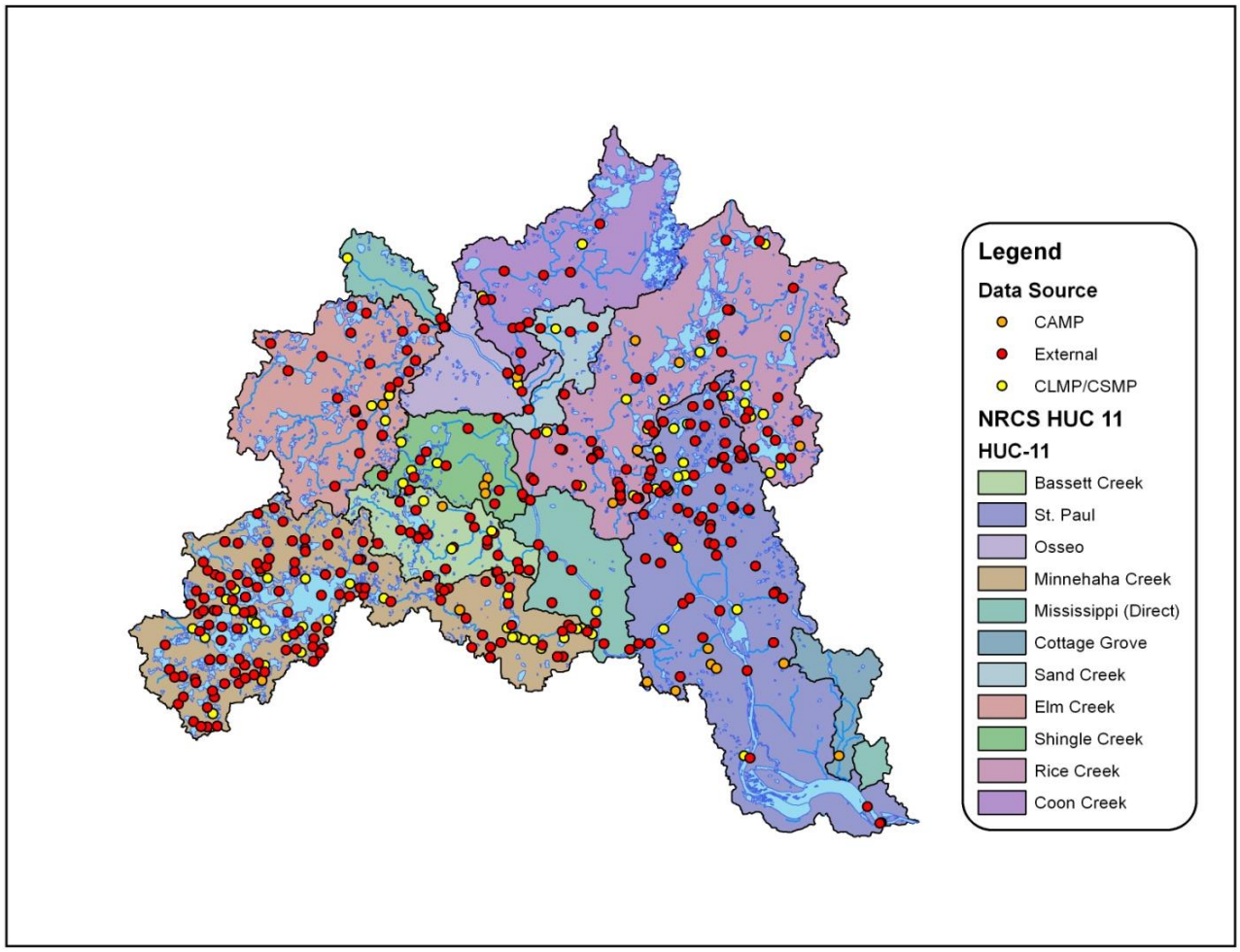

Figure 4. Locations and providers of water quality data in the Mississippi River-Twin Cities Watershed.

II. Assessment methodology

The Clean Water Act 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 2012) http://www.pca.state.mn.us/index.php/view-document.html?gid=16988. For the Impaired Waters List: http://www.pca.state.mn.us/index.php?option=com_k2&Itemid=250&id=859&layout=item&view=item.

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 life means the maintenance of a healthy aquatic community, including fish, invertebrates and plants. The sampling of aquatic organisms for assessment is called biological monitoring. Biological monitoring 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. Interpretations of narrative criteria for aquatic life in streams are based on multi-metric biological indices including the Fish Index of Biological Integrity (Fish IBI), which evaluates the health of the fish community, and the Macroinvertebrate Index of Biological Integrity (Invert IBI), which evaluates the health of the aquatic invertebrate community. Additionally, chemical parameters are measured and assessed against numeric standards developed to be protective of aquatic life, including pH, dissolved oxygen, un-ionized ammonia nitrogen, chloride and turbidity.

Protection of aquatic recreation means the maintenance of conditions with reduced risk of illness 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 as indicators. Lakes that are enriched with nutrients and have abundant algal growth are eutrophic and do not support aquatic recreation.

Protection of aquatic 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 water body 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.

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 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 Minnesota Department of Natural Resources (MDNR). The Protected Waters Inventory (PWI) 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 5.

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

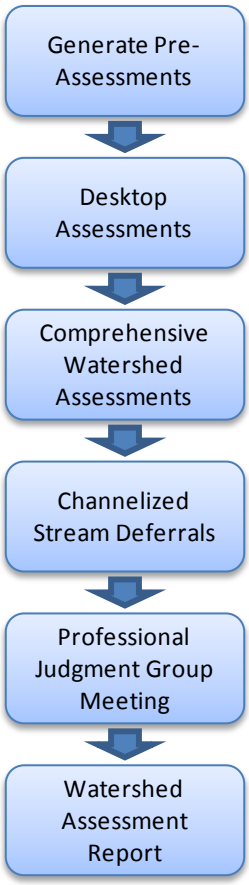

Figure 5. Flowchart of aquatic life use assessment process.

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 2012) http://www.pca.state.mn.us/index.php/view-document.html?gid=16988 for guidelines and factors considered when making such determinations.

Any new impairment (i.e., waterbody not attaining its beneficial use) is first reviewed using GIS to determine if greater than 50% of the assessment unit is channelized. Currently, the MPCA is deferring any new impairments on channelized reaches until new aquatic life use standards have been developed as part of the Tiered Aquatic Life Use (TALU) framework. For additional information see: http://www.pca.state.mn.us/index.php/water/water-permits-and-rules/water-rulemaking/tiered-aquatic-life-use-talu-framework.html. However, in this report, channelized reaches with biological data are evaluated on a "good-fair-poor" system to help evaluate their condition (see Section IV and Appendix 5.1).

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.

Data management

It is MPCA policy to use all credible and relevant monitoring data to assess surface waters. The MPCA relies on data it collects along with data from other sources, such as sister agencies, local governments and volunteers. The data must meet rigorous quality assurance protocols before being used. All monitoring data required or paid for by MPCA are entered into EQuIS (Environmental Quality Information System), MPCA's data system and are also uploaded to the US Environmental Protection Agency's (EPA's) data warehouse. Data for monitoring projects with federal or state funding are required to be stored in EQuIS (e.g., Clean Water Partnership, CWLA Surface Water Assessment Grants and TMDL program). Many local projects not funded by MPCA also choose to submit their data to the MPCA in an EQuIS-ready format so that the monitoring data may be utilized in the assessment process. Prior to each assessment cycle, the MPCA sends out a request for monitoring data to local entities and partner organizations.

Period of record

The MPCA uses data collected over the most recent 10 year period for all water quality assessments. This time-frame provides a reasonable assurance that data that have been collected over a range of weather and flow conditions and that all seasons will be adequately represented; however, data for the entire period is not required to make an assessment. The goal is to use data that best represents current water quality conditions. Therefore, recent data for pollutant categories such as toxics, lake eutrophication and fish contaminants may be given more weight during assessment.

III. Watershed overview

The Mississippi River-Twin Cities Watershed is located within the seven county metropolitan area surrounding Minneapolis and St Paul (Figure 6). Six of the seven counties have a portion of their area in the watershed: Ramsey, Hennepin, Anoka, Washington, Dakota and Carver; only Scott county is excluded. Each subwatershed drains directly to the Mississippi River, which runs through the central corridor from the confluence with the Crow River near Ramsey to Lock and Dam #2 near Hastings.

The waters of the watershed provide drinking water for households and industry, habitat for aquatic life, riparian corridors for wildlife, and recreational opportunities. The Twin-Cities area is known for its plentiful parks and natural areas which are often associated with lakes and streams that provide recreational enjoyment from fishing, swimming, sailing, canoeing, hiking, and kayaking.

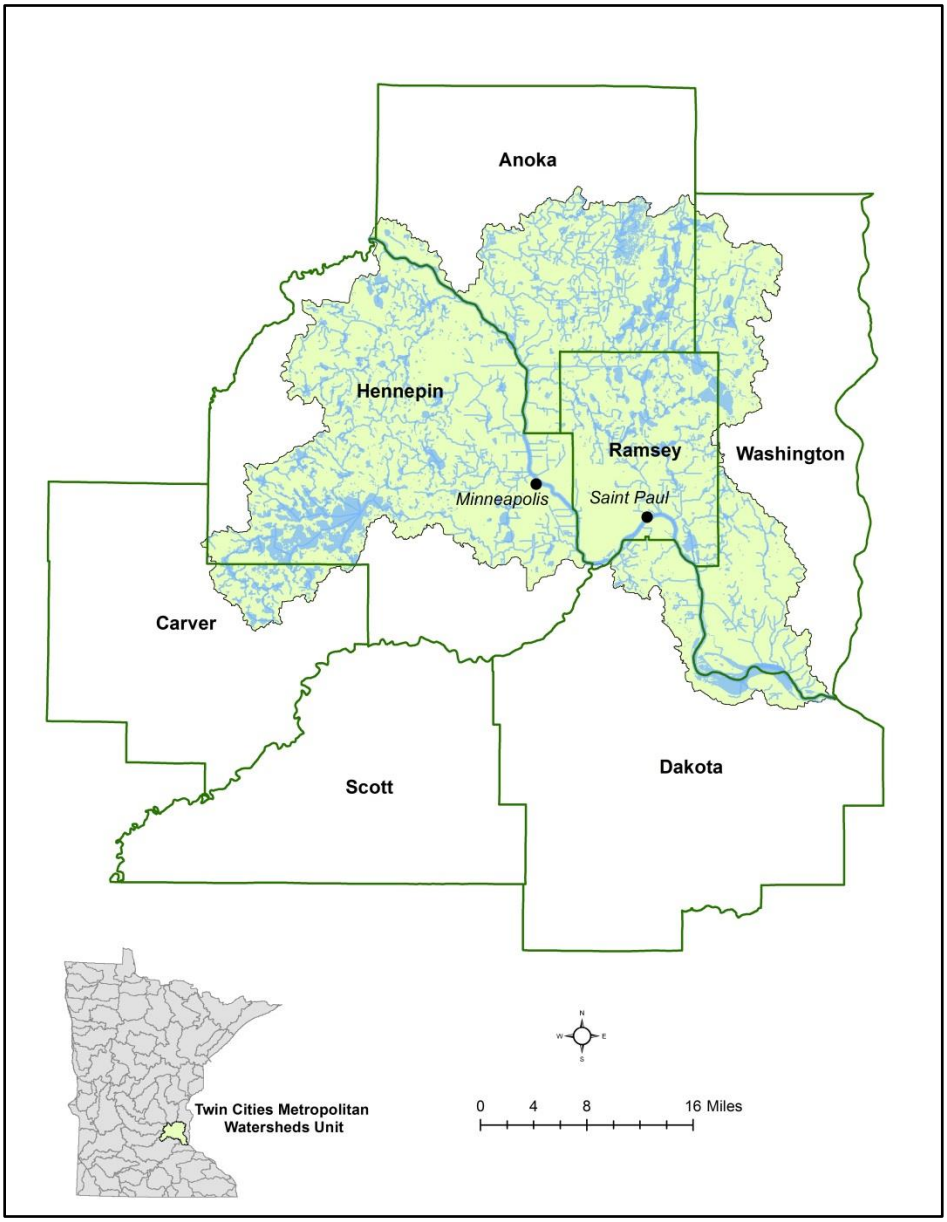

Figure 6. Outline of the seven county metropolitan area within the Mississippi River-Twin Cities Watershed.

Land use summary

Historically, the Mississippi River-Twin Cities Watershed was largely covered with maple-basswood forests and dotted throughout with numerous lakes and wetlands. Many of the wetlands were drained during the 1890s when wetlands were considered an impediment to farming and a public health threat.

At the heart of the watershed are the cities of Minneapolis and St Paul. Historically, the land south of St. Paul was known as the Dakota village of Kaposia. In the early 1800s, the military reservation called Fort Snelling was established on the banks of the Mississippi between Minneapolis and St. Paul in order to protect an active fur trade (Robison 1958). Timber was in need for building houses and railroads throughout the Midwest, creating a timber harvesting boom of the expansive white pines to the north of the Twin Cities. With the mighty falls as a barrier to boats, saw mills were built along the banks of the Mississippi River at what had become known as St. Anthony Falls (Robison 1958). With the rise in population, other industries sprouted up along the banks of the Mississippi River and a new city just upstream of St Paul began—the city of Minneapolis. With the fertile Minnesota soils and westward expansion of the railroad, immigrants from many areas came to plow the prairies and farm. Minneapolis soon became the "Mill City" with flour mills dotting the banks of the river, utilizing the rapids of St. Anthony falls to operate the mills (Wirth 2006). Thanks to visionaries in the growing city, namely Horace W. S. Cleveland, William Folwell, Charles Loring and Theodore Wirth, many natural corridors within Minneapolis were protected and connected as a public park system. Between 1883 to 1944 numerous parks and connector roadways were planned and developed, such as Loring Park, Minnehaha Park, Theodore Wirth Parkway, Minnehaha Parkway, Bassett Creek Park, the Minneapolis Chain of Lakes, and Victory Memorial Drive, among others (Wirth 2006).

Today, the central corridor of the Mississippi River-Twin Cities Watersheds is densely urban while less developed land and agricultural land use (row crops and range land) lie mostly on the fringes of the watershed (Figure 7). There are numerous lakes and river corridors in the watershed which are highly developed with residential houses, lawns, and roads.

Due to the density of industry, housing, and roads, lake and streams in the Twin Cities are showing signs of stress from pollution, such as higher levels of nutrients causing unsightly algae blooms, bacteria in waterbodies making swimming areas potentially unsafe, impervious pavement contributing to flashier storm flows and eroding stream banks, and increased use of deicers creating toxic conditions for aquatic life. Agencies, watershed groups and local citizens are collaboratively working to address these problems in order to improve and protect the scenic beauty and recreational enjoyment of the lakes and streams of the Mississippi River-Twin Cities Watershed.

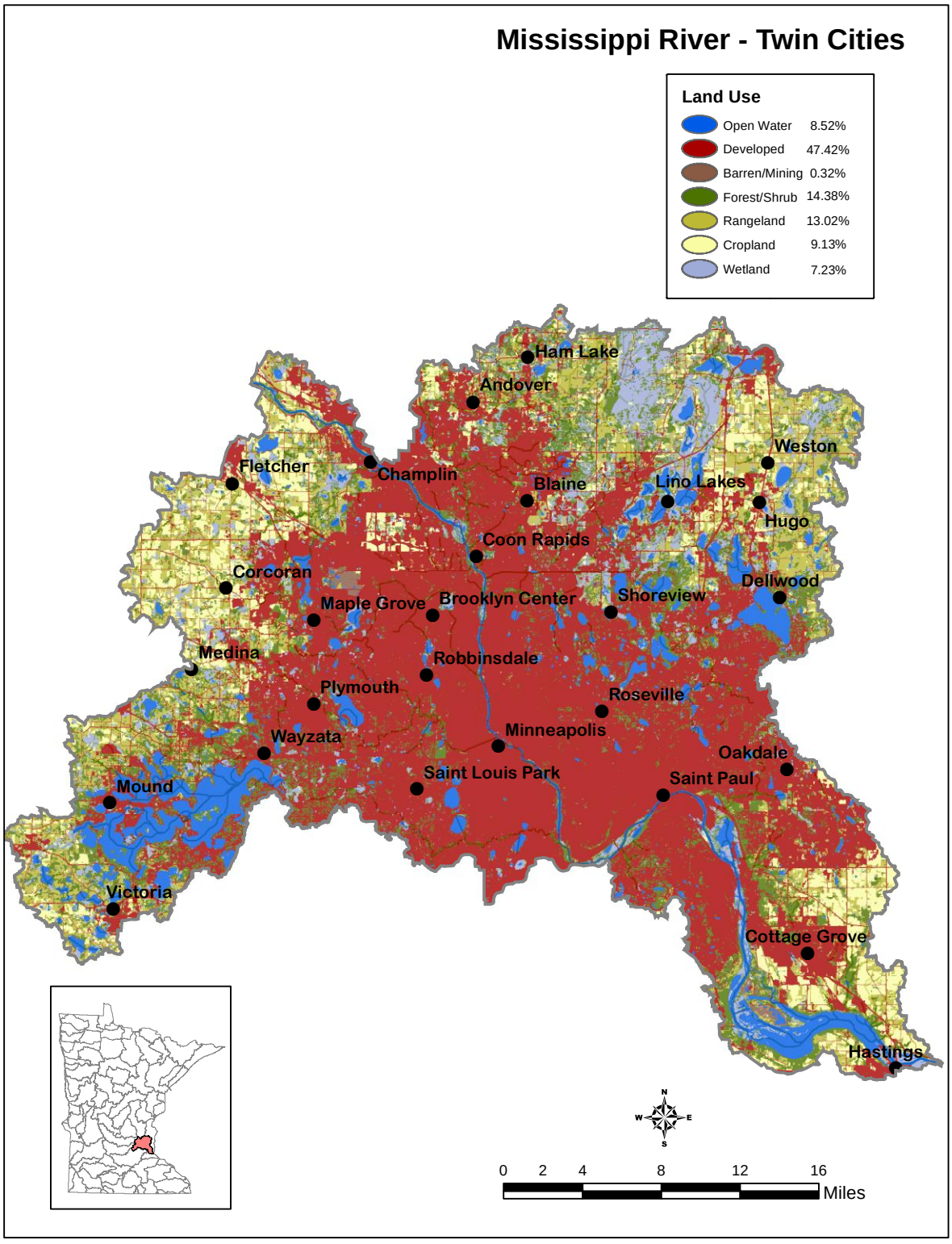

Figure 7. Land use and select cities in the Mississippi River-Twin Cities Watershed.

Surface water hydrology

The Mississippi River runs primarily from north to south through the center of the watershed, except for notable turns to the north at its confluence with the Minnesota River and further downstream near Saint Paul where it turns south again (Figure 8). Tributary streams that drain directly to the Mississippi River include Rice Creek, Minnehaha Creek, Shingle Creek, Coon Creek, Elm Creek and Bassett Creek. This 8-HUC watershed is lake rich, with over 250 lakes. Prominent lakes include: Lake Minnetonka, the Minneapolis Chain of Lakes, Bald Eagle Lake, White Bear Lake, and the Lake Phalen chain.

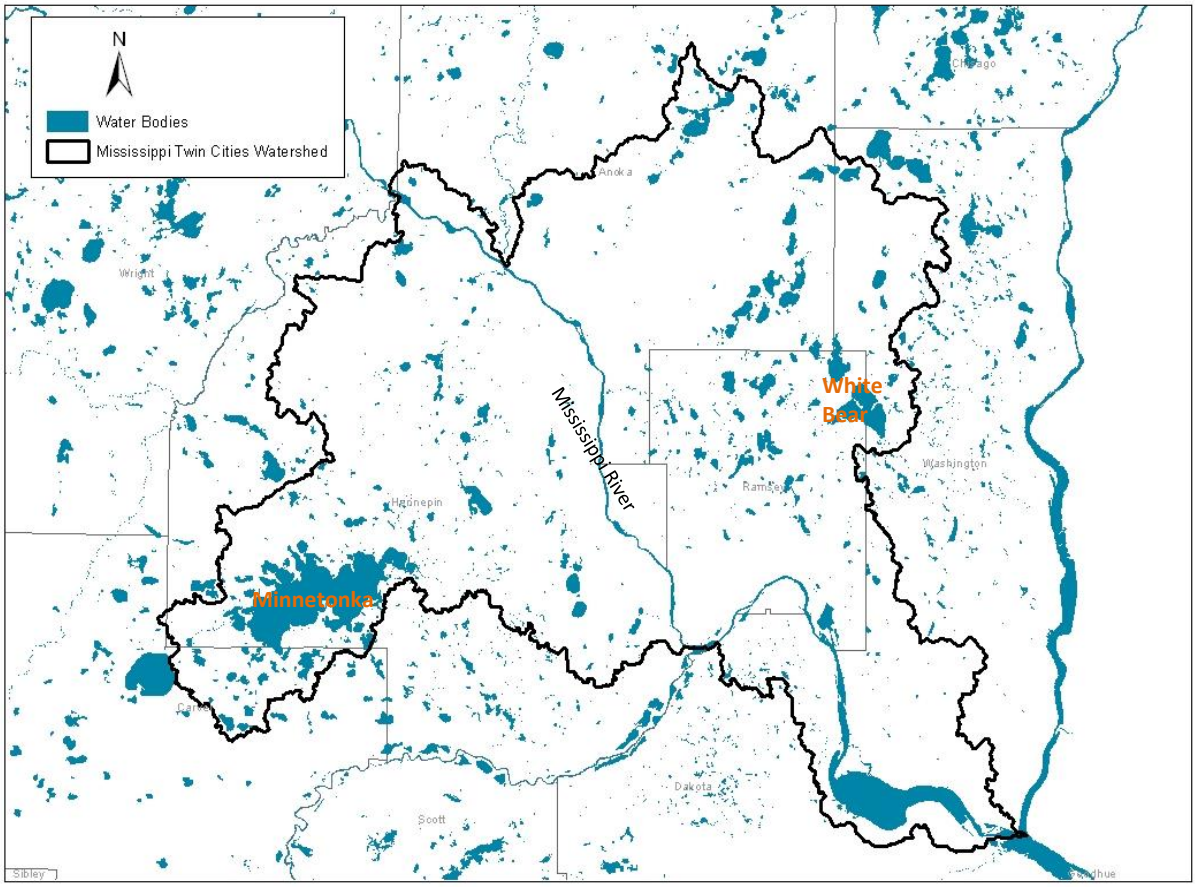

Figure 8. Lakes and waterbodies in the Mississippi River-Twin Cities Watershed.

Wetlands

Excluding the open water portions of lakes, ponds, and rivers, the Mississippi River-Twin Cities Watershed comprises approximately 82,000 acres of vegetated wetlands, equivalent to ~13% of the total watershed area as of 1980. Wetlands with herbaceous emergent vegetation are the most predominant wetland type in this watershed (Figure 9). The distribution of wetlands across the watershed is not uniform with the majority of wetland area occurring in the northern and western regions, coinciding largely with the Coon Creek, Rice Creek and Elm Creek drainages. It should be noted that these estimates represent a snapshot of the location, type, and extent of wetlands occurring in 1980, which is the year that data was acquired to develop National Wetlands Inventory (NWI) maps in this part of the state. Many changes to wetlands have occurred in this watershed since 1980 due to development typical of any major metropolitan area. An updated NWI for the 13 counties comprising the larger Twin Cities metropolitan area is expected to be completed in 2013 and will provide a more accurate representation of wetlands in this watershed.

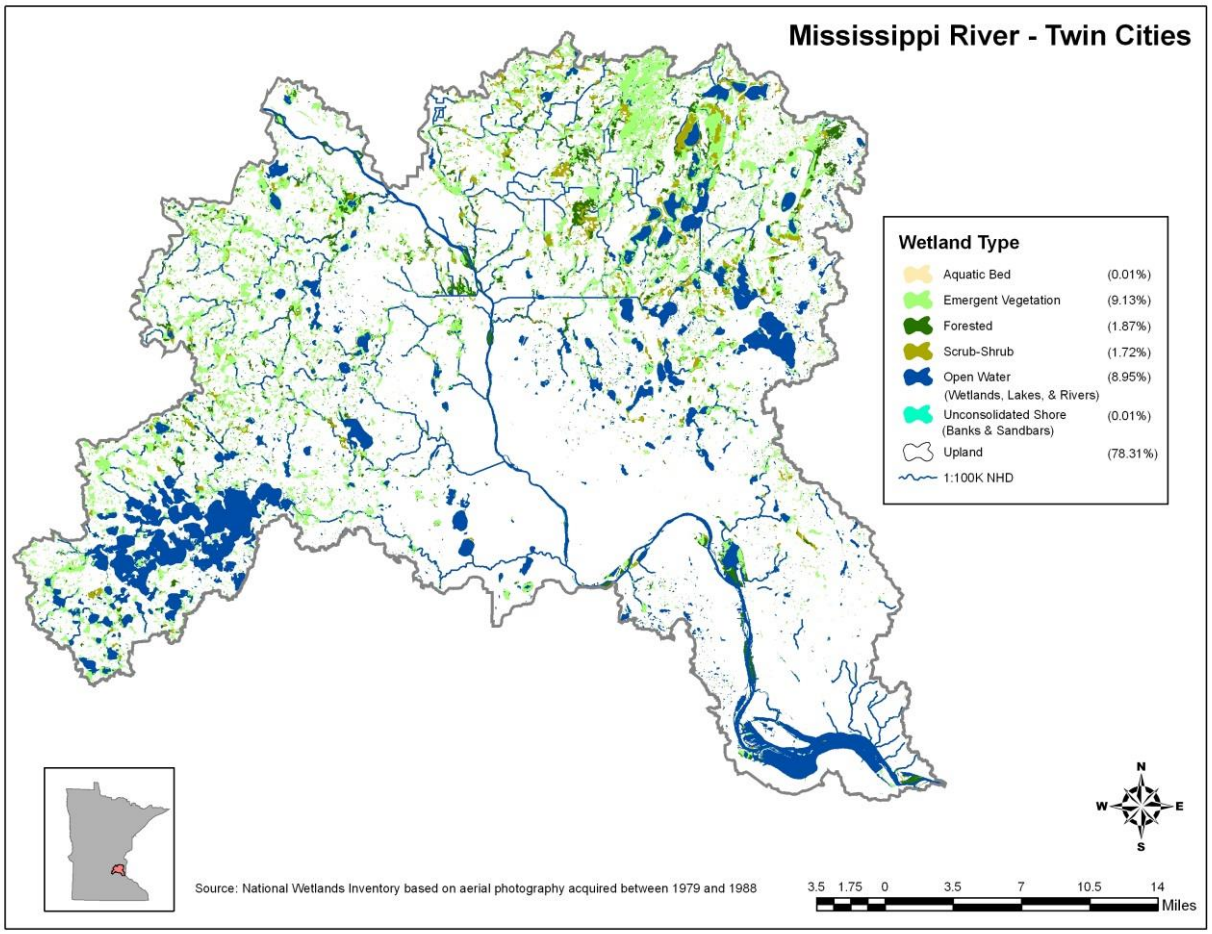

Figure 9. Wetland types and their distribution across the Mississippi River-Twin Cities Watershed.

Climate and precipitation

Figure 10 shows two representations of precipitation for calendar year 2010, the start year for IWM work in the Mississippi River-Twin Cities Watershed. On the left is total precipitation, showing the typical pattern of increasing precipitation toward the southeast portion of the state. According to this map the Twin Cities area received 32 to 40 inches of precipitation in 2010. The display on the right shows the amount that precipitation levels in 2010 departed from normal. For the Twin Cities area it shows that precipitation exceeded normal in some locations by up to 10 inches.

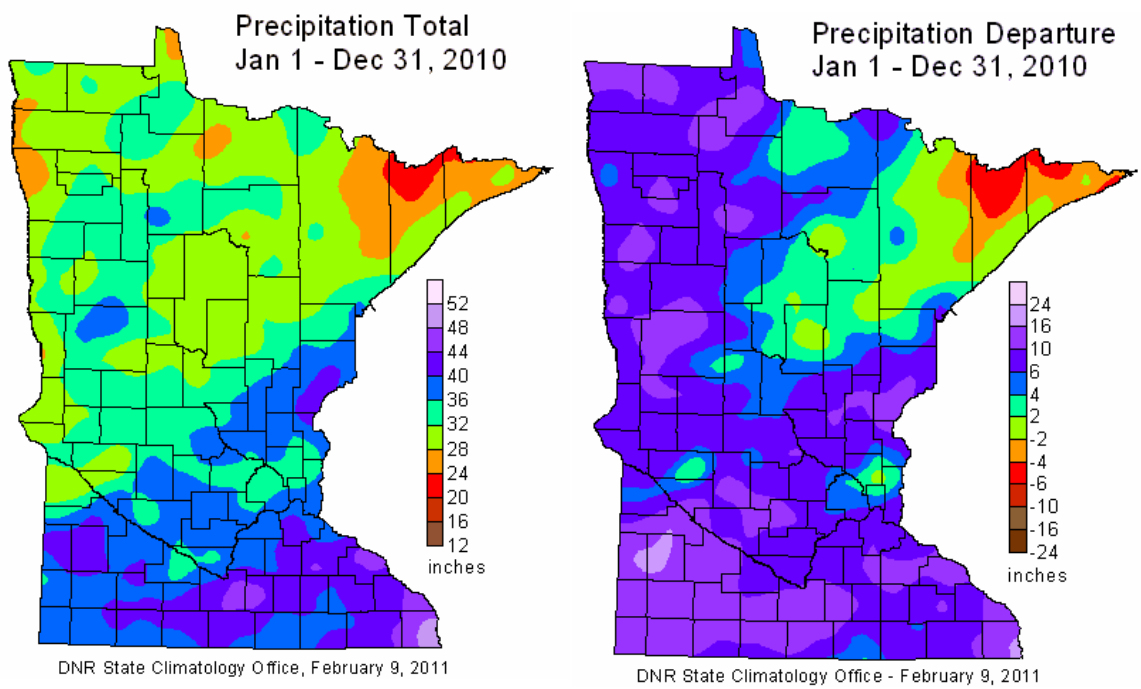

Figure 10. State-wide precipitation levels during the 2010 water year.

Figure 11 is an areal average representation of precipitation in east central Minnesota. An areal average is a spatial average of all the precipitation data collected within a certain area, presented as a single dataset. This data is taken from the Western Regional Climate Center, available as a link off of the University of Minnesota Climate website (http://www.wrcc.dri.edu/spi/divplot1map.html).

Rainfall in the east-central region displays no statistically significant trend over the last 20 years. Though rainfall can vary in intensity and time of year, it would appear that east-central Minnesota precipitation has not changed dramatically over this 20-year time period.

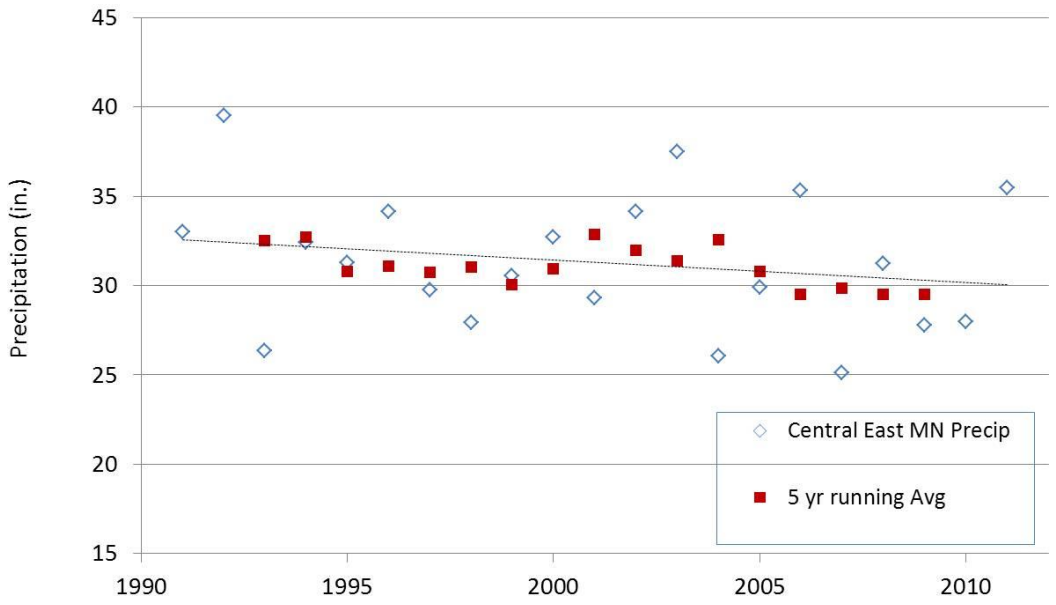

Figure 11. 20-year precipitation trend for east-central Minnesota with five year running average (1990-2011).

Precipitation in East-central Minnesota exhibits a statistically significant rising trend over the past 100 years, p = 0.001. This is a strong trend and matches similar trends throughout Minnesota (Figure 12).

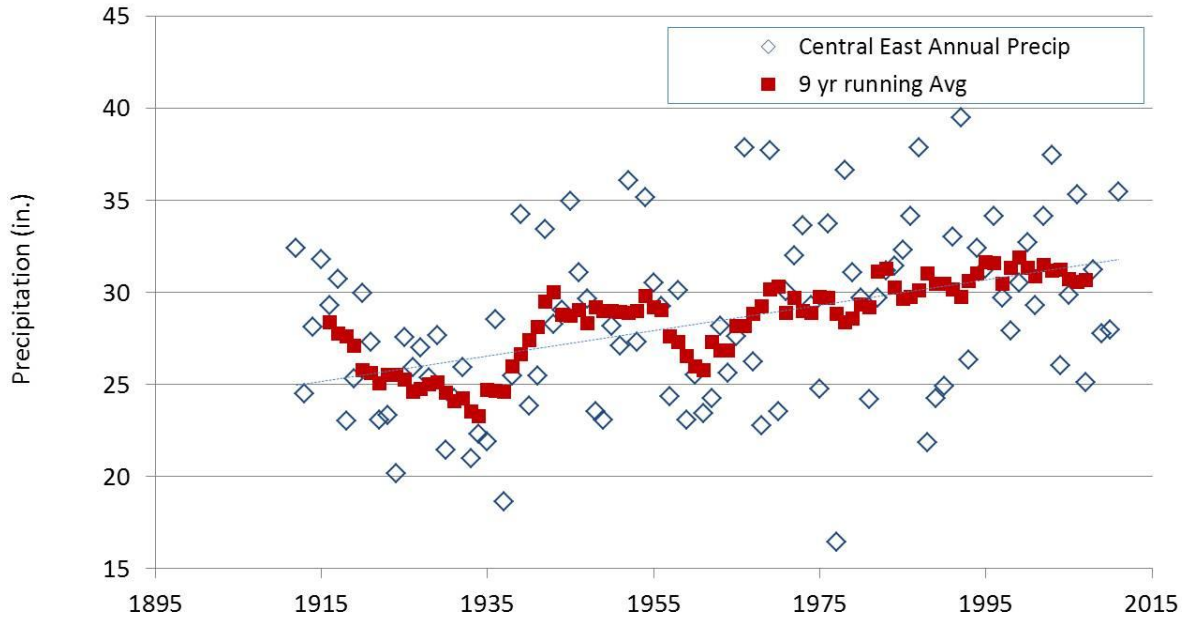

Figure 12. 100-year precipitation trend for east-central MN with nine year running average.

High capacity withdrawals

The Minnesota Department of Natural Resources (MDNR) permits all high capacity water withdrawals where the pumped volume exceeds 10,000 gallons per day or 1 million gallons per year. Permit holders are required to track water use and report back to the MDNR yearly. Information on the program and the program database are found at: http://www.dnr.state.mn.us/waters/watermgmt_section/appropriations/wateruse.html.

Displayed in Figure 13 are the locations of permitted groundwater and surface water withdrawals in the Mississippi River-Twin Cities Watershed. Blue symbols are groundwater withdrawals and red are surface water taken from lake, stream or other surface water feature.

The three largest permitted consumers of water in the state (in order) are municipalities, industry and irrigation. The withdrawals within the Mississippi River-Twin Cities Watershed are mostly municipal and industrial use.

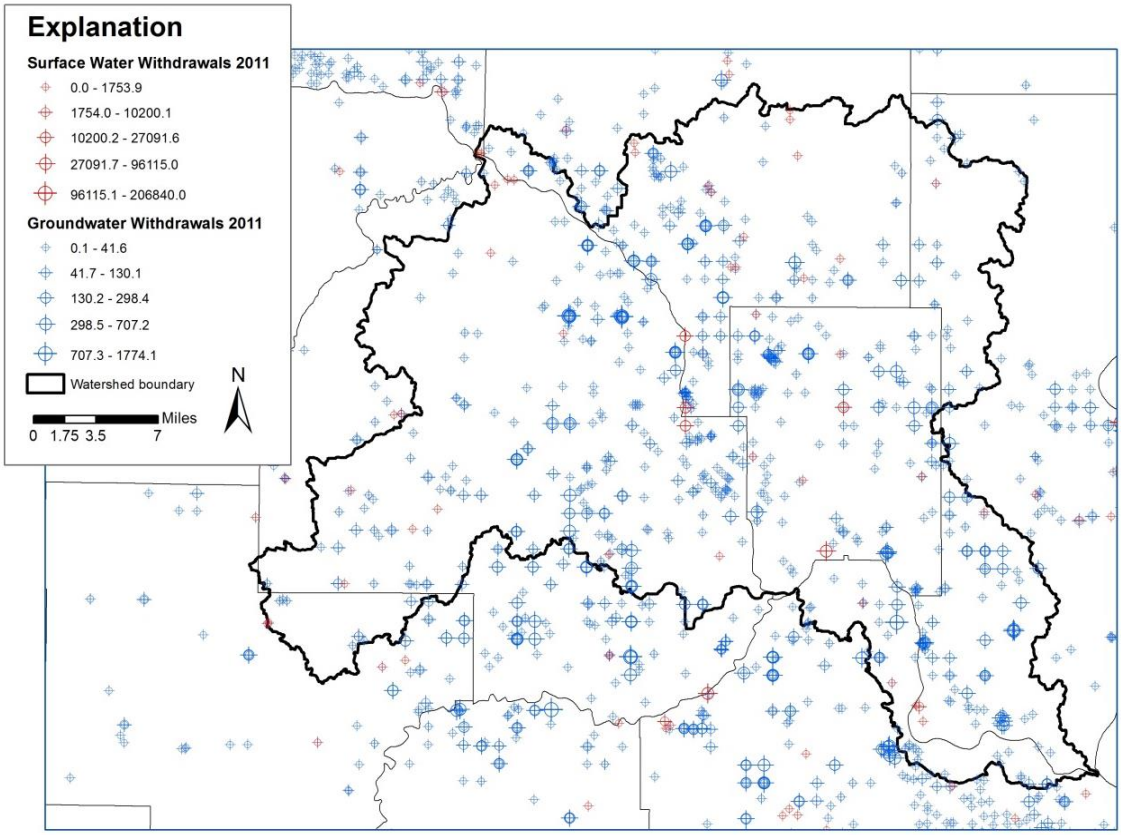

Figure 13. Locations of 2011 permitted groundwater and surface water withdrawals in the Mississippi River-Twin Cities Watershed and surrounding area. Units are in million gallons per year.

IV. Watershed-wide data collection methodology

Load monitoring

There is no load monitoring station that represents pollution inputs from the Mississippi River-Twin Cities Watershed since there is no discrete 8-HUC outlet on one major tributary to the Mississippi River, but instead many relatively small tributaries drain independently at different points along the Mississippi River. There are load monitoring stations on the Mississippi River in and around the Twin Cities operated by the Metropolitan Council in cooperation with the MPCA that are located at Anoka, Saint Paul and Hastings, but these stations capture flow and water chemistry data from a larger drainage area upstream of the Mississippi River-Twin Cities Watershed than is the focus of this report. A future report which focuses on the monitoring and assessment results along the Mississippi River is planned.

Stream water chemistry sampling

Six water chemistry stations were sampled from May through September in 2010, and again June through August of 2011, 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 subwatershed that was >40 mi^2 in area (green circles/triangles in Figure 2). Monitoring was completed using existing monitoring frameworks with local government units (watershed districts, water management organizations, etc.) and supplemented by MPCA collection (See Appendix 2 for locations of stream water chemistry monitoring sites. See Appendix 1 for definitions of stream chemistry analytes monitored in this study). A number of the subwatersheds were less than 40 mi^2, or contained the main stem Mississippi River; these subwatersheds did not have an outlet water chemistry station. The Mississippi River was not sampled as part of the watershed design and will not be included in the discussion in this report. A large river strategy for monitoring and assessment is under development and the Mississippi River will be included in that process.

Stream biological sampling

The biological monitoring component of the intensive watershed monitoring (IWM) in the Mississippi River-Twin Cities Watershed was completed during the summer of 2010. A total of 42 sites were sampled. Thirty-nine were IWM sites and an additional three sites were previously sampled sites, in order to compare results between time-periods. The IWM sites were placed near the outlets of most subwatersheds; 24 were newly established stations and 15 were existing stations. In addition, data from 18 existing biological monitoring stations that were sampled in previous years within the 10-year assessment window were included in the assessment process. These monitoring stations were initially established for biocriteria development, stressor identification of aquatic life impairments identified in previous assessment cycles, or as part of a 2007 survey which investigated the quality of channelized streams with intact riparian zones. While data from the last 10 years contributed to the watershed assessments, the majority of data utilized for the 2012 assessment was collected in 2010.

A total of 54 stream reaches (AUIDs) were sampled for biology in the Mississippi River-Twin Cities Watershed. Waterbody assessments to determine aquatic life use support were conducted for 17 AUIDs. Waterbody assessments were not conducted for five AUIDs where the biological station was close to a large body of water that may influence a stream assessment. Assessments were also not conducted for 32 AUIDs because criteria for channelized reaches had not been developed prior to the assessments; the biological condition of these reaches were assigned qualitative categories (good-fair-poor) using a lower threshold than what was used for determining aquatic life impairments for unchannelized reaches that were assessed. This information will be useful to the stressor identification process and will also be used as a basis for long term trend results in subsequent reporting cycles. Qualitative ratings for non-assessed reaches area included in Appendix 5.1.

To measure the health of aquatic life at each biological monitoring station, indices of biological integrity (IBIs), specifically fish and invertebrate 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 Invertebrate 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 4.1). IBI scores that are 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 and Appendix 5.

Wetland monitoring

The MPCA began biological monitoring of wetlands in the early 1990s, focusing on wetlands with emergent vegetation (i.e., marshes) in a depressional geomorphic setting. This work resulted in the development of plant and macroinvertebrate (aquatic bugs, snails, leeches, and crustaceans) IBIs for evaluating the ecological condition or health of this type of wetland habitat. Both IBIs are on a 0 to 100 scale with higher scores indicating better condition. Today, these indicators are used in a statewide survey of wetland condition where results can be summarized statewide and for each of Minnesota's ecoregions (Genet 2012). Depressional wetland condition results in this report are based on data from the statewide survey and earlier indicator development projects.

Lake water sampling

Lakes in the Mississippi River-Twin Cities Watershed were sampled primarily by local entities (watershed districts, water management organizations, etc.) and staff and volunteers through the Metropolitan Council Environmental Services (MCES). 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.

The aquatic recreation use standard requires eight observations/samples within a 10 year period for phosphorus, chlorophyll-a and Secchi depth. Additionally, lakes are also compared to the toxicity standard for chloride.

Fish contaminants

Mercury and polychlorinated biphenyls (PCBs) were analyzed in fish tissue samples collected from 78 lakes in the watershed. Minnesota DNR fisheries staff collected the fish. There are many fish tissue samples from the Mississippi River in the fish contaminant database, which will be summarized and discussed in a later report on large rivers in Minnesota. Bassett Creek is the only tributary in the Mississippi River-Twin Cities Watershed having had fish collected for contaminants.

In addition, fish from 39 lakes in the watershed were tested for perfluorochemicals (PFCs). PFCs became a contaminant of emerging concern in 2004 when high concentrations were measured in fish from the Mississippi River, Pool 2. Extensive statewide monitoring of lakes and rivers for PFCs in fish was continued through 2010. More focused monitoring for PFCs will continue in known contaminated waters in this Twin Cities watershed.

Captured fish were wrapped in aluminum foil and frozen until they were thawed, scaled, filleted, and ground. The homogenized fillets were placed in 125 mL glass jars with Teflon™ lids and frozen until thawed for mercury or PCBs analyses. The Minnesota Department of Agriculture Laboratory performed all mercury and PCBs analyses of fish tissue. For PFCs, whole fish were shipped to AXYS Analytical Services Ltd in Sidney, British Columbia, Canada. AXYS did the fish measurements and processing before

analyzing the tissue samples for 13 PFCs. The PFC that primarily bioaccumulates in fish and is a known health concern for human consumption is perfluorooctane sulfonate (PFOS).

The MPCA has included waters impaired for contaminants in fish on the 303d Impaired Waters List since 1998. Impairment assessment for PCBs and PFCs in fish tissue is based on the fish consumption advisories prepared by the Minnesota Department of Health (MDH). If the consumption advice is to restrict consumption of a particular fish species to less than a meal per week because of PCBs or PFCs, the MPCA considers the lake or river impaired. The threshold concentration for impairment (consumption advice of one meal per month) is 0.22 mg/kg for PCBs and 0.200 mg/kg for PFOS.

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

PCBs in fish have not been monitored as intensively as mercury in the last three decades due to monitoring completed in the 1970s and 1980s. These studies identified that high concentrations of PCBs were only a concern downstream of large urban areas in large rivers, such as the Mississippi River and in Lake Superior. This implied that it was not necessary to continue widespread frequent monitoring of smaller river systems as is done with mercury. However, limited PCB monitoring was included in the watershed sampling design to ensure that this conclusion is still accurate. Impairment assessment for PCBs 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 because of PCBs, the MPCA considers the lake or river impaired. The threshold concentration for impairment is 0.22 mg/kg PCBs and more restrictive advice is recommended for consumption (one meal per month).

Groundwater monitoring

Groundwater quality

The ambient 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. Figure 14 displays the locations of Ambient Groundwater Monitoring wells in and around the Mississippi River-Twin Cities Watershed.

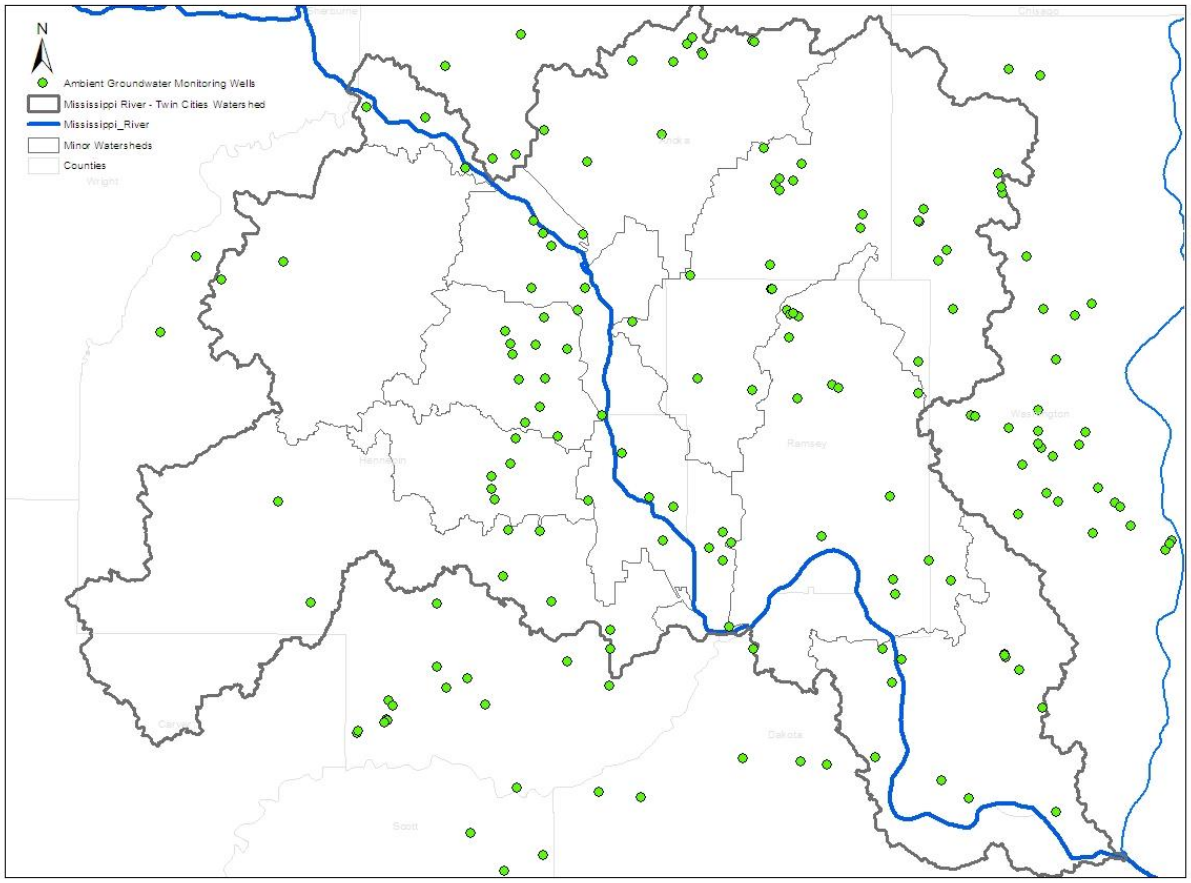

Figure 14. MPCA ambient groundwater monitoring wells in and around the Mississippi River-Twin Cities Watershed.

Groundwater quantity

Monitoring wells from the MDNR Observation Well Network track the elevation of groundwater across the state. Data from these wells and others are available at: http://www.dnr.state.mn.us/waters/groundwater_section/obwell/waterleveldata.html.

Individual subwatershed results

Subwatersheds

Assessment results for aquatic life and recreation use are presented for each subwatershed within the Mississippi River-Twin Cities Watershed. The primary objective is to portray all the full support and impairment listings within a 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 watershed restoration and protection strategies. The graphics presented for each of the subwatersheds contain the assessment results from the 2012 Assessment Cycle as well as any impairment listings from previous assessment cycles. Discussion of assessment results focuses primarily on the 2010 intensive watershed monitoring effort, but also considers available data from the last ten years.

MPCA assessment results on the AUIDs of the Mississippi River in Minnesota will be included in a large river report at a later date based on monitoring conducted in 2013-2014. This report will include condition and impairment information along the portion of the Mississippi River from headwaters to Lock and Dam #1 at St. Anthony Falls in Minneapolis. Below St. Anthony Falls the Mississippi River is considered a Great River that drains watersheds within more than one state and will require the development of specific water quality criteria for lock and dam systems. The monitoring and assessment for this lower portion of the Mississippi River will be conducted under the auspices of an interstate multiagency organization, the Upper Mississippi River Basin Association (UMBRA).

The following pages provide an account of each subwatershed. Each account includes a brief description of the subwatershed, and summary tables of the results for each of the following where applicable: a) stream aquatic life and aquatic recreation assessments, b) biological condition of channelized streams and ditches, c) stream habitat quality assessments, d) channel stability assessments, e) water chemistry for the subwatershed outlet and f) lake aquatic recreation assessments. Following the tables is a narrative summary of the assessment results and pertinent water quality projects completed or planned for the subwatershed. A brief description of each of the summary tables is provided below.

Stream assessments

A table is provided in each section summarizing aquatic life and aquatic recreation assessments of all accessible stream reaches within the watershed (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); these determinations were made during the desktop phase of the assessment process (see Figure 5). Assessments of aquatic life are derived from the analysis of biological (Fish and Invertebrate IBIs), dissolved oxygen, turbidity, chloride, pH 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). Stream reaches that do not have sufficient information for either an aquatic life or aquatic recreation assessment (from current or previous assessment cycles) are not included in these tables, but are included in Appendix 5.2 and Appendix 5.3. 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 subwatershed as well as in the Watershed-Wide Results and Discussion section.

Channelized stream evaluations

Biological criteria have not been developed yet for channelized streams and ditches, therefore, assessment of fish and macroinvertebrate community data for aquatic life use support was not possible at some monitoring stations. A separate table provides a narrative rating of the condition of fish and macroinvertebrate communities at such stations based on IBI results. Evaluation criteria are based on aquatic life use assessment thresholds for each individual IBI class (see Appendix 4.1). IBI scores above this threshold are given a "good" rating, scores falling below this threshold by less than ~15 points (i.e., value varies slightly by IBI class) are given a "fair" rating, and scores falling below the threshold by more than ~15 points are given a "poor" rating. For more information regarding channelized stream evaluation criteria refer to Appendix 5.1.

Stream habitat results

Habitat information documented during each fish sampling visit is provided in each subwatershed section. These tables 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 subwatershed.

Stream stability results

Stream channel stability information evaluated during each invertebrate sampling visit is provided in each subwatershed section. These tables display the results of the Channel Condition and Stability Index (CCSI) which rates the geomorphic stability of the stream reach sampled for biology. This may provide an indication of recent stream channel geomorphic changes and loss of habitat quality, which may be related to changes in watershed hydrology, stream gradient, sediment supply, or sediment transport capacity. The CCSI score is comprised of three scoring zones associated with three different areas of the stream channel (upper banks, lower banks, and substrate). Within each zone, individual metrics are rated and summed and both the zone and total scores are included in the 11HUC tables. The CCSI total score range is from 14 to 148 where higher scores indicate greater channel instability. The final row in each table displays the average CCSI scores and a rating for the subwatershed. The CCSI was recently implemented in 2008, and is collected once at each biological station. Consequently, the CCSI ratings are only available for biological visits sampled in 2010 or later.

Subwatershed outlet water chemistry results

These summary tables display the water chemistry results for the monitoring station representing the outlet of the subwatershed. This data along with other data collected within the 10 year assessment window can provide valuable insight on water quality characteristics and potential parameters of concern within the subwatershed. Parameters included in these tables are those most closely related to the standards or expectations used for assessing aquatic life and recreation.

Lake assessments

A summary of lake water quality is provided in the subwatershed sections where available data exists. Morphometric data and the assessment results for all lakes in the watershed are available in Appendix 3.2. Lake modeling results can be found in Appendix 6.2. For lakes with active watershed districts or management organizations, links are included to more comprehensive plans available by smaller governing units.

Mississippi (Direct) - Champlin Subwatershed HUC 7010206810

Mississippi (Direct) - Champlin Subwatershed is the smallest subwatershed, draining 17.8 mi^2. The subwatershed land area stretches northwest from the City of Champlin. The Mississippi River runs through the center of the subwatershed, and serves as the border separating Anoka and Hennepin Counties. A few small lakes, streams, and wetlands dot the watershed. Open water, wetlands, and forest land comprise 24% of the subwatershed area, while agricultural land (crop and range) make up 39%, and developed land for housing and roads cover 37%. Three local watershed management organizations have jurisdiction within this small subwatershed: the Lower Rum River Watershed Management Organization on the north side of the Mississippi River, and Elm Creek Watershed Management Commission and West Mississippi Watershed Management Commission on the south side of the river. Since there are no tributary streams > 40 mi^2 in this subwatershed, there is no intensive water chemistry collection station.

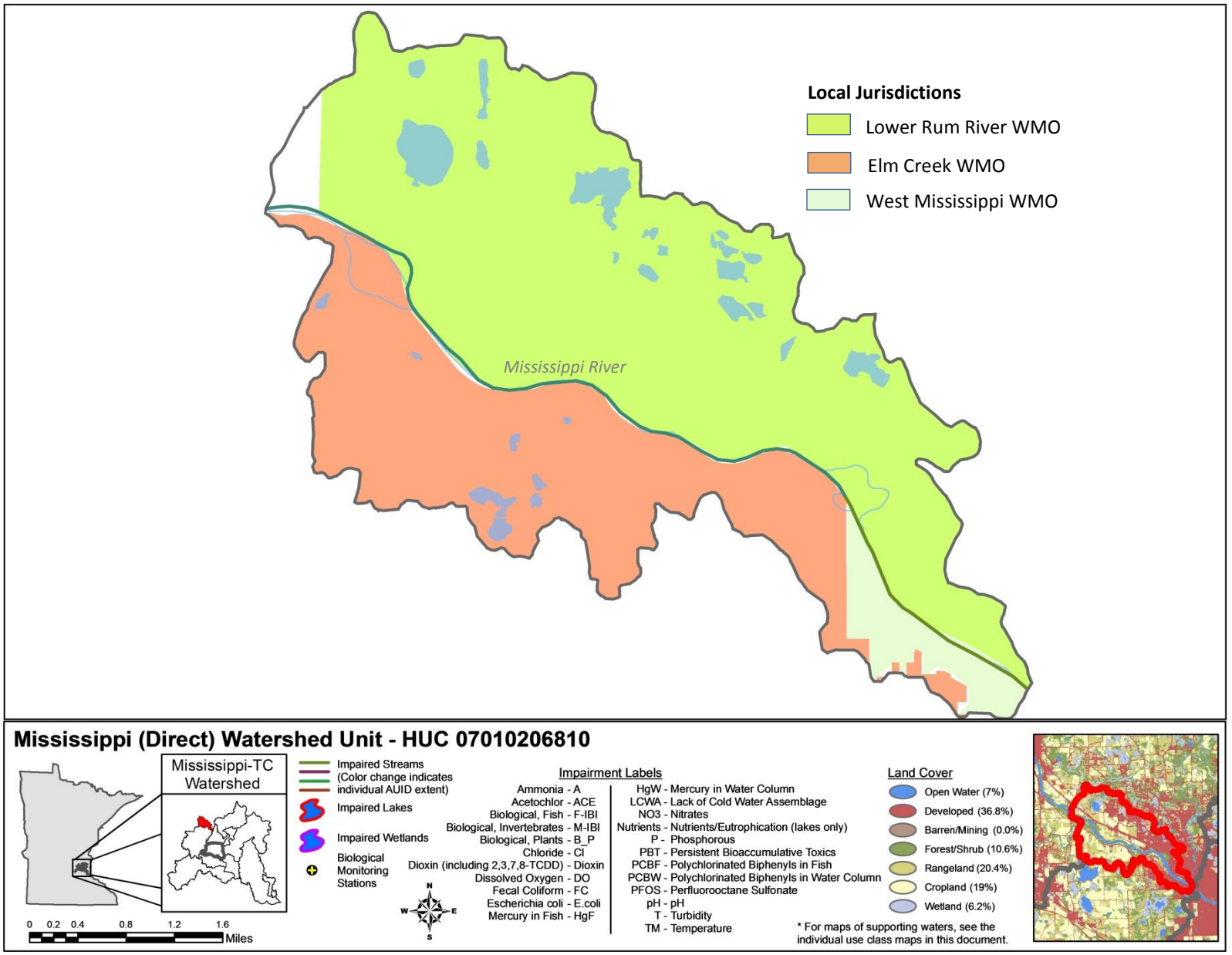

Figure 15. Waterbodies, local watershed organizations and land use characteristics (inset) in Mississippi (Direct)-Champlin Subwatershed.

Elm Creek Subwatershed HUC 7010206820

The Elm Creek Subwatershed drains 106 mi^2 in Hennepin County and includes the cities of Medina, Hamel, Corcoran, and the west side of Maple Grove. Recreational amenities in the subwatershed include Weaver Lake, Sylvan Lake, the Elm Creek Park Reserve and Fish Lake Regional Park. According to the most recently available land cover data (NLCD 2006), agriculture is the dominant land use at 54%, developed land comprises 21%, while undeveloped land (forest, wetland, open water) covers 25%. The subwatershed is under the jurisdiction of the Elm Creek Watershed Management Commission. The intensive water chemistry collection station is at the outflow of Elm Creek just southwest of Dayton (STORET/EQuIS station: S004-222, biological station: 10EM167).

Table 2. Aquatic life and recreation assessments on stream reaches: Elm Creek Subwatershed.

Local Jurisdiction	AUID *Reach Name* *Reach Description*	Reach Length (miles)	Use Class	Biological Station ID	Location of Biological Station	Aquatic Life Indicators: Fish IBI	Invert IBI	Dissolved Oxygen	Turbidity	Chloride	pH	NH_3	Pesticides	Bacteria	Aquatic Life	Aquatic Rec.
ECWMC	***07010206-525*, Diamond Creek**, Headwaters (French Lk 27-0127-00) to Unnamed lk	5.9	2B	10UM008	Downstream of 129th Ave N, 1.5 mi. W of Dayton	EXS	EXP	EXS	MTS	MTS	MTS	MTS	--	EX	NS	NS
ECWMC	***07010206-760*, Rush Creek, South Fork,** Unnamed ditch to County Ditch 16	0.5	2B	10UM014	Upstream of CR 10, 1.5 mi. N W of Corcoran	EXS	EXP	IF	MTS	--	MTS	--	--	--	NS	NA
ECWMC	***07010206-732*, Rush Creek, South Fork**, Unnamed lk (27-0439-00) to Rush Cr	4.2	2B	10UM011	Upstream of 101st Ave N, in Maple Grove	EXS	EXS	EXS	MTS	--	MTS	MTS	--	EX	NS	NS
ECWMC	***07010206-528*, Rush Creek,** Headwaters to Elm Cr	16.9	2B	99UM081	Adjacent to Fenbrook Ln, in Elm Creek Park Reserve Group Camp, Maple Grove.	EXS	EXS	EXS	MTS	--	MTS	--	--	EX	NS	NS
ECWMC	***07010206-508*, Elm Creek,** Headwaters (Lk Medina 27-0146-00) to Mississippi R	21.1	2B	10EM167	0.5 mi. upstream of Elm Creek Rd, 2 mi. NW of Osseo	EXS	EXP	EXS	MTS	EXS	MTS	MTS	IF	EX	NS	NS

ECWMC = Elm Creek Watershed Management Commission

Abbreviations for Indicator Evaluations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **MTS** = Meets criteria; **EXP** = Exceeds criteria, potential impairment; **EXS** = Exceeds criteria, potential severe impairment; **EX** = Exceeds criteria (Bacteria).

Abbreviations for Use Support Determinations: **NA** = Not Assessed, **IF** = Insufficient Information, **NS** = Non-Support, **FS** = Full Support

Key for Cell Shading: = existing impairment, listed prior to 2012 assessment; = new impairment, identified during 2012 assessment; = full support of designated use.

Table 3. Non-assessed biological stations on channelized AUIDs: Elm Creek Subwatershed.

Local Jurisdiction	AUID ***Reach Name***, *Reach Description*	Reach length (miles)	Use Class	Biological Station ID	Location of Biological Station	Fish IBI	Invert IBI
ECWMC	***07010206-761*, County Ditch 16,** Unnamed ditch to S Fk Rush Cr	2.9	2B	10UM013	Upstream of CR 10, 1 mi. N W of Corcoran	Poor	Poor
ECWMC	***07010206-528*, Rush Creek,** Headwaters to Elm Cr	16.9	2B	07UM097	Upstream of CR 117, 4 mi. E of Hanover	Poor	Poor (2)
ECWMC	***07010206-508*, Elm Creek,** Headwaters (Lk Medina 27-0146-00) to Mississippi R	21.1	2B	10UM034 10UM035 10UM009	Upstream of Sioux Dr, in Hamel Upstream of Elm Rd, in Maple Grove Downstream of Territorial Rd, 1 mi. NW of Osseo	Poor (4)	Fair (3)

ECWMC = Elm Creek Water Management Commission
See Appendix 5.1 for clarification on the good/fair/poor thresholds and Appendix 5.2 and Appendix 5.3 for IBI results.
Parentheses behind ratings indicate the quantity of site visits when >1, which may or may not occur in the same year.

Table 4. Minnesota Stream Habitat Assessment (MSHA) Elm Creek Subwatershed.

Local Jurisdiction	# 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
ECWMC	1	10UM013	County Ditch 16	0	7.5	8	6	9	30.5	Poor
ECWMC	1	10UM008	Diamond Creek	5	13	10.8	15	20	63.8	Fair
ECWMC	1	10UM014	Rush Creek, South Fork	0	10	7	13	8	38	Poor
ECWMC	1	10UM011	Rush Creek, South Fork	0	10	10.8	16	26	62.8	Fair
ECWMC	1	07UM097	Rush Creek	2	13	9	14	17	55	Fair
ECWMC	1	99UM081	Rush Creek	3.5	11.5	13.4	13	24	65.4	Fair
ECWMC	1	10UM034	Elm Creek	2	8	15.9	17	28	70.9	Good
ECWMC	2	10UM035	Elm Creek	2.5	8	10.4	11.5	16.5	48.9	Fair
ECWMC	1	10UM009	Elm Creek	3.5	10	10	15	20	58.5	Fair
ECWMC	1	10EM167	Elm Creek	4.3	12	16.5	12	17	61.8	Fair
			Average Habitat Results: *Elm Creek Subwatershed*	**2.3**	**10.3**	**11.2**	**13.3**	**18.6**	**55.5**	**Fair**

ECWMC = Elm Creek Water Management Commission

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)

Table 5. Channel Condition and Stability Assessment (CCSI): Elm Creek Subwatershed

Local Jurisdiction	# Visits	Biological Station ID	Stream Name	Upper Banks (4-43)	Lower Banks (5-46)	Substrate (3-37)	Channel Evolution (1-11)	CCSI Score (13-137)	CCSI Rating
ECWMC	1	10UM013	County Ditch 16	14	13	13	5	45	Fairly stable
ECWMC	1	10UM008	Diamond Creek	6	18	26	3	43	Fairly stable
ECWMC	1	10UM014	Rush Creek, South Fork	8	13	13	5	39	Fairly stable
ECWMC	1	10UM011	Rush Creek, South Fork	18	32	27	3	80	Moderately unstable
ECWMC	1	07UM097	Rush Creek	4	9	6	2	21	Stable
ECWMC	1	99UM081	Rush Creek	24	5	8	3	40	Fairly stable
ECWMC	1	10UM034	Elm Creek	17	7	13	3	40	Fairly stable
ECWMC	1	10UM035	Elm Creek	20	25	14	3	62	Moderately unstable
ECWMC	1	10UM009	Elm Creek	6	14	15	4	39	Fairly stable
ECWMC	1	10EM167	Elm Creek	13	18	8	5	44	Fairly stable
Average Stream Stability Results: *Elm Creek Subwatershed*				**12.9**	**15.7**	**14.4**	**3.4**	**45.3**	**Fairly stable**

ECWMC = Elm Creek Water Management Commission

Qualitative channel stability scores and ratings (Higher scores indicate greater channel instability)

= Stable: CCSI < 27 = Fairly stable: 27 < CCSI < 45 = Moderately unstable: 45 < CCSI < 80 = Severely unstable: 80 < CCSI < 115 = Extremely unstable: CCSI > 115

Table 6. Outlet water chemistry results: Elm Creek Subwatershed.

Station location:	**Elm Creek at Elm Creek Rd, 1 mi. SW of Dayton**
STORET/EQuIS ID:	**S004-222**
Station #:	**10EM167**
Local Jurisdiction:	**Elm Creek Watershed Management Commission**

Parameter	Units	# of Samples	Minimum	Maximum	Mean	Median	WQ Standard1	# of WQ Exceedances
Ammonia-nitrogen	mg/L	20	< 0.5	0.5	0.5	0.5		
BOD	mg/L	20	< 2	2.5	2.045	2		
Chloride	mg/L	22	36	98	65.7	66	230	0
Chlorophyll-a, Corrected	ug/L	2	5	5	5	5		
Dissolved Oxygen	mg/L	37	2.3	12.5	6.4	5.88	5	9
Escherichia coli[1,2]	MPN/100ml	30	16	579	77	68	1260	0
NO2NO3	mg/L	9	< 0.1	0.1	0.1	0.1		
Kjeldahl nitrogen	mg/L	--	--	--	--	--		
Orthophosphate	ug/L	22	59	639	211	198		
pH	SU	20	7.27	7.91	7.6	7.6	6.5-9	0
Phosphorus	ug/L	22	84	839	315	299		
Specific Conductance	uS/cm	37	437	651	530	526		
Temperature, water	deg °C	37	5.49	25.96	18.4	19.5		
Total suspended solids	mg/L	20	< 2	17	6.7	5.6		
Total volatile solids	mg/L	19	< 4	8	4.5	4		
Transparency tube	60 cm	--	--	--	--	--	>20	--

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

2 # WQ exceedances represents exceedances of individual maximum standard for *E. coli* (1260 cfu/100 ml).

****Data found in the table above was compiled using the results from data collected at the outlet monitoring station in the Elm Creek subwatershed, a component of the IWM work conducted between May and September in 2010 and 2011. This specific data does not reflect all data that was used to assess the AUID.**

Table 7. Lake morphometric and assessment data for the Elm Creek Subwatershed (07010206-820).

Local Jurisdiction[1]	Lake ID	Lake Name	Trophic Status[2]	Lake Area (ha)	% Littoral	Max Depth (m)	Mean Depth (m)	Trend[3]	Mean TP (ug/L)	Mean Chl-a (ug/L)	Mean Secchi (m)	Aquatic Recreation Use Support[4]	Aquatic Life Use Support[5]	Aquatic Consumption Use Support[6]
ECWMC	27-0061-00	Champlin Mill Pond	H	15	100	3.2	1.0	IF	306	9.8	1.8	IF	NA	NA
ECWMC	27-0066-00	Lemans	--	40	--	--	--	--	--	--	--	--	--	--
ECWMC	27-0112-00	Mud	--	65	--	--	1.0	IF	--	--	--	--	--	--
ECWMC	27-0116-01	Rice (Main)	H	124	100	3.4	1.7	D	336	95.8	0.9	NS	NA	NA
ECWMC	27-0116-02	Rice (West Bay)	H	13	100	3.4	0.5	IF	221	24.5	1.4	NS	IF	NA
ECWMC	27-0117-00	Weaver	E	64		17.4	6.3	N	36	16.8	2.8	FS	IF	NS
ECWMC	27-0118-00	Fish	E	119	45	18.6	6.2	D	48	27.6	1.3	NS	NA	NS
ECWMC	27-0120-02	Cook (South Portion)	--	6	--	6.1	2.1	IF	--	--	--	--	--	--
ECWMC	27-0121-00	Edward	--	11	--	--	--	--	--	--	--	--	--	--
ECWMC	27-0122-00	Goose	--	34	--	--	1.0	IF	--	--	--	--	--	FS
ECWMC	27-0125-00	Diamond	H	184	100	2.4	1.7	I	187	73.2	0.7	NS	IF	NA
ECWMC	27-0127-00	French	H	148	--	--	0.9	I	262	147.5	0.4	NS	IF	NA
ECWMC	27-0128-00	Hayden	--	162	--	--	--	--	--	--	--	--	-	--
ECWMC	27-0129-00	DuBay	--	7	--	--	0.6	IF	--	--	--	--	--	--
ECWMC	27-0130-00	Powers	--	65	--	--	--	--	--	--	--	--	--	FS
ECWMC	27-0165-00	Jubert	--	101	76	12.5	--	IF	--	--	--	--	--	--
ECWMC	27-0175-00	Henry	H	29	100	1.5	1.0	IF	171	39.5	0.8	NS	NA	--

1. ECWMC = Elm Creek Water Management Commission
2. H = hypereutrophic, E = eutrophic, M = mesotrophic, O = oligotrophic,-- not assigned
3. IF = Insufficient information, N = no trend, I = improving trend, D = declining trend, -- not determined
4. NS = not supporting, FS = supporting, IF = insufficient information to determine support, NA = not assessed (too small or wetland-like), -- no data
5. NS = not supporting, IF = insufficient information to determine support or meeting chloride standard, NA = not assessed, -- no data
6. NS = not supporting, FS = supporting, NA = not assessed, -- no data

Key for Cell Shading: = existing impairment, listed during 2012 reporting cycle; = new impairment; = full support of designated use.

Summary

Stream assessment results

Chemistry data were available from Rush Creek, South Fork of Rush Creek, Diamond Creek and Elm Creek. Bacteria data is highly variable on all AUIDs with data; values ranged from single digit counts to greater than the reporting limit of 2420 individuals per 100 ml. On many of the AUIDs both the geometric mean and individual standards were exceeded, with impairments assigned on all four creeks. Dissolved oxygen levels sometimes in concentrations less than 1 mg/L were found throughout the watershed, and impairments were assigned on Rush, Diamond and Elm Creeks. In the case of the South Fork of Rush Creek values for dissolved oxygen were low, but likely wetland-influenced due to the station location, and a formal listing was not made.

Of the five AUIDs assessed for aquatic life, all are not supporting fish and invertebrates. Elm Creek (07010206-508) is a low gradient stream in the northwest metro that was determined to be impaired for aquatic life use in 2004 based on low dissolved oxygen levels. Biological monitoring data from 2010 confirm this impairment with low fish and macroinvertebrate IBI scores at several sampling stations. The macroinvertebrate data was assessed using an IBI developed specifically for low gradient streams in the central hardwood forests ecoregion. Low gradient streams typically lack rock habitat with adequate flow to sample in contrast to higher gradient streams where rock substrate with flow supports a wider range of macroinvertebrate clinger taxa. Hence, the lower IBI scores found on Elm Creek are more likely indicative of a biological stress rather than differences in the macroinvertebrate community related to habitat availability. Site 10UM009 had an extremely low dissolved oxygen reading (0.78 mg/l) during fish sampling indicating that dissolved oxygen is a potential stressor. Many dead fish were also observed during the 2010 visit. Elm Creek flows through or drains (naturally or via channelization) a large number of wetlands throughout its watershed, potentially contributing to its low dissolved oxygen condition. Urban development in this watershed is also potentially impacting aquatic life in Elm Creek as evidenced by the chloride impairment, high nutrient concentrations in the creek as well as several lakes in the watershed, and high suspended solid concentrations at the outlet of Rice Lake.

Rush Creek (07010206-528) is a tributary to Elm Creek that also has impaired aquatic life. This stream was first included on the 2002 Impaired Waters List based on an assessment of the fish community, which was dominated by central mudminnows and green sunfish that are tolerant of low dissolved oxygen conditions. In 2010, low dissolved oxygen was added as an impairment. During the 2012 assessment, biological monitoring data collected in 2010 indicate that this stream is still impaired for aquatic life (fish) use and, in addition, macroinvertebrate bio assessment was added as an impairment. Macroinvertebrate IBI scores are particularly low (15 and 6, threshold 47) at a station further up in the watershed (07UM097) which represents a channelized section of the creek that was historically wetland habitat. The impaired status of the macroinvertebrate community at this site is likely resulting from a combination of factors in this dredged channel: low flow, low dissolved oxygen, anoxic substrates and lack of hard substrates. Fish community quality was also rated poor (24, threshold 40) using an IBI developed for low-gradient streams. Downstream at 99UM081, where the creek has more stream than wetland characteristics, the macroinvertebrate community appears to be in better condition with an IBI score of 43 (threshold 47). The fish community was rated fair using and IBI developed for headwater streams. Habitat quality was rated fair and channel stability fairly stable. Habitat characteristics include good depth and flow variability with deep pools and riffle habitat with gravel substrates. Despite the improved habitat at this site located within Elm Creek Park Reserve, low dissolved oxygen concentrations stemming from sources upstream are potentially impacting the

macroinvertebrate and fish communities here as well. The fish community at 99UM081 was dominated by low-dissolved oxygen tolerant mudminnows but still had a good diversity of fish species, although many species were represented by only a few individuals.

Two other streams within the Elm Creek subwatershed have impaired aquatic life according to assessments of both fish and macroinvertebrate community data. The South Fork Rush Creek (07010206-732 & 07010206-760) and Diamond Creek (07010206-525) both have macroinvertebrate communities dominated by pollution tolerant organisms, suggesting that nutrients and low dissolved oxygen are key stressors to aquatic life in these streams as well. Few fish were collected (less than twenty-five individuals) on both stations on the South Fork Rush Creek (10UM011 & 10UM014). Individuals present were tolerant or moderately tolerant of low-dissolved oxygen conditions. One time measurements of dissolved oxygen taken midmorning and afternoon (3.5 mg/L and 5.6 mg/L) suggest that dissolved oxygen is a potential stressor. In addition, habitat quality was rated fair to poor, with moderate to severe bank instability, moderate channel instability, and silt present in pools and runs. This may indicate a potential hydrologic stress as well. Few fish were also collected on Diamond Creek (10UM008) and were mostly tolerant individuals. Dissolved oxygen was low (3.8 mg/L) and phosphorus was high (1.38 mg/L) indicating a potential biological stress due to excess nutrients. In addition, habitat quality at this station was rated fair with silt moderately embedding gravel in run habitat which may also be limiting the biological community.

Lake assessment results

Four lakes have been assessed for fish aquatic consumption. Of those, two were determined to be non support (Weaver, Fish) while two were assessed as supporting (Goose, Powers). Seven of the 16 lakes in the Elm Creek subwatershed were assessed for aquatic recreation use support. Weaver Lake is meeting the eutrophication standard and fully supporting recreation use. Rice (West Bay) (27-0116-02) was determined to be impaired for aquatic recreation use. In total, six lakes are considered to be impaired for recreation use due to excess phosphorus (Table 7). Although impaired, Diamond and French lakes are exhibiting an improving trend in Secchi transparency. In contrast, Rice and Fish lakes are experiencing a declining trend in Secchi transparency.

Water quality plans, projects, and TMDLs

A watershed restoration and protection strategy (WRAPS) is currently under development by local partners for MPCA. To view approved and underway TMDL projects for impaired waters in this watershed visit http://www.pca.state.mn.us/qzqha1b and http://www.pca.state.mn.us/index.php/water/water-types-and-programs/minnesotas-impaired-waters-and-tmdls/tmdl-projects/upper-mississippi-river-basin-tmdl/upper-mississippi-river-basin-tmdls.html. The local watershed management plan can be viewed at http://elmcreekwatershed.org.

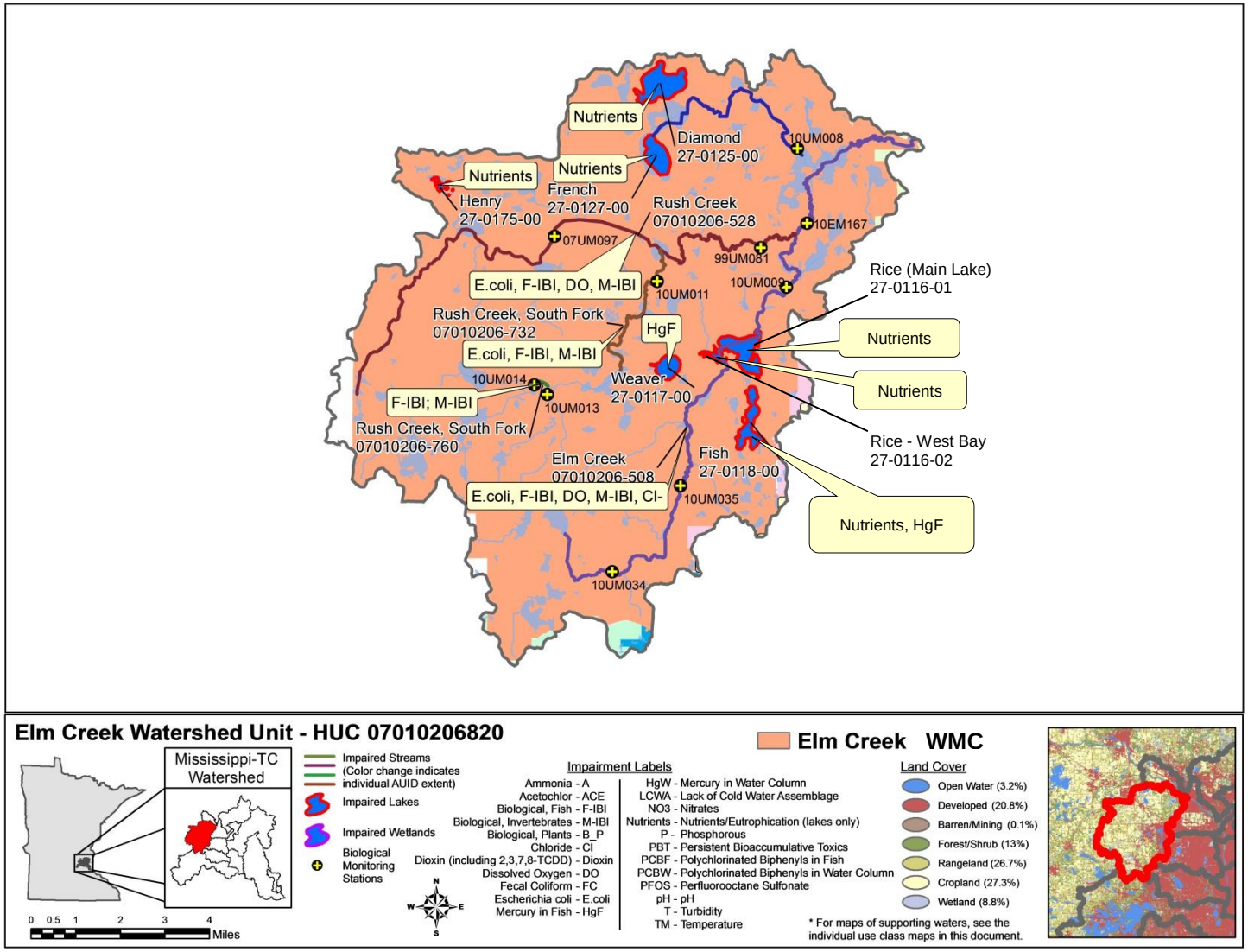

Figure 16. Currently listed impaired waters by parameter and land use characteristics (inset) in the Elm Creek Subwatershed.

Osseo Subwatershed HUC 7010206830

The Osseo Subwatershed lies just south of the Mississippi (Direct)-Champlin (HUC 07010206810) unit and includes the cities of Coon Rapids in Anoka County, and Osseo and the east side of Champlin in Hennepin County. The Mississippi River runs through the center of the subwatershed and divides the two counties. Land area draining to the Mississippi River is 35 mi^2. Land use is largely developed (71%) with some agricultural land (17%), while the remainder is forest, wetlands and open water (14%). The Mississippi River is the largest waterbody, while only a few small ponds and unnamed lakes dot the watershed. A prominent park is the Coon Rapids Dam Regional Park. Five watershed management organizations cover the subwatershed: West Mississippi, Coon Creek, Elm Creek, Lower Rum River and Shingle Creek. There are only a few small streams (< 5 mi^2) that flow directly into the Mississippi River; hence, no intensive water chemistry station was established.

Table 8. Aquatic life and recreation assessments on stream reaches: Osseo Subwatershed.

Local Jurisdiction	AUID *Reach Name* *Reach Description*	Reach Length (miles)	Use Class	Biological Station ID	Location of Biological Station	Aquatic Life Indicators: Fish IBI	Invert IBI	Dissolved Oxygen	Turbidity	Chloride	pH	NH_3	Pesticides	Bacteria	Aquatic Life	Aquatic Rec.
CCWD	***07010206-594*, unnamed ditch,** Headwaters to Mississippi R	3.7	2B	00UM062	Downstream of CR 1 (East River Rd), in Coon Rapids	--	--	EXP	MTS	MTS	MTS	--	--	EX	NA	NS

Abbreviations for Indicator Evaluations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **MTS** = Meets criteria; **EXP** = Exceeds criteria, potential impairment; **EXS** = Exceeds criteria, potential severe impairment; **EX** = Exceeds criteria (Bacteria).

Abbreviations for Use Support Determinations: **NA** = Not Assessed, **IF** = Insufficient Information, **NS** = Non-Support, **FS** = Full Support

Key for Cell Shading: = existing impairment, listed prior to 2012 assessment; = new impairment, identified during 2012 assessment; = full support of designated use.

Table 9. Minnesota Stream Habitat Assessment (MSHA): Osseo Subwatershed.

Local Jurisdiction	# 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
CCWD	1	00UM062	Unnamed ditch	0.5	12.5	18.1	9	19	59.1	Fair
			Average Habitat Results: *Osseo Subwatershed*	**0.5**	**12.5**	**18.1**	**9**	**19**	**59.1**	**Fair**

CCWD = Coon Creek Watershed District

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)

Table 10. Channel Condition and Stability Assessment (CCSI): Osseo Subwatershed

Local Jurisdiction	# Visits	Biological Station ID	Stream Name	Upper Banks (4-43)	Lower Banks (5-46)	Substrate (3-37)	Channel Evolution (1-11)	CCSI Score (13-137)	CCSI Rating
CCWD	0	00UM062	Unnamed ditch	--	--	--	--	--	--
Average Stream Stability Results: *Osseo Subwatershed*				**--**	**--**	**--**	**--**	**--**	**--**

CCWD = Coon Creek Watershed District

Qualitative channel stability scores and ratings (Higher scores indicate greater channel instability)

= Stable: CCSI < 27 = Fairly stable: 27 < CCSI < 45 = Moderately unstable: 45 < CCSI < 80 = Severely unstable: 80 < CCSI < 115 = Extremely unstable: CCSI > 115

-- No data. This station was sampled prior to CCSI data collection.

Table 11. Lake morphometric and assessment data for the Osseo Subwatershed (07010206-830).

Local Jurisdiction[1]	Lake ID	Lake Name	Trophic Status[2]	Lake Area (ha)	% Littoral	Max Depth (m)	Mean Depth (m)	Trend[3]	Mean TP (ug/L)	Mean Chl-a (ug/L)	Mean Secchi (m)	Aquatic Recreation Use Support[4]	Aquatic Life Use Support[5]	Aquatic Consumption Use Support[6]
CCWD	02-0654-00	Unnamed (Cenaiko)	M	1	--	11.0	3.7	N	16	2.4	2.5	FS	NA	NA

1. CCWD = Coon Creek Watershed District
2. H = hypereutrophic, E = eutrophic, M = mesotrophic, O = oligotrophic
3. IF = Insufficient information, N = no trend, I = improving trend, D = declining trend
4. NS = not supporting, FS = supporting, IF = insufficient information to determine support, NA = not assessed (too small or wetland-like)
5. NS = not supporting, IF = insufficient information to determine support or meeting chloride standard, NA = not assessed
6. NS = not supporting, FS = supporting, NA = not assessed

Summary

Stream assessment results

Assessment data were available from an Unnamed ditch (AUID 07010206-594) that drains from just northeast of Pleasure Creek Pond to the southwest directly to the Mississippi River near the Minnesota Highway 610 overpass. Bacteria exceeded the standard on this reach and it is considered to be impaired for aquatic recreation use. One biological station (00UM061) was previously assessed in 2006 and determined to be impaired for aquatic life use for aquatic macroinvertebrates. In 2011, due to a recent update to the IBI, the aquatic macroinvertebrate community was rescored using the new criteria and the existing impairment was confirmed. Fish were collected but not assessed in 2006 due to the station being close to a large body of water (Mississippi River) and the potential for large river species to uncharacteristically influence the IBI metrics developed for headwater streams.

Lake assessment results

Unnamed (Cenaiko) Lake, in the Coon Rapids Dam Regional Park, is the sole lake in the Osseo Subwatershed. The lake is meeting recreation uses and is not exhibiting a trend in Secchi transparency. It is a designated trout lake; it is stocked annually with brown trout. As a designated trout lake, it is subject to a more restrictive eutrophication standard. This resource has very high water quality and should be considered for protection efforts.

Water quality plans, projects, and TMDLs

Part of this watershed was formerly under the jurisdiction of the Six Cities Water Management Organization and now is locally regulated by the Coon Creek Watershed District. A watershed restoration and protection strategy (WRAPS) is currently under development by local partners for MPCA. To view approved and underway TMDL projects for impaired waters in this watershed visit http://www.pca.state.mn.us/index.php/water/water-types-and-programs/minnesotas-impaired-waters-and-tmdls/tmdl-projects/upper-mississippi-river-basin-tmdl/upper-mississippi-river-basin-tmdls.html. A comprehensive plan is available describing local efforts at www.cooncreekwd.org.

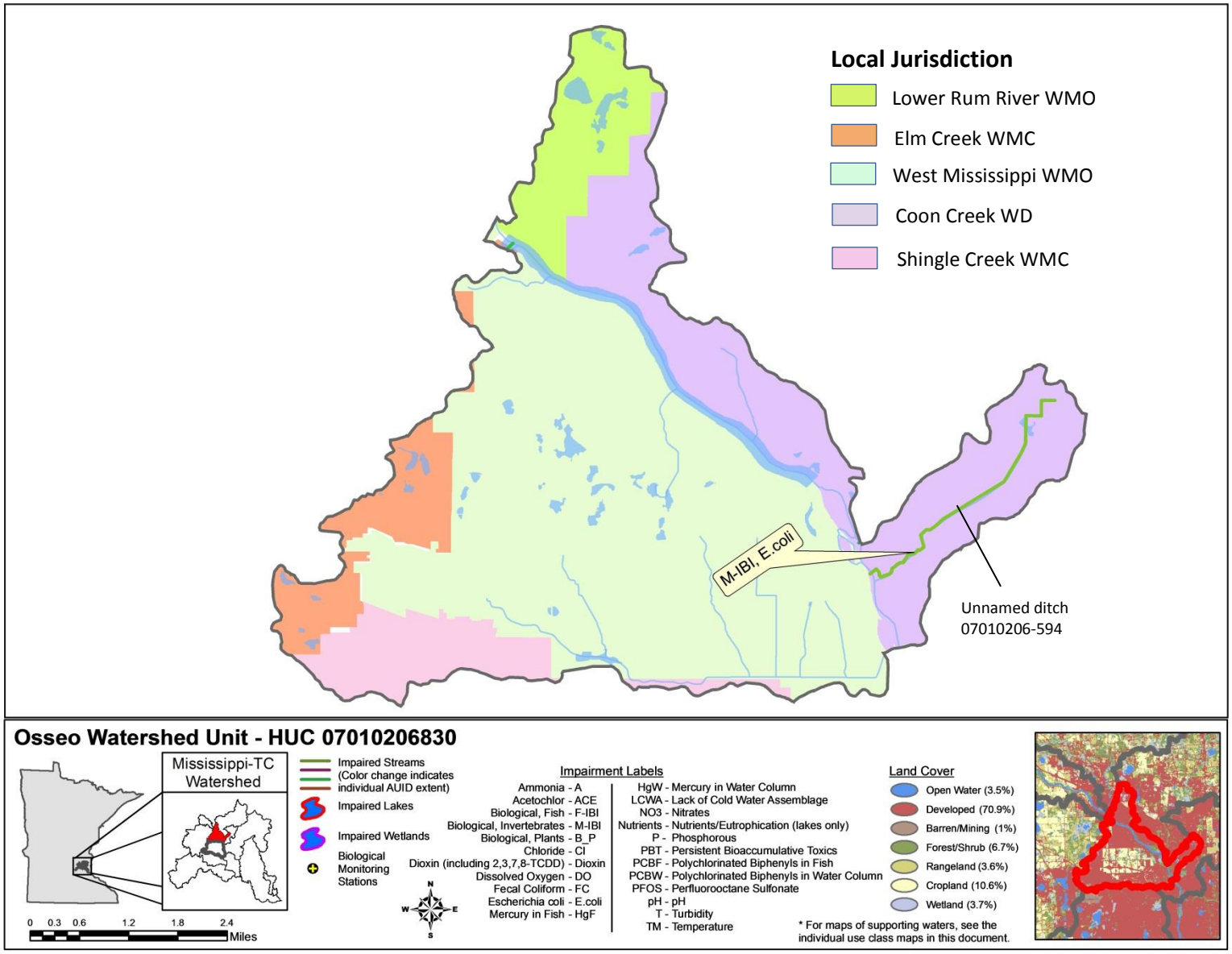

Figure 17. Currently listed impaired waters, local watershed organizations and land use characteristics (inset) in the Osseo Subwatershed.

Sand Creek Subwatershed HUC 7010206840

At 23 mi^2, the Sand Creek Subwatershed is one of the smaller subwatersheds draining to the Mississippi River. This subwatershed includes the rapidly developing city of Blaine in Anoka County. A majority of the subwatershed is considered developed land (69%) while small portions are agricultural (18%) or forest and wetland (49%)(NLCD 2006). Only 1.5% of watershed land is open water; there are no lakes in this watershed and only a few small streams and ponds. Sand Creek is in the jurisdiction of the Coon Creek Watershed District (CCWD). Due to its small size (<40 mi^2) there is no intensive water chemistry station for this subwatershed.

Table 12. Aquatic life and recreation assessments on stream reaches: Sand Creek Subwatershed.

Local Jurisdiction	AUID *Reach Name* Reach Description	Reach Length (miles)	Use Class	Biological Station ID	Location of Biological Station	Aquatic Life Indicators: Fish IBI	Invert IBI	Dissolved Oxygen	Turbidity	Chloride	pH	NH_3	Pesticides	Bacteria	Aquatic Life	Aquatic Rec.
CCWD	***07010206-737*, Unnamed creek,** Unnamed cr to Sand Cr	0.5	2B	--	--	--	--	IF	MTS	MTS	MTS	--	--	--	IF	NA
CCWD	***07010206-744*, Unnamed ditch,** Unnamed ditch to Unnamed cr	2.0	2B	--	--	--	--	IF	MTS	MTS	MTS	--	--	--	IF	NA
CCWD	***07010206-748*, Unnamed ditch,** Unnamed ditch to Unnamed cr	0.9	2B	--	--	--	--	IF	MTS	MTS	MTS	--	--	--	IF	NA
CCWD	***07010206-749*, Unnamed ditch,** Headwaters to Sand Cr	1.9	2B	--	--	--	--	IF	MTS	MTS	MTS	--	--	--	IF	NA
CCWD	***07010206-765*, Unnamed ditch,** Unnamed ditch to Unnamed ditch	0.8	2B	--	--	--	--	IF	MTS	MTS	MTS	--	--	--	IF	NA
CCWD	***07010206-558*, Sand Creek,** Unnamed cr to Coon Cr	2.2	2B	00UM065	Upstream of Olive St, in Coon Rapids	EXS*	EXS	IF	MTS	MTS	MTS	--	--	--	IF*	NA
CCWD	***07010206-557*, County Ditch 17,** Headwaters to Mississippi R	4.0	2B	00UM061	Upstream of Riverview Terrace Rd, in Fridley	--	--	IF	MTS	--	MTS	--	--	EX	NA	NS

Abbreviations for Indicator Evaluations: -- = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **MTS** = Meets criteria; **EXP** = Exceeds criteria, potential impairment; **EXS** = Exceeds criteria, potential severe impairment; **EX** = Exceeds criteria (Bacteria).

Abbreviations for Use Support Determinations: **NA** = Not Assessed, **IF** = Insufficient Information, **NS** = Non-Support, **FS** = Full Support

Key for Cell Shading: = existing impairment, listed prior to 2012 assessment; = new impairment, identified during 2012 assessment; = full support of designated use.

*Aquatic Life assessment and/or impairments have been deferred until the adoption of Tiered Aquatic Life Uses due to the AUID being predominantly (>50%) channelized or having biological data limited to a station occurring on a channelized portion of the stream.

Table 13. Non-assessed biological stations on channelized reaches: Sand Creek Subwatershed.

Local Jurisdiction	AUID *Reach Name* *Reach Description*	Reach length (miles)	Use Class	Biological Station ID	Location of Biological Station	Fish IBI	Invert IBI
CCWD	***07010206-558*, Sand Creek,** Unnamed Cr to Coon Cr	2.2	2B	00UM065	Upstream of Olive St, in Coon Rapids	Fair	Fair

See Appendix 5.1 for clarification on the good/fair/poor thresholds and Appendix 5.2 and Appendix 5.3 for IBI results.

Table 14. Channel Condition and Stability Assessment (CCSI): Sand Creek Subwatershed.

Local Jurisdiction	# 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
CCWD	3	00UM065	Sand Creek	2	8.3	15.2	9.3	16.0	50.9	Fair
CCWD	1	00UM061	County Ditch 17	1.5	12	18.7	12	18	62.2	Fair
Average Habitat Results: *Sand Creek Subwatershed*				1.8	10.2	17	10.7	17	56.6	**Fair**

CCWD = Coon Creek Watershed District

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)

Table 15. Channel Condition and Stability Assessment (CCSI): Sand Creek Subwatershed.

Local Jurisdiction	# Visits	Biological Station ID	Stream Name	Upper Banks (4-43)	Lower Banks (5-46)	Substrate (3-37)	Channel Evolution (1-11)	Upper Banks (4-43)	CCSI Score (13-137)	CCSI Rating
CCWD	0	00UM065	Sand Creek	--	--	--	--	--	--	--
CCWD	0	00UM061	County Ditch 17	--	--	--	--	--	--	--
Average Stream Stability Results: *Sand Creek Subwatershed*				**--**	**--**	**--**	**--**	**--**	**--**	**--**

CCWD = Coon Creek Watershed District

Qualitative channel stability scores and ratings (Higher scores indicate greater channel instability)

= Stable: CCSI < 27 = Fairly stable: 27 < CCSI < 45 = Moderately unstable: 45 < CCSI < 80 = Severely unstable: 80 < CCSI < 115 = Extremely unstable: CCSI > 115

-- CCSI data not available. Station sampled prior to CCSI assessment being implemented as part of biological monitoring protocol.

Summary

Stream assessment results

Assessment data were available from Sand Creek which drains to the west to Coon Creek, and County Ditch 17 which drains directly to the Mississippi River. On County Ditch 17, a recreation use impairment for excess bacteria was found. Existing macroinvertebrate impairments were confirmed for Sand Creek and County Ditch 17. Sand Creek was listed in 2006 for an impaired aquatic macroinvertebrate community using data collected at station 00UM065 in 2000. During the 2010 assessment, the M-IBI from 2000 was rescored using the new statewide IBI and found to be just below the impairment threshold (M-IBI 34.4, threshold 35.9). Additional data collected at this station in 2010 was well below the threshold (17) indicating a deteriorating biological condition (M-IBI 17.2). This same station (00UM065) on Sand Creek was sampled for fish in 2000, 2004, and 2010 and F-IBI scores also indicate deteriorating conditions (F-IBI 32, 30, 0, respectively). However, the fish impairment identified will be deferred until Tiered Aquatic Life Uses are promulgated. Habitat quality was rated fair, with channel instability a potential stressor. Site images and habitat ratings suggest that the stream is over-widened and lacks depth variability. For County Ditch 17, a macroinvertebrate impairment was listed in 2006 using data from 2000; no new data was collected in 2010 at station 00UM065. This data was rescored with the new statewide M-IBI and found to be below threshold (24.6, threshold 35.9), confirming the existing impairment. Habitat quality was rated fair, with channel stability indicated as a potential stressor. Site images (see Images 1 & 2 below) also indicate an overwidened channel with excessive bank erosion.

Image 1: Station 00UM065 on Sand Creek. Stream appears overwidened and has a loss of depth variability due to excess sedimentation.

Image 2: Station 00UM061 on County Ditch 17. Cut banks and point bars indicate an unstable stream channel.

Water quality plans, projects, and TMDLs

The Sand Creek watershed is primarily under the jurisdiction of the Coon Creek Watershed District (CCWD) (http://www.cooncreekwd.org); a small portion on the southwest side of the Mississippi River is under the jurisdiction of the West Mississippi Watershed Management Commission (www.shinglecreek.org). A WRAPS is currently under http://www.pca.state.mn.us/index.php/water/water-types-and-programs/minnesotas-impaired-waters-and-tmdls/tmdl-projects/upper-mississippi-river-basin-tmdl/upper-mississippi-river-basin-tmdls.html. Both organizations have management plans available on their webpages for further information regarding local efforts.

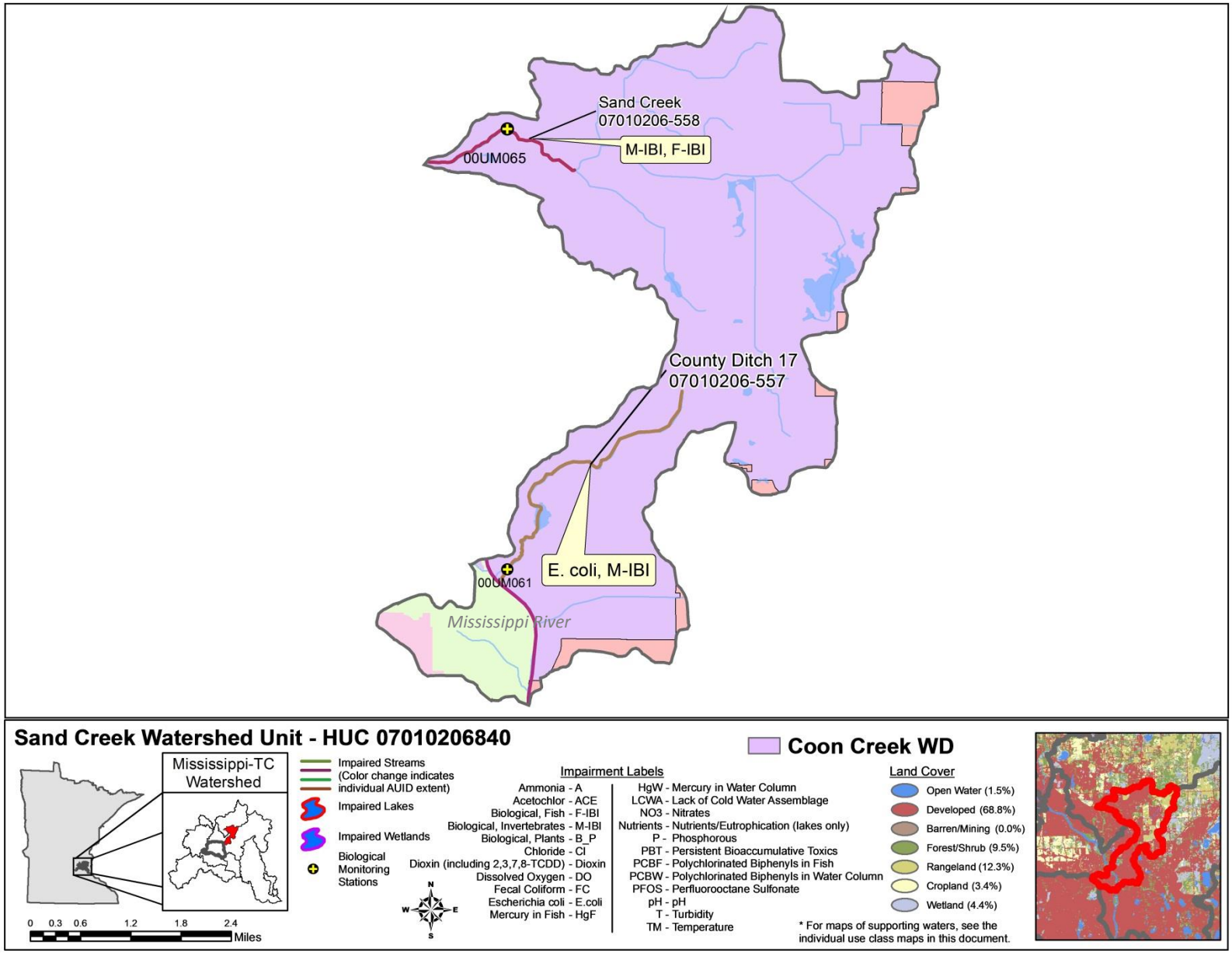

Figure 18. Currently listed impaired waters by parameter and land use characteristics (inset) in the Sand Creek Subwatershed.

Coon Creek Subwatershed HUC 7010206850

The Coon Creek Subwatershed spans 93.7 mi^2 and includes the cities of Coon Rapids, Ham Lake and Andover. Coon Creek begins as a series of channelized streams in a large wetland complex on the northeastern side of the subwatershed. Coon Creek joins Sand Creek (HUC 7010206860) near the City of Coon Rapids and then flows into the Mississippi River just south of the Coon Rapids Dam. Land use shifts from predominantly forest and wetland in the headwaters to densely urban-residential near the outlet. Twenty percent of the watershed is wetland, while an additional 24% is forest and 4.3% is open water (48% undeveloped). The subwatershed is home to 1600 acre Bunker Hills Regional Park. Developed land as a mix of industrial and residential use comprises 27%, and agricultural land the remaining 25% of the watershed. Coon Creek Watershed District is largely the only entity in the subwatershed, except for a small portion of the subwatershed under Rice Creek Watershed District (RCWD) jurisdiction. The intensive water chemistry station is located at Vale Street, in Coon Rapids (STORET/EQuIS: S003-993, biological station: 10UM003), one mile upstream of the confluence with the Mississippi River.

Table 16. Aquatic life and recreation assessments on stream reaches: Coon Creek Subwatershed.

Local Jurisdiction	AUID *Reach Name* *Reach Description*	Reach Length (miles)	Use Class	Biological Station ID	Location of Biological Station	Aquatic Life Indicators: Fish IBI	Invert IBI	Dissolved Oxygen	Turbidity	Chloride	pH	NH_3	Pesticides	Bacteria	Aquatic Life	Aquatic Rec.
CCWD	***07010206-530*, Coon Creek,** Unnamed cr to Mississippi R	24.6	2B	10UM003 00UM064	Downstream of bike bridge at Vale St NW, in Coon Rapids In Erlandson Nature Center by 111th Ave NW, in Coon Rapids	EXS*	EXP	MTS	MTS	MTS	MTS	MTS	--	EX	IF*/IF	NS

CCWD = Coon Creek Watershed District

Abbreviations for Indicator Evaluations: -- = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **MTS** = Meets criteria; **EXP** = Exceeds criteria, potential impairment; **EXS** = Exceeds criteria, potential severe impairment; **EX** = Exceeds criteria (Bacteria).

Abbreviations for Use Support Determinations: **NA** = Not Assessed, **IF** = Insufficient Information, **NS** = Non-Support, **FS** = Full Support

Key for Cell Shading: = existing impairment, listed during 2012 reporting cycle; = new impairment; = full support of designated use.

*Aquatic Life assessment and/or impairments have been deferred until the adoption of Tiered Aquatic Life Uses due to the AUID being predominantly (>50%) channelized or having biological data limited to a station occurring on a channelized portion of the stream.

Table 17. Non-assessed biological stations on channelized reaches: Coon Creek Subwatershed.

Local Jurisdiction	AUID ***Reach Name*** *Reach Description*	Reach length (miles)	Use Class	Biological Station ID	Location of Biological Station	Fish IBI	Invert IBI
CCWD	***07010206-756*** **County Ditch 11,** Unnamed ditch to Unnamed ditch	0.8	2B	10UM021	Downstream of 149th Ave NE, 2 mi. SE of Ham Lake	Poor	Poor
CCWD	***07010206-636*** **County Ditch 58,** CD 29 to Coon Cr	2.7	2B	10UM018	Downstream of Andover Blvd, 1 mi NE of Andover	Good	Good
CCWD	***07010206-530*, Coon Creek** Unnamed cr to Mississippi R	24.6	2B	00UM059 10UM020 10UM017	Downstream of Hwy 65, in Ham Lake Upstream of Naples St NE, 2 mi. SE of Ham Lake Downstream of Hanson Blvd SW, in Coon Rapids	Fair (3)	Fair (5)

CCWD = Coon Creek Watershed District
See Appendix 5.1 for clarification on the good/fair/poor thresholds and Appendix 5.2 and Appendix 5.3 for IBI results.
Parentheses behind ratings indicate the quantity of site visits when >1, which may or may not occur in the same year.

Table 18. Minnesota Stream Habitat Assessment (MSHA): Coon Creek Subwatershed.

Local Jurisdiction	# 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
CCWD	1	10UM021	County Ditch 11	2.3	8	9	13	4	36.3	Poor
CCWD	1	10UM018	County Ditch 58	3.5	10	12.8	12	17	55.3	Fair
CCWD	1	00UM059	Coon Creek	2	11.5	9	15	12	49.5	Fair
CCWD	1	10UM020	Coon Creek	2.5	11	9	16	11	49.5	Fair
CCWD	1	10UM017	Coon Creek	2	6.5	14	7	19	48.5	Fair
CCWD	1	00UM064	Coon Creek	1	11.5	17.1	9	23	61.6	Fair
CCWD	1	10UM003	Coon Creek	4.3	14.5	18	13	26	75.8	Good
		Average Habitat Results: *Coon Creek Subwatershed*		**2.5**	**10.4**	**12.7**	**12.1**	**16**	**53.8**	**Fair**

CCWD = Coon Creek Watershed District
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)

Table 19. Channel Condition and Stability Assessment (CCSI): Coon Creek Subwatershed.

Local Jurisdiction	# Visits	Biological Station ID	Stream Name	Upper Banks (4-43)	Lower Banks (5-46)	Substrate (3-37)	Channel Evolution (1-11)	CCSI Score (13-137)	CCSI Rating
CCWD	1	10UM021	County Ditch 11	26	11	17	1	55	Moderately unstable
CCWD	1	10UM018	County Ditch 58	27	19	10	5	51	Moderately unstable
CCWD	1	00UM059	Coon Creek	27	15	16	3	61	Moderately unstable
CCWD	1	10UM020	Coon Creek	29	21	17	5	72	Moderately unstable
CCWD	0	10UM017	Coon Creek	--	--	--	--	--	--
CCWD	0	10UM003	Coon Creek	--	--	--	--	--	--
Average Stream Stability Results: *Coon Creek Subwatershed*				**27.3**	**16.5**	**15**	**3.5**	**59.8**	**Moderately unstable**

CCWD = Coon Creek Watershed District

Qualitative channel stability scores and ratings (Higher scores indicate greater channel instability)

= Stable: CCSI < 27 = Fairly stable: 27 < CCSI < 45 = Moderately unstable: 45 < CCSI < 80 = Severely unstable: 80 < CCSI < 115 = Extremely unstable: CCSI > 115

-- CCSI data not available. Station sampled prior to CCSI assessment being implemented as part of biological monitoring protocol.

Table 20. Outlet water chemistry results: Coon Creek Subwatershed.

Station location:	**Coon Creek, at bike bridge at Vale St NW, in Coon Rapids**
STORET/EQuIS ID:	**S003-993**
Station #:	**10UM003**
Local Jurisdiction:	**Coon Creek Watershed District**

Parameter	Units	# of Samples	Minimum	Maximum	Mean	Median	WQ Standard1	# of WQ Exceedances2
Ammonia-nitrogen	mg/L	10	< 0.05	0.08	0.055	0.05		
Calcium	mg/L	1	79	79	79	79		
Chloride	mg/L	1	56.6	56.6	56.6	56.6	230	0
Chlorophyll-a, Corrected	ug/L	8	2.72	11	6.1	5.56		
Dissolved Oxygen	mg/L	18	5.5	8.5	7.4	7.53	5	
Escherichia coli1,2	MPN/100ml	15	48	1600	274	210	1260	1
Hardness	mg/L	1	260	260	260	260		
NO2NO3	mg/L	10	0.22	0.62	0.504	0.515		
Kjeldahl nitrogen	mg/L	10	0.85	1.38	1.068	1.07		
Magnesium	mg/L	1	15.2	15.2	15.2	15.2		
pH	SU	18	7.3	8.85	7.95	7.955	6.5 - 9	0
Pheophytin-a	ug/L	8	1.38	11.7	6.04	4.75		
Phosphorus	ug/L	10	64	147	111.8	119.5		
Specific Conductance	uS/cm	18	464	2111	691.7	613		
Sulfate	mg/L	1	51.8	51.8	51.8	51.8		
Temperature, water	deg °C	17	10.7	23.8	19.6	20		
Total suspended solids	mg/L	10	5.6	32	15.4	15		
Total volatile solids	mg/L	10	< 1	8.4	4.86	4.8		
Transparency tube	60 cm	16	32	100	58.25	55.5	>20	0

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

2 # WQ exceedances represents exceedances of individual maximum standard for *E. coli* (1260 cfu/100 ml).

****Data found in the table above was compiled using the results from data collected at the outlet monitoring station in the Coon Creek subwatershed, a component of the IWM work conducted between May and September in 2010 and 2011. This specific data does not reflect all data that was used to assess the AUID.**

Table 21. Lake morphometric and assessment data: Coon Creek Subwatershed (07010206-850).

Local Jurisdiction[1]	Lake ID	Lake Name	Trophic Status[2]	Lake Area (ha)	% Littoral	Max Depth (m)	Mean Depth (m)	Trend[3]	Mean TP (ug/L)	Mean Chl-a (ug/L)	Mean Secchi (m)	Aquatic Recreation Use Support[4]	Aquatic Life Use Support[5]	Aquatic Consumption Use Support[6]
CCWD	02-0052-00	Netta	E	109	--	5.8	1.3	I	26	6.4	3.6	FS	NA	--
CCWD	02-0053-00	Ham	E	91	91	6.7	1.8	I	33	8.0	2.6	FS	NA	NS
CCWD	02-0084-00	Crooked	E	36	74	7.9	2.7	I	31	7.4	2.0	FS	IF	NS
CCWD	02-0520-00	Unnamed	--	612	--	--	--	--	--	--	--	--	--	--

1. CCWD = Coon Creek Watershed District
2. H = hypereutrophic, E = eutrophic, M = mesotrophic, O = oligotrophic,-- not assigned
3. IF = Insufficient information, N = no trend, I = improving trend, D = declining trend, -- not determined
4. NS = not supporting, FS = supporting, IF = insufficient information to determine support, NA = not assessed (too small or wetland-like), -- no data
5. NS = not supporting, IF = insufficient information to determine support or meeting chloride standard, NA = not assessed, -- no data
6. NS = not supporting, IF = insufficient information to determine support or meeting chloride standard, NA = not assessed, – no data

Key for Cell Shading: = existing impairment, listed during 2012 reporting cycle; = new impairment; = full support of designated use.

Summary

Stream assessment results

Assessment data were available from the entire twenty-five mile reach of Coon Creek for both chemical and biological parameters. An aquatic recreation use impairment was found on Coon Creek; bacteria levels at the downstream end exceeded the standard.

For aquatic life use, Coon Creek (07010206-530) was originally listed in 2006 as impaired due to macroinvertebrate bioassessment based on data collected in 2000. Interpretation of the sampling data was provided by a macroinvertebrate IBI that was specifically developed for the Upper Mississippi River Basin (above Hastings dam). Since that time the MPCA has adopted an ecoregion-based classification scheme, resulting in the application of new statewide fish and macroinvertebrate IBIs. Using the new macroinvertebrate IBI to re-score the data collected in 2000 yields IBI scores that are at or above the impairment threshold. However, the current assessment primarily considered 2010 data in the decision on whether or not the original 2006 impairment listing needed to be removed. In 2010, macroinvertebrate data was collected from four stations along Coon Creek, including one of the stations sampled in 2000 (00UM059). In 2000 this station scored a 53 and a 46 on two separate visits (threshold 47), while in 2010 the invert IBI score was 48; indicating that the condition of this creek did not change substantially in this ten-year period. Examining the 2010 macroinvertebrate IBI scores for Coon Creek reveals that its condition remains fair to good along its entire length. Considering that these new scores were not definitive in their demonstration of support for the aquatic life designated use as well, the current fish bioassessment results indicating aquatic life impairment (deferred pending TALU implementation) led to the decision to retain the original macroinvertebrate impairment. For fish, while the IBI score at 10UM003 on

Coon Creek indicates impairment and the community was dominated by tolerant fish, there were still a number of sensitive species collected but in low numbers (Iowa darter, longnose dace, smallmouth bass and hornyhead chub) suggesting that improvements in water quality or habitat conditions may lead to a balanced biological community. Observations during sampling and site images (see Image 3 below) suggest that channel instability and excess sedimentation are potential stressors. For aquatic life use assessment, dissolved oxygen and turbidity met applicable standards on Coon Creek – exceedances observed were close to the standard or were from event based sampling. Chloride concentrations increase from upstream to downstream, but the concentrations are well below the standard. Including both biological assemblages in the TMDL implementation process and watershed planning will also increase the likelihood that restoration activities result in aquatic life use attainment in the long term.

Biological condition on channelized reaches ranged from good to poor. County Ditch 58, which is a channelized reach, was rated good for both fish and aquatic macroinvertebrates. Two sensitive fish species were collected (northern redbelly dace and mottled sculpin) and seven macroinvertebrate EPT taxa. Habitat quality was rated fair with a lack of coarse substrates; however, fish cover was diverse and channel morphology ratings suggest that this stream is moderately stable with good depth and flow variability. In contrast County Ditch 11, which is also a channelized reach, was rated poor for both fish and aquatic macroinvertebrates. Habitat quality was also rated poor with silt substrates and lack of depth variability. Dense macrophytes and duckweed were observed which may indicate a potential nutrient issue (see Image 4 below).

Image 3: Coon Creek (10UM003). Stream is overwidened with excess sedimentation and lack of depth variability.

Image 4: County Ditch 11 (10UM021). Stream has dense macrophytes and duckweed which may be a symptom of excess nutrients.

Lake water chemistry assessment results

Two lakes have been assessed for fish aquatic consumption; both are impaired (Ham, Crooked). Three of the four lakes in the watershed have been assessed for aquatic recreation use and are considered to be fully supporting. Netta, Ham, and Crooked Lakes all have improving trends in Secchi transparency. All three lakes are in the headwaters region of the larger Mississippi River-Twin Cities Watershed; their upstream position is likely a factor in their having good water quality. These basins are relatively shallow and are facing development pressure; protection efforts will be necessary to prevent degradation from increases in watershed runoff.

Water quality plans, projects and TMDLs

A WRAPS is currently under development by local partners for MPCA. To view approved and underway TMDL projects for impaired waters in this watershed visit http://www.pca.state.mn.us/index.php/water/water-types-and-programs/minnesotas-impaired-waters-and-tmdls/tmdl-projects/upper-mississippi-river-basin-tmdl/upper-mississippi-river-basin-tmdls.html. A comprehensive plan is available at www.cooncreekwd.org detailing local activities.

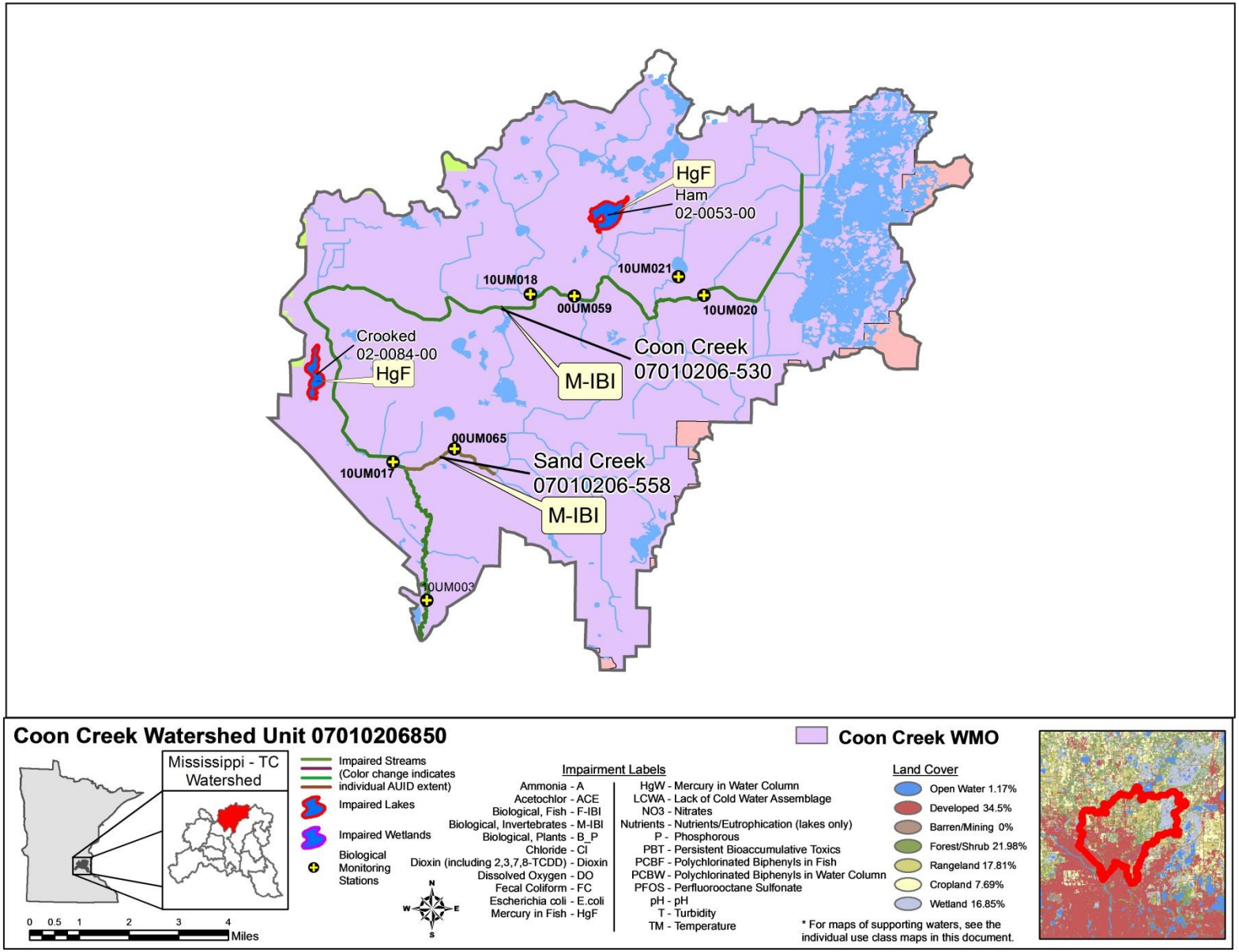

Figure 19. Currently listed impaired waters by parameter and land use characteristics (inset) in the Coon Creek Subwatershed.

Rice Creek Subwatershed HUC 7010206860

The Rice Creek Subwatershed is one of the more lake-rich subwatersheds within the Mississippi River-Twin Cities Watershed, and is the second largest watershed at 192.4 mi^2 stretching across parts of three counties. Cities in the watershed include Hugo, Weston and Mahtomedi in Washington County; Columbus, Lino Lakes and Circle Pines in Anoka County; the eastern side of Brooklyn Center in Hennepin County; and Roseville, Mounds View, New Brighton, Arden Hills, the western side of Shoreview, and the eastern side of White Bear Lake in Ramsey County. Land use is predominantly forest, wetland and open water in the headwaters of the subwatershed and transitions to residential/industrial along the I-35/694 corridor. Forty percent of the subwatershed is undeveloped land while agriculture makes up 26% and developed land 35% of the total watershed area (NLCD 2006). Prominent parks and lakes in the watershed include the 5,500 acre Rice Creek Chain of Lakes Park Reserve, Long Lake Regional Park, White Bear Lake and Peltier Lake. This subwatershed shares jurisdiction between the Rice Creek Watershed District (RCWD) and Mississippi River Watershed Management Organization (MRWMO). The intensive water chemistry station on Rice Creek is located off Central Ave in Fridley (STORET/EQuIS: S003-049) and is co-located with biological station 97UM005.

Table 22. Aquatic life and recreation assessments on stream reaches: Rice Creek Subwatershed.

Local Jurisdiction	AUID *Reach Name* *Reach Description*	Reach Length (miles)	Use Class	Biological Station ID	Location of Biological Station	Aquatic Life Indicators: Fish IBI	Invert IBI	Dissolved Oxygen	Turbidity	Chloride	pH	NH_3	Pesticides	Bacteria	Aquatic Life	Aquatic Rec.
RCWD	***07010206-565,* Unnamed ditch (Ramsey/Washington Judicial Ditch),** Headwaters to Bald Eagle Lk	2.3	2B	--	--	--	--	EXS	MTS	--	MTS	--	--	--	NS	NA
RCWD	***07010206-595,* Hardwood Creek**, Headwaters to Hwy 61	8.3	2B	--	--	--	--	EXS	MTS	--	MTS	IF	--	--	NS	NA
RCWD	***07010206-596,* Hardwood Creek**, Hwy 61 to Peltier Lk	5.4	2B	06UM002 08UM072 08UM073 99UM103	Upstream of CR 4A (80th Ave), 2 mi. NE of Centerville Downstream of 80th Ave, 2 mi. NW of Hugo Downstream of 165th St, 2 mi. NE of Centerville Upstream of CR 21, 2 mi. N of Centerville	EXS	EXS	EXP	MTS	MTS	MTS	MTS	--	--	NS	NA
RCWD	***07010206-519*, Clearwater Creek,** Bald Eagle Lk to Peltier Lk	5.3	2B	00UM084	Upstream of Peltier Lake Dr, in Centerville	EXS	--	IF*	IF*	--	EXP	--	--	--	NS	NA
RCWD	***07010206-583*, Rice Creek,** Unnamed lk (02-0041-00) to Long Lk	6.1	2Bd	99UM107 06UM002	0.5 mi. upstream of Mississippi St, in Ramsey County Open Space, New Brighton Upstream of CR 4A (80th Ave), 2 mi. NE of Centerville	EXS	EXP	IF	EXP	--	MTS	MTS	--	--	NS	NA
RCWD	***07010206-584,* Rice Creek,** Long Lk to Locke Lk	5.8	2Bd	97UM005 00UM060	At Central Avenue, in Fridley Downstream of University Ave, in Fridley	EXS	EXS	IF	MTS	MTS	MTS	MTS	--	EXS	NS	NS

Local Jurisdiction	AUID *Reach Name* *Reach Description*	Reach Length (miles)	Use Class	Biological Station ID	Location of Biological Station	Aquatic Life Indicators:									Aquatic Life	Aquatic Rec.
						Fish IBI	Invert IBI	Dissolved Oxygen	Turbidity	Chloride	pH	NH_3	Pesticides	Bacteria		
RCWD	***07010206-586,* Rice Creek,** Locke Lk to Mississippi R	0.5	2Bd	--	--	--	--	IF	MTS	--	MTS	--	--	EXS	NA	IF

RCWD = Rice Creek Watershed District

Abbreviations for Indicator Evaluations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **MTS** = Meets criteria; **EXP** = Exceeds criteria, potential impairment; **EXS** = Exceeds criteria, potential severe impairment; **EX** = Exceeds criteria (Bacteria).

Abbreviations for Use Support Determinations: **NA** = Not Assessed, **IF** = Insufficient Information, **NS** = Non-Support, **FS** = Full Support

Key for Cell Shading: = existing impairment, listed prior to 2012 assessment; = new impairment, identified during 2012 assessment; = full support of designated use.

***Aquatic Life assessment and/or impairments have been deferred until the adoption of Tiered Aquatic Life Uses due to the AUID being predominantly (>50%) channelized or having biological data limited to a station occurring on a channelized portion of the stream.**

Table 23. Non-assessed biological stations on channelized AUIDs: Rice Creek Subwatershed .

Local Jurisdiction	AUID *Reach Name* *Reach Description*	Reach length (miles)	Use Class	Biological Station ID	Location of Biological Station	Fish IBI	Invert IBI
RCWD	***07010206-519,* Clearwater Creek,** Bald Eagle Lk to Peltier Lk	5.3	2B	05UM001 07UM095 00UM084	Upstream of CR 14, in Centerville Upstream of CR 84, 1.5 mi. E of Centerville Upstream of Peltier Lake Dr, in Centerville	Poor (4)	Poor (3)
RCWD	***07010206-522,* County Ditch 2,** 1st St SW (New Brighton) to Pike Lk	1.1	2B	99UM100	0.2 mi. upstream of 1st St NW, in New Brighton	Poor (2)	Poor
RCWD	***07010206-559,* Unnamed ditch (Anoka County Ditch 53-62),** Unnamed cr to Golden Lk	2.7	2B	10UM024	Upstream of Lexington Ave N, in Circle Pines	Poor	Poor
RCWD	***07010206-564,* Unnamed ditch (Anoka County Ditch 4),** Unnamed cr to Rice Cr	2.4	2B	10UM026	Downstream of W Freeway Dr, 5 mi. SW of Forest Lake	Poor	Poor
RCWD	***07010206-583,* Rice Creek,** Unnamed lk (02-0041-00) to Long Lk	6.1	2Bd	99UM105	Upstream of CR I in Ramsey Country open space	Poor (2)	Fair (2)
RCWD	***07010206-596,* Hardwood Creek,** Hwy 61 to Peltier Lk	5.4	2B	06UM001	Upstream of CR 4A, 2 mi. NW of Hugo	Fair	--

RCWD = Rice Creek Watershed District

See Appendix 5.1 for clarification on the good/fair/poor thresholds and Appendix 5.2 and Appendix 5.3 for IBI results.

Parentheses behind ratings indicate the quantity of site visits when >1, which may or may not occur in the same year.

Table 24. Minnesota Stream Habitat Assessment (MSHA): Rice Creek Subwatershed.

Local Jurisdiction	# 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
RCWD	1	99UM100	County Ditch 2	2	10	12	11	8	43	Poor
RCWD	1	10UM024	Unnamed ditch (Anoka County Ditch 53-62)	1.5	4	4	10	1	20.5	Poor
RCWD	1	10UM026	Unnamed ditch (Anoka County Ditch 4)	5	10	9	12	1	37	Poor
RCWD	1	00UM084	Clearwater Creek	0	12	17.6	6	28	63.6	Fair
RCWD	3	05UM001	Clearwater Creek	1.3	10.5	14	5	9.3	40.2	Poor
RCWD	1	07UM095	Clearwater Creek	2.5	11	12.4	11	21	57.9	Fair
RCWD	2	99UM107	Rice Creek	2.8	9.5	14.1	10	24	60.3	Fair
RCWD	1	06UM001	Rice Creek	1	9.5	14.5	9	15	49	Fair
RCWD	1	99UM100	Rice Creek	3.5	12.5	18.4	14	33	81.4	Good
RCWD	2	99UM105	Rice Creek	2.3	10	14.6	13	16.5	56.3	Fair
RCWD	2	06UM002	Rice Creek	3.1	10.3	17	11.5	17	58.8	Fair
RCWD	2	08UM072	Hardwood Creek	2.8	12.5	17.7	13.5	30	76.4	Good
RCWD	1	08UM073	Hardwood Creek	1.5	8.5	20	7	21	58	Fair
RCWD	4	99UM103	Hardwood Creek	2.6	9.5	13.8	6.5	17.8	50.2	Fair
RCWD	1	06UM001	Hardwood Creek	1	9.5	14.5	9	15	49	Fair
			Average Habitat Results: *Rice Creek Subwatershed*	2.2	10.0	14.2	9.9	17.2	53.4	**Fair**

RCWD = Rice Creek Watershed District

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)

Table 25. Channel Condition and Stability Assessment (CCSI): Rice Creek Subwatershed.

Local Jurisdiction	# Visits	Biological Station ID	Stream Name	Upper Banks (43-4)	Lower Banks (46-5)	Substrate (37-3)	Channel Evolution (11-1)	CCSI Score (137-13)	CCSI Rating
RCWD	1	99UM100	County Ditch 2	21	18	15	7	61	Moderately unstable
RCWD	1	10UM024	Unnamed ditch (Anoka County Ditch 53-62)	21	13	16	7	57	Moderately unstable
RCWD	1	10UM026	Unnamed ditch (Anoka County Ditch 4)	26	13	17	1	67	Moderately unstable
RCWD	1	00UM084	Clearwater Creek	27	17	8	3	45	Moderately unstable
RCWD	0	05UM001	Clearwater Creek	--	--	--	--	--	--
RCWD	0	07UM095	Clearwater Creek	--	--	--	--	--	--
RCWD	1	99UM105	Rice Creek	6	11	20	3	30	Fairly stable
RCWD	1	99UM107	Rice Creek	6	11	22	3	42	Fairly stable
RCWD	0	06UM001	Rice Creek	--	--	--	--	--	--
RCWD	1	06UM002	Rice Creek	24	11	11	3	49	Moderately unstable
RCWD	0	08UM072	Hardwood Creek	--	--	--	--	--	--
RCWD	0	08UM073	Hardwood Creek	--	--	--	--	--	--
RCWD	1	99UM103	Hardwood Creek	17	15	14	3	49	Moderately unstable
Average Stream Stability Results: *Rice Creek Subwatershed*				18.5	13.6	15.4	3.8	50	**Moderately unstable**

RCWD = Rice Creek Watershed District

Qualitative channel stability scores and ratings (Higher scores indicate greater channel instability)

= Stable: CCSI < 27 = Fairly stable: 27 < CCSI < 45 = Moderately unstable: 45 < CCSI < 80 = Severely unstable: 80 < CCSI < 115 = Extremely unstable: CCSI > 115

-- CCSI data not available. Station sampled prior to CCSI assessment being implemented as part of biological monitoring protocol.

Table 26. Outlet water chemistry results: Rice Creek Subwatershed.

Station location:	**Rice Creek, 150m W of Central Ave (Hwy 61), in Fridley**
STORET/EQuIS ID:	**S003-049**
Station #:	**97UM005**
Local Jurisdiction:	**Rice Creek Watershed District**

Parameter	Units	# of Samples	Minimum	Maximum	Mean	Median	WQ Standard[1]	# of WQ Exceedances
Ammonia-nitrogen	mg/L	16	< 0.02	0.202	0.79	0.07		
Chloride	mg/L	--	--	--	--	--	230	--
Chlorophyll-a, Corrected	ug/L	8	64	100	76.9	73.5		
Dissolved Oxygen (DO)	mg/L	33	5.48	9.09	7	6.9	5	0
Escherichia coli[1,2]	MPN/100ml	15	36	1600	127	120	1260	1
NO2NO3	mg/L	16	< 0.01	0.158	0.069	0.064	10	0
Kjeldahl nitrogen	mg/L	19	1.05	3.17	1.6	1.38		
Orthophosphate	ug/L	15	< 10	36	17.3	16		
pH	SU	32	6.97	8.51	7.8	7.88	6.5-9	1
Phosphorus	ug/L	18	54	186	90	82.5		
Specific Conductance	uS/cm	33	353	1732	527	489		
Temperature, water	deg °C	33	12.06	27.8	22	23.2		
Total suspended solids	mg/L	18	5.8	48.8	16	12		
Total volatile solids	mg/L	18	2	16.3	6.1	4.75		
Transparency tube	60 cm	28	25	> 120	65.8	63.5	>20	0

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

2 # WQ exceedances represents exceedances of individual maximum standard for *E. coli* (1260 cfu/100 ml).

****Data found in the table above was compiled using the results from data collected at the outlet monitoring station in the Rice Creek subwatershed, a component of the IWM work conducted between May and September in 2010 and 2011. This specific data does not reflect all data that was used to assess the AUID.**

Table 27. Lake morphometric and assessment data for the Rice Creek Subwatershed (07010206-860)

Local Jurisdiction[1]	Lake ID Figure 23	Lake ID	Lake Name	Trophic Status[2]	Lake Area (ha)	% Littoral	Max Depth (m)	Mean Depth (m)	Trend[3]	Mean TP (ug/L)	Mean Chl-a (ug/L)	Mean Secchi (m)	Aquatic Recreation Use Support[4]	Aquatic Life Use Support[5]	Aquatic Consumption Use Suport[6]
CCWD	--	02-0072-00	Laddie	E	28	100	1.5	1.0	N	33	5.6	1.1	FS	NA	NA
MWMO	20	02-0079-00	Unnamed (Highland)	H	6	--	--	1.0	D	293	177.9	0.3	FS	NA	NA
MWMO	19	02-0080-00	Sandy	H	8	--	--	1.0	D	118	76.2	0.5	NS	NA	NA
VLAWMO	--	02-0014-00	Amelia	E	79	100	0.6	1.0	N	45	14.0	1.3	FS	NA	NA
RCWD	4	02-0003-00	Otter	M	273	99	6.4	1.6	N	19	2.9	3.3	FS	IF	NS
RCWD	7	02-0004-00	Peltier	H	195	89	4.9	2.0	N	251	101.6	1.0	NS	IF	NS
RCWD	9	02-0005-00	George Watch	H	397	100	1.5	1.5	N	205	64.0	0.5	NS	NA	NA
RCWD	8	02-0006-00	Centerville	E	200	61	5.8	3.3	N	37	44.7	0.8	NS	IF	FS
RCWD	11	02-0007-00	Marshan	H	144	100	1.1	1.2	N	211	62.3	0.4	NS	NA	NA
RCWD	12	02-0008-00	Rice	H	242	100	1.5	1.2	N	183	56.8	0.6	NS	NA	NA
RCWD	10	02-0009-00	Reshanau	E	162	100	3.0	1.5	N	95	45.0	0.7	NS	IF	NA
RCWD	--	02-0010-00	Wards	--	85	--	--	--	--	--	--	--	--	--	--
RCWD	--	02-0011-00	Sherman	--	17	100	1.5	--	--	--	--	--	--	--	--
RCWD	13	02-0013-00	Baldwin	H	328	100	1.4	0.6	N	213	79.6	0.4	NS	NA	NA
RCWD	--	02-0015-00	Rondeau	--	223	100	3.7	0.9	N	--	--	--	--	--	--
RCWD	6	02-0016-00	Howard	E	219	100	1.7	1.2	N	49	8.6	1.2	FS	NA	NA
RCWD	--	02-0019-00	Crossways	--	214	100	2.7	1.2	--	--	--	--	--	--	--
RCWD	--	02-0041-00	Unnamed	--	37	--	--	--	--	--	--	--	--	--	--
RCWD	14	02-0045-00	Golden	E	23	89	7.3	2.4	I	95	38.7	1.2	NS	NA	NS
RCWD	--	02-0071-00	Spring	--	22	96	5.5	1.5	N	--	--	--	--	--	FS
RCWD	18	02-0075-01	East Moore	E	12	79	6.7	1.6	N	55		1.5	NS	NA	FS
RCWD	--	02-0075-02	West Moore	E	28	100	1.5	0.6	N	77		1.5	IF	NA	NA
RCWD	--	02-0077-00	Locke	--	10	100	1.8	1.2	--	--	--	--	--	--	--
RCWD	--	02-0585-00	Loch Ness	E	21	--		1.0	IF	30	8.6	2.4	FS	NA	FS
RCWD	3	62-0002-00	Bald Eagle	E	539	58	11.3	4.1	N	60	33.5	1.3	NS	IF	NS
RCWD	28	62-0036-00	Priebe	H	3	--	--	1.0	N	158	84.9	0.4	NS	NA	NA

Local Jurisdiction[1]	Lake ID Figure 23	Lake ID	Lake Name	Trophic Status[2]	Lake Area (ha)	% Littoral	Max Depth (m)	Mean Depth (m)	Trend[3]	Mean TP (ug/L)	Mean Chl-a (ug/L)	Mean Secchi (m)	Aquatic Recreation Use Support[4]	Aquatic Life Use Support[5]	Aquatic Consumption Use Suport[6]
RCWD	--	62-0044-00	Poplar	--	63	--	--	1.0	--	--	--	--	--	--	--
RCWD	--	62-0049-01	Langton (N. Bay)	E	1	100	1.5	1.2	N	56	16.2	1.0	NA	IF	FS
RCWD	--	62-0049-02	Langton (S. Bay)	E	1	100	1.5	1.2	I	63	15.9	1.2	NA	NA	FS
RCWD	22	62-0057-00	Josephine	E	46	69	13.4	3.3	N	32	12.3	1.9	FS	IF	NS
RCWD	27	62-0058-00	Little Johanna	E	7	69	8.5	3.0	N	74	26.2	1.3	NS	NS	NS
RCWD	--	62-0059-00	Marsden	--	121	--	1.7	0.5	--	--	--	--	--	--	--
RCWD	15	62-0061-00	Turtle	M	180	60	8.5	3.4	I	19	5.0	2.4	FS	IF	NS
RCWD	16	62-0067-00	Long	E	74	60	7.3	3.4	N	86	35.3	1.2	NS	IF	NS
RCWD	--	62-0068-00	Rush	H	33	100	1.8	0.5	IF			0.2	IF	NA	NA
RCWD	17	62-0069-00	Pike	E	16	91	4.9	1.9	N	93	48.7	0.8	NS	NA	NA
RCWD	--	62-0070-00	Round	--	51	100	2.1	0.8	IF	--	--	--	--	--	--
RCWD	25	62-0071-00	Valentine	E	30	100	4.0	1.4	I	70	18.6	1.7	NS	NS	NA
RCWD	23	62-0075-01	Island (S. Basin)	E	18	100	2.7	1.4	N	82	29.7	1.2	NS	IF	NS
RCWD	24	62-0075-02	Island (N. Basin)	E	8	100	2.7	0.9	--	86	23.6	1.3	NS	IF	NS
RCWD	--	62-0077-00	Poplar	--	5	100	1.5	0.5	--	--	--	--	--	--	--
RCWD	26	62-0078-00	Johanna	E	93	45	13.1	5.2	I	29	11.6	1.9	FS	IF	NS
RCWD	21	62-0083-00	Silver (West)	E	30	90	14.3	2.3	N	54	32.7	1.0	NS	IF	NS
RCWD	--	62-0095-00	Evergreen Ponds	E	7	--	5.5	--	N			1.6	IF	NA	NA
RCWD	--	82-0121-00	Mann	--	31	--	--	--	--	--	--	--	--	--	--
RCWD	--	82-0122-00	Pine Tree	E	70	91	9.1	3.0	I	28	8.9	2.2	FS	IF	NA
RCWD	--	82-0130-00	Long	E	19	93	7.6	1.5	N	27	6.1	2.6	FS	NA	NA
RCWD	--	82-0134-01	Lost (NW Bay)	E	6	--	--	1.0	IF	61	15.2	1.7	IF	NA	NA
RCWD	--	82-0134-02	Lost (SE Bay)	--	--	--	7.9	--	---	--	--	--	--	--	--
RCWD	--	82-0136-00	Round	--	21	--	--	--	--	--	--	--	--	--	--
RCWD	2	82-0137-00	Fish	H	10	68	10.4	2.7	IF	114	34.4	1.4	NS	NA	NA
RCWD	--	82-0138-00	Horseshoe	--	38	100	2.7	1.4	--	--	--	--	--	--	--
RCWD	--	82-0140-00	Oneka	E	153	100	2.1	1.2	N	26	7.5	1.4	FS	NA	NA

Local Jurisdiction[1]	Lake ID Figure 23	Lake ID	Lake Name	Trophic Status[2]	Lake Area (ha)	% Littoral	Max Depth (m)	Mean Depth (m)	Trend[3]	Mean TP (ug/L)	Mean Chl-a (ug/L)	Mean Secchi (m)	Aquatic Recreation Use Support[4]	Aquatic Life Use Support[5]	Aquatic Consumption Use Suport[6]
RCWD	5	82-0163-00	Clear	E	179	63	8.5	3.4	I	33	7.8	1.7	FS	IF	NS
RCWD	1	82-0167-00	White Bear	M	984	54	25.3	5.2	I	19	5.1	3.4	FS	IF	NS
RCWD	--	82-0168-00	Mud	H	93	100	1.2	1.0	IF	199	7.6	1.1	IF	NA	NA

1. CCWD = Coon Creek Watershed District, RCWD = Rice Creek Watershed District, VLAWMO = Vadnais Lakes Area Watershed Management Organization, MWMO = Mississippi Watershed Management Organization
2. H = hypereutrophic, E = eutrophic, M = mesotrophic, O = oligotrophic, -- = not assigned.
3. IF = Insufficient information, N = no trend, I = improving trend, D = declining trend, -- = no data.
4. FS = supporting, NS = not supporting, IF = insufficient information to determine support, NA = not assessed (too small or wetland-like), -- = no data.
5. NS = not supporting, IF = insufficient information to determine support or meeting chloride standard, NA = not assessed, -- no data.
6. FS = supporting, NS = not supporting, NA = not assessed. – no data.

Key for Cell Shading: = existing impairment; = new impairment; = full support of designated use; = previously impaired, delisting completed or proposed.

Summary

Stream assessment results

Assessment data were available from several reaches of Rice Creek, Hardwood Creek, Clearwater Creek and Judicial Ditch 1. The headwaters region of Rice Creek, which includes the chain of lakes of Peltier and Centerville, is very low gradient and many of the reaches are heavily influenced by wetland conditions. Data on the mainstem of Rice Creek were available downstream of Baldwin Lake.

For assessment of aquatic recreation, bacteria datasets were available downstream of Long Lake; however, these datasets were small and the exceedance rate was very close to the threshold for impairment. Additional sampling was undertaken in 2012 and the reach between Long and Locke Lakes was reassessed in spring 2013. Elevated bacteria concentrations were observed and it is now considered impaired for aquatic recreation uses.

For aquatic life assessment, one wetland (Jones Lake, 62-0076-00) was determined to be impaired in 2008. Jones Lake, which is actually a wetland with a maximum depth of ~1 ft (RCWD 2001), was determined to be impaired for aquatic life use based on IBI scores for wetland plants and macroinvertebrates. Jones Lake is located near the headwaters of this watershed and may be a factor in downstream impairments. A 2000 analysis by the Rice Creek Watershed District (RCWD 2001) estimated annual loadings to be 0.36 lbs/ac of total phosphorus, 79.7 lbs/ac of total suspended solids, and 2.65 lbs/ac of total Kjeldahl nitrogen coming into the basin from three separate tributaries. Comparing these results to loads calculated at the outlet revealed retention rates of 13%, 65% and 34%, respectively. These nutrient and sediment inputs likely contribute to the impaired plant and macroinvertebrate communities found within this wetland. Recent water quality monitoring data collected by the MPCA indicate that chloride and water level fluctuations may be additional stressors to aquatic life in this wetland.

Rice Creek (07010206-584) was first listed in 2006 as impaired for aquatic life use based on the macroinvertebrate IBI. Fish and macroinvertebrate data collected from this section of the creek in 2010 confirm this aquatic life use impairment. At biological station 97UM005 the fish community had a low percentage of sensitive species (1%) and only three EPT macroinvertebrate species. The section of Rice Creek (07010206-583) between Long Lake and Baldwin Lake--lakes that are impaired due to excess nutrients--has aquatic life impairments that were first listed in 2004. Biological monitoring conducted in 2008 and 2010 indicates that this stretch of creek is still impaired. Oxygen and turbidity datasets were small, but not indicative of a stressor to aquatic life. Rice Creek Watershed District has restored a few channelized sections of Rice Creek in this vicinity and there are at least preliminary indications that these activities, and likely other Best Management Practices (BMPs) in the watershed, are improving the health of aquatic life in this stream. For instance, fish and macroinvertebrate IBI scores both demonstrated an improvement in the condition of these aquatic communities between 2008 and 2010 at station 99UM107. However, the same pattern does not exist at station 99UM105 that is further upstream and closer to the restored channels. Observations during the 2010 biological survey suggest that the restoration has provided greater depth variability for pool dwelling game fish species (rock bass, largemouth bass, bluegill and pumpkin seed). These pools may also provide summer refuge from hot summer weather and provide recreational fishing opportunities.

For two unassessed channelized reaches that flow into Rice Creek, fish and macroinvertebrate communities were rated poor with tolerant individuals dominating. Habitat quality at these reaches was rated fair to poor with silt and sand substrates and lack of depth and flow variability. At some stations, one-time measurements of dissolved oxygen were extremely low (e.g., 1.4 mg/L at 10UM024, 0.61 mg/L at 10UM026). These channelized reaches, although currently not assessable, should be scrutinized for their potential contribution to downstream lake and stream impairments. For example, the string of poor aquatic conditions (i.e., Jones Lake, Ramsey County Ditch 2 (channelized), Pike Lake, Long Lake and Rice Creek to the Mississippi River) provides the opportunity to simultaneously restore all of these impaired uses in this heavily developed portion of the Rice Creek watershed.

Within this subwatershed only two other streams were assessed for aquatic life, Clearwater Creek (07010206-519) and Hardwood Creek (07010206-596). Both occur upstream of the Rice Creek Chain of Lakes and flow into Peltier Lake. Clearwater Creek was listed as impaired for aquatic life for fish in 2002 and aquatic macroinvertebrates in 2006. At biological station 00UM084, habitat quality was rated fair with coarse substrates. Site images at 05UM001 indicate that the channel may also be unstable and overwidened which may contribute to excess sedimentation in riffles and runs and reduce depth and flow variability for fish. Water chemistry data from Clearwater Creek over the 10-year assessment window indicates that low-dissolved oxygen and turbidity are stressors and may be considered impairments, although the recent dataset was light and a few samples appeared to be event biased. Additional monitoring could confirm whether or not these are existing impairments. Regardless, the decision will be deferred until TALU standards are developed since greater than 50% of the AUID is considered channelized.

Hardwood Creek was determined to have impaired aquatic life in 2002 based on a fish bioassessment and in 2004 low dissolved oxygen was also listed as an aquatic life impairment. A TMDL to address these two impairments was completed in May 2009, which also considered macroinvertebrates in the development of restoration targets (EOR 2009). Therefore, even though 2008 and 2010 macroinvertebrate IBI scores indicate aquatic life impairment of Hardwood Creek, a separate impairment listing based on these findings is not being recommended at this time. Stressors identified in the TMDL included altered habitat and altered hydrology (EOR 2009). Restoration projects have been completed on Hardwood Creek although these projects were recently completed in 2009 and hence it may be too early to ascertain the effectiveness of these and other BMPs for restoring the beneficial use of aquatic life.

Monitoring data collected before the next scheduled assessment of the Mississippi River-Twin Cities Watershed in 2022 will be used to gauge the effectiveness of restoration activities undertaken during this intervening time period.

Lake assessment results

For fish aquatic consumption use, six lakes are supporting while 13 lakes are not supporting (Table 27). Three lakes were recently assessed as impaired for contaminants in fish tissue; two for mercury (Island, Silver) and one for PFOS (Little Johanna). Many of the lakes in this watershed are shallow; there are some notable exceptions, such as Bald Eagle Lake, White Bear Lake, Lake Josephine and Lake Johanna all with at least 13 meters maximum depth. There are 14 lakes in the watershed that fully support aquatic recreation uses, including Clear, Johanna, Josephine and White Bear Lake, while 21 lakes do not support recreation uses (Table 27). During the 2012 assessment, one new lake (Priebe Lake) was assessed as impaired for aquatic recreation. In contrast, Howard Lake was listed as impaired for aquatic recreation due to excess nutrients in 2006. During the 2012 assessment, recent data indicate that Howard Lake is now meeting aquatic recreation standards and is proposed to be delisted pending EPA approval in 2014. Lakes Little Johanna and Valentine were found to be impaired for aquatic life uses due to excess chloride in the water.

In White Bear Lake, water levels have dropped dramatically in recent years (Figure 20) prompting the United States Geological Survey (USGS) to investigate. The 2012 study concluded that lower lake levels could be explained by a combination of higher regional pumping of groundwater primarily by municipal suppliers and lower precipitation (http://mn.water.usgs.gov/projects/description/NQ00EHR00.html). Follow-up study by the USGS of the White Bear Lake and lakes in the surrounding area was appropriated by the 2013 legislature using the Clean Water Fund.

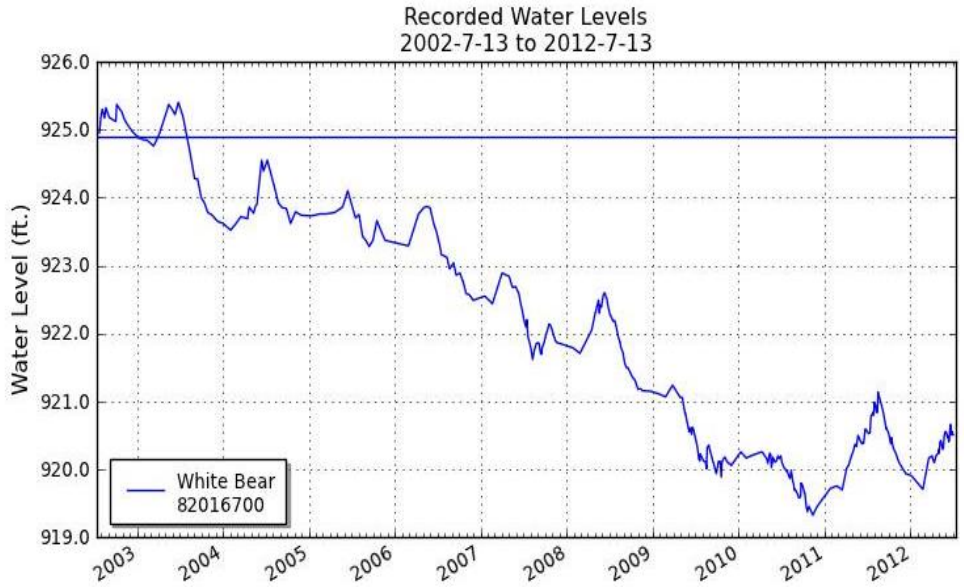

Figure 20. Recorded water levels for White Bear Lake between 2002 and 2012.

http://maps1.dnr.state.mn.us/cgi-bin/lakesdb/hydrograph_cgi.py?basins=82016700:White Bear&startdate=2003-6-19&enddate=2013-6-19&&hydrograph_type=time_series&show_ohwl=1&show_legend=1&output_format=png&width=780&height=440

Water quality plans, projects, and TMDLs

Waters in this watershed are primarily under the jurisdiction of the Rice Creek Watershed District (http://ricecreek.org); a number of waterbodies fall to the jurisdiction of the Vadnais Lakes Area Water Management Organization (www.vlawmo.org) or the Mississippi Watershed Management Organization (http://www.mwmo.org/). Most of the impairments in the watershed have been or are currently being addressed with TMDLs. To view approved and underway TMDL projects for impaired waters in this watershed visit http://www.pca.state.mn.us/index.php/water/water-types-and-programs/minnesotas-impaired-waters-and-tmdls/tmdl-projects/upper-mississippi-river-basin-tmdl/upper-mississippi-river-basin-tmdls.html. Both RCWD and VLAWMO have watershed management plans on their websites.

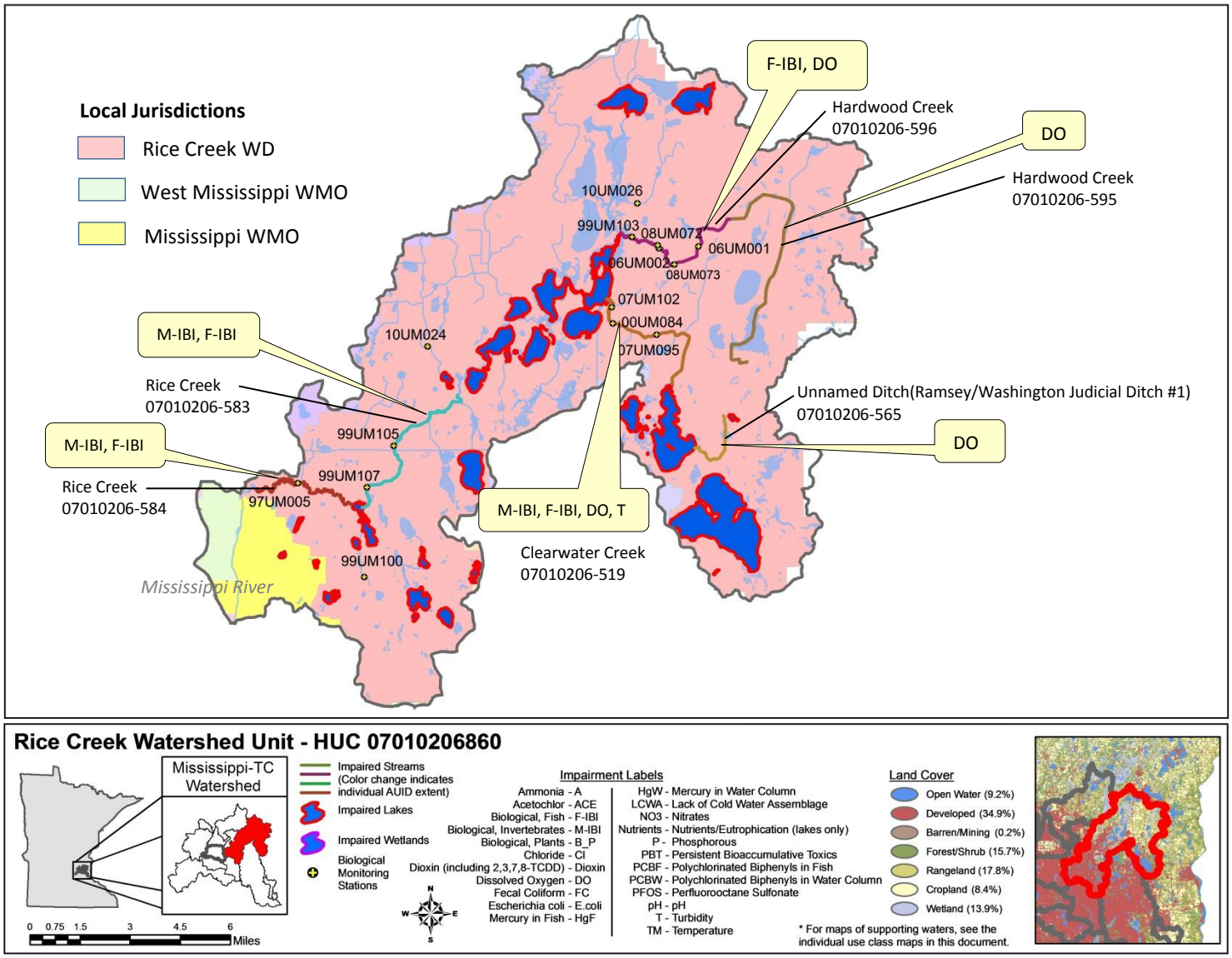

Figure 21. Impaired streams by parameter and land use characteristics (inset) in the Rice Creek Subwatershed.

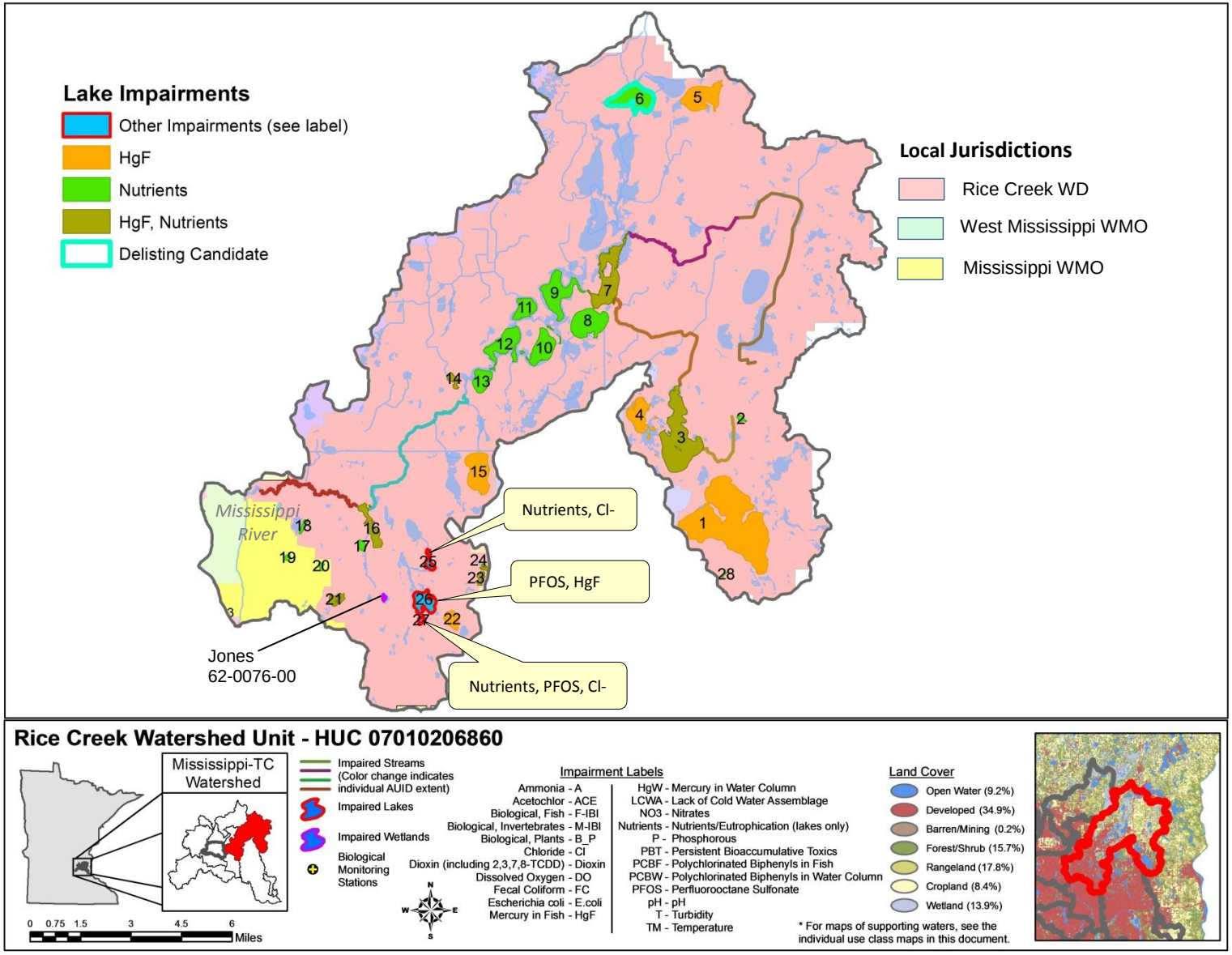

Figure 22. Impaired lakes and wetlands by parameter and land use characteristics (inset) in the Rice Creek Subwatershed. See Table 27 for lakes names.

Shingle Creek Subwatershed HUC 7010206870

The Shingle Creek Subwatershed is a densely developed urban watershed (83% developed), comprising 41.6 mi^2 of Hennepin County. The subwatershed lies on the northwest suburban corridor of Minneapolis, and includes the eastern side of Plymouth, New Hope, Robbinsdale, Brooklyn Center and the eastern side of Maple Grove. Only 12% of the subwatershed is forest, wetland and open water. Prominent waterbodies include: Pomerleau Lake, Schmidt Lake, Eagle Lake, Bass Lake, Twin Lakes, Ryan Lake and Shingle Creek. This subwatershed is solely under is the Shingle Creek Watershed Management Commission (SCWMC). The intensive water chemistry station on Shingle Creek (STORET/EQuIS: S003-049) is located off 45th Avenue in Minneapolis and is co-located with biological station 08UM083.

Table 28. Aquatic life and recreation assessments on stream reaches: Shingle Creek Subwatershed.

Local Jurisdiction	AUID *Reach Name* *Reach Description*	Reach Length (miles)	Use Class	Biological Station ID	Location of Biological Station	Aquatic Life Indicators: Fish IBI	Invert IBI	Dissolved Oxygen	Turbidity	Chloride	pH	NH_3	Pesticides	Bacteria	Aquatic Life	Aquatic Rec.
SCWMC	***07010206-673,*** *Unnamed cr,* Unnamed cr to Bass Lk	1.3	2B	--	--	--	--	IF	MTS	MTS	MTS	MTS	--	--	IF	NA
SCWMC	***07010206-506,*** **Shingle Creek,** Headwaters (Eagle Cr/Bass Cr) to Mississippi R	11.2	2B	--	--	--	--	EXS	EXS*	EX	MTS	MTS	--	EX	NS	NS
SCWMC	***07010206-784,*** **Bass Creek,** Unnamed wetland (27-0096-00) to Eagle Cr	2.3	2B	--	--	--	--	--	--	EX	--	--	--	--	NS	NA

SCWMO = Shingle Creek Watershed Management Organization

Abbreviations for Indicator Evaluations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **MTS** = Meets criteria; **EXP** = Exceeds criteria, potential impairment; **EXS** = Exceeds criteria, potential severe impairment; **EX** = Exceeds criteria.

Abbreviations for Use Support Determinations: **NA** = Not Assessed, **IF** = Insufficient Information, **NS** = Non-Support, **FS** = Full Support

Key for Cell Shading: = existing impairment, listed prior to 2012 assessment; = new impairment, identified during 2012 assessment; = full support of designated use.

*Aquatic Life assessment and/or impairments have been deferred until the adoption of Tiered Aquatic Life Uses due to the AUID being predominantly (>50%) channelized or having biological data limited to a station occurring on a channelized portion of the stream.

Table 29. Non-assessed* biological stations on channelized AUIDs: Shingle Creek Subwatershed.

Local Jurisdiction	AUID *Reach Name* *Reach Description*	Reach length (miles)	Use Class	Biological Station ID	Location of Biological Station	Fish IBI	Invert IBI
SCWMC	***07010206-784,* Bass Creek,** Unnamed wetland (27-0096-00) to Eagle Cr	2.3	2B	10UM015	Downstream of 67th Ave N, in New Hope	Poor	Poor
SCWMC	***07010206-506,* Shingle Creek (County Ditch 13),** Headwaters (Eagle Cr/Bass Cr) to Mississippi R	11.2	2B	10UM032 08UM083	Downstream of 73rd Ave N, in Brooklyn Park Upstream of 45th Ave, Minneapolis	Poor (2)	Poor (2)

*These AUIDs were assessed previously but were not assessed in 2012 due to a more recent policy decision not to assess channelized reaches until TALU standards are developed.
SCWMC = Shingle Creek Watershed Management Commission
See Appendix 5.1 for clarification on the good/fair/poor thresholds and Appendix 5.2 and Appendix 5.3 for IBI results.
Parentheses behind ratings indicate the quantity of site visits when >1, which may or may not occur in the same year.

Table 30. Minnesota Stream Habitat Assessment (MSHA): Shingle Creek Subwatershed.

Local Jurisdiction	# 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
SCWMC	1	10UM015	Bass Creek	2	4	9.9	8	22	45.9	Fair
SCWMC	1	08UM083	Shingle Creek	1	7	17.9	6	15	46.9	Fair
SCWMC	1	10UM032	Shingle Creek	1	8.5	13	9	14	45.5	Fair
Average Habitat Results: *Shingle Creek Subwatershed*				**1.3**	**6.5**	**13.6**	**7.7**	**17.0**	**46.1**	**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)

Table 31. Channel Condition and Stability Assessment (CCSI): Shingle Creek Subwatershed.

Local Jurisdiction	# Visits	Biological Station ID	Stream Name	Upper Banks (4-43)	Lower Banks (5-46)	Substrate (3-37)	Channel Evolution (1-11)	CCSI Score (13-137)	CCSI Rating
SCWMC	1	10UM015	Bass Creek	4	8	11	3	26	Stable
SCWMC	1	08UM083	Shingle Creek	27	16	6	5	54	Moderately un stable
SCWMC	1	10UM032	Shingle Creek	33	18	30	5	86	Severely unstable
Average Stream Stability Results *Shingle Creek Subwatershed*				**21.3**	**14**	**15.7**	**4.3**	**55.3**	**Moderately unstable**

Qualitative channel stability scores and ratings (Higher scores indicate greater channel instability)
= Stable: CCSI < 27 = Fairly stable: 27 < CCSI < 45 = Moderately unstable: 45 < CCSI < 80 = Severely unstable: 80 < CCSI < 115 = Extremely unstable: CCSI > 115

Table 32. Outlet water chemistry results: Shingle Creek Subwatershed

Station location:	**Shingle Creek at 45th Ave & RR Track, in Minneapolis**							
STORET/EQuIS ID:	**S001-946**							
Station #:	**08UM083**							
Local Jurisdiction:	**Shingle Creek Watershed Management Commission**							
Parameter	**Units**	**# of Samples**	**Minimum**	**Maximum**	**Mean**	**Median**	**WQ Standard[1]**	**# of WQ Exceedances**
Ammonia-nitrogen	mg/L	--	--	--	--	--		
Chloride	mg/L	17	23	180	98	83	230	0
Chlorophyll-a, Corrected	ug/L	--	--	--	--	--		
Dissolved Oxygen (DO)	mg/L	14	2.4	11.4	6.1	5.9	5	6
Escherichia coli[1,2]	MPN/100ml	11	106	3635	440	494	1260	2
NO2NO3	mg/L	17	0.05	0.48	0.26	0.27		
Kjeldahl nitrogen	mg/L	17	< 0.5	2.4	1.17	1		
Orthophosphate	ug/L	17	7	100	44.3	40		
pH	SU	14	7.4	8.36	7.8	7.7	6.5-9	0
Phosphorus	ug/L	17	41	390	163	120		
Specific Conductance	uS/cm	13	280	1069	658	619		
Temperature, water	deg °C	14	9.1	26.8	19	19.9		
Total suspended solids	mg/L	17	< 5	110	28.6	10		
Total volatile solids	mg/L	17	< 5	37	13.6	10		
Transparency tube	60 cm	3	2.4	18	8.3	4.6	>20	0

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

2 # WQ exceedances represents exceedances of individual maximum standard for *E. coli* (1260 cfu/100 ml).

****Data found in the table above was compiled using the results from data collected at the outlet monitoring station in the Shingle Creek subwatershed, a component of the IWM work conducted between May and September in 2010 and 2011. This specific data does not reflect all data that was used to assess the AUID.**

Table 33. Lake morphometric and assessment data for the Shingle Creek Subwatershed (07010206-870)

Local Jurisdiction[1]	Lake ID	Lake Name	Trophic Status[2]	Lake Area (ha)	% Littoral	Max Depth (m)	Mean Depth (m)	Trend[3]	Mean TP (ug/L)	Mean Chl-a (ug/L)	Mean Secchi (m)	Aquatic Recreation Use Support[4]	Aquatic Life Use Support[5]	Aquatic Consumption Use Support[6]
SCWMC	27-0034-00	Crystal	E	28	68	11.9	3.0	N	85	45.3	1.1	NS	IF	FS
SCWMC	27-0042-01	Upper Twin	H	48	100	3.0	1.2	N	156	111.7	0.5	NS	NA	NS
SCWMC	27-0042-02	Middle Twin	E	22	58	12.8	4.4	N	51	19.7	1.3	NS	NA	NS
SCWMC	27-0042-03	Lower Twin	E	12	85	6.4	2.1	I	42	26.6	1.2	FS	NA	NS
SCWMC	27-0057-00	Meadow	H	4	100	1.1	0.4	IF	282	148.0	0.5	NS	IF	NA
SCWMC	27-0058-00	Ryan	E	14	52	10.1	4.6	I	40	8.7	1.9	FS	IF	NA
SCWMC	27-0059-00	Palmer	--	110	100	1.2	--	--	--	--	--	--	--	--
SCWMC	27-0065-00	Magda	H	5	100	2.0	0.6	IF	161	91.0	0.4	NS	IF	NA
SCWMC	27-0100-00	Pomerleau	H	14	67	7.9	3.3	IF	111	37.2	1.1	NS	NA	NA
SCWMC	27-0102-00	Schmidt	E	19	92	8.2	1.7	I	42	12.9	2.4	FS	NA	NA
SCWMC	27-0111-01	Eagle	E	116	68	11.0	3.3	N	46	29.8	1.7	NS	NA	NS
SCWMC	27-0111-02	Pike	E	24	95	6.7	2.6	D	90	54.3	1.0	NS	NA	NS
SCWMC	27-0119-00	Cedar Island	H	32	100	2.1	1.1	D	294	117.5	0.4	NS	NA	NA

1. SCWMC = Shingle Creek Water Management Commission
2. H = hypereutrophic, E = eutrophic, M = mesotrophic, O = oligotrophic, -- not assigned
3. IF = Insufficient information, N = no trend, I = improving trend, D = declining trend, -- not determined
4. NS = not supporting, FS = supporting, IF = insufficient information to determine support, NA = not assessed (too small or wetland-like), -- no data
5. NS = not supporting, IF = insufficient information to determine support or meeting chloride standard, NA = not assessed, -- no data
6. FS = supporting, NS = not supporting, NA = not assessed, -- no data

Key for Cell Shading: = existing impairment; = new impairment; = full support of designated use; = previously impaired, delisting completed or proposed.

Summary

Stream assessment results

Water quality data were available on Bass and Shingle Creeks in this highly developed subwatershed extending from Minneapolis to Plymouth and Maple Grove. Bass Creek is in the upper reaches of the subwatershed; the reach currently is listed as impaired for aquatic life use due to chloride toxicity. Water chemistry was sampled at the downstream end of Shingle Creek and it was determined that the creek was not meeting aquatic recreation uses and was impaired due to elevated levels of E. coli. Fish and macroinvertebrates have been sampled at three separate locations along Bass and Shingle Creeks, and all three stations exhibit signs of a severely stressed aquatic community with high percentages of pollution tolerant individuals and low taxa richness. Aquatic life in these channelized reaches is showing the effects of urban development as indicated by chloride, low dissolved oxygen, turbidity (deferred in 2008), fish and aquatic macroinvertebrate impairments. Habitat quality was rated fair with channel instability and silt and detritus comprising the substrate composition. Other observations during sampling indicate that bank erosion is prevalent, and riparian buffer vegetation is variable by landowner with buffers of deep rooted vegetation intermixed with areas mowed to stream edge. Channel stability was rated moderately unstable to severely unstable. Site images from 10UM032 indicate an unstable, overwidened stream channel with excess sedimentation infilling pool and run habitat (See Image 5 below). Macrophytes were also dense in areas indicating a potential eutrophication issue.

Image 5: Station 10UM032 on Shingle Creek. Stream is overwidened with severe bank erosion and excess sedimentation infilling habitats.

Currently the reach also has a deferred turbidity impairment awaiting development of TALU standards; however, the stressor identification report for Shingle Creek did not identify turbidity as a stressor to aquatic life. The stressor identification analysis found that altered hydrology, low dissolved oxygen, and lack of habitat were the leading contributors to the impaired biota of these two creeks (SCWMC & MPCA 2010). Work is underway to address the impairments on Shingle Creek and Bass Creek.

Lake assessment results

For aquatic consumption use, one lake is supporting (Crystal) while five lakes are not supporting (Table 33). For aquatic recreation use, 12 lakes are currently on the 2012 impaired waters list; however, three lakes (Ryan, Schmidt and Lower Twin) are all proposed to be removed from the list in 2014 as they are now meeting the eutrophication standard. Lakes in the watershed are relatively small (< 40 ha) and the subwatershed is heavily developed. Storm water runoff and the shallow nature of the basins will complicate remediation of the additional impaired basins.

Water quality plans, projects, and TMDLs

Most of the impairments in the watershed have been or are currently being addressed with TMDLs. To view approved and underway TMDL projects for impaired waters in this watershed visit http://www.pca.state.mn.us/index.php/water/water-types-and-programs/minnesotas-impaired-waters-and-tmdls/tmdl-projects/upper-mississippi-river-basin-tmdl/upper-mississippi-river-basin-tmdls.html. The Shingle Creek WMC watershed management plan is available for further details at www.shinglecreek.org.

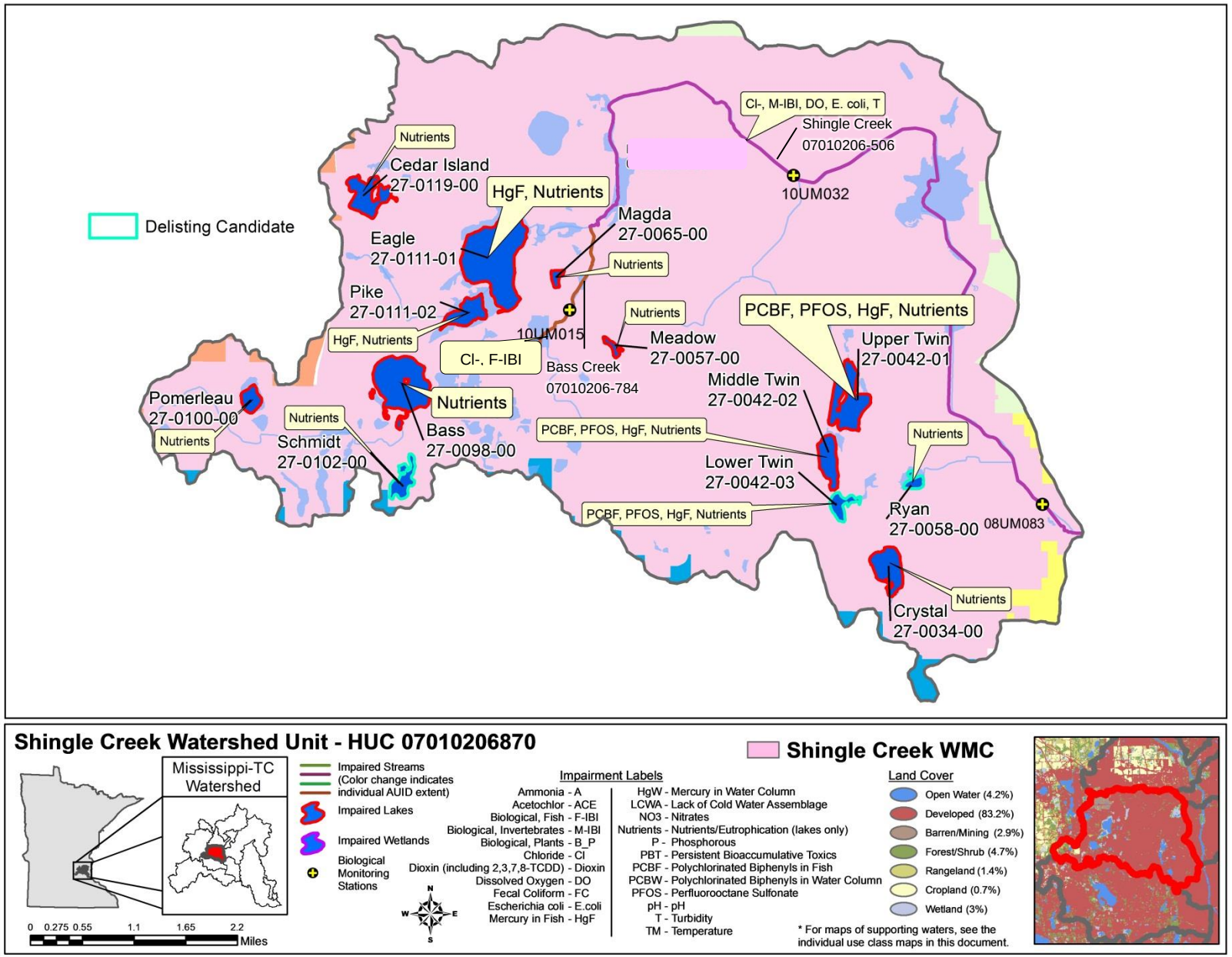

Figure 23. Currently listed impaired waters by parameter and land use characteristics in the Shingle Creek Subwatershed.

Mississippi (Direct)-Minneapolis Subwatershed HUC 7010206880

This subwatershed drains 45 mi^2 of dense urban land of Minneapolis and Saint Paul in Hennepin and Ramsey Counties. Other cities include the south side of Columbia Heights and western side of Falcon Heights. Ninety-three percent of the watershed is developed land, with only 3% forest and 0.4% wetland (NLCD 2006). The Mississippi River runs through the center of the watershed from north of St Anthony Falls in downtown Minneapolis to the confluence with the Minnesota River near Fort Snelling in Saint Paul. Parks and prominent landmarks include the West Mississippi Parkway, University of Minnesota and the Minnesota State Fair Grounds. There is only one lake in this watershed (Powderhorn Lake) and no tributary streams, hence there are no biological or intensive water chemistry collection stations. This 11HUC watershed includes jurisdictions of five watershed management organizations: Mississippi River Watershed Management Organization, Capital Region Watershed District, Minnehaha Creek Watershed District and small sections under Bassett Creek Watershed Management Organization and Rice Creek Watershed District.

Table 34. Lake morphometric and assessment data for the Mississippi River (Direct)-Minneapolis Subwatershed (07010206-880).

Local Jurisdiction[1]	Lake ID	Lake Name	Trophic Status[2]	Lake Area (ha)	% Littoral	Max Depth (m)	Mean Depth (m)	Trend[3]	Mean TP (ug/L)	Mean Chl-a (ug/L)	Mean Secchi (m)	Aquatic Recreation Use Support[4]	Aquatic Life Use Support[5]	Aquatic Consumption Use Support[6]
MCWD	27-0014-00	Powderhorn	H	4	95	6.1	1.2	I	103	26.2	1.2	IF	IF	NS

1. MCWD = Minnehaha Creek Watershed District
2. H = hypereutrophic, E = eutrophic, M = mesotrophic, O = oligotrophic
3. IF = Insufficient information, N = no trend, I = improving trend, D = declining trend
4. NS = not supporting, FS = supporting, IF = insufficient information to determine support, NA = not assessed (too small or wetland-like)
5. NS = not supporting, IF = insufficient information to determine support or meeting chloride standard, NA = not assessed
6. NS = not supporting, FS = supporting, NA = not assessed

Key for Cell Shading: = existing impairment; = new impairment; = full support of designated use; = previously impaired, delisting completed or proposed.

Summary

Lake assessment results

Powderhorn Lake was listed in 2002 for aquatic recreation impairment due to excess nutrients and in 2006 for aquatic consumption due to mercury in fish tissue. Chlorophyll-a and Secchi are now meeting the thresholds in the eutrophication standard; this urban lake was delisted in 2012 for aquatic recreation due to in-lake and watershed projects that resulted in reduced algal concentrations and higher clarity. Phosphorus still exceeds the standard, so continued management will be required to achieve swimmable conditions in the lake.

Water quality plans, projects, and TMDLs

To view the approved TMDL for Powderhorn Lake visit http://www.pca.state.mn.us/index.php/water/water-types-and-programs/minnesotas-impaired-waters-and-tmdls/tmdl-projects/upper-mississippi-river-basin-tmdl/upper-mississippi-river-basin-tmdls.html. A watershed management plan is available at http://www.minnehahacreek.org.

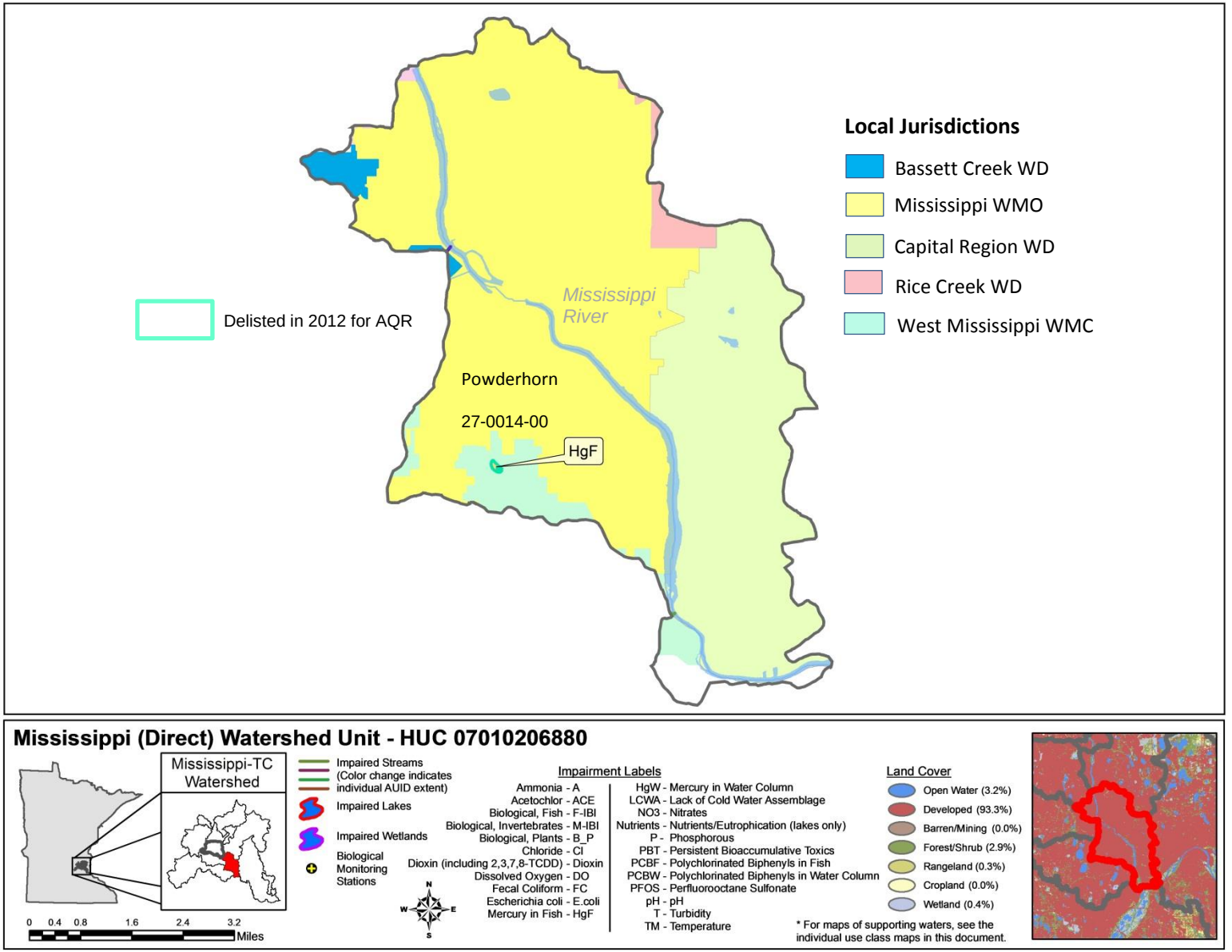

Figure 24. Waterbodies, local watershed organizations and land use characteristics (inset) in the Mississippi (Direct)-Minneapolis Subwatershed.

Bassett Creek Subwatershed HUC 7010206890

The Bassett Creek Subwatershed is 43 mi^2 and includes the cities of Plymouth and Golden Valley in Hennepin County. At 880 acres, Medicine Lake is the largest lake in the subwatershed and considered by the MDNR to be one of the best fishing lakes in the Twin Cities. Other lakes include Sweeney, Parkers and Wirth. Bassett Creek begins as an outflow of Medicine Lake and winds 12 miles before entering the Mississippi River (spending the last 1.5 miles underground in a stormwater tunnel running under downtown Minneapolis (http://www.mninter.net/~stack/bassett/descript.htm). Land use in the watershed is largely developed (82%) as residential and industrial land, while many natural areas are maintained as woodlands and park, including Clifford E French, Parkers Creek, Bassett Creek, and Theodore Wirth Parkway. This subwatershed is largely under the jurisdiction of Bassett Creek Watershed Management Commission; however, within the current subwatershed boundaries small portions of the watershed are also under the jurisdiction of Shingle Creek Watershed Management Commission, Mississippi River Watershed Management Organization and Minnehaha Creek Watershed District. The intensive water chemistry station is on Bassett Creek at Irving Avenue in Minneapolis (STORET/EQuIS S005-017) and co-located with biological station 00UM105.

Table 35. Aquatic life and recreation assessments on stream reaches: Bassett Creek Subwatershed.

Local Jurisdiction	AUID *Reach Name* *Reach Description*	Reach Length (miles)	Use Class	Biological Station ID	Location of Biological Station	Aquatic Life Indicators: Fish IBI	Invert IBI	Dissolved Oxygen	Turbidity	Chloride	pH	NH_3	Pesticides	Bacteria	Aquatic Life	Aquatic Rec.
BCWMC	***07010206-526,*** **Unnamed creek,** Headwaters to Medicine Lk	5.9	2B	--	--	--	--	--	EXS	--	--	--	--	EX	IF*	NS
BCWMC	***07010206-734,*** **Unnamed creek,** Headwaters to Sweeney Lk	1.6	2B	--	--	--	--	--	EXS	--	--	--	--	--	IF	NA
BCWMC	***07010206-738,*** **Unnamed creek,** Headwaters to Sweeney Lk	0.8	2B	--	--	--	--	--	EXS	--	--	--	--	--	IF	NA
BCWMC	***07010206-739,*** **Unnamed creek,** Headwaters to Medicine Lk	1.7	2B	--	--	--	--	--	EXS	--	--	--	--	--	IF	NA
BCWMC	***07010206-552,*** **Unnamed creek,** Unnamed lk to Bassett Cr	2.6	2B	--	--	--	--	--	--	--	--	--	--	EX	NA*	NS
BCWMC	***07010206-740,*** **Unnamed creek,** Unnamed cr to Medicine Lk	0.3	2B	--	--	--	--	--	EXS	--	--	--	--	--	IF	NA

Local Jurisdiction	AUID *Reach Name* *Reach Description*	Reach Length (miles)	Use Class	Biological Station ID	Location of Biological Station	Aquatic Life Indicators:									Aquatic Life	Aquatic Rec.
						Fish IBI	Invert IBI	Dissolved Oxygen	Turbidity	Chloride	pH	NH_3	Pesticides	Bacteria		
BCWMC	***07010206-741,* Unnamed creek,** Headwaters to Unnamed cr	0.7	2B	--	--	--	--	--	EXS	--	--	--	--	--	IF	NA
BCWMC	***07010206-538,* Bassett Creek,** Medicine Lk to Mississippi R	12.7	2B	--	--.	--	--	EXS	MTS	EX	IF	--	MTS	EX	NS	NS

BCWMC = Bassett Creek Watershed Management Commission

Abbreviations for Indicator Evaluations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **MTS** = Meets criteria; **EXP** = Exceeds criteria, potential impairment; **EXS** = Exceeds criteria, potential severe impairment; **EX** = Exceeds criteria (Bacteria).

Abbreviations for Use Support Determinations: **NA** = Not Assessed, **IF** = Insufficient Information, **NS** = Non-Support, **FS** = Full Support

Key for Cell Shading: = existing impairment, listed prior to 2012 assessment; = new impairment, identified during 2012 assessment; = full support of designated use.

*Aquatic Life assessment and/or impairments have been deferred until the adoption of Tiered Aquatic Life Uses due to the AUID being predominantly (>50%) channelized or having biological data limited to a station occurring on a channelized portion of the stream.

Table 36. Non-assessed biological stations on channelized AUIDs: Bassett Creek Subwatershed.

Local Jurisdiction	AUID *Reach Name* *Reach Description*	Reach length (miles)	Use Class	Biological Station ID	Location of Biological Station	Fish IBI	Invert IBI
BCWMC	***07010206-526,* Unnamed creek,** Headwaters to Medicine Lk	5.9	2B	10UM033	Downstream of 26th Ave N, in Plymouth	Fair	--
BCWMC	***07010206-552,* Unnamed creek,** Unnamed lk to Bassett Cr	2.6	2B	00UM094	Upstream of Douglas Drive, in Crystal	Poor	Fair
BCWMC	***07010206-538,* Bassett Creek,** Medicine Lk to Mississippi R	12.7	2B	08UM074 97UM006 00UM105	Downstream of Hwy 55, in Golden Valley At Dresden Lane, in Golden Valley Downstream of Penn Ave N, in Minneapolis	Poor (5)	Fair (7)

BCWMC = Bassett Creek Watershed Management Commission

See Appendix 5.1 for clarification on the good/fair/poor thresholds and Appendix 5.2 and Appendix 5.3 for IBI results.

Parentheses behind ratings indicate the quantity of site visits when >1, which may or may not occur in the same year.

Table 37. Minnesota Stream Habitat Assessment (MSHA): Bassett Creek Subwatershed.

Local Jurisdiction	# 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
BCWMC	1	10UM033	Unnamed creek	2	10.5	19	13	23	67.5	Good
BCWMC	1	00UM094	Unnamed creek	2	10.5	18.3	7	18	55.8	Fair
BCWMC	2	08UM074	Bassett Creek	2	8.8	19.2	7	18	55.0	Fair
BCWMC	1	97UM006	Bassett Creek	2	9.5	20.4	9	20	60.9	Fair
BCWMC	2	00UM105	Bassett Creek	1.5	9.8	15.5	11	16.5	54.2	Fair
Average Habitat Results: *Bassett Creek Subwatershed*				**1.9**	**9.8**	**18.5**	**9.4**	**19.1**	**58.7**	**Fair**

BCWD = Bassett Creek Watershed District

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)

Table 38. Channel Condition and Stability Assessment (CCSI): Bassett Creek Subwatershed.

Local Jurisdiction	# Visits	Biological Station ID	Stream Name	Upper Banks (4-43)	Lower Banks (5-46)	Substrate (3-37)	Channel Evolution (1-11)	CCSI Score (13-137)	CCSI Rating
BCWMC	1	10UM033	Unnamed creek	16	22	21	5	64	Moderately stable
BCWMC	0	00UM094	Unnamed creek	--	--	--	--	--	--
BCWMC	1	08UM074	Bassett Creek	22	10	13	5	50	Moderately stable
BCWMC	0	97UM006	Bassett Creek	--	--	--	--	--	--
BCWMC	1	00UM105	Bassett Creek	18	18	18	3	57	Moderately stable
Average Stream Stability Results: *Bassett Creek Subwatershed*				**18.7**	**16.7**	**17.3**	**4.3**	**57**	**Moderately stable**

BCWMC = Bassett Creek Watershed Management Commission

Qualitative channel stability scores and ratings (Higher scores indicate greater channel instability)

= Stable: CCSI < 27 = Fairly stable: 27 < CCSI < 45 = Moderately unstable: 45 < CCSI < 80 = Severely unstable: 80 < CCSI < 115 = Extremely unstable: CCSI > 115

-- CCSI data not available. Station sampled prior to CCSI assessment being implemented as part of biological monitoring protocol.

Table 39. Outlet water chemistry results: Bassett Creek Subwatershed.

Station location:	**Bassett Creek at Irving Ave, in Minneapolis**
STORET/EQuIS ID:	**S005-017**
Station #:	**00UM105**
Local Jurisdiction:	**Bassett Creek Watershed District**

Parameter	Units	# of Samples	Minimum	Maximum	Mean	Median	WQ Standard[1]	# of WQ Exceedances
Ammonia-nitrogen	mg/L	23	< 0.02	0.22	0.08	0.08		
Chloride	mg/L	--	--	--	--	--	230	0
Chlorophyll-a, Corrected	ug/L	16	3.9	29	12.7	12.5		
Dissolved Oxygen	mg/L	--	--	--	--	--	5	0
Escherichia coli[1,2]	MPN/100ml	32	29	> 2420	157	131	1260	3
Inorganic nitrogen (nitrate and nitrite)	mg/L	--	--	--	--	--		
Kjeldahl nitrogen	mg/L	23	0.74	1.4	0.96	0.94		
Orthophosphate	ug/L	--	--	--	--	--		
pH		--	--	--	--	--	6.5 - 9	--
Pheophytin-a	ug/L	--	--	--	--	--		
Phosphorus	ug/L	23	32	184	93	95		
Specific Conductance	uS/cm	29	619	1171	832	809		
Temperature, water	deg °C	29	10.9	26.6	20	21		
Total suspended solids	mg/L	23	4	45	9.4	7		
Total volatile solids	mg/L	23	2	15	3.6	3		
Transparency tube	60 cm	28	30	> 60	58	> 60	>20	0

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

2 # WQ exceedances represents exceedances of individual maximum standard for *E. coli* (1260 cfu/100 ml).

****Data found in the table above was compiled using the results from data collected at the outlet monitoring station in the Bassett Creek subwatershed, a component of the IWM work conducted between May and September in 2010 and 2011. This specific data does not reflect all data that was used to assess the AUID.**

Table 40. Lake morphometric and assessment data for the Bassett Creek Subwatershed (07010206-890)

Local Jurisdiction[1]	Lake ID	Lake Name	Trophic Status[2]	Lake Area (ha)	% Littoral	Max Depth (m)	Mean Depth (m)	Trend[3]	Mean TP (ug/L)	Mean Chl-a (ug/L)	Mean Secchi (m)	Aquatic Recreation Use Support[4]	Aquatic Life Use Support[5]	Aquatic Consumption Use Support[6]
BCWMC	27-0035-01	Sweeney	E	27	61	8.2	3.7	N	58	18.4	1.4	NS	NS	FS
BCWMC	27-0035-02	Twin	M	8	38	16.6	7.8	IF	19	2.9	3.2	IF	NA	NA
BCWMC	27-0037-00	Wirth	E	16	61	7.6	4.3	I	39	16.9	2.3	IF	NA	NS
MCWD	27-0082-00	Windsor	H	5	100	1.5	1.0	IF	155	43.2	0.7	NS	NA	--
BCWMC	27-0103-00	Lost	E	9	100	1.8	1.1	N	--	--	0.6	IF	NA	--
BCWMC	27-0104-00	Medicine	E	385	45	14.9	4.8	N	60	33.9	1.6	NS	IF	NS
BCWMC	27-0107-00	Parkers	E	39	70	11.3	3.7	I	31	11.8	2.4	FS	NS	NS
BCWMC	27-0627-00	Northwood	H	6	100	1.5	0.8	D	204	35.7	1.1	NS	NA	--
BCWMC	27-0711-00	Westwood	E	46	100	1.5	--	N	55	11.8	1.2	FS	NA	--
BCWMC	27-0734-00	Unnamed (Crane)	E	38	100	1.5	1.0	IF	66	15.3	0.9	IF	NA	--

1. BCWMC = Bassett Creek Watershed Management Commission, MCWD = Minnehaha Creek Watershed District
2. H = hypereutrophic, E = eutrophic, M = mesotrophic, O = oligotrophic
3. IF = Insufficient information, N = no trend, I = improving trend, D = declining trend
4. NS = not supporting, FS = supporting, IF = insufficient information to determine support, NA = not assessed (too small or wetland-like)
5. NS = not supporting, IF = insufficient information to determine support or meeting chloride standard, NA = not assessed
6. NS = not supporting, FS = supporting, NA = not assessed, -- no data

Key for Cell Shading: = existing impairment; = new impairment; = full support of designated use.

Summary

Stream assessment results

Assessment data were available on Bassett Creek and two tributaries. For aquatic recreation, three reaches had elevated bacteria levels. Bassett Creek was listed for this reason in 2006 and during this assessment two unnamed creeks (07010206-526, 07010206-552) were determined to be impaired and will be added to the 2014 impaired waters list.

For aquatic life assessment, Bassett Creek is already listed as impaired for fishes bioassessment (2004) and chloride toxicity (2008). Samples from 1997 to 2000 at two biological stations were assessed in 2004 and determined the fish impairment. This data was reassessed against new fish IBI standards developed in recent years and the results confirmed the previous listing. In total, three biological stations were sampled along Bassett Creek (08UM004, 97UM006, 00UM105) across various years between 1997 and 2010. Bassett Creek is greater than 50% channelized and a policy decision was made to not

assess the most recent biological collections in 2010 until TALU expectations are developed. For a majority of the samples, the fish community was dominated by tolerant fish (>70%). Dissolved oxygen measurements were low (~4 mg/L) indicating a possible stressor to aquatic life but the dataset was not large enough to warrant a listing during this assessment period.

Chemistry data from two unnamed creeks were also reviewed and found to have elevated turbidity. One AUID (07010206-740) was a small reach draining a wetland and flowing into Medicine Lake. Some samples were determined to be event-biased and with the Medicine Lake TMDL likely to address issues with tributaries, this reach was not listed for turbidity. The other AUID (07010206-526) which flows into Bassett Creek recently underwent a large restoration in 2010 and 2011 which may improve conditions; therefore, this reach was not listed at this time, but additional monitoring was suggested to see if conditions have indeed improved.

Lake assessment results

One of the lake-poorer subwatersheds, the Bassett Creek Subwatershed has four lakes that are not meeting aquatic recreation use support due to excess phosphorus (Table 40). Parkers and Westwood Lakes are both fully supporting of aquatic recreation, while Medicine, Sweeney, Windsor and Northwood lakes do not support recreation activities. Chloride toxicity has been identified as a problem on both Parkers and Sweeney Lakes; these two lakes will be added to the 2014 Impaired Waters List for not meeting aquatic life standards. For aquatic consumption, only one lake is supporting (Sweeney) while three lakes are impaired due to mercury in fish tissue (Medicine, Wirth, Parkers).

Water quality, plans, projects and TMDLs

Most of the impairments in the watershed have been or are currently being addressed with TMDLs. To view approved and underway TMDL projects for impaired waters in this watershed visit http://www.pca.state.mn.us/index.php/water/water-types-and-programs/minnesotas-impaired-waters-and-tmdls/minnesotas-impaired-waters-and-total-maximum-daily-loads-tmdls.html. A watershed management plan is available at www.bassettcreekwmo.org.

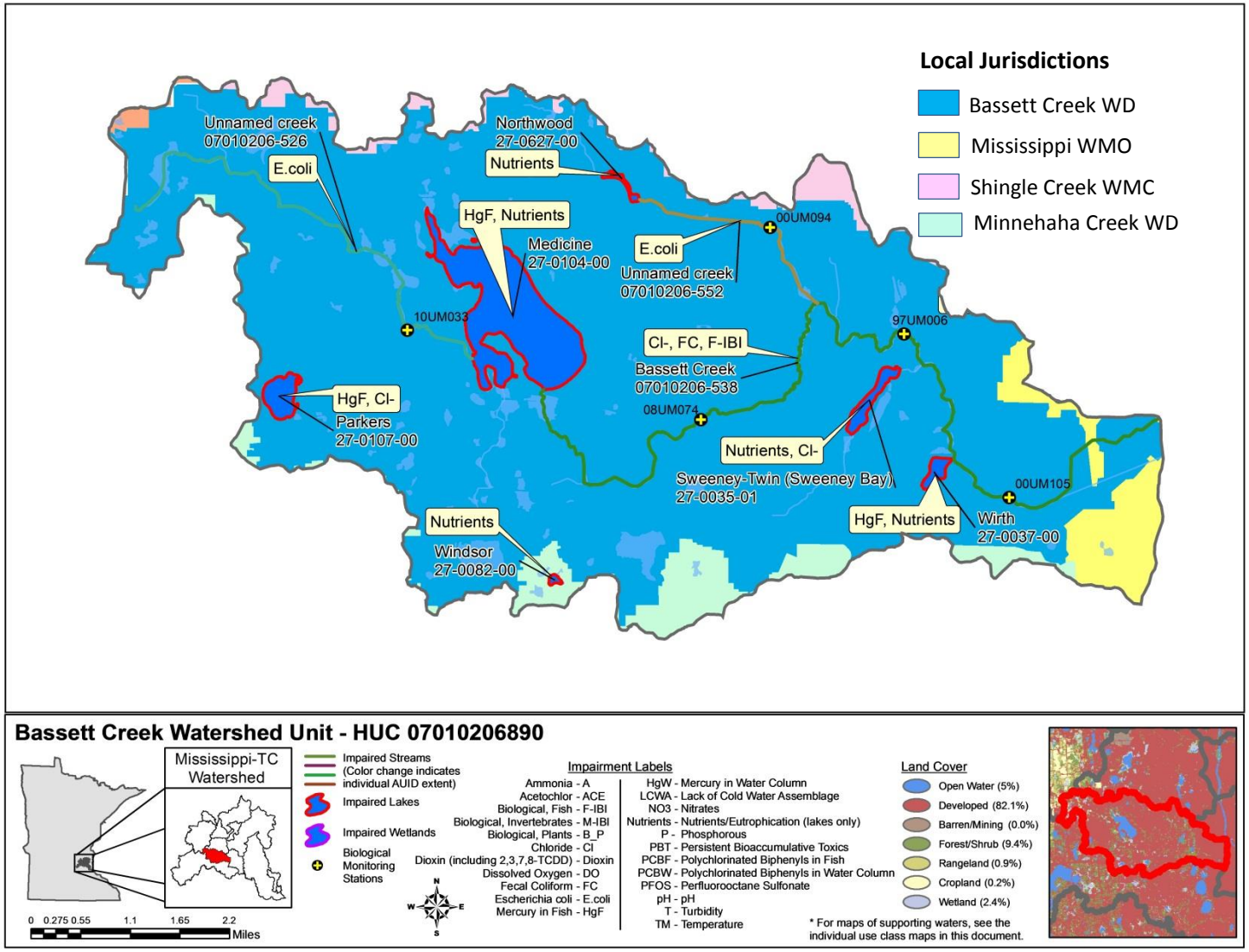

Figure 25. Currently listed impaired waters by parameter and land use characteristics (inset) in the Bassett Creek Subwatershed.

Minnehaha Creek Subwatershed HUC 7010206900

At 176 mi^2, the Minnehaha Creek Subwatershed has the most lakes of any subwatershed in the Mississippi River-Twin Cities Watershed. Minnehaha Creek travels 21 miles from Lake Minnetonka to the Mississippi River. This watershed starts in agricultural areas, flows through the lake-rich Minnetonka area, and then through the urban setting of Minneapolis near Uptown. Additional cities include: Victoria, Mound, Excelsior, Wayzata, Hopkins and St Louis Park in Hennepin County. Agricultural land comprises 18%. Lakes in the watershed include Minnetonka, Minnewashta, Calhoun, Harriet, Nokomis, and many smaller lakes. The subwatershed is largely under the jurisdiction of the Minnehaha Creek Watershed District while a small portion of the urban area of the watershed is under the Mississippi Watershed Management Organization. Intensive water chemistry was collected at Minnehaha Creek near 36th Avenue South in Minneapolis (STORET/EQuIS station: S001-375, Biological station: 08UM075).

Table 41. Aquatic life and recreation assessments on stream reaches: Minnehaha Creek Subwatershed.

Local Jurisdiction	AUID *Reach Name* *Reach Description*	Reach Length (miles)	Use Class	Biological Station ID	Location of Biological Station	Aquatic Life Indicators: Fish IBI	Invert IBI	Dissolved Oxygen	Turbidity	Chloride	pH	NH_3	Pesticides	Bacteria	Aquatic Life	Aquatic Rec.
MCWD	***07010206-712*, Long Lake Creek,** Long Lk to Lk Minnetonka	2.5	2B	10UM006	Upstream of Brown Rd S, 2 mi. S of Long Lake	EXS*	EXP*	EXS*	MTS	MTS	MTS	--	--	--	IF*	NA
MCWD	***07010206-551*, Sixmile Creek,** Mud Lk to Lk Minnetonka	2.5	2B	--	--	--	--	NA¥	NA¥	MTS	NA¥	--	--	MTS	NA¥	FS
MCWD	***07010206-697*, Painter Creek,** Katrina Lk to Unnamed cr	3.8	2B	--	--	--	--	EXS*	--	MTS	--	--	--	--	IF*	NA
MCWD	***07010206-700*, Painter Creek,** Unnamed cr to Lk Minnetonka	2.4	2B	--	--	--	--	EXS*	--	MTS	--	--	--	EX	NA*	NS
MCWD	***07010206-674*, Unnamed creek,** Headwaters to Christmas Lk	0.7	2B	--	--	--	--	MTS	MTS	MTS	MTS	--	--	--	IF	NA
MCWD	***07010206-679*, Unnamed creek,** Headwaters to Peavey Lk	1.1	2B	--	--	--	--	IF	IF	--	EXS	--	--	--	IF	NA
MCWD	***07010206-703*, Unnamed creek,** Lk Classen to Lk Minnetonka	1.9	2B	--	--	--	--	EXP	--	MTS	MTS	--	--	--	IF	NA
MCWD	***07010206-704*, Unnamed creek,** Unnamed cr to Gleason Lk	1.1	2B	--	--	--	--	EXS*	MTS	EXS	MTS	--	--	--	IF*	NA

Local Jurisdiction	AUID *Reach Name* *Reach Description*	Reach Length (miles)	Use Class	Biological Station ID	Location of Biological Station	Aquatic Life Indicators:									Aquatic Life	Aquatic Rec.
						Fish IBI	Invert IBI	Dissolved Oxygen	Turbidity	Chloride	pH	NH_3	Pesticides	Bacteria		
MCWD	***07010206-709,* Unnamed creek,** Unnamed Cr to Long Lk	0.8	2B	--	--	--	--	MTS	MTS	MTS	MTS	--	--	--	FS	NA
MCWD	***07010206-716,* Unnamed creek,** Headwaters to Schultz Lk	1.1	2B	--	--	--	--	MTS	MTS	MTS	MTS	--	--	--	FS	NA
MCWD	***07010206-539,*** **Minnehaha Creek,** Lk Minnetonka to Mississippi R	21.2	2B	10UM004 97UM007 08UM075	Upstream of Logan Ave S, in Mpls At Nicollet Ave S, in Mpls Upstream of 34th Ave S, in Mpls	EXS	EXS	EXS	MTS	EX	MTS	IF	MTS	EX	NS	NS

MCWD = Minnehaha Creek Watershed District

Abbreviations for Indicator Evaluations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **MTS** = Meets criteria; **EXP** = Exceeds criteria, potential impairment; **EXS** = Exceeds criteria, potential severe impairment; **EX** = Exceeds criteria (Bacteria).

Abbreviations for Use Support Determinations: **NA** = Not Assessed, **IF** = Insufficient Information, **NS** = Non-Support, **FS** = Full Support

Key for Cell Shading: = existing impairment, listed prior to 2012 assessment; = new impairment, identified during 2012 assessment; = full support of designated use.

*Aquatic Life assessment and/or impairments have been deferred until the adoption of Tiered Aquatic Life Uses due to the AUID being predominantly (>50%) channelized or having biological data limited to a station occurring on a channelized portion of the stream.

¥Station was too close to lake to assess using stream aquatic life standards.

Table 42. Non-assessed biological stations on channelized AUIDs: Minnehaha Creek Subwatershed.

Local Jurisdiction	AUID *Reach Name* *Reach Description*	Reach length (miles)	Use Class	Biological Station ID	Location of Biological Station	Fish IBI	Invert IBI
MCWD	***07010206-700,* Painter Creek,** Unnamed cr to Lk Minnetonka	2.4	2B	10UM007	Downstream of Painter Rd, 3 mi. S of Maple Plain	Good	Poor
MCWD	***07010206-539,* Minnehaha Creek,** Lk Minnetonka to Mississippi R	21.2	2B	08UM077 08UM076	Upstream of Cedar Lake Rd, in Minnetonka Upstream of Louisiana Ave, in St Louis Park	Fair (2)	Fair (4)

MCWD = Minnehaha Creek Watershed District

See Appendix 5.1 for clarification on the good/fair/poor thresholds and Appendix 5.2 and Appendix 5.3 for IBI results.

Parentheses behind ratings indicate the quantity of site visits when >1, which may or may not occur in the same year.

Table 43. Minnesota Stream Habitat Assessment (MSHA): Minnehaha Creek Subwatershed.

Local Jurisdiction	# 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
MCWD	1	10UM006	Long Lake Creek	2	11.5	12.6	11	13	50.1	Fair
MCWD	1	10UM007	Painter Creek	2	9	12.3	12	13	48.3	Fair
MCWD	1	08UM077	Minnehaha Creek	2	8	22.6	12	22	66.6	Good
MCWD	1	08UM076	Minnehaha Creek	1	9.5	19.8	13	19	62.3	Fair
MCWD	1	10UM004	Minnehaha Creek	2	7.5	19.3	9	23	60.8	Fair
MCWD	1	97UM007	Minnehaha Creek	2	8	20.2	8	18	56.2	Fair
MCWD	1	08UM075	Minnehaha Creek	2	7.5	17.5	12.5	15.5	55	Fair
Average Habitat Results: *Minnehaha Creek Subwatershed*				**1.9**	**8.7**	**17.8**	**8.1**	**17.6**	**57**	**Fair**

MCWD = Minnehaha Creek Watershed District

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)

Table 44. Channel Condition and Stability Assessment (CCSI): Minnehaha Creek Subwatershed.

Local Jurisdiction	# Visits	Biological Station ID	Stream Name	Upper Banks (4-43)	Lower Banks (5-46)	Substrate (3-37)	Channel Evolution (1-11)	CCSI Score (13-137)	CCSI Rating
MCWD	1	10UM006	Long Lake Creek	29	25	11	3	68	Moderately unstable
MCWD	1	10UM007	Painter Creek	29	26	13	5	72	Moderately unstable
MCWD	1	08UM077	Minnehaha Creek	27	9	16	2	44	Fairly stable
MCWD	1	08UM076	Minnehaha Creek	29	21	12	3	65	Moderately unstable
MCWD	1	10UM004	Minnehaha Creek	31	17	8	5	71	Moderately unstable
MCWD	1	97UM007	Minnehaha Creek	23	15	13	3	44	Fairly stable
MCWD	1	08UM075	Minnehaha Creek	22	11	10	3	46	Moderately unstable
Average Stream Stability Results: *Minnehaha Creek Subwatershed*				27.1	17.7	11.9	3.4	58.6	**Moderately unstable**

MCWD = Minnehaha Creek Watershed District

Qualitative channel stability scores and ratings (Higher scores indicate greater channel instability)

= Stable: CCSI < 27 = Fairly stable: 27 < CCSI < 45 = Moderately unstable: 45 < CCSI < 80 = Severely unstable: 80 < CCSI < 115 = Extremely unstable: CCSI > 115

Table 45. Outlet water chemistry results: Minnehaha Creek Subwatershed.

Station location:	**Minnehaha Creek, near 36th Ave South, in Minneapolis**
STORET/EQuIS ID:	**S001-375**
Station #:	**08UM075**
Local Jurisdiction:	**Minnehaha Creek Watershed District**

Parameter	Units	# of Samples	Minimum	Maximum	Mean	Median	WQ Standard[1]	# of WQ Exceedances[2]
Ammonia-nitrogen	mg/L	18	< 0.02	0.14	0.06	0.05		
Chloride	mg/L	--	--	--	--	--	230	--
Chlorophyll-a, Corrected	ug/L	18	5.2	25	13	11.5		
Dissolved Oxygen	mg/L	--	--	--	--	--	5	--
Escherichia coli[1,2]	MPN/100ml	22	16	770	139	133.5	1260	0
NO2NO3	mg/L	--	--	--	--	--		
Kjeldahl nitrogen	mg/L	18	0.7	1.2	0.8	0.8		
Orthophosphate	ug/L	--	--	--	--	--		
pH	SU	--	--	--	--	--	6.5 - 9	--
Pheophytin-a	ug/L	--	--	--	--	--		
Phosphorus	ug/L	18	17	96	52	46		
Specific Conductance	uS/cm	22	383	733	483	462		
Temperature, water	deg °C	22	12.7	27.2	20.3	19.5		
Total suspended solids	mg/L	18	3	18	7.1	6		
Total volatile solids	mg/L	18	2	7	3.2	3		
Transparency tube	60 cm	22	< 60	< 60	< 60	< 60	>20	0

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

2 # WQ exceedances represents exceedances of individual maximum standard for *E. coli* (1260 cfu/100 ml).

****Data found in the table above was compiled using the results from data collected at the outlet monitoring station in the Minnehaha Creek subwatershed, a component of the IWM work conducted between May and September in 2010 and 2011. This specific data does not reflect all data that was used to assess the AUID.**

Table 46. Lake water aquatic recreation assessments: Minnehaha Creek Subwatershed.

Local Jurisdiction[1]	Lake ID Figure 28	Lake ID	Lake Name	Trophic Status[2]	Lake Area (ha)	% Littoral	Max Depth (m)	Mean Depth (m)	Trend [3]	Mean TP (ug/L)	Mean Chl-a (ug/L)	Mean Secchi (m)	Aquatic Recreation Use Support[4]	Aquatic Life Use Support[5]	Aquatic Consumption Use upport[6]
MCWD	--	27-0022-00	Diamond	H	23	100	1.8	0.9	D	191	56.7	0.6	NA	--	NA
MCWD	1	10-0009-00	Minnewashta	M	299	50	21.3	5.2	N	21	9.7	2.5	FS	IF	NS
MCWD	2	10-0010-00	Tamarack	E	26	41	25.0	9.1	N	41	16.2	2.1	NS	IF	NA
MCWD	--	10-0011-00	St. Joe	E	19	47	15.8	4.6	N	26	6.2	2.8	FS	IF	NA
MCWD	3	10-0015-00	Virginia	E	70	28	10.4	3.4	N	53	33.3	1.3	NS	IF	NS
MCWD	--	10-0018-00	Schutz	E	51	38	14.9	6.1	N	37	21.2	1.8	IF	IF	NA
MCWD	4	10-0041-00	Zumbra-Sunny	E	89	55	17.7	4.3	I	26	10.4	2.8	FS	IF	NS
MCWD	5	10-0042-00	Parley	E	166	95	5.5	1.9	N	89	80.0	0.7	NS	IF	FS
MCWD	--	10-0043-00	Lundsten	E	85	100	3.0	0.9	IF	62	18.1	1.6	IF	NA	NA
MCWD	--	10-0044-01	West Auburn	E	57	--	25.6	7.6	I	32	11.5	2.4	FS	NA	FS
MCWD	6	10-0044-02	East Auburn	E	49	--	25.6	4.6	N	49	36.3	1.2	NS	NA	FS
MCWD	7	10-0045-00	Steiger	E	84	61	11.3	4.0	I	39	14.9	2.0	IF	NA	NS
MCWD	--	10-0046-00	Church	H	11	59	16.5	9.1	IF	117	22.8	3.0	IF	NA	NA
MCWD	8	10-0048-00	Wassermann	E	105	73	12.5	3.0	N	71	46.9	1.0	NS	IF	NS
MCWD	--	10-0050-00	Carl Krey	E	32	--	--	1.0	IF	25	6.4	2.3	FS	NA	NA
MCWD	9	10-0051-00	Turbid	E	22	66	11.3	3.0	IF	61	26.4	1.5	NS	NA	NA
MCWD	--	10-0053-00	Piersons	E	144	35	12.2	5.4	N	25	9.5	2.5	FS	IF	FS
MCWD	--	10-0054-00	Marsh	--	81	100	1.2	1.0	IF	--	--	--	--	--	--
MCWD	10	10-0056-00	Stone	E	113	72	8.8	3.0	IF	39	19.0	2.1	NS	NA	NA
MCWD	--	10-0135-00	Unnamed	--	8	--	--	--	--	--	--	--	--	--	--
MCWD	--	10-0140-00	Unnamed	--	15	--	--	--	--	--	--	--	--	--	--
MCWD	--	10-0200-02	Unnamed	--	--	--	--	--	--	--	--	--	--	--	--
MCWD	11	27-0015-00	Bass	--	--	--	--	--	--	--	--	--	--	--	--
MCWD	12	27-0016-00	Harriet	M	138	25	26.5	9.8	N	20	5.3	2.7	FS	IF	NS

Local Jurisdiction[1]	Lake ID Figure 28	Lake ID	Lake Name	Trophic Status[2]	Lake Area (ha)	% Littoral	Max Depth (m)	Mean Depth (m)	Trend [3]	Mean TP (ug/L)	Mean Chl-a (ug/L)	Mean Secchi (m)	Aquatic Recreation Use Support[4]	Aquatic Life Use Support[5]	Aquatic Consumption Use upport[6]
MCWD	--	27-0017-00	Cemetery	--	4	--	--	--	--	--	--	--	--	--	--
MCWD	13	27-0018-00	Hiawatha	E	27	25	9.4	4.6	N	74	20.7	1.4	NS	NA	FS
MCWD	14	27-0019-00	Nokomis	E	81	51	10.1	4.2	N	57	23.7	1.3	NS	IF	NS
MCWD	--	27-0023-00	Mother	--	55	100	1.4	1.0	IF	--	--	--	--	--	--
MCWD	15	27-0031-00	Calhoun	M	165	31	25.0	10.1	I	16	3.6	3.8	FS	NA	NS
MCWD	16	27-0038-00	Brownie	E	4	63	14.3	6.7	N	40	15.5	1.4	IF	NA	NS
MCWD	12	27-0039-00	Cedar	E	69	37	15.5	6.0	N	24	8.9	1.9	FS	NA	NS
MCWD	18	27-0040-00	Lake of the Isles	E	52	89	9.4	2.3	I	46	32.1	1.4	FS	NA	NS
MCWD	--	27-0052-00	Hannan	--	13	100	1.8	1.0	IF	--	--	--	--	--	--
MCWD	19	27-0053-00	Unnamed (Cobblecrest)	H	4	--	--	1.0	D	161	128.8	0.3	NS	NA	NA
MCWD	--	27-0054-00	Meadowbrook	--	34	--	--	--	--	--	--	--	--	--	--
MCWD	--	27-0085-00	Libbs	M	9	100	2.4	1.0	IF	19	1.9	1.8	IF	NA	NA
MCWD	--	27-0086-00	Shaver	E	7	100	2.1	1.0	IF	44	7.1	1.2	FS	NA	NA
MCWD	--	27-0087-00	Marion	M	17	--	13.7	4.6	IF	13	2.1	4.0	FS	NA	NA
MCWD	20	27-0095-00	Gleason	--	63	--	4.9	2.3	N	92	50.0	1.1	NS	IF	NA
MCWD	21	27-0108-00	Snyder	E	6	--	--	1.0	IF	72	41.3	1.0	NS	NA	NA
MCWD	22	27-0109-00	Hadley	E	24	--	--	1.5	IF	57	16.4	1.7	NS	NA	NA
MCWD	23	27-0133-01	Minnetonka-Grays Bay	M	72	--	11.0	2.4	N	21	5.0	3.0	FS	IF	NS
MCWD	24	27-0133-02	Minnetonka-Lower Lake	M	2381	--	10.4	8.5	I	21	5.4	3.3	FS	IF	NS
MCWD	25	27-0133-03	Minnetonka-Carsons Bay	M	45	--	13.1	3.1	N	20	5.2	2.9	FS	IF	NS
MCWD	26	27-0133-04	Minnetonka-St. Albans Bay	M	65	--	25.6	4.4	N	21	5.3	3.1	FS	IF	NS
MCWD	27	27-0133-05	Minnetonka-Upper Lake	E	1697	--	25.3	6.6	I	25	10.9	2.4	FS	IF	NS
MCWD	28	27-0133-06	Minnetonka-Black Lake	E	34	--	7.6	3.0	N	29	15.0	2.0	FS	IF	NS
MCWD	29	27-0133-07	Minnetonka-Seton Lake	E	17	--	27.7	--	IF	--	--	1.7	IF	NA	NS

Local Jurisdiction[1]	Lake ID Figure 28	Lake ID	Lake Name	Trophic Status[2]	Lake Area (ha)	% Littoral	Max Depth (m)	Mean Depth (m)	Trend [3]	Mean TP (ug/L)	Mean Chl-a (ug/L)	Mean Secchi (m)	Aquatic Recreation Use Support[4]	Aquatic Life Use Support[5]	Aquatic Consumption Use upport[6]
MCWD	30	27-0133-08	Minnetonka-Emerald Lake	--	6	--	27.7	--	--	--	--	--	--	--	NS
MCWD	31	27-0133-09	Minnetonka-Halsteds Bay	E	255	--	9.1	4.0	N	89	63.0	0.9	NS	IF	NS
MCWD	32	27-0133-10	Minnetonka-Crystal Bay	E	322	--	21.3	8.6	N	24	10.7	2.2	FS	IF	NS
MCWD	33	27-0133-11	Minnetonka-Maxwell Bay	E	122	--	9.1	4.3	I	32	15.3	1.7	FS	IF	NS
MCWD	34	27-0133-12	Minnetonka-Stubbs Bay	E	78	--	27.7	4.9	N	50	41.8	1.0	NS	IF	NS
MCWD	35	27-0133-13	Minnetonka-North Arm	E	154	--	17.7	4.0	N	29	13.4	1.9	FS	IF	NS
MCWD	36	27-0133-14	Minnetonka-West Arm	E	324	--	27.7	4.0	N	57	51.7	1.0	NS	IF	NS
MCWD	37	27-0133-15	Minnetonka-Jennings Bay	H	119	--	6.7	3.4	N	97	66.0	0.9	NS	IF	NS
MCWD	38	27-0134-00	Mooney	E	48	100	3.0	1.0	N	73	48.4	1.0	NS	IF	NA
MCWD	39	27-0137-00	Christmas	M	107	30	26.5	11.3	N	14	2.2	5.7	FS	IF	NS
MCWD	50	27-0138-00	Peavey	E	4	--	19.2	9.1	N	71	25.0	2.1	NS	NS	NA
MCWD	41	27-0139-00	Forest	E	51	--	12.8	4.0	D	61	50.7	0.9	NS	IF	NA
MCWD	--	27-0140-01	French Marsh (North)	--	10	100	1.8	--	--	--	--	--	--	--	--
MCWD	--	27-0140-02	French Marsh (South)	--	10	100	1.8	--	--	--	--	--	--	--	--
MCWD	43	27-0141-00	Tanager	E	30	--	7.0	1.5	N	71	72.7	1.0	NS	IF	NA
MCWD	--	27-0144-00	Galpin	E	18	100	4.0		IF			1.4	--	--	--
MCWD	--	27-0150-00	Unnamed	--	49	--	--	--	--	--	--	--	--	--	--
MCWD	44	27-0154-00	Katrina	--	--	--	--	--	--	--	--	--	--	--	--
MCWD	--	27-0156-00	Thies	--	12	75	8.2	3.0	IF	--	--	--	--	--	--
MCWD	45	27-0157-00	Wolsfeld	E	18	74	7.9	3.4	IF	85	60.6	0.8	NS	NA	NA
MCWD	46	27-0158-00	Holy Name	H	38	100	2.1	1.8	IF	150	96.1	0.8	NS	NA	NA
MCWD	47	27-0160-00	Long	E	129	50	10.1	4.2	N	61	37.9	1.0	NS	IF	NS
MCWD	--	27-0161-00	Dickey's	--	11	59	7.6	3.7	IF	--	--	--	--	--	--

Local Jurisdiction[1]	Lake ID Figure 28	Lake ID	Lake Name	Trophic Status[2]	Lake Area (ha)	% Littoral	Max Depth (m)	Mean Depth (m)	Trend [3]	Mean TP (ug/L)	Mean Chl-a (ug/L)	Mean Secchi (m)	Aquatic Recreation Use Support[4]	Aquatic Life Use Support[5]	Aquatic Consumption Use upport[6]
MCWD	--	27-0162-00	Classen	--	47	100	1.2	1.0	IF	--	--	--	--	--	--
MCWD	48	27-0181-00	Dutch	E	98	52	13.1	4.4	IF	53	33.8	1.1	NS	IF	FS
MCWD	49	27-0182-00	Langdon	H	74	84	11.6	2.3	N	106	45.8	0.7	NS	IF	NA
MCWD	--	27-0183-00	Unnamed	--	13	--	--	1.0	IF	--	--	--	--	--	--
MCWD	--	27-0185-00	Saunders	E	21	--	--	1.0	IF	--	--	1.2	IF	NA	--
MCWD	50	27-0186-00	Mud	--	--	--	--	--	--	--	--	--	--	--	--
MCWD	--	27-0408-00	Unnamed	--	13	--	--	--	--	--	--	--	--	--	--
MCWD	--	27-0521-00	Unnamed	--	14	--	--	--	--	--	--	--	--	--	--
MCWD	--	27-0522-00	Unnamed	--	4	--	--	--	--	--	--	--	--	--	--
MCWD	51	27-0656-00	Twin	H	5	--	--	1.0	N	170	53.7	0.7	NS	NA	NA
MCWD	--	27-0683-00	Taft	E	7	36	13.7	7.6	IF	37	25.7	1.3	IF	IF	--

1. MCWD = Minnehaha Creek Watershed District
2. H = hypereutrophic, E = eutrophic, M = mesotrophic, O = oligotrophic, -- not assigned
3. IF = Insufficient information, N = no trend, I = improving trend, D = declining trend, -- not determined
4. NS = not supporting, FS = supporting, IF = insufficient information to determine support, NA = not assessed (too small or wetland-like), -- no data
5. NS = not supporting, IF = insufficient information to determine support or meeting chloride standard, NA = not assessed, -- no data
6. NS = not supporting, FS = supporting, NA = not assessed, -- no data

Key for Cell Shading: = existing impairment; = new impairment; = full support of designated use; = previously impaired, delisting completed or proposed.

Summary

Stream assessment results

Assessment data were available on Six Mile Creek, Painter Creek, Long Lake Creek, Minnehaha Creek and a number of unnamed tributaries. Previous impairments for aquatic recreation and aquatic life use were confirmed and a number of new impairments were found. For aquatic recreation, the existing impairments on Minnehaha Creek and Painter Creek (07010206-700) were confirmed while Six Mile Creek was assessed as fully supporting.

For aquatic life assessment, two unnamed creeks (07010206-709, 07010206-716) were determined to be fully supporting of aquatic life based solely on water chemistry data; no biological data was available for assessment. Three reaches were assessed as impaired due to low-dissolved oxygen levels however, these impairments will be deferred until TALU expectations for channelized reaches are developed. In the meantime, the cause of low-

dissolved oxygen levels in these reaches may warrant investigation as these reaches could potentially be impacting conditions in downstream lakes (i.e., Painter Lake, Lake Minnetonka). In addition, chloride and total suspended solids (TSS) were elevated in a tributary to Gleason Lake (07010206-704) but not enough exceedences were recorded to warrant a listing at this time. Additional monitoring is recommended to determine the extent and magnitude of exceedences. Some reaches with water chemistry data were not assessed since they are very short connectors between lakes and consequently, due to the strong influence of lake water, were considered inappropriate to assess with stream water quality standards.

Long Lake Creek (07010206-712) was determined to be impaired for aquatic life for fish and aquatic macroinvertebrate communities, as well as low-dissolved oxygen. This 2.5 mile reach flows out of Long Lake and through a series of wetlands before flowing into Lake Minnetonka. Relatively few fish were collected, and the fish community was dominated by fathead minnows, a pollution tolerant fish, while the macroinvertebrate community was fairly diverse but dominated by tolerant individuals (83%). One sensitive fish species (i.e., Iowa Darter) and 5 EPT invertebrate taxa were collected indicating that conditions are somewhat tolerable and there is potential for the aquatic community to improve with remediation. At biological station 10UM006, dissolved oxygen measurements were between 4 and 5 mg/L during both early morning and late afternoon sampling events while at other water chemistry monitoring stations dissolved oxygen concentrations were below 1 mg/L indicating that dissolved oxygen is a likely stressor that should be investigated. Additionally, habitat quality was rated fair and channel stability moderately unstable with bank instability noted. Images during sampling suggest that the channel is very incised and may experience flashy stream flows exacerbated by stormwater contributions.

Minnehaha Creek (07010206-539) is 21 miles in length and connects Lake Minnetonka to the Mississippi River. This reach was listed in 2004 as impaired for aquatic life use for fish. Since that time, additional aquatic life impairments have been added including chloride (2008) and low dissolved oxygen (2010). Monitoring data collected in 2010 re-confirmed these existing impairments while aquatic macroinvertebrates was added to the list of impairments. Macroinvertebrates were monitored on Minnehaha Creek in both 2008 and 2010 at four separate locations with one additional station established in 2010 (Figure 26). Invertebrate IBI scores are remarkably similar between the two years at the two lower stations (97UM007 & 08UM075), but vary quite considerably at the two upper stations (08UM077 and 08UM076). Flow was higher in 2010 at the time of sampling (late August) compared to the late August sampling in 2008; however, results are not in consistent agreement as one station had a higher IBI score in 2010, another had a higher score in 2008, while two stations had scores that were similar between the two years. It is worth noting however, that despite zero flow in the creek on several occasions in 2009 (MCWD 2010) due to drought conditions and Grays Bay Dam being closed on June 2, 2009, macroinvertebrate communities remained relatively stable or improved at three out of four stations in 2010 compared to the 2008 sampling results. While Minnehaha Creek's fish and macroinvertebrate communities are imbalanced relative to the proportion of sensitive to tolerant individuals, it is surprising how fairly resilient the communities appear to be due to extreme low flow conditions such as were seen in 2009 (see Images 6 & 7 below).

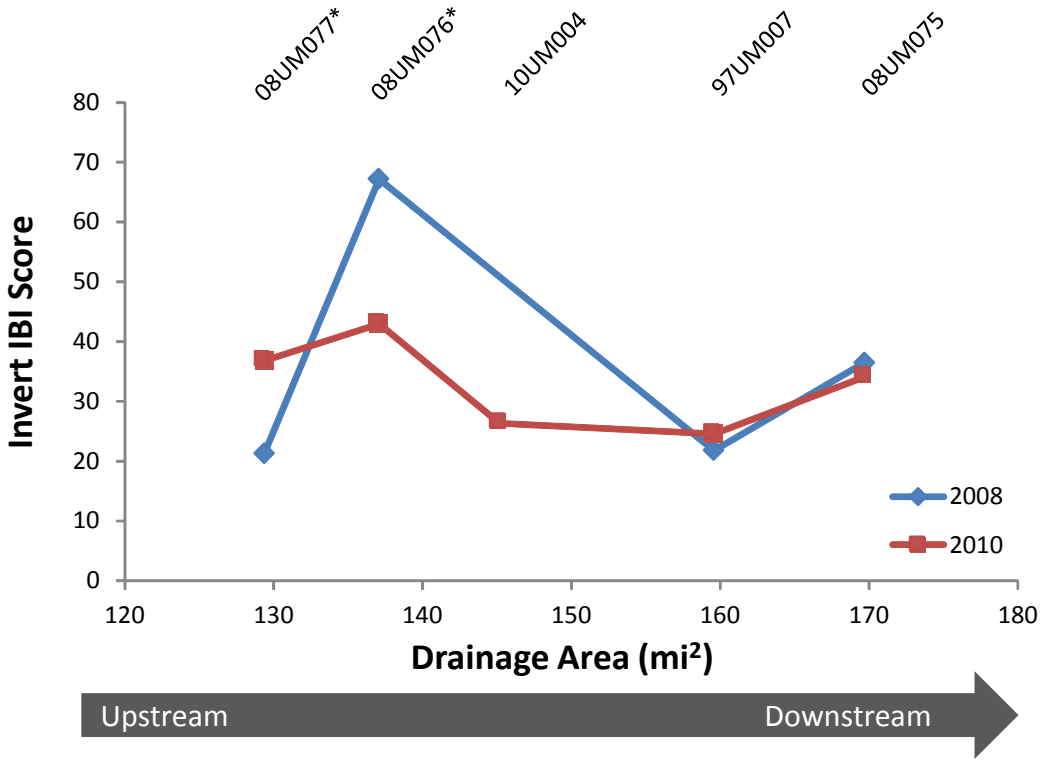

Figure 26. A longitudinal comparison of Invert IBI scores between years (2008, 2010) at four biological stations along Minnehaha Creek.

Image 6: Minnehaha Creek (10UM004) in June 2010.

Image 7: Minnehaha Creek (10UM004) in September 2009.

In addition to stressors associated with the heavily developed landscape of Minnehaha Creek's watershed, aquatic invasive species are also potentially impacting the biological communities of the creek. The entire length of Minnehaha Creek is a MDNR designated infested water for Eurasian water milfoil (*Myriophyllum spicatum*) and zebra mussels (*Dreissena* spp.) (MDNR 2012), as well as other terrestrial and aquatic invasives. Zebra mussels were not collected by MPCA staff during any of the 2008 and 2010 macroinvertebrate visits despite sampling rocks and other hard substrates. However, another MDNR regulated invasive species, the Chinese mystery snail (*Cipangopaludina* sp.), was collected at the lowest station on the creek (08UM075). This snail prefers lakes and slow moving rivers and may have washed into Minnehaha Creek from Lake Hiawatha.

Lake assessment results

There are a total of 79 lakes are in the subwatershed. Of those, 22 are fully supporting of aquatic recreation while 27 are not (Table 46). Three new lakes will be added to the Impaired Waters List in 2014 for not meeting aquatic recreation or aquatic life uses. For aquatic recreation, Turbid, Peavey, and Hadley are not meeting eutrophication standards. In addition to the nutrient impairment, Peavey Lake was determined to be impaired for aquatic life use due to excess chloride levels. Lakes that are fully supporting aquatic recreation uses include the Chain of Lakes – Harriet, Calhoun, Cedar and Lake of the Isles. Lake Minnetonka, the largest lake in the metropolitan area, is assessed by bay; as such, there are portions of the lake that meet swimming uses and portions that do not. Halsteds Bay, Stubbs Bay, West Arm and Jennings Bay are all impaired for aquatic recreation use. These basins are upstream of

the main lake and receive runoff from more agricultural lands than other parts of the lake. For aquatic consumption, 28 lakes are impaired for fish contaminants in fish tissue while five are supporting of their aquatic consumption use (Table 46).

Water quality plans, projects and TMDLs

Most of the impairments in the watershed have been or are currently being addressed with TMDLs. To view approved and underway TMDL projects for impaired waters in this watershed visit http://www.pca.state.mn.us/index.php/water/water-types-and-programs/minnesotas-impaired-waters-and-tmdls/minnesotas-impaired-waters-and-total-maximum-daily-loads-tmdls.html. A watershed management plan is at www.minnehahacreek.org.

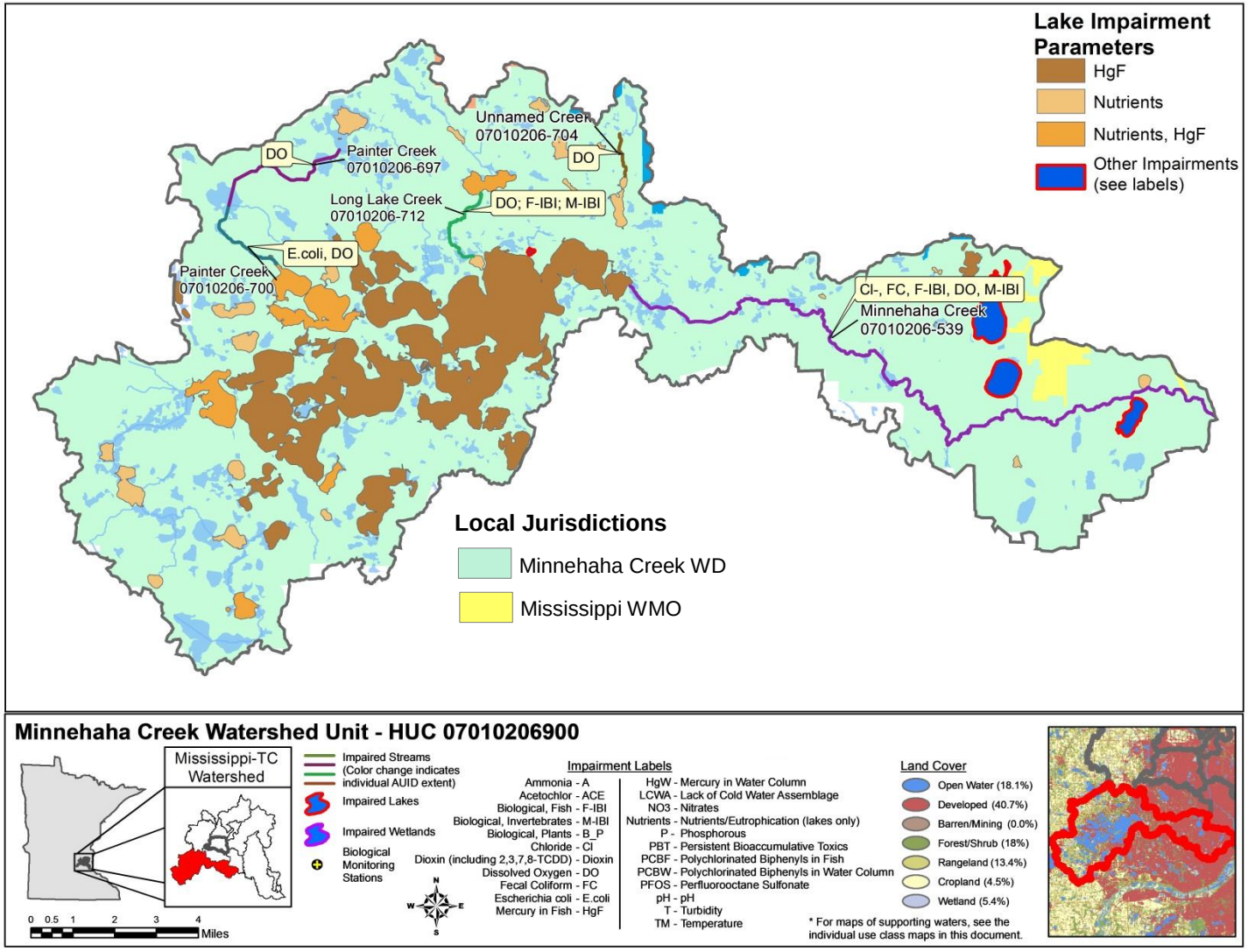

Figure 27. Currently listed impaired streams by parameter and land use characteristics in the Minnehaha Creek Subwatershed. See Figure 28 for impaired lakes.

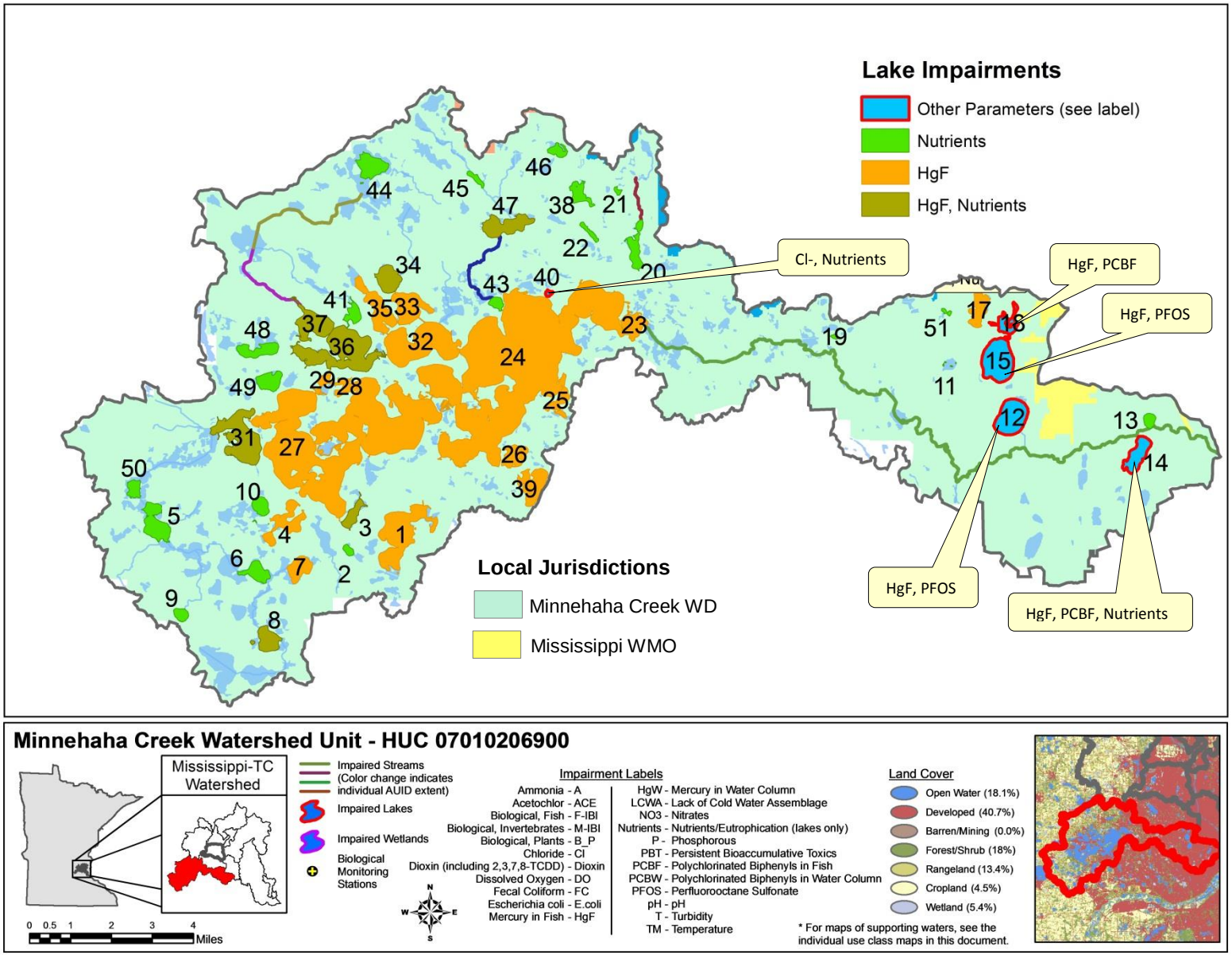

Figure 28. Currently listed impaired lakes by parameter and land use characteristics in the Minnehaha Creek Subwatershed. See Figure 27 for names of impaired streams.

Saint Paul Subwatershed HUC 7010206910

The largest subwatershed at 217 mi^2, the Saint Paul Subwatershed spans across portions of four counties. Land use is dominated by developed land (58.4%) in the city of Saint Paul and neighboring communities. This watershed is lake-rich with 67 lakes. Forest, wetland and water comprise 30% of the watershed to the north and south of the densely urban central corridor. Agricultural land use is limited (12%) and mostly located the lower portion of the subwatershed in Washington and Dakota Counties. Select cities and counties in the subwatershed include the southern portion of Lino Lakes in Anoka County; the eastern side of Shoreview, Vadnais Heights, Roseville, Maplewood, Little Canada, Falcon Heights, and Saint Paul in Ramsey County; South Saint Paul, West Saint Paul, Sunfish Lake, Mendota Heights, Inver Grove Heights, the eastern side of Rosemount, and Hastings in Dakota County; and Saint Paul Park and Cottage Grove in Washington County. The subwatershed crosses the boundaries of six watershed management organizations: Vadnais Lake Area Watershed Management Organization, Rice Creek Watershed District, Ramsey Washington Metro Watershed District, Capital Region Watershed District, Lower Mississippi River Watershed Management Organization and South Washington Watershed District. There is no intensive water chemistry station since there is no single discrete outlet for this watershed as each tributary flows directly into the Mississippi River, which flows through this subwatershed from Fort Snelling to Lock and Dam #2 near Hastings.

Table 47. Aquatic life and recreation assessments on stream reaches: St Paul Subwatershed.

Local Jurisdiction	AUID *Reach Name* *Reach Description*	Reach Length (miles)	Use Class	Biological Station ID	Location of Biological Station	Aquatic Life Indicators: Fish IBI	Invert IBI	Dissolved Oxygen	Turbidity	Chloride	pH	NH_3	Pesticides	Bacteria	Aquatic Life	Aquatic Rec.
LMRWMO	***07010206-542*, Unnamed creek**, Unnamed cr to Mississippi R	0.7	2B	--	--	--	--	--	--	--	--	--	--	EX	NA	NS
RWMWD	***07010206-592*, Battle Creek**, Battle Creek Lk to Pigs Eye Lk	5.0	2B	04UM011 97UM008	At Upper Afton Rd, in St Paul Downstream of McKnight Rd, in St Paul	EXS	EXS	IF	MTS	EX	--	--	MTS	IF	NS	IF
RWMWD	***07010206-606*, Fish Creek**, Carver Lk to Unnamed (North Star) lk	2.1	2C	--	--	--	--	--	MTS	MTS	--	--	MTSs	EX	IF	NS
RWMWD	***07010206-801*, Unnamed ditch,** Headwaters to Mississippi R	3.7	2B	--	--	--	--	EXP	MTS	MTS	MTS	--	--	EX	NA	NS

LMRWMO = Lower Mississippi River Watershed Management Organization; RWMWD = Ramsey Washington Metro Watershed District

Abbreviations for Indicator Evaluations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **MTS** = Meets criteria; **EXP** = Exceeds criteria, potential impairment; **EXS** = Exceeds criteria, potential severe impairment; **EX** = Exceeds criteria (Bacteria, Chloride).

Abbreviations for Use Support Determinations: **NA** = Not Assessed, **IF** = Insufficient Information, **NS** = Non-Support, **FS** = Full Support

Key for Cell Shading: = existing impairment, listed prior to 2012 assessment; = new impairment, identified during 2012 assessment; = full support of designated use.

Table 48. Non-assessed biological stations on channelized AUIDs: St Paul Subwatershed.

Local Jurisdiction	AUID *Reach Name* *Reach Description*	Reach length (miles)	Use Class	Biological Station ID	Location of Biological Station	Fish IBI	Invert IBI
RWMWD	***07010206-758*, Unnamed creek (Kohlman Creek)**, Unnamed ditch to Beam Pond	1.7	2B	10UM029	Upstream of CR CE, in Maplewood	Poor	Poor
RWMWD	***07010206-910*, Unnamed creek (Gervais Creek),** to Gervais Lk	1.5	2B	10UM030	Upstream of County Dr, in Little Canada	Poor	Fair

RWMWD = Ramsey Washington Metro Watershed District
See Appendix 5.1 for clarification on the good/fair/poor thresholds and Appendix 5.2 and Appendix 5.3 for IBI results.

Table 49. Minnesota Stream Habitat Assessment (MSHA): St Paul Subwatershed.

Local Jurisdiction	# Visits	Biological Station ID	Reach Name	Land Use (0-5)	Riparian (0-15)	Substrate (0-27)	Fish Cover (0-17)	Channel Morphology (0-36)	MSHA Score (0-100)	MSHA Rating
RWMWD	1	97UM008	Battle Creek	2	11	19.5	11	32	75.5	Good
RWMWD	0	04UM011	Battle Creek	--	--	--	--	--	--	--
RWMWD	1	10UM029	Kohlman Creek	2	11	12.3	12	22	59.3	Fair
RWMWD	1	10UM030	Gervais Creek	0	11.5	3	4	4	22.5	Poor
		Average Habitat Results: *St Paul Subwatershed*		**1.3**	**11.2**	**11.6**	**9**	**19.3**	**52.4**	**Fair**

RWMWD = Ramsey Washington Metro Watershed District
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)

-- MSHA not collected

Table 50. Channel Condition and Stability Assessment (CCSI): St Paul Subwatershed.

Local Jurisdiction	# Visits	Biological Station ID	Stream Name	Upper Banks (4-43)	Lower Banks (5-46)	Substrate (3-37)	Channel Evolution (1-11)	CCSI Score (13-137)	CCSI Rating
RWMWD	1	97UM008	Battle Creek	26	21	20	5	72	Moderately unstable
RWMWD	0	04UM011	Battle Creek	--	--	--	--	--	--
RWMWD	1	10UM029	Kohlman Creek	21	17	17	5	60	Moderately unstable
RWMWD	1	10UM030	Gervais Creek	28	17	26	3	74	Moderately unstable
Average Stream Stability Results: *St Paul Subwatershed*				**25**	**18.3**	**21**	**4.3**	**68.7**	**Moderately unstable**

RWMWD = Ramsey Washington Metro Watershed District

Qualitative channel stability scores and ratings (Higher scores indicate greater channel instability)

= Stable: CCSI < 27 = Fairly stable: 27 < CCSI < 45 = Moderately unstable: 45 < CCSI < 80 = Severely unstable: 80 < CCSI < 115 = Extremely unstable: CCSI > 115

-- CCSI data not available. Station sampled prior to CCSI assessment being implemented as part of biological monitoring protocol.

Table 51. Lake morphometric and assessment data for the Saint Paul Subwatershed (07010206-910).

Local Jurisdiction[1]	Lake ID In Figure 31	Lake ID	Lake Name	Trophic Status[2]	Lake Area (ha)	% Littoral	Max Depth (m)	Mean Depth (m)	Trend[3]	Mean TP (ug/L)	Mean Chl-a (ug/L)	Mean Secchi (m)	Aquatic Recreation Use Support[4]	Aquatic Life Use Support[5]	Aquatic Consumption Use Support[6]
CRWD	5	62-0055-00	Como	H	29	36	4.7	2.2	I	162	28.5	1.3	NS	IF	NS
CRWD	14	62-0054-00	McCarron	M	33	100	17.4	8.2	I	23	9.3	3	FS	IF	NS
CRWD	--	62-0047-00	Crosby	E	25	47	5.2	0.9	D	85	16.2	2.3	IF	IF	NA
CRWD	--	62-0231-00	Loeb	E	4	81	8.5	2.7	N	28	6.4	3.3	FS	IF	FS
LMRWMO	18	19-0079-00	Pickerel	H	59	100	3.4	1.2	IF	116	63.7	0.9	NS	IF	NS
LMRWMO	23	19-0050-00	Sunfish	E	21	87	9.8	2.1	N	45	31.8	1.6	NS	IF	NA
LMRWMO	--	19-0034-00	Unnamed	--	8	--	--	--	--	--	--	--	--	--	--
LMRWMO	--	19-0035-00	Unnamed	--	8	--	--	--	--	--	--	--	--	--	--
LMRWMO	--	19-0037-00	Unnamed (Simley)	E	4	--	5.2	1.5	N	52	27.6	1	IF	NA	FS
LMRWMO	--	19-0047-00	Hornbean	E	8	--	--	1	IF	57	21.6	1.4	IF	NA	NA
LMRWMO	--	19-0049-00	Unnamed (Golf Course Pnd)	--	6	--	--	--	IF	--	--	--	--	--	--

Local Jurisdiction[1]	Lake ID In Figure 31	Lake ID	Lake Name	Trophic Status[2]	Lake Area (ha)	% Littoral	Max Depth (m)	Mean Depth (m)	Trend[3]	Mean TP (ug/L)	Mean Chl-a (ug/L)	Mean Secchi (m)	Aquatic Recreation Use Support[4]	Aquatic Life Use Support[5]	Aquatic Consumption Use Support[6]
LMRWMO	--	19-0052-00	Schmitt	H	23	--	--	1.5	IF			0	IF	NA	NA
LMRWMO	--	19-0080-00	Rogers	E	43	100	2.4	1.3	IF	39	6.6	1.3	FS	NA	FS
LMRWMO	--	19-0103-00	Unnamed	--	40	--	--	--	--	--	--	--	--	--	--
RCWD	--	62-0072-00	Karth	E	6	93	4.3	1.5	IF	51	34.2	1.1	IF	NA	NA
RWMWD	1	82-0091-00	Battle Creek	E	62	100	4.7	1.1	I	75	10.8	1.8	IF	IF	NS
RWMWD	2	62-0016-00	Beaver	E	39	100	3.4	1.2	I	63	11.1	2	FS	IF	NS
RWMWD	3	62-0048-00	Bennett	H	15	97	2.7	1	I	138	37.4	0.9	NS	IF	NS
RWMWD	4	82-0166-00	Carver	E	21	49	11	4.6	I	42	14.7	1.8	FS	NS	NS
RWMWD	8	62-0007-00	Gervais	E	111	40	14.6	5.8	N	28	10	2	FS	IF	NS
RWMWD	11	62-0010-02	Keller (main bay)	E	29	100	2.4	2.1	I	47	16.2	1.2	FS	IF	FS
RWMWD	12	62-0006-00	Kohlman	E	58	100	2.7	1.2	I	79	26.3	1.2	NS	IF	NA
RWMWD	15	62-0237-00	North Star Steel	--	--	--	--	--	--	--	--	--	--	--	NS
RWMWD	16	62-0056-00	Owasso	E	159	100	11.3	3.3	N	41	19.3	1.3	IF	IF	NS
RWMWD	17	62-0013-00	Phalen	M	74	40	27.7	7.1	I	22	6.7	3	FS	IF	NS
RWMWD	21	62-0073-00	Snail	M	68	100	9.1	2	I	20	3.8	3.1	FS	FS	NS
RWMWD	24	82-0115-00	Tanners	E	32	40	13.7	6.1	I	76	6	2.9	FS	NS	NS
RWMWD	26	62-0082-00	Wabasso	E	20	--	22.3	10.7	N	27	8.7	2.7	FS	IF	NA
RWMWD	27	62-0011-00	Wakefield	H	8	100	2.9	0.9	I	107	28.8	1.5	NS	IF	FS
RWMWD	--	62-0004-00	Pigs Eye	--	207	100	1.2	1	IF	--	--	--	--	--	FS
RWMWD	--	62-0005-00	Casey	--	6	100	1.1	1	IF	--	--	--	--	--	FS
RWMWD	--	62-0008-00	Savage	--	8	100	1.8	--	IF	--	--	--	--	--	--
RWMWD	--	62-0009-00	Round	--	5	100	2	1.2	IF	--	--	--	--	--	--
RWMWD	--	62-0012-00	Round	E	12	98	5.2	2	I	38	9.6	2.6	FS	IF	NA
RWMWD	--	62-0017-00	Unnamed	--	20	--	--	--	--	--	--	--	--	--	--
RWMWD	--	62-0039-00	Twin	M	17	35	10.1	5.2	N	22	5.4	3	FS	IF	NA

Local Jurisdiction[1]	Lake ID In Figure 31	Lake ID	Lake Name	Trophic Status[2]	Lake Area (ha)	% Littoral	Max Depth (m)	Mean Depth (m)	Trend[3]	Mean TP (ug/L)	Mean Chl-a (ug/L)	Mean Secchi (m)	Aquatic Recreation Use Support[4]	Aquatic Life Use Support[5]	Aquatic Consumption Use Support[6]
RWMWD	--	62-0040-00	Willow	--	32	44	2.4	1	IF	--	--	--	--	--	--
RWMWD	--	62-0042-00	Heiner's	--	5	--	--	--	--	--	--	--	--	--	--
RWMWD	--	62-0074-00	Grass	--	57	87	--	1	IF	--	--	--	--	--	--
RWMWD	--	62-0080-00	Emily	E	5	--	--	--	I	--	--	1.4	IF	NA	NA
RWMWD	--	62-0081-00	Judy	--	6	--	--	1	N	--	--	--	--	--	--
RWMWD	--	62-0141-00	Beam Pond	--	8	--	--	1	IF	--	--	--	--	--	--
RWMWD	--	62-0237-00	Unnamed (North Star)	--	38	100	1.5	--	--	--	--	--	--	--	NS
RWMWD	--	62-0243-00	Unnamed	--	10	--	--	--	--	--	--	--	--	--	--
SWWD	13	82-0097-00	La	H	17	100	3	1.8	D	108	37.1	1.3	NS	NA	NA
SWWD	--	25-0017-07	Conley	--	--	100	2.7	--	--	--	--	--	--	--	--
SWWD	--	82-0089-00	Markgrafs	H	15	100	2.4	1.5	D	174	68.2	0.4	NS	NA	--
SWWD	--	82-0090-00	Wilmes	E	13	92	5.5	1.2	N	78	31	1.3	NS	NA	--
SWWD	--	82-0092-00	Powers	E	17	48	12.5	4.9	D	40	23.4	1.7	IF	FS	FS
SWWD	--	82-0094-00	Colby	H	28	100	3.4	2.1	N	183	61.2	0.5	NS	NA	FS
SWWD	--	82-0116-01	Armstrong-North Portion	--	--	--	--	--	--	--	--	--	--	--	--
SWWD	--	82-0116-02	Armstrong-South Portion	E	16	100	1.5	1.2	I	73	9.6	1	IF	FS	NA
VLAWMO	6	62-0038-01	East Vadnais	E	62	--	17.7	7.6	IF	27	7	3.1	FS	IF	NS
VLAWMO	7	62-0037-00	Gem	E	8	100	5.2	2.6	N	71	62.1	1.2	NS	NA	NA
VLAWMO	9	62-0027-00	Gilfillan	H	40	100	1.5	0.8	N	109	29.3	0.8	NS	NA	NA
VLAWMO	10	62-0034-00	East Goose	H	47	100	2.7	1.7	N	281	81.5	0.3	NS	NA	FS
VLAWMO	19	62-0046-00	Pleasant	E	284	100	17.7	5.1	N	57	19	2.6	NS	IF	NS
VLAWMO	22	62-0028-00	Sucker	--	32	79	7.3	--	IF	--	--	--	--	--	NS

Local Jurisdiction[1]	Lake ID In Figure 31	Lake ID	Lake Name	Trophic Status[2]	Lake Area (ha)	% Littoral	Max Depth (m)	Mean Depth (m)	Trend[3]	Mean TP (ug/L)	Mean Chl-a (ug/L)	Mean Secchi (m)	Aquatic Recreation Use Support[4]	Aquatic Life Use Support[5]	Aquatic Consumption Use Support[6]
VLAWMO	25	62-0022-00	Unnamed (Tamarack)	--	--	--	--	--	--	--	--	--	NS	--	NS
VLAWMO	28	62-0038-02	West Vadnais	H	35	100	2.7	1.7	IF	168	90	0.6	NS	IF	NA
VLAWMO	30	62-0043-00	Wilkinson	H	39	100	1.2	0.5	N	123	23.8	0.9	NS	NA	NA
VLAWMO	--	62-0018-00	Deep	E	41	100	3.4	1	IF	88	26.8	1.1	IF	NA	NA
VLAWMO	--	62-0019-00	Black	E	34	100	2.4	--	IF	33	6.3	1.8	FS	NA	NA
VLAWMO	--	62-0020-01	Mallard Pond (North)	--	--	--	--	--	--	--	--	--	--	--	--
VLAWMO	--	62-0024-00	Birch	E	59	100	1.8	1	N	33	5.8	1.8	FS	NA	NA
VLAWMO	--	62-0062-00	Charley	E	19	76	6.1	1.5	IF	79	12	1.3	IF	NA	--
VLAWMO	--	62-0126-00	Unnamed (West Goose)	H	10	55	2.1	1.3	--	258	56.8	0.2	NS	NA	FS
VRWJPO	20	19-0003-00	Rebecca	--	11	100	4.6	--	--	--	--	--	--	--	NS
VRWJPO	--	19-0005-01	Spring	H	--	--	5.2	--	IF	238	52	0	NA	IF	NA

1. CRWD = Capital Region Watershed District, LMRWMO = Lower Mississippi River Watershed Management Organization, MCWD = Minnehaha Creek Watershed District, RCWD = Rice Creek Watershed District, RWMWD = Ramsey Washington Metro Watershed District, SWWD = South Washington Watershed District, VLAWMO = Vadnais Lakes Area Watershed Management Organization, VRWJPO = Vermillion River Watershed Joint Powers Organization
2. H = hypereutrophic, E = eutrophic, M = mesotrophic, O = oligotrophic
3. IF = Insufficient information, N = no trend, I = improving trend, D = declining trend
4. NS = not supporting, FS = supporting, IF = insufficient information to determine support, NA = not assessed (too small or wetland-like)
5. NS = not supporting, IF = insufficient information to determine support or meeting chloride standard, NA = not assessed

Key for Cell Shading: = existing impairment; = new impairment; = full support of designated use; = previously impaired, delisting completed or proposed.

Summary

Stream assessment results

Assessment data were available on portions of Battle Creek and Fish Creek in Saint Paul and Maplewood. For aquatic recreation, Fish Creek (07010206-606) was determined to be impaired due to excess bacteria. For Battle Creek, bacteria levels are elevated but sufficient data were not available to determine if aquatic recreation use is truly impaired; therefore, it was not listed during this assessment.

For aquatic life use assessment, chloride values on Fish Creek are just below the standard (230 mg/L); hence, continued exposure to salts could potentially lead to an impairment for aquatic life. Battle Creek was found to be not supporting of aquatic life based on assessments of chloride, fish, and macroinvertebrate community data. At biological station 97UM008, the macroinvertebrate community was comprised of 80% tolerant individuals and no EPT taxa. The fish community sampled consisted of only 48 fish of which 97% are considered tolerant. A few fish species were collected that are typically found in wetlands or lakes (e.g., golden shiner, yellow bullhead, central mudminnow). Habitat quality was rated good with decent cover for fish, coarse substrates in riffles, and a fairly extensive riparian area within the park. However, storm water culverts and channel instability were noted which may indicate flashy hydrology. The source of this stream is Battle Creek Lake (82-0091) which has elevated nutrients that could be an additional source of stress to the biological communities in Battle Creek. Elevated chloride is also a potential stress in Battle Creek and potentially Fish Creek.

Two other AUIDs were not assessed due to channelization. These two reaches are both upstream of lakes (Kohlman and Gervais). Both stations (10UM029, 10UM030) rate poor for the fish community with F-IBI scores of 0 and 100% tolerant fish, while aquatic macroinvertebrates were rated poor and fair, respectively, with 87% tolerant taxa at both stations. Habitat at this station was also rated poor with silt substrate and lack of cover and depth variability, which is typical of streams that have been channelized. At biological station 10UM029, the reach appears to be recovering from past channelization. Habitat quality was rated fair with sand and gravel substrate, good fish cover and depth and flow variability. The dissolved oxygen at 10UM030 was measured at 3.19 mg/L indicating that low dissolved oxygen is a likely stressor on this densely urban reach. There are many other potential stressors that may be impacting these urbanized reaches (e.g., flashy hydrology, excess nutrients, chloride toxicity) and perhaps contributing to the impaired conditions in downstream lakes.

Lake assessment results

For aquatic consumption use, seven lakes are supporting while 19 lakes are not supporting (Table 51). Of those that are not supporting, three are lakes that will be added to the impaired waters list in 2014 (Battle Creek, Bennet, Phalen) for elevated mercury in fish tissue.

Across the watershed, 13 lakes are supporting aquatic recreation uses while 15 lakes are not supporting (Table 51). During this assessment, six new lakes were assessed as impaired; four lakes for aquatic recreation use (Pleasant, West Vadnais, Pickerel, La) and two lakes for aquatic life use due to chloride toxicity (Carver, McCarron). Phalen and Gervais Lakes provide suitable recreational conditions. The following lakes are currently on the impaired waters list and are proposed to be delisted for aquatic recreation due to local management activities (e.g., stormwater management, sedimentation ponds and alum treatments) that have resulted in improved conditions: Keller, Beaver, Carver and Battle Creek Lake. In contrast, Wakefield, Kohlman, West

Vadnais, Pleasant and Como Lakes all contain elevated phosphorus concentrations resulting in poor transparency and elevated algae concentrations during the summer months.

MPCA biologists have monitored the wetland plant and macroinvertebrate communities within the littoral (near shore) zone on Battle Creek Lake. From 1999 to 2003, wetland plant IBI scores ranged from 68 in 1999 to 21 in 2003, exhibiting a decreasing trend over time (Figure 29). Currently, the littoral plant community of Battle Creek Lake appears to be in poor condition. Macroinvertebrate IBI scores remained relatively stable of this four year period, ranging from 65 in 1999 to 50 in 2003. (Figure 29). These scores translate to a condition rating of fair for the macroinvertebrate community inhabiting the littoral zone. Additional monitoring of aquatic life in Battle Creek Lake is recommended to ascertain whether or not there has been a response of these communities to recent stormwater management projects. While the linkage between Battle Creek Lake's past nutrient problems and poor plant community rating has not been directly established, wetland plant communities in general tend to be negatively affected by high nutrient concentrations and invasive species. For example increased cover of invasive species tends to lower native species richness. Invasive plant species observed along the shore of Battle Creek Lake include hybrid cattail (*Typha X glauca*), curly-leaf pondweed (*Potamogeton crispus*), reed canary grass (*Phalaris arundinacea*), and purple loosestrife (*Lythrum salicaria*).

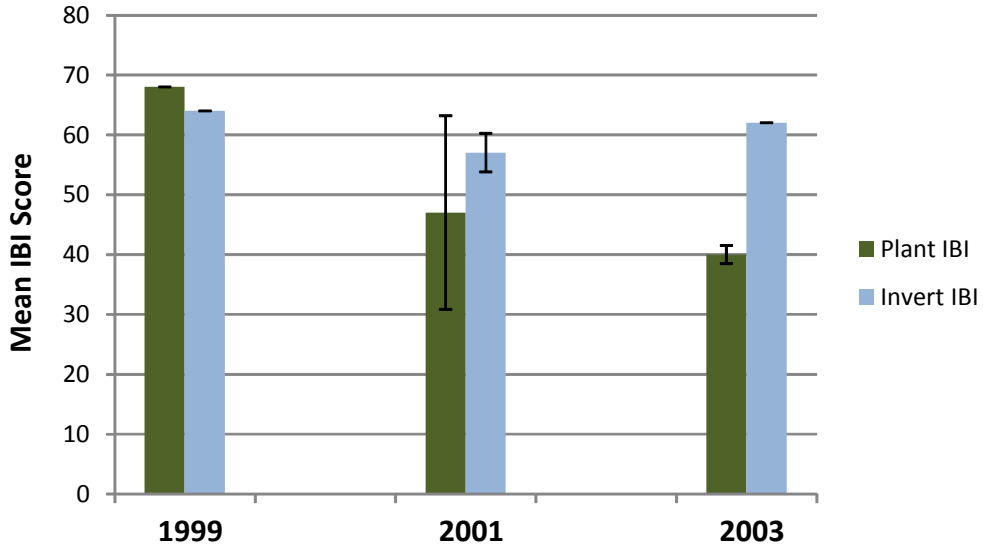

Figure 29. Wetland IBI results from the littoral zone of Battle Creek Lake. Sample sizes for plants and invertebrate scores, respectively: 1999 (n=1.1); 2001 (n=2,1).

Water quality plans, projects, and TMDLs

This area is overseen by a number of local jurisdictions, including Vadnais Lake Area WMO (www.vlawmo.org), Ramsey Washington Metro WD (www.rwmwd.org), Capital Region WD (www.capitolregionwd.org), Lower Mississippi River WMO

(www.dakotacountyswcd.org/watersheds/lowermisswmo/index.html) and South Washington WD (www.swwdmn.org). Most of the impairments in the watershed have been or are currently being addressed with TMDLs/WRAPS. To view approved and underway TMDL/WRAPS projects for impaired waters in this watershed visit http://www.pca.state.mn.us/index.php/water/water-types-and-programs/watersheds/mississippi-river-twin-cities.html. Ramsey Washington Metro Watershed District (http://www.rwmwd.org/)and Vermillion River Joint Powers Organization (http://www.vermillionriverwatershed.org/) have ongoing WRAPS projects. Each entity has a watershed management plan available online that details local efforts to protect and restore water quality.

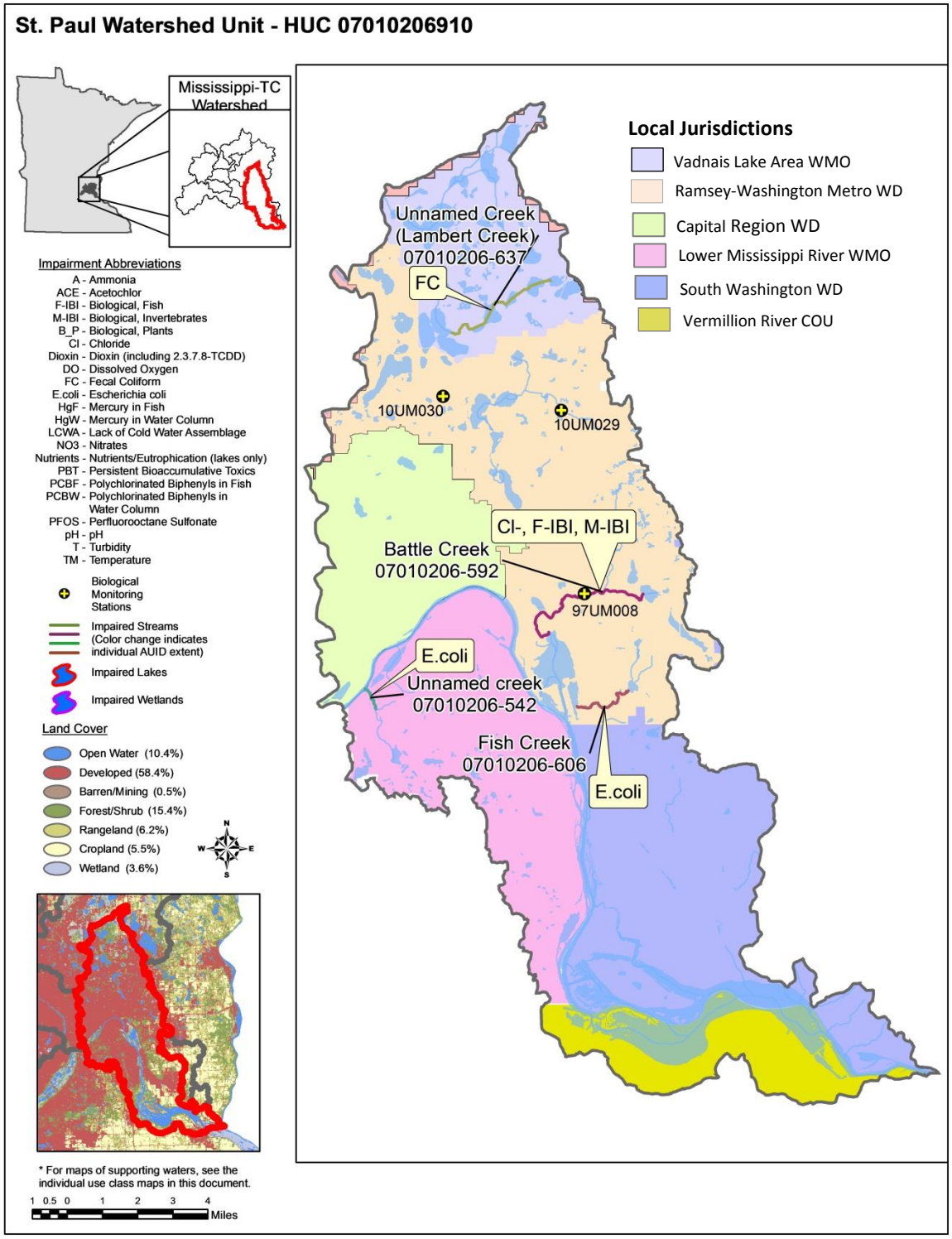

Figure 30. Currently listed impaired streams by parameter and land use characteristics in the St Paul Subwatershed.

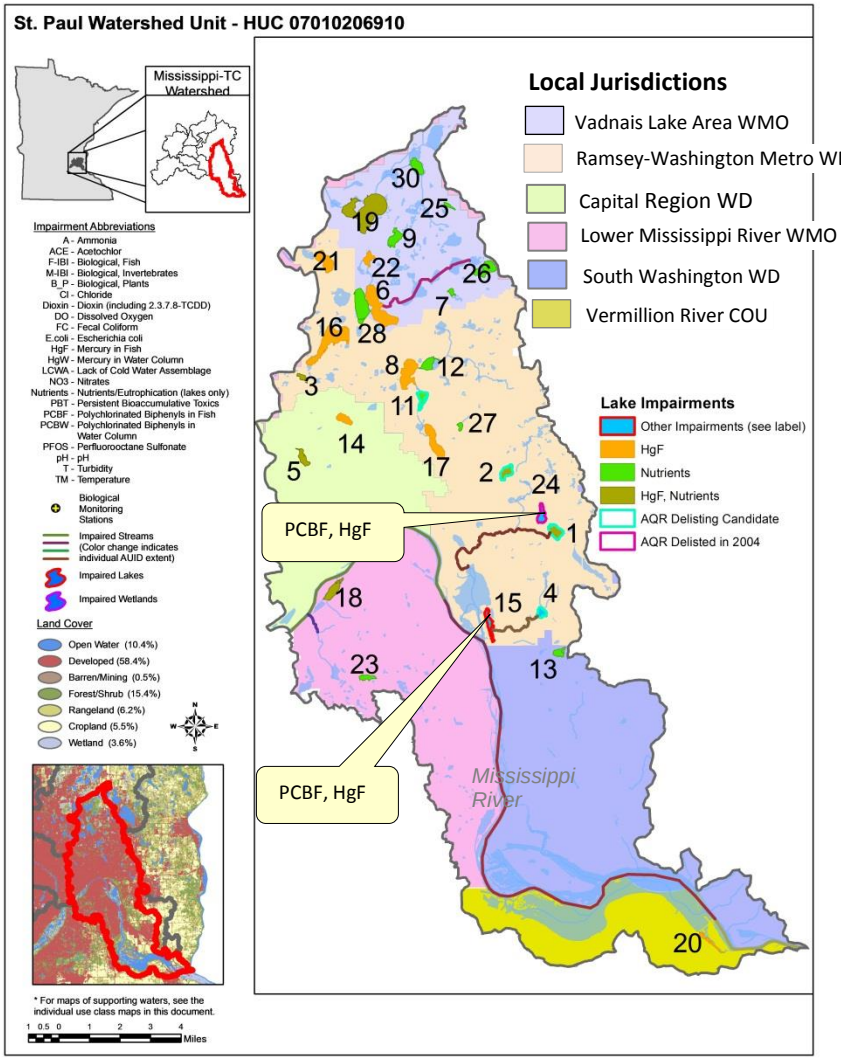

Figure 31. Currently listed impaired lakes by parameter and land use characteristics (inset) for the St Paul Subwatershed. See Table 51 for lake names.

Cottage Grove Subwatershed HUC 7010206920

The Cottage Grove Subwatershed is the third smallest subwatershed at 19.3 mi^2. This watershed is dominated by agriculture (60%), followed by developed land (25%) which is largely associated with the city of Cottage Grove in Washington County. Twelve percent of the land cover is in forest and wetland while only 1% is open water. Lake Ravine is the only lake in the subwatershed. Karst features dot the eastern half of the subwatershed near the St Croix River (http://www.swwdmn.org/geomoose/). This subwatershed is under the jurisdiction of the South Washington Watershed District. Due to its small size (< 40 mi^2) there is no intensive water monitoring station for this subwatershed.

Table 52. Aquatic life and recreation assessments on stream reaches: Cottage Grove Subwatershed.

Local Jurisdiction	AUID *Reach Name* *Reach Description*	Reach Length (miles)	Use Class	Biological Station ID	Location of Biological Station	Aquatic Life Indicators: Fish IBI	Invert IBI	Dissolved Oxygen	Turbidity	Chloride	pH	NH_3	Pesticides	Bacteria	Aquatic Life	Aquatic Rec.
SWWD	***07010206-517*, Unnamed Creek,** Headwaters to Mississippi R	4.6	2B	99UM092	Upstream of Frontage Rd along Hwy 6, downstream of Cottage Grove Ravine Regional Park, Cottage Grove	--	--	--	--	--	--	--	--	--	NA	NA

SWWD = South Washington Watershed District

Abbreviations for Indicator Evaluations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **MTS** = Meets criteria; **EXP** = Exceeds criteria, potential impairment; **EXS** = Exceeds criteria, potential severe impairment; **EX** = Exceeds criteria (Bacteria).

Abbreviations for Use Support Determinations: **NA** = Not Assessed, **IF** = Insufficient Information, **NS** = Non-Support, **FS** = Full Support

Key for Cell Shading: = existing impairment, listed prior to 2012 assessment; = new impairment, identified during 2012 assessment; = full support of designated use.

Table 53. Lake morphometric and assessment data for the Cottage Grove Subwatershed (07010206-920).

Local Jurisdiction[1]	Lake ID	Lake Name	Trophic Status[2]	Lake Area (ha)	% Littoral	Max Depth (m)	Mean Depth (m)	Trend[3]	Mean TP (ug/L)	Mean Chl-a (ug/L)	Mean Secchi (m)	Aquatic Recreation Use Support[4]	Aquatic Life Use Support[5]	Aquatic Consumption Use Support[6]
SWWD	82-0087-00	Unnamed (Ravine)	E	10	100	4.9	2.1	I	74	33.4	1.3	NS	IF	FS

1. SWWD = South Washington Watershed District
2. H = hypereutrophic, E = eutrophic, M = mesotrophic, O = oligotrophic
3. IF = Insufficient information, N = no trend, I = improving trend, D = declining trend
4. NS = not supporting, FS = supporting, IF = insufficient information to determine support, NA = not assessed (too small or wetland-like)
5. NS = not supporting, IF = insufficient information to determine support or meeting chloride standard, NA = not assessed
6. NS = not supporting, FS = supporting, NA = not assessed

Key for Cell Shading: = existing impairment, listed prior to 2012 reporting cycle; = new impairment; = full support of designated use.

Summary

Stream assessment results

No new data was available for assessment in 2010. In 2002, an unnamed creek (07010206-517) was listed for an aquatic life use impairment for fish. The fish community was sampled in 1999 and was comprised entirely of fathead minnow, which is a very pollution-tolerant fish. There was no invertebrate collection.

Lake assessment results

Unnamed (Ravine) Lake is the only lake in the Cottage Grove Subwatershed. The lake is in a transitional area between two ecoregions and its watershed is currently undergoing development. According to a 2003 lake management report, this 25 acre lake has an open area of water of only six acres (http://www.swwdmn.org/pdf/projects/completed/RavineLakeReport2003.pdf) and has been recently reclassified from being a Type 4 wetland to a lake due to increased groundwater input creating deeper lake levels in recent years. The maximum depth measured in 2001 was 16 ft. Phosphorus levels are elevated in Ravine Lake and the corresponding decline in transparency/increase in algae has triggered an aquatic recreation use impairment. Unnamed (Ravine) Lake is also impaired for its aquatic consumption use.

Water quality plans, projects and TMDLs

Information on Ravine Lake is available at http://www.swwdmn.org/pdf/projects/completed/RavineLakeReport2003.pdf

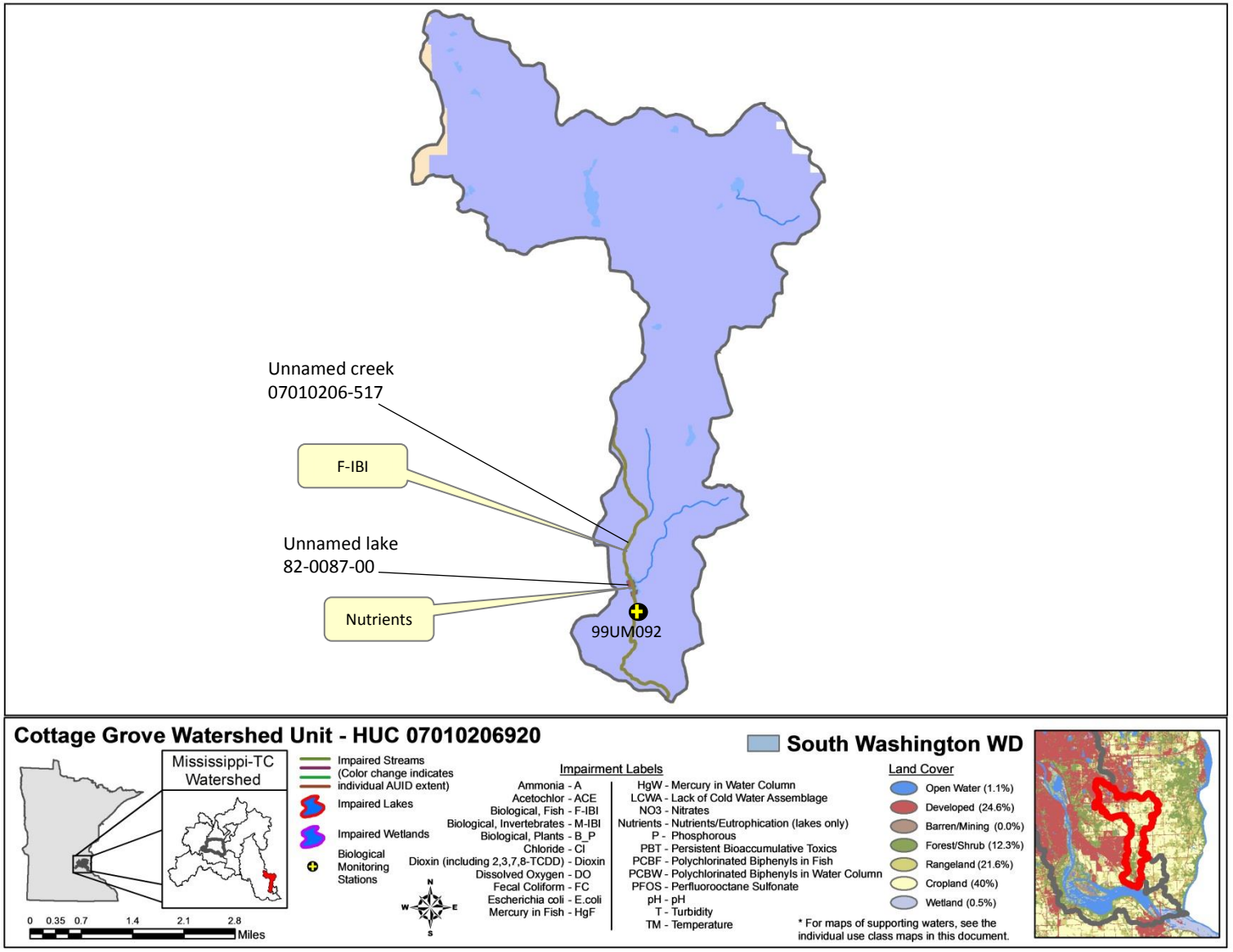

Figure 32. Currently listed impaired waterbodies by parameter and land use characteristics (inset) in the Cottage Grove Subwatershed.

Mississippi (Direct)-Hastings Subwatershed HUC 7010206960

At only 4.9 mi^2, the Mississippi (Direct)-Hastings Subwatershed is the smallest subwatershed of the Mississippi River-Twin Cities Watershed. This subwatershed drains to the Mississippi River just north of Lock and Dam #2 near Hastings in Washington County. Land use is predominantly agriculture (88%) with a small portion in forest and wetland (6%) and only 5% developed land. The subwatershed is under the jurisdiction of the South Washington Watershed District. The only waterbody is one small unassessed stream that runs through the subwatershed and flows into the Mississippi River. Since the total watershed area is <5 mi^2 and due to its close proximity to the Mississippi River, there is no intensive water chemistry station or biological station in this subwatershed.

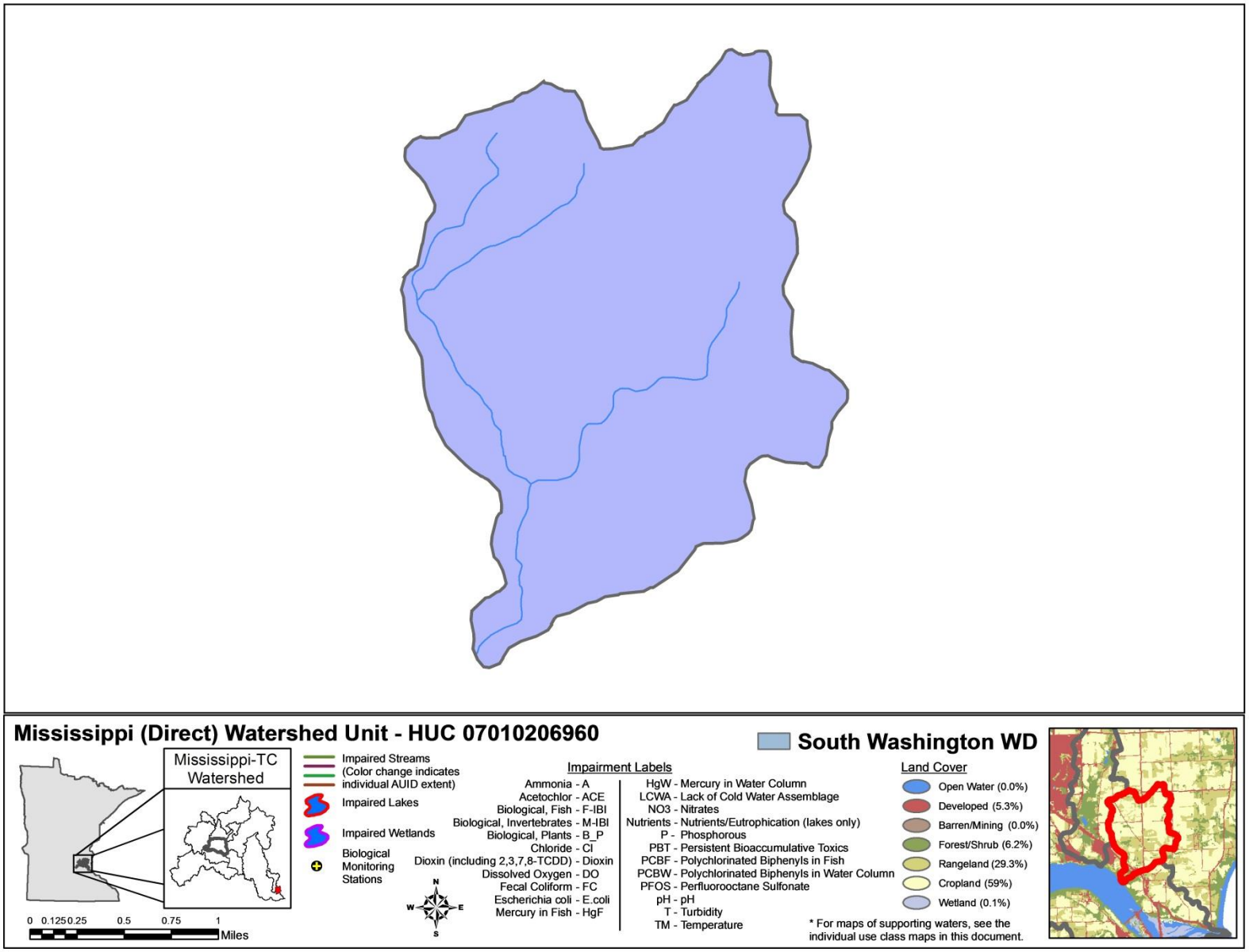

Figure 33. There are currently no listed waterbodies in the Mississippi (Direct)-Hastings Subwatershed. Land use characteristics in the map inlay.

V. Watershed-wide results and discussion

Assessment results and data summaries are included below for the entire HUC-8 watershed of the Mississippi River-Twin Cities Watershed, grouped by sample type. Summaries are provided for aquatic life and recreation uses in streams and lakes throughout the watershed, and for aquatic consumption results at select river and lake locations along the watershed. Additionally, groundwater monitoring results and long-term monitoring trends are included where applicable.

Stream water quality

During the 2012 assessment, 84 stream AUIDs reaches of the 209 numbered stream AUIDs (stream reaches are not assigned a unique AUID until they are assessed) had data that were reviewed. Of those, 46 were assessed for aquatic recreation and/or aquatic life uses (not all reaches had sufficient data for assessment or were determined to be appropriate to assess against current stream water quality standards).

Of the 46 assessed reaches, only two are considered to be fully supporting aquatic life and one reach is fully supporting aquatic recreation. In total, 28 stream reaches were determined to be impaired for aquatic life and/or aquatic recreation use. Of those, 16 reaches were impaired for aquatic life and 17 for aquatic recreation use (seven reaches were impaired for both aquatic life and aquatic recreation). In total, 22 new stream impairments were found (more than one aquatic life impairment can be listed for a reach). The new impairments included nine stream aquatic recreation impairments due to elevated bacteria and 13 aquatic life impairments (six fishes bioassessments, seven macroinvertebrate bioassessements). No stream reaches were candidates for delisting. Twenty-three reaches had insufficient information to complete the assessment. Of those, five reaches with aquatic life impairments were deferred due to the AUID being >50% channelized (these deferred impairments will be reassessed when TALU standards are developed) and 18 reaches were reviewed and found not to have enough data to meet the minimum required to assess. An additional 38 reaches that had sufficient data to assess for aquatic life use support were not assessed due to channelization (11 reaches, will be reassessed after TALU criteria developed) or the water chemistry stations were considered inappropriate to assess with stream aquatic life criteria (27 reaches were small connectors between lakes or wetlands where data may have been collected for a different purpose than stream assessment, e.g., a lake TMDL).

In total, 23 stream reaches (AUIDs) are on the 2012 Impaired Waters List for not supporting aquatic life and/or recreation: 20 are non-supporting for aquatic life and eight are non-supporting for aquatic recreation use (six reaches are non-supporting for both aquatic life and recreation). Additional stream reaches were recently monitored as part of the Twin Cities Metro Area Chloride Project and assessment of aquatic life use will be completed during summer 2013. Consequently, additional reaches may be assessed as impaired for aquatic life due to chloride toxicity and added to the 303(d) list in 2014.

Table 54. 2010 assessment summary for stream water quality in the Mississippi River-Twin Cities Watershed.

				Supporting		Non-supporting		
Watershed	Area (mi^2)	# Total AUIDs	# Assessed AUIDs	# Aquatic Life	# Aquatic Recreation	# Aquatic Life	# Aquatic Recreation	Insufficient Data
07010206 HUC 8	**1015.4**	**209**	**46**	**2**	**1**	**16**	**17**	**23**
07010206810	17.8	0	0					
07010206820	106.1	13	5			5	4	
07010206830	34.7	2	1				1	
07010206840	23.1	9	6				1	6
07010206850	93.7	15	1				1	1
07010206860	192.4	45	7			6	1	1
07010206870	41.6	10	3			2	1	1
07010206880	44.9	3	0					
07010206890	42.9	12	8			1	3	6
07010206900	176.4	46	11	2	1	1	2	6
07010206910	217.7	47	4			1	3	2
07010206920	19.3	7	0					
07010206960	4.9	0	0					

Lake water quality

One hundred-eighty of the 252 lake AUIDs were assessed (Table 55) during the 2012 assessment. Of the assessed lakes, 84 lake basins were considered to be fully supporting of aquatic recreation uses. While lakes were reviewed for aquatic life use, the only criterion available was chloride; as a result, no full support designations were assigned even though the basins met the chloride standard. Once the development of the fish and plant IBIs are completed, full support for aquatic life use will be reported.

Throughout the watersheds, 87 lake AUIDs are non-supporting of aquatic life and/or recreation. Of those, 84 are non-supporting of aquatic recreation and seven are non-supporting of aquatic life due to elevated chloride (four are impaired for both uses). Additional lakes were recently monitored as part of the Twin Cities Metro Area Chloride Project. The official MPCA assessment of these waterbodies to determine impairments due to chloride will be completed during 2013, consequently, in addition to the seven aquatic life impairments already identified in this report, additional waterbodies may also be found to be impaired and listed on the draft 2014 303(d) list.

Eight lakes in the watershed are proposed to be removed from the 2014 Impaired Waters List as management activities in the lake and/or watershed have resulted in improvements. Many of the lakes are highly managed to help control phosphorus levels and this will need to continue in order to sustain improved conditions in such a highly altered watershed.

Table 55. Assessment summary for lakes in the Mississippi River-Twin Cities Watershed.

				Supporting		Non-supporting			
Watershed	Area (mi^2)	Lakes >10 Acres	Assessed Lakes	Aquatic Life	Aquatic Recreation	Aquatic Life	Aquatic Recreation	Proposed Delisting	Insufficient Data
07010206 HUC 8	**1015.4**	**252**	**180**	**NA**	**63**	**7**	**84**	**8**	**33**
07010206810	17.8	1							
07010206820	106.1	17	8		1		6		1
07010206830	34.7	1	1		1				
07010206840	23.1	0							
07010206850	93.7	4	3		3				
07010206860	192.4	57	40		14	2	21	1	5
07010206870	41.6	14	13		2		10	3	1
07010206880	44.9	1	1					1	1
07010206890	42.9	10	10		2	2	4		4
07010206900	176.4	79	58		22	1	27		9
07010206910	217.7	67	45		18	2	15	4	12
07010206920	19.3	1	1				1		
07010206960	4.9	0							

Wetland monitoring results

The majority of the Mississippi River-Twin Cities Watershed lies within the North Central Hardwood Forests (NCHF) ecoregion. For wetland plant communities, IBI scores ranged from 3 to 61 with a mean of 35 (34 sites monitored between 1999 and 2010). Generally speaking, these results indicate that depressional wetland plant communities in this watershed are in poor condition. In comparison the statewide survey of the NCHF ecoregion found that approximately 18% of depressional wetland plant communities are in good condition, 21% are in fair condition, and 61% are in poor condition.

Macroinvertebrate IBI scores for depressional wetlands within the Mississippi River-Twin Cities Watershed ranged from 26 to 77 with a mean of 54 (34 sites monitored between 1999 and 2010). These results indicate that depressional wetland macroinvertebrate communities in this watershed are generally in fair condition. In comparison, the statewide survey of the NCHF ecoregion found that 44% of macroinvertebrate communities are in good condition, 40 in fair condition, and 15% in poor condition (Genet 2012).

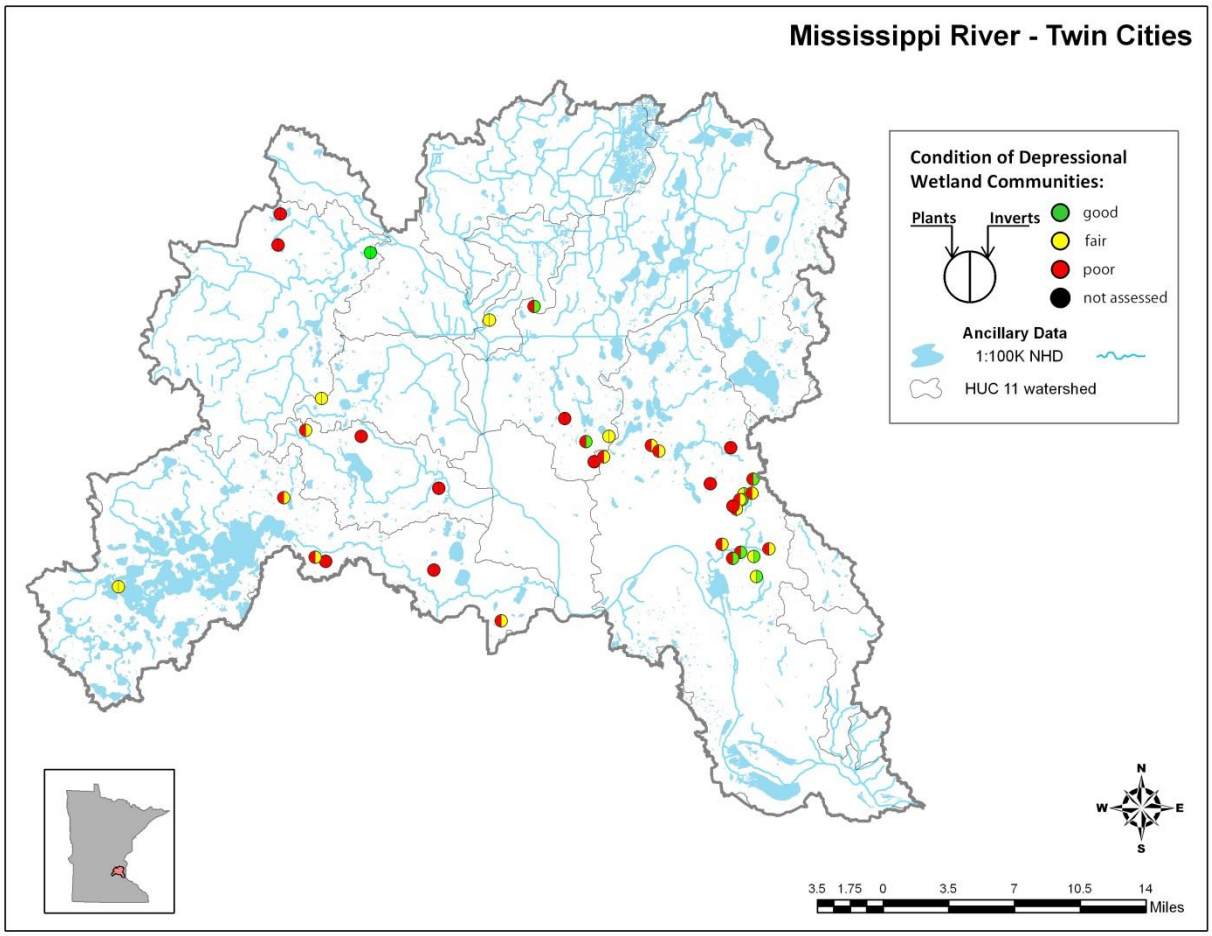

Figure 34. Condition of plant and macroinvertebrate communities of depressional wetlands in the Mississippi River-Twin Cities Watershed.

Fish contaminant results

The list of lakes in Table 56 shows if they are impaired for aquatic consumption (i.e., fish contaminants). A contaminant causing the impairment is either mercury (Hg), PCBs, or PFOS. Mercury has been measured in 22 fish species in lakes within this watershed. During the recent assessment, five lakes were determined to be newly impaired for mercury (Table 56). In total, 51 of the 78 lakes tested (65%) are on the 2012 impaired waters list because of contaminants in fish. Of those, 50 lakes are impaired by mercury, of which, three lakes are also impaired for PCBs, two lakes are also impaired PFOs, and one lake is impaired also for both PCBs and PFOs. Only one lake is impaired only for PFOs.

Table 56 also shows the number of fish tested by species. Bluegill sunfish (BGS) was the most commonly tested fish, followed by northern pike (NP), black crappie (BKS), common carp (C), walleye (WE), largemouth bass (LMB), white sucker (WSU), black bullhead (BKB), yellow bullhead (YEB), yellow perch (YP), and channel catfish (CHC).

Appendix 7.1 is a summary of contaminant concentrations by waterway, fish species, and year. The table shows which contaminants, species, and years were sampled within a given lake. "Total Fish" and "Samples" are shown because many of the panfish, such as bluegill sunfish (BGS) and yellow perch (YP) were composite samples—multiple fish homogenized into a single sample. Sample years ranged from 1968 to 2011. Most of the samples were skin-on fillets (FILSK) or for fish without scales (catfish and bullheads), skin-off fillets (FILET). In 1979, many whole fish (WHORG) were sampled. Since then, many yellow perch were homogenized as whole fish because of their small size.

Across the Mississippi River-Twin Cities Watershed, mercury was measured in 1435 fish samples from 59 lakes, as well as two white suckers (WSU) from Bassett Creek. As indicated above, 50 lakes are on the impaired waters list because of mercury in fish tissue. Therefore, 85% of the lakes tested for mercury in fish were shown to be impaired. The highest mercury concentrations since 1990 were in northern pike (NP) and walleye (WE) from Calhoun, Harriet and Cedar lakes. These lakes, along with Lake of the Isles, are the "Chain of Lakes" in Minneapolis. The maximum mercury concentration was 1.9 ppm in a walleye caught in Lake Calhoun in 1992. Subsequent collections of walleye from Lake Calhoun in 1996 and 2000 showed decreases in the maximum mercury concentrations: 1.3 ppm and 0.61 ppm. Yet, maximum concentrations in northern pike from Lake Calhoun continued to increase: 0.72 ppm in 1996, 0.86 ppm in 2003, and 1.18 ppm in 2009. The decline of mercury concentrations in walleye was likely a result of smaller fish collected over time. The average total fish length (in inches) of walleye decreased: 19.1 in 1992, 18.7 in 1996, 17.5 in 2000. Average and maximum lengths of northern pike remained about the same over time. This is why fish are standardized to a common length when analyzing the mercury data for spatial and temporal trends. Trends of mercury have been examined statewide for northern pike and walleye using standard lengths of 55 cm (21.65 in) and 40 cm (15.75 in), respectively. Many of the impaired lakes due to mercury in fish tissue are included in the Statewide Mercury TMDL and Pollutant Reduction Plan (http://www.pca.state.mn.us/wfhy9ef).

PCBs were measured in 363 fish samples from 56 lakes and in two white suckers from Bassett Creek. Only three lakes have impairments because of PCBs in fish: Nokomis, North Star Steel and Twin lakes. In Lake Nokomis the impairment was found in walleye and white sucker captured in 1992. In North Star Steel Lake, the impairment was found in black bullhead and common carp captured in 1991. In Twin Lake, the impairment was found in common carp captured in 1995. The maximum total PCBs concentration was from a Lake Nokomis walleye in 1992: 0.48 ppm. Excluding PCB results from Lake Superior and large rivers, that is the highest PCBs concentration since 1990.

PFOS was measured in 599 fish from 39 lakes. Lakes impaired for consumption because of PFOS are Calhoun, Harriet, Isles, Johanna and Twin. Calhoun has four species with average PFOS concentrations exceeding 200 ppb. Largemouth bass (LMB) have the highest average concentration, 431 ppb, while the other three species have similar PFOS concentrations just above the threshold level. Lake of the Isles is connected to Lake Calhoun by a short, wide channel in which fish can move between lakes, but LMB is

the only species in Isles that exceeds the 200 ppb (0.200 mg/kg) threshold and only slightly (212 ppb). Lake Harriet is downstream of Calhoun, connected by a narrow (and longer) open channel. Northern pike in the two lakes have nearly identical average PFOS concentrations of 205 and 204 ppb, respectively. The LMB in Harriet have a PFOS concentration slightly below the threshold (197 ppb). Lake Johanna only has PFOS results for bluegill sunfish (BGS) and black crappie (BKS). These two species have similar average PFOS concentrations above the threshold (217 and 222 ppb). Twin Lake has PFOS results for those two species and for LMB. All three species exceed the threshold at similar PFOS concentrations (328, 363, and 395 ppb).

Table 56. Lake impairments based on contaminants in fish tissue and number of fish tested by species.

Waterway	Lake ID	Assessment results[1]	Fish species[2] and number tested											
			BGS	BKB	BKS	C	CHC	LMB	NP	WE	WSU	YEB	YP	OTHER
AUBURN	10004400	FS	10	8					6					
BALD EAGLE	62000200	NS (Hg)	30		25	6		5	28	25				
BATTLE CREEK	82009100	NS (Hg)	5	1					9					
BEAVER	62001600	NS (Hg)	9					3	5					
BENNETT	62004800	NS (Hg)	21		9		2		12					
BROWNIE	27003800	NS (Hg)	10			1			1	1	8			
CALHOUN	27003100	NS (Hg, PFOS)	29		21			10	56	46	23			
CARVER	82016600	NS (Hg)	20			6			36			5		
CASEY	62000500	FS			10									
CEDAR	27003900	NS (Hg)	33		7	6		28	22	12				
CENTERVILLE	02000600	FS	20		10	2			12	5	3			
CHRISTMAS	27013700	NS (Hg)	26			6			77		2			13 RBT
CLEAR	82016300	NS (Hg)			10	3				8				
CLUB WEST	02076400	FS	10		9				1	2				
COLBY	82009400	FS	20		20				3					
COMO	62005500	NS (Hg)	16		5			5	4	8		8		
CROOKED	02008400	NS (Hg)	18						5	5	6	4		
CRYSTAL	27003400	FS	5		5								5	
DUTCH	27018100	FS	15		5	8			15					
EAGLE/PIKE	27011100	NS (Hg)	10		10	4			25	9				
EAST MOORE	02007501	FS	8	7			1		5					
EAST VADNAIS	62003801	NS (Hg)	9		4	1		5	7	21	11	4		10 WHS
FISH	27011800	NS (Hg)	3		10	3		6	10					
GERVAIS	62000700	NS (Hg)	23		5	8		10	16	22				1 SMB
GOLDEN	02004500	NS (Hg)	10	8					6					
GOOSE	62003400	FS	10								4			
HAM	02005300	NS (Hg)	10						6		1			
HARRIET	27001600	NS (Hg, PFOS)	24		23	1		15	26	71	13		8	
HIAWATHA	27001800	FS	20		15				12		3			
ISLAND	62007500	NS (Hg)	5			2	8		3	5				
JOHANNA	62007800	NS (PFOS)	21		13	11			15		3			
JOSEPHINE	62005700	NS (Hg)	22						18			8		
KELLER	62001000	FS	15					5						
LAKE OF THE ISLES	27004000	NS (Hg, PFOS)	18		11	6		5	9	2	13		10	6 ML
LANGTON	62004900	FS	8	11	9									
LOCH NESS	02058500	FS												9 HSF
LOEB	62023100	FS	10											
LONG	27016000	NS (Hg)	1		16	9			19					
LONG	62006700	NS (Hg)	23		1	34			16	18	7			
MCCARRON	62005400	NS (Hg)	5					8	3					
MEDICINE	27010400	NS (Hg)	23		28	15		8	26			9		

Waterway	Lake ID	Assessment results[1]	Fish species[2] and number tested											
			BGS	BKB	BKS	C	CHC	LMB	NP	WE	WSU	YEB	YP	OTHER
MINNETONKA	27013300	NS (Hg)	87	10	10	111		5	166	115	2	10		
MINNEWASHTA	10000900	NS (Hg)	20						12			19		
NOKOMIS	27001900	NS (Hg, PCB)	17	5	40	4				42	6			4 TMU
NORTH STAR STEEL	62023700	NS (Hg, PCB)	6	8	7	27			20			2		1 BBU; 1 FWD
OTTER	02000300	NS (Hg)	10	10					6					
OWASSO	62005600	NS (Hg)	18	8	9	1			74	20	2	1	4	
PARKERS	27010700	NS (Hg)	20						49		2	14		
PARLEY	10004200	FS	6	8	9	2			10					
PELTIER	02000400	NS (Hg)	31	6				5	18		2			5 SF
PHALEN	62001300	NS (Hg)	20		3	4		5	12	6	1		5	
PICKEREL	19007900	NS (Hg)	5						5					
PIERSONS	10005300	FS	10		11	5			6			8		
PIGS EYE	62000400	FS	16			1			5					
PLEASANT	62004600	NS (Hg)	8		20		1			6				4 RHS; 11 SMB; 23 WHB
POWDERHORN	27001400	NS (Hg)	8	9	10									
POWERS	82009200	FS	20		10				7				5	
RAVINE	82008700	FS	10		5			5						
REBECCA	19000300	NS (Hg)	15		10	11		4	17	8		8		
ROGERS	19008000	FS	8						2					
SILVER	62008300	NS (Hg)	10	6	20		2			10				
SIMLEY	19003700	FS	7		7				1	3				
SNAIL	62007300	NS (Hg)	10					4	8					
SPRING	02007100	FS	12											
STEIGER	10004500	NS (Hg)	17		13	3		5	8			5		
SUCKER	62002800	NS (Hg)	10	8					9	7				
SWEENEY	27003501	FS	5		3			5						
TANNERS	82011500	NS (Hg)	10		5		3	5	17					
THOMPSON	19004800	FS	20		3									9 GSF
TURTLE	62006100	NS (Hg)				8			57					
TWIN	27004200	NS (Hg, PCB, PFOS)	21		32	10		10	27					
VIRGINIA	10001500	NS (Hg)	14		5	3			10					
WAKEFIELD	62001100	FS	9		3									
WASSERMANN	10004800	NS (Hg)	19	8	18	5			16			5	9	
WEAVER	27011700	NS (Hg)	20						24			18		
WHITE BEAR	82016700	NS (Hg)	31		16			5	21	8	1			
WIRTH	27003700	NS (Hg)			1	8	2		23	13	4			
ZUMBRA-SUNNY	10004100	NS (Hg)	10	8	8				10					

[1]Abbreviations for Use Support Determinations: **NA** = Not Assessed, **IF** = Insufficient Information, **NS** = Non-Support, **FS** = Full Support
Key for Cell Shading: = existing impairment, listed prior to 2012 reporting cycle; = new impairment; = full support of designated use.

[2]Fish Species: BU = Bigmouth Buffalo, BGS = Bluegill Sunfish, BKB = Black Bullhead, BKS = Black Crappie, C = Common Carp, CHC = Channel Catfish, FWD = Freshwater Drum, GSF = Green Sunfish, HSF = Hybrid Sunfish, LMB = Largemouth Bass, ML = Muskellunge, NP = Northern Pike, RBT = Rainbow Trout, RHS = redhorse, unknown species, SF = Pumpkinseed Sunfish, SMB = Smallmouth Bass, TMU = Tiger Muskie Hybrid, WE = Walleye, WHB = White Bass, WSU = White Sucker, YEB = Yellow Bullhead, YP = Yellow Perch

Groundwater monitoring

Groundwater quality

Of the ambient groundwater monitoring sites sampled within the Mississippi River-Twin Cities Watershed, detections of aesthetic contaminants like calcium, magnesium, iron and hydrogen sulfide were common. These do not typically cause health effects but do cause tastes, odors, staining and scaling that may require water to be treated before household use.

Chloride was also a common detection in the Ambient Network wells within the watershed. The EPA classifies chloride as an aesthetic contaminant in drinking water and has set a Secondary Maximum Contaminant Level (SMCL) of 250 mg/L. SMCLs are not enforced by the EPA; this only is a guideline to assist public drinking water suppliers in managing their systems. Chloride in groundwater is not solely a drinking water concern. In streams and lakes, high levels of chloride are toxic to plants and animals and to protect them from water with high chloride concentrations, the State of Minnesota has set a chronic water quality standard for chloride of 230 mg/L, and an acute water quality standard of 860 mg/L. The inflow of groundwater containing chloride concentrations that exceed the chronic water quality standard to streams may cause chloride impairments to occur during baseflow conditions, as well as during the usual winter period (Wenck Associates, 2009).

In the MPCA's available data from 2004-2009 (Figure 35), chloride was most frequently detected at levels below 50 mg/L, but repeatedly found at that level and higher. Shallow wells exhibited higher and more variable concentrations of chloride.

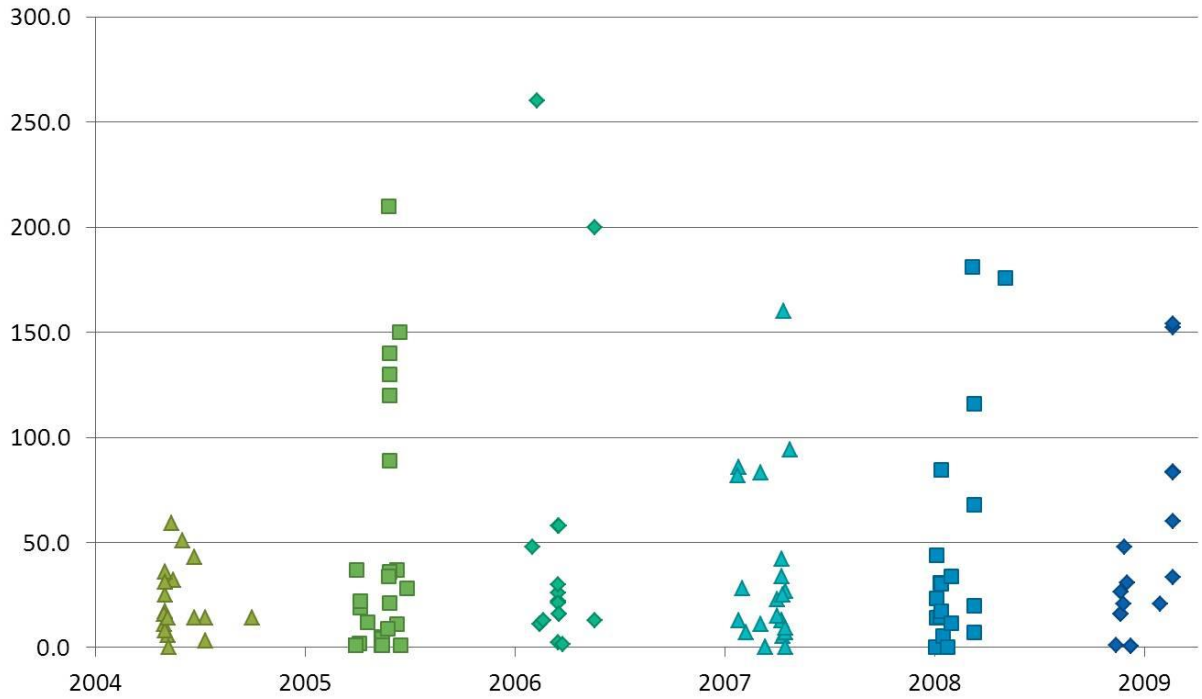

Figure 35. Annual concentrations of Chloride in ambient groundwater wells in the Mississippi River-Twin Cities Watershed.

A USGS publication on chloride in groundwater in the Northern United States (http://pubs.usgs.gov/sir/2009/5086/) found an upward trend in chloride from urban areas, attributing the trend to factors including de-icing of an expanding road system, discharges from wastewater and septic systems, chloride from drinking water and others. All these factors are associated with increased urbanization. With the Mississippi River-Twin Cities Watershed being the most heavily urbanized in the state, chloride in groundwater and surface water can be a contributing factor in drinking water and aquatic life impairments. The MPCA also recently released a publication on the condition of

groundwater in Minnesota http://www.pca.state.mn.us/index.php/water/water-types-and-programs/groundwater/index.html.

Chloride sources can be determined by analyzing the ratio of the concentrations of chloride and bromide in groundwater samples. A chloride/bromide ratio of 1000 or greater indicates a halite, or human-induced salt, source. The highest chloride concentrations measured by the MPCA's Ambient Groundwater Monitoring Network generally occurred in groundwater that was contaminated with halite. Groundwater that was unaffected by human-caused contamination generally had a chloride concentration that was less than 7 mg/L. In contrast, groundwater that was affected by halite contamination often had a chloride concentration that was 30 mg/L or greater and a Cl/Br ratio of 1000 or greater.

Groundwater levels

Depth to groundwater will fluctuate seasonally around an average depth, as is apparent in the figures below. Peaks indicate times when groundwater quantity was high and conversely, at low points, when groundwater quantity was low. Causes for concern arise when there is a long-term trend evident in groundwater level change.

Observation Well 27034 is a shallow well located in the central area of the watershed near Brooklyn Park in Hennepin County. Levels in this well fluctuate seasonally (Figure 36) but do not exhibit a change in trend.

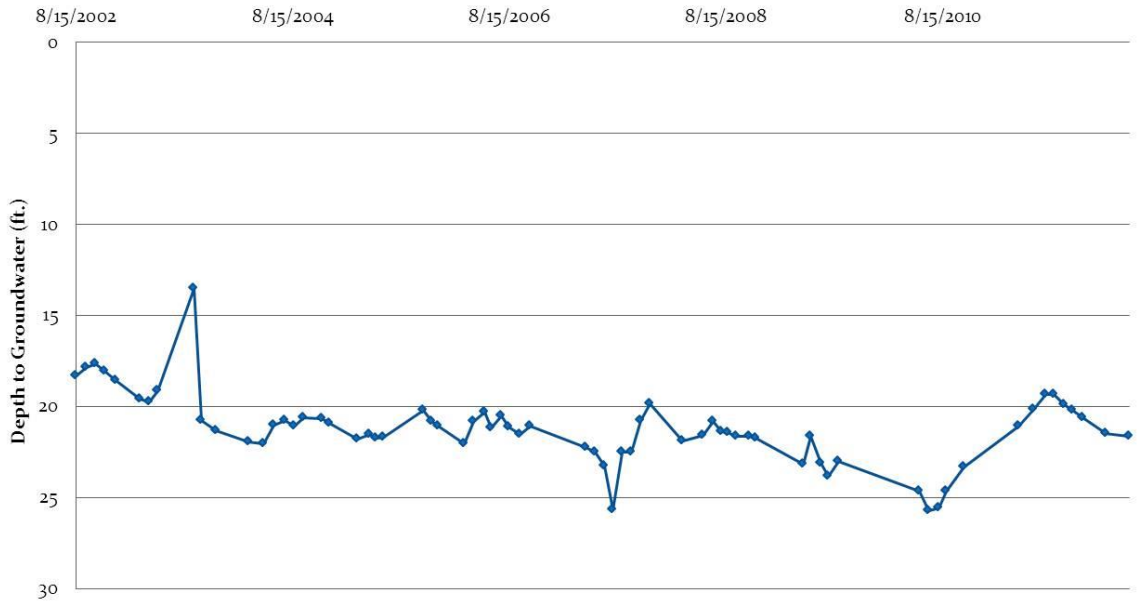

Figure 36. Depth to groundwater at DNR observation well 27034 between 2002 and 2012.

Observation well 19015 is a deeper well located in the southeastern area of the watershed near Pine Bend in Dakota County. Levels in this well seem to fluctuate around a regular depth (Figure 37). Time will tell if the decline apparent in the past decade is significant or not.

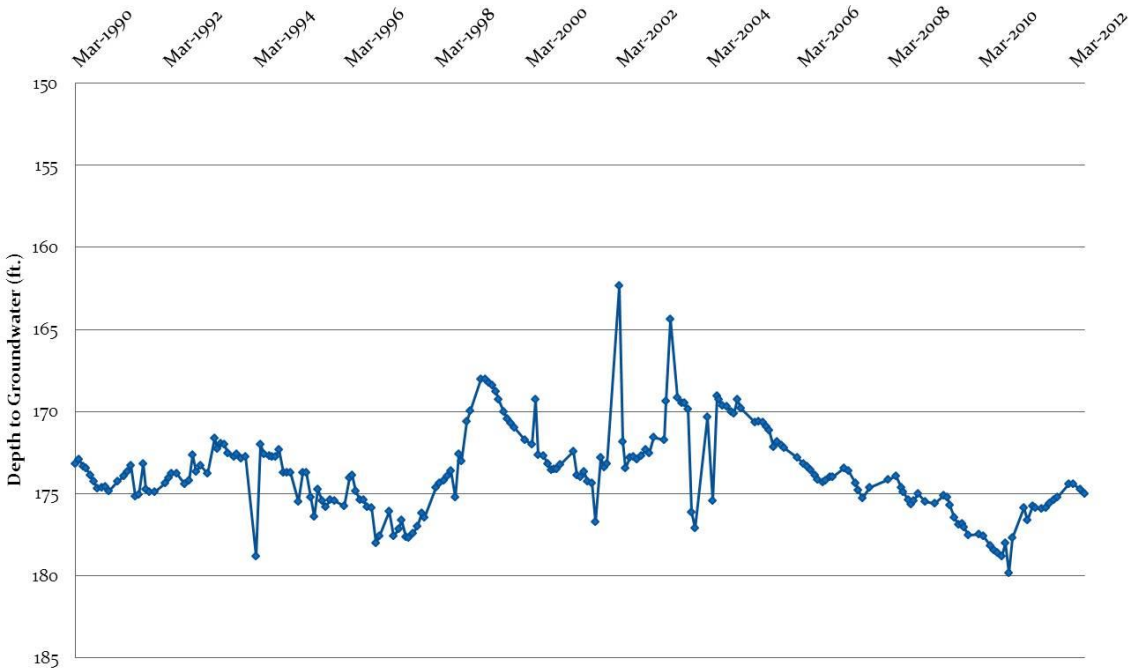

Figure 37. Depth to groundwater at DNR observation well 19015 between 1990 and 2012.

Groundwater/surface water withdrawals

The changes in withdrawal volume detailed below are a representation of water use and demand in the watershed and are taken into consideration when the MNDNR issues permits for water withdrawals. Other factors not discussed in this report but considered when issuing permits include: interactions between individual withdrawal locations, cumulative effects of withdrawals from individual aquifers and potential interactions between aquifers. This holistic approach to water allocations is necessary to ensure the sustainability of Minnesota's groundwater resources.

A longer term record from 1941 to 2010 (Figure 38) shows how as a percentage of use, the water supply source for the seven-county Twin Cities Metropolitan Region has changed from primarily surface water to today, about 70% groundwater from municipal and private wells. This is a result of growing populations in the suburbs which created a demand for more water. To meet this demand, it was easier and less-expensive for communities to drill groundwater wells than to connect to the surface water supply (Metropolitan Council 2013).

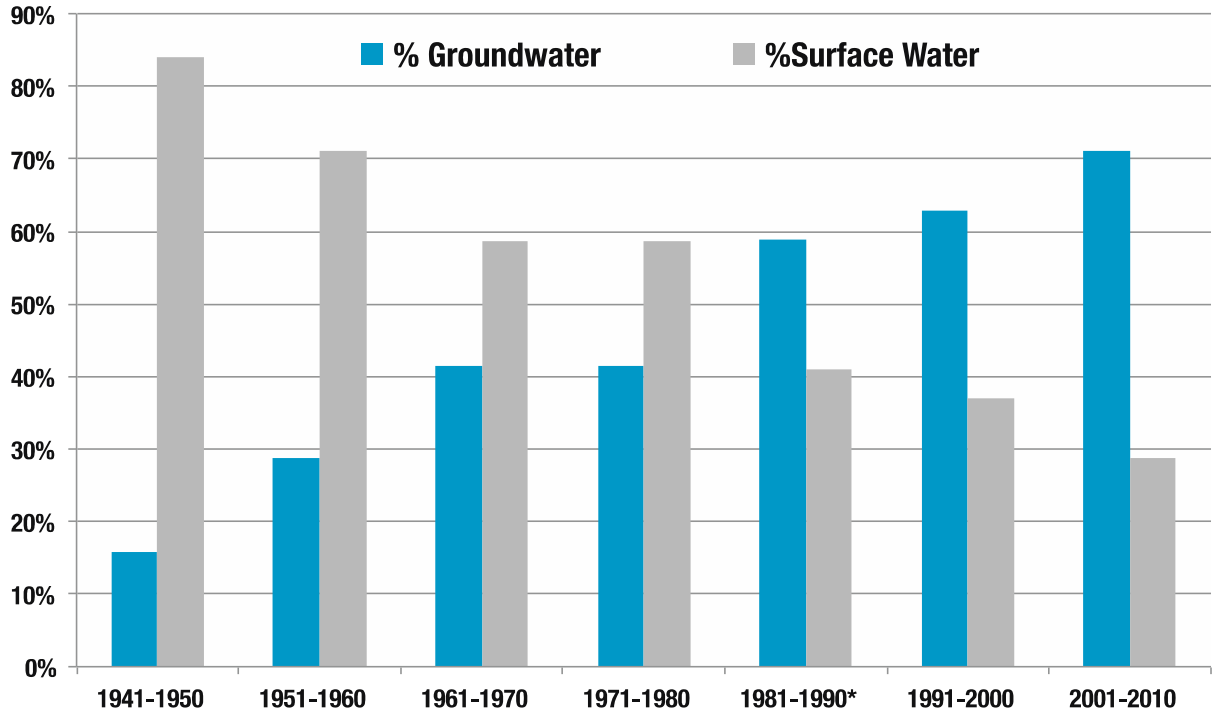

Figure 38. Municipal water use in seven-county Twin Cities Metro Region as a percentage of use between surface water and groundwater between 1941 – 2010 (courtesy of Metropolitan Council).

Total groundwater withdrawals from the watershed from 1988 to 2010 are displayed in Figure 39 as blue diamonds with total surface water withdrawals as red squares. Though the two appear similar when graphed, groundwater withdrawals exhibit a significant rising trend (p=0.001) while surface water withdrawals exhibit no trend. The data is taken from the MDNR Water Use Permit database. http://www.dnr.state.mn.us/waters/watermgmt_section/appropriations/wateruse.html.

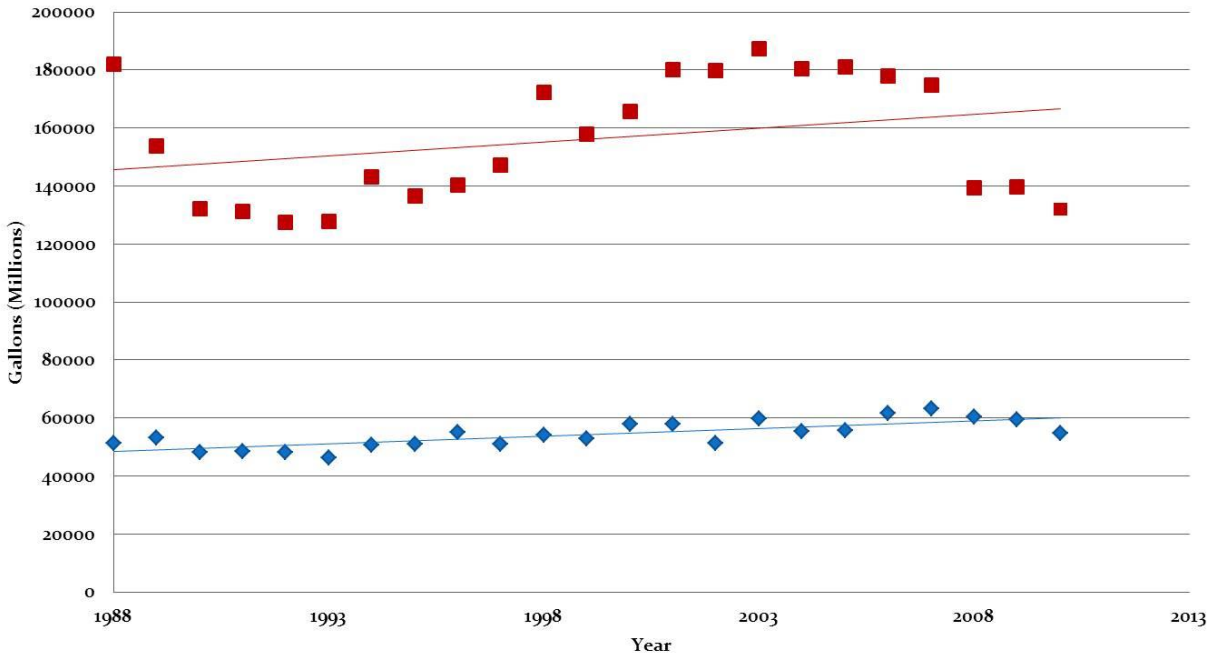

Figure 39. Total groundwater (blue diamonds) and surface water (red squares) withdrawals in the Mississippi River-Twin Cities Watershed between 1988-2010.

More specifically, withdrawals from just the shallow water table aquifer (Figure 40) within the watershed have increased significantly (p=0.001) over the same time period (1988-2010).

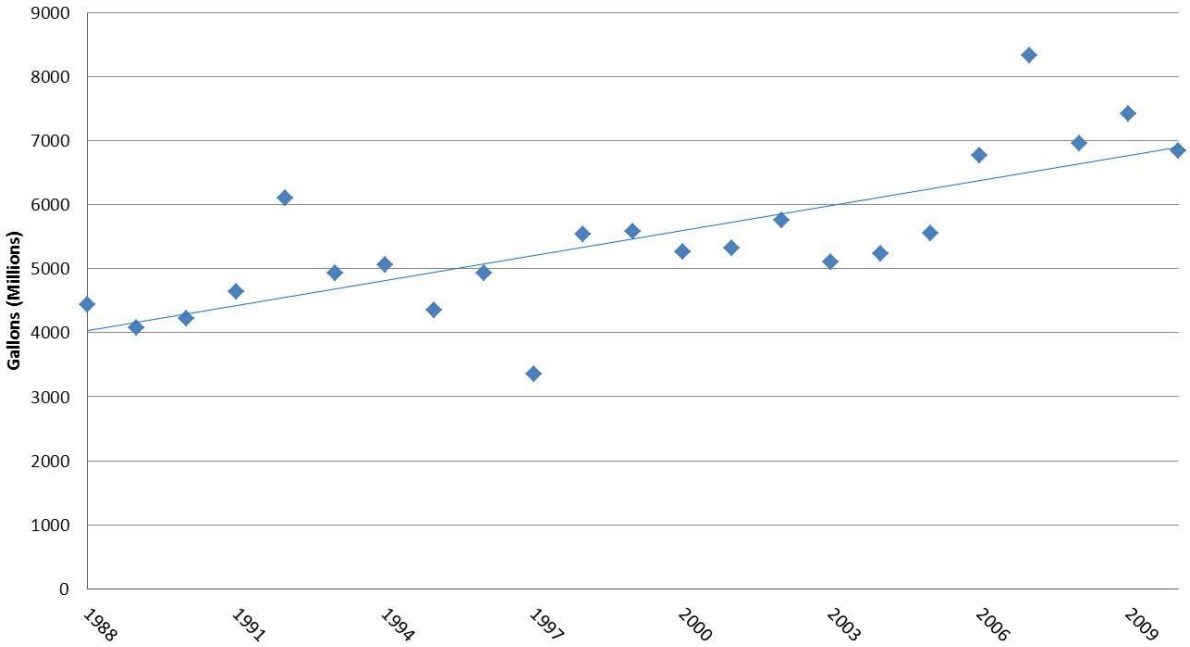

Figure 40. Total groundwater (blue diamonds) withdrawals from the shallow table aquifer in the Mississippi River-Twin Cities Watersheds between 1988 and 2010.

Groundwater withdrawals from within the Minnehaha Creek Watershed show no significant change from 1988 to 2010 (Figure 41). Surface water withdrawals were infrequent and relatively small.

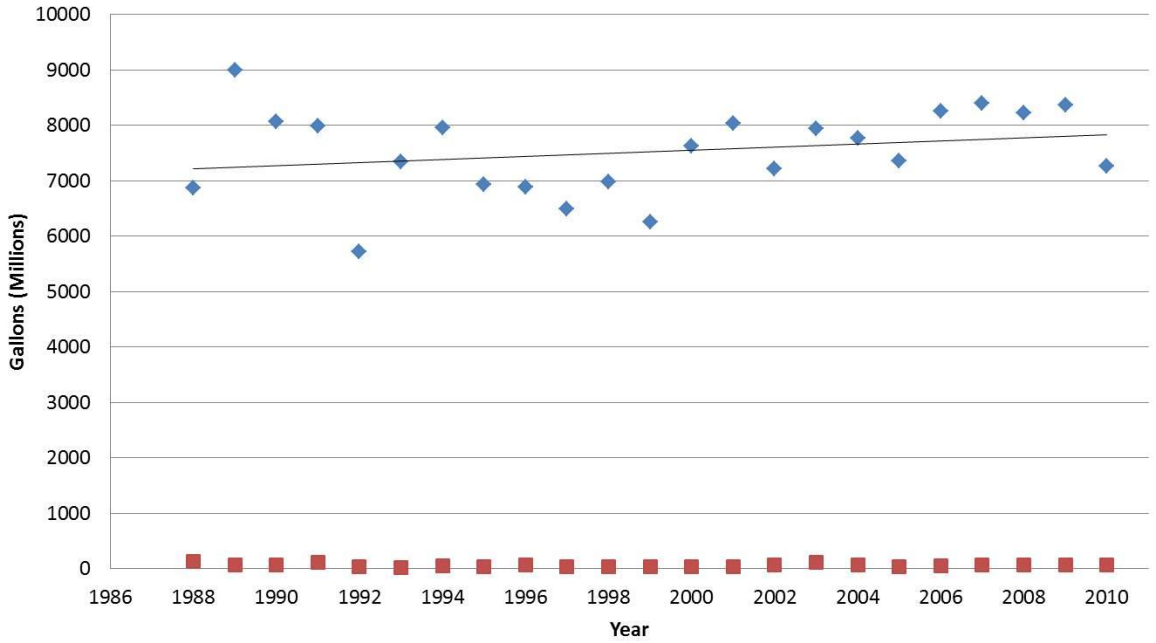

Figure 41. Total groundwater (blue diamonds) and surface water (red squares) withdrawals in the Minnehaha Creek Watershed between 1988 and 2010.

Groundwater withdrawals from within the Elm Creek Watershed have increased significantly (p=0.001) from 1988 to 2010 (Figure 42). Surface water withdrawals were infrequent and relatively small.

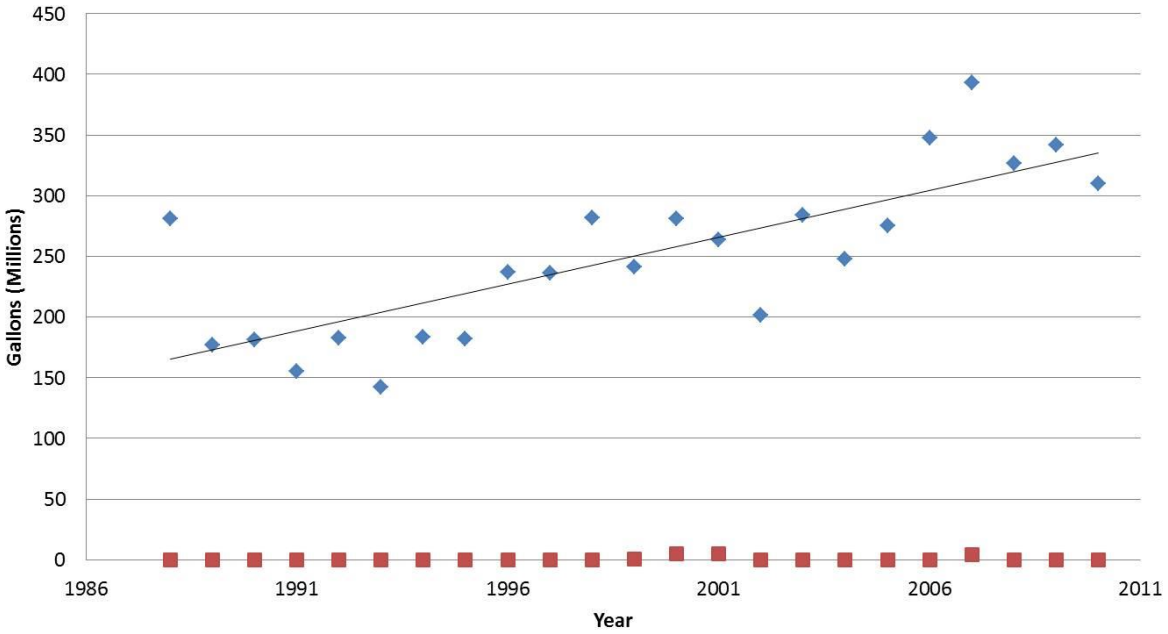

Figure 42. Total groundwater (blue diamonds) and surface water (red squares) withdrawals in the Elm Creek Watershed between 1988 and 2010.

Groundwater withdrawals from within the Shingle Creek Watershed have increased significantly (p=0.001) from 1988 to 2010 (Figure 43). Surface water withdrawals were infrequent and relatively small.

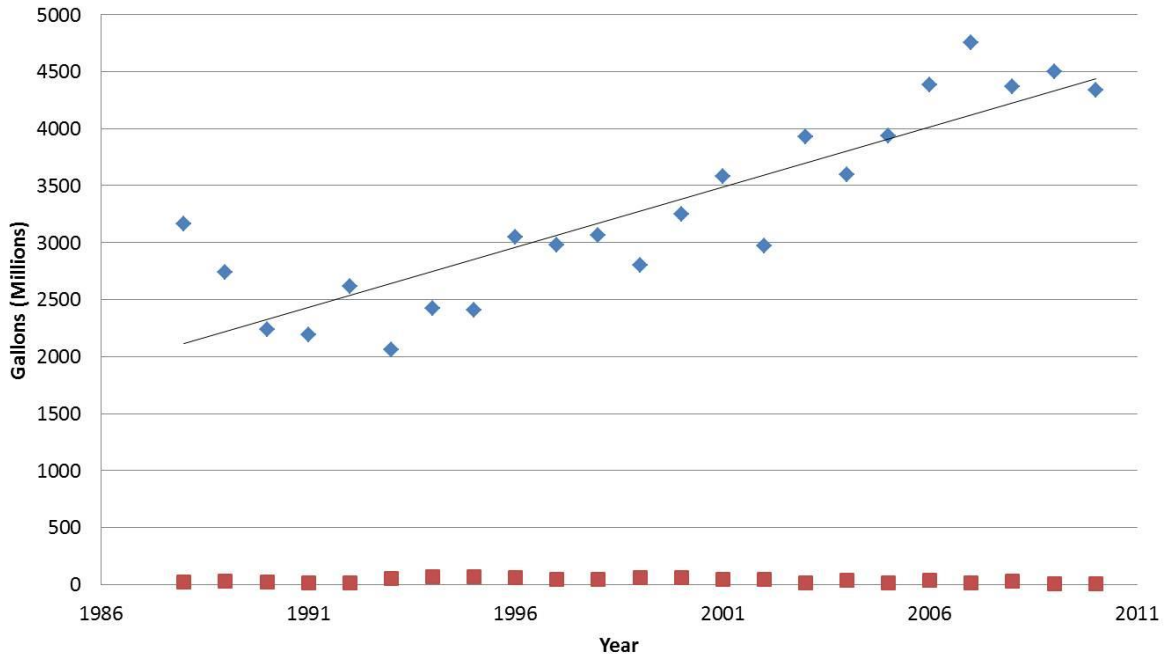

Figure 43. Total groundwater (blue diamonds) and surface water (red squares) withdrawals in the Shingle Creek Watershed between 1988 and 2010.

Stream flow

Analysis of stream flow over time may show indications of groundwater/surface water interaction. For example, steep declines in flow along with an increase in groundwater withdrawals within a watershed may indicate a significant connection between groundwater and that surface water body.

Data from the USGS indicates discharge in Elm Creek (Figure 44) has not statistically significantly increased or decreased since 1990.

Elm Creek near Champlin, MN
USGS ID: 05287890
Description:
Hennepin County, Minnesota
Hydrologic Unit Code 07010206
Latitude 45 09'48", Longitude 93 26'11" NAD27
Drainage area 86.0 mi^2
Gage datum 850.70 feet above NGVD29
Data retrieved from http://waterdata.usgs.gov/mn/nwis/nwisman/?site_no=05287890

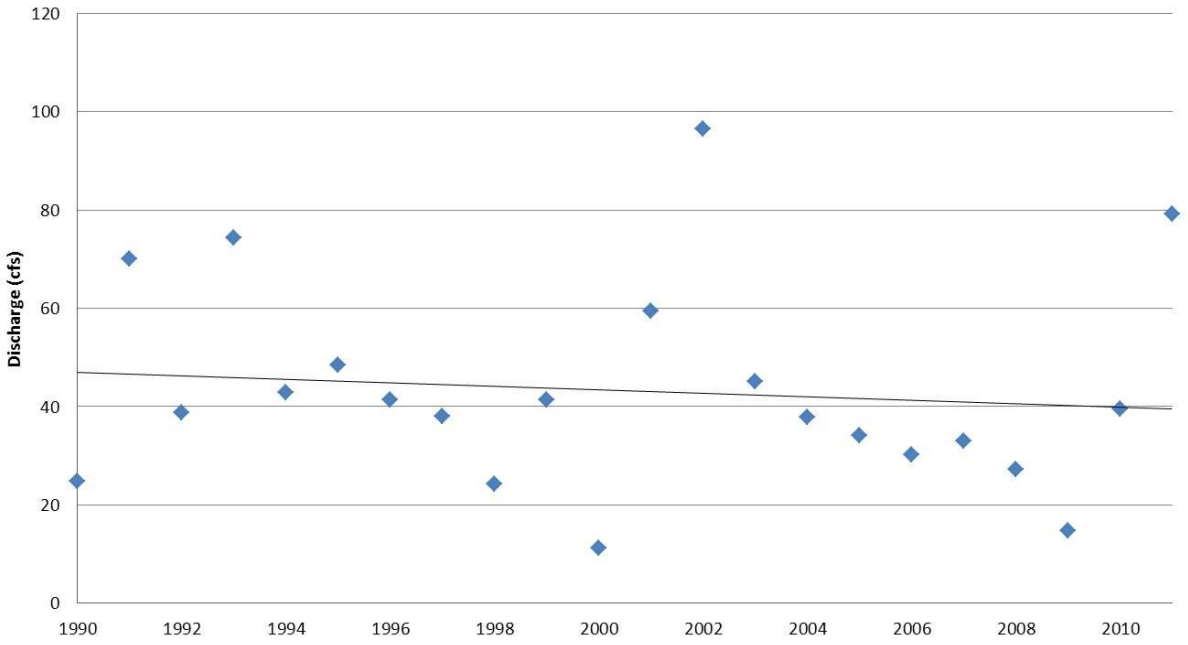

Figure 44. Annual mean discharge in $feet^3$/second, Elm Creek near Champlin, Minnesota.

With only five years of discharge information available from the USGS gaging station it appears that discharge is declining from Minnehaha Creek (Figure 45), but with so few data points it is difficult to determine any trend.

Minnehaha Creek at Minneapolis, Hiawatha Ave
USGS ID: 05289800
Description:
Hennepin County, Minnesota
Hydrologic Unit Code 07010206
Latitude 44 54'56", Longitude 93°12'45" NAD27
Drainage area 176 mi^2
Data retrieved from http://waterdata.usgs.gov/mn/nwis/nwisman/?site_no=05289800

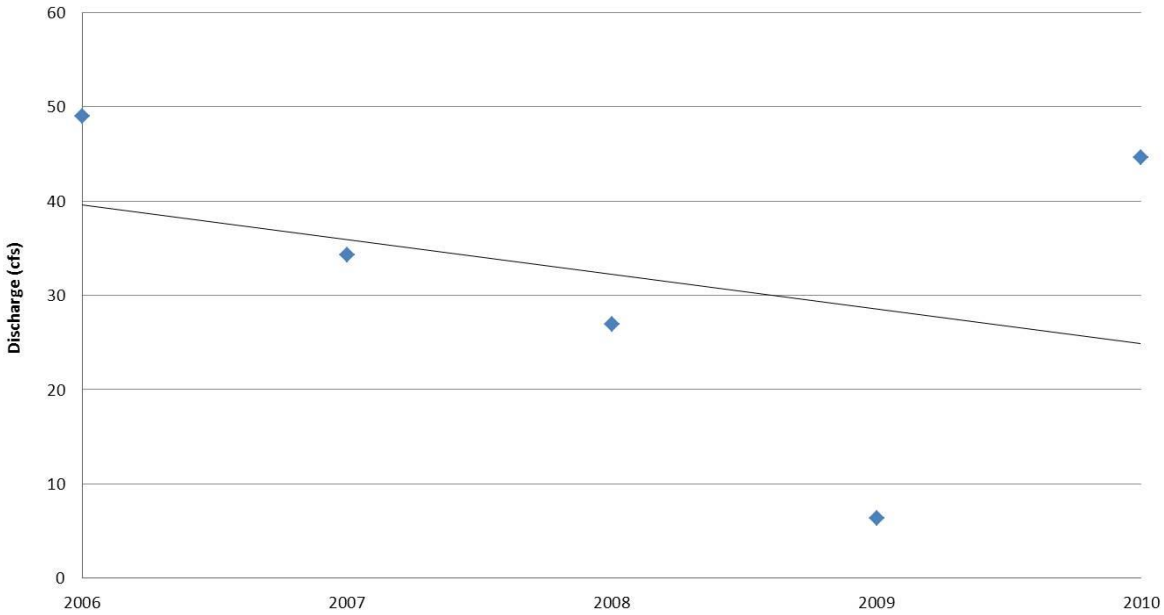

Figure 45. Annual mean discharge in $feet^3$/second, Minnehaha Creek at Hiawatha Avenue, Minneapolis, Minnesota.

Nine years of discharge measurements in Shingle Creek (Figure 46) show a significant declining trend (p=0.05).

Shingle Creek at Queen Ave in Minneapolis, MN
USGS ID: 05288705
Description:
Hennepin County, Minnesota
Hydrologic Unit Code 07010206
Latitude 45 03'00", Longitude 93 18'36" NAD27
Drainage area 28.2 mi^2
Gage datum 840 feet above NGVD29
Data retrieved from http://waterdata.usgs.gov/mn/nwis/nwisman/?site_no=05288705

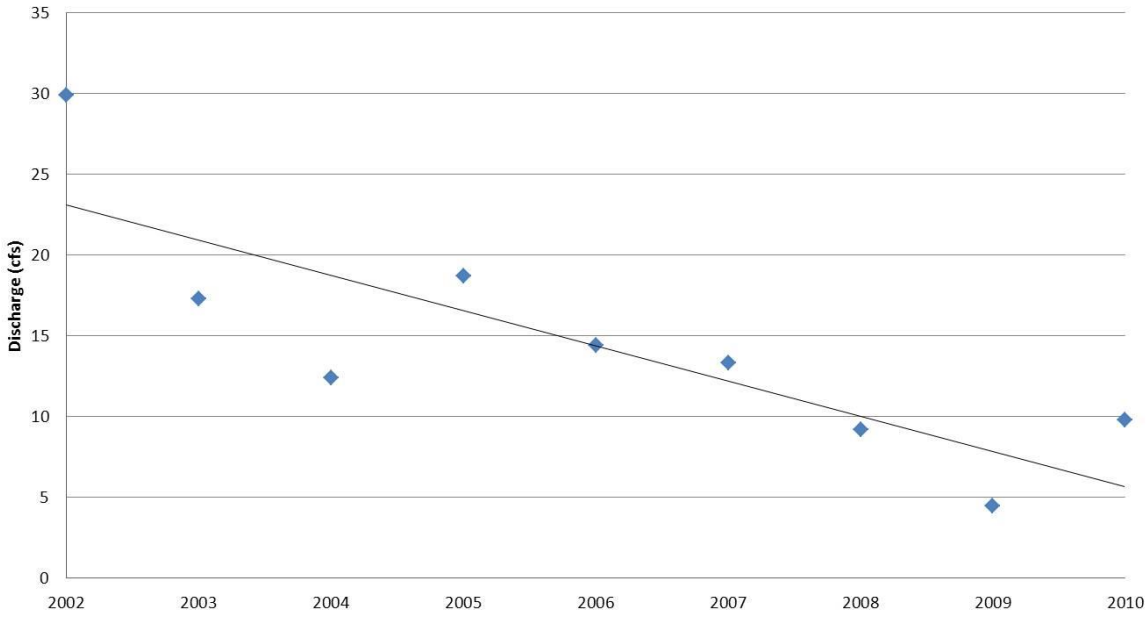

Figure 46. Annual mean discharge in $feet^3$/second, Shingle Creek at Queen Avenue, Minneapolis, Minnesota

The following maps 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 Mississippi River-Twin Cities Watershed.

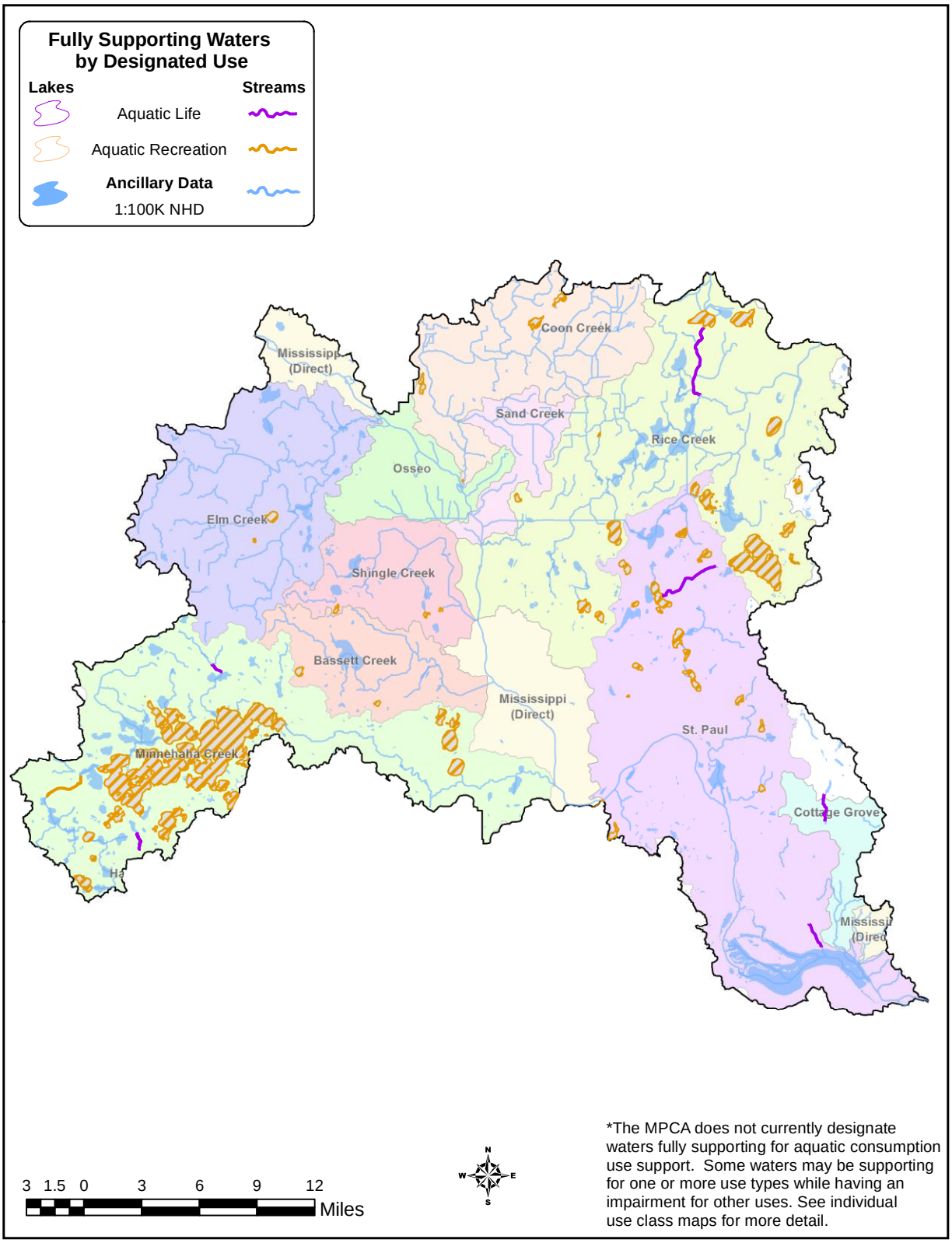

Figure 47. Fully supporting waters by designated use in the Mississippi River-Twin Cities Watershed.

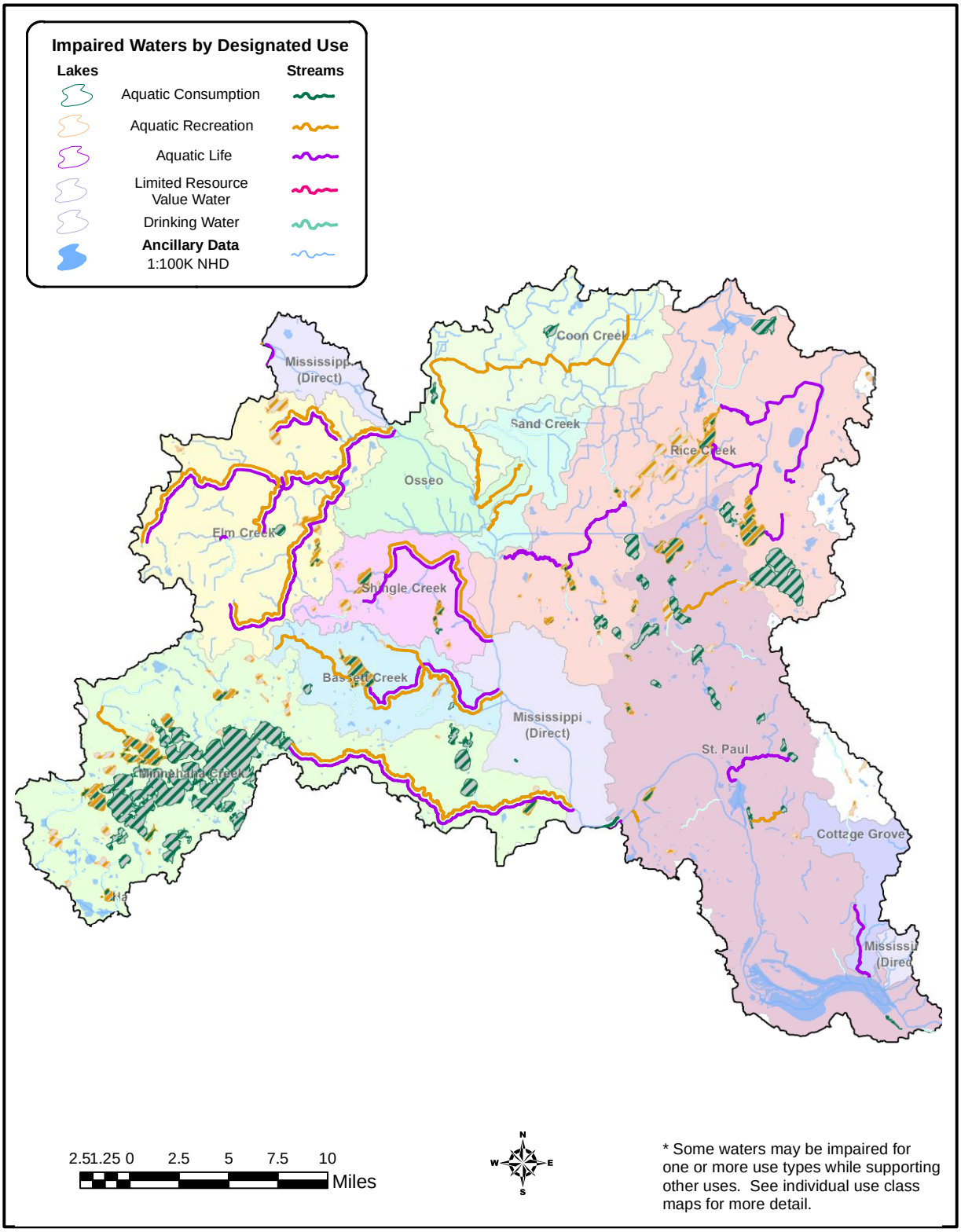

Figure 48. Impaired waters by designated use in the Mississippi River-Twin Cities Watershed.

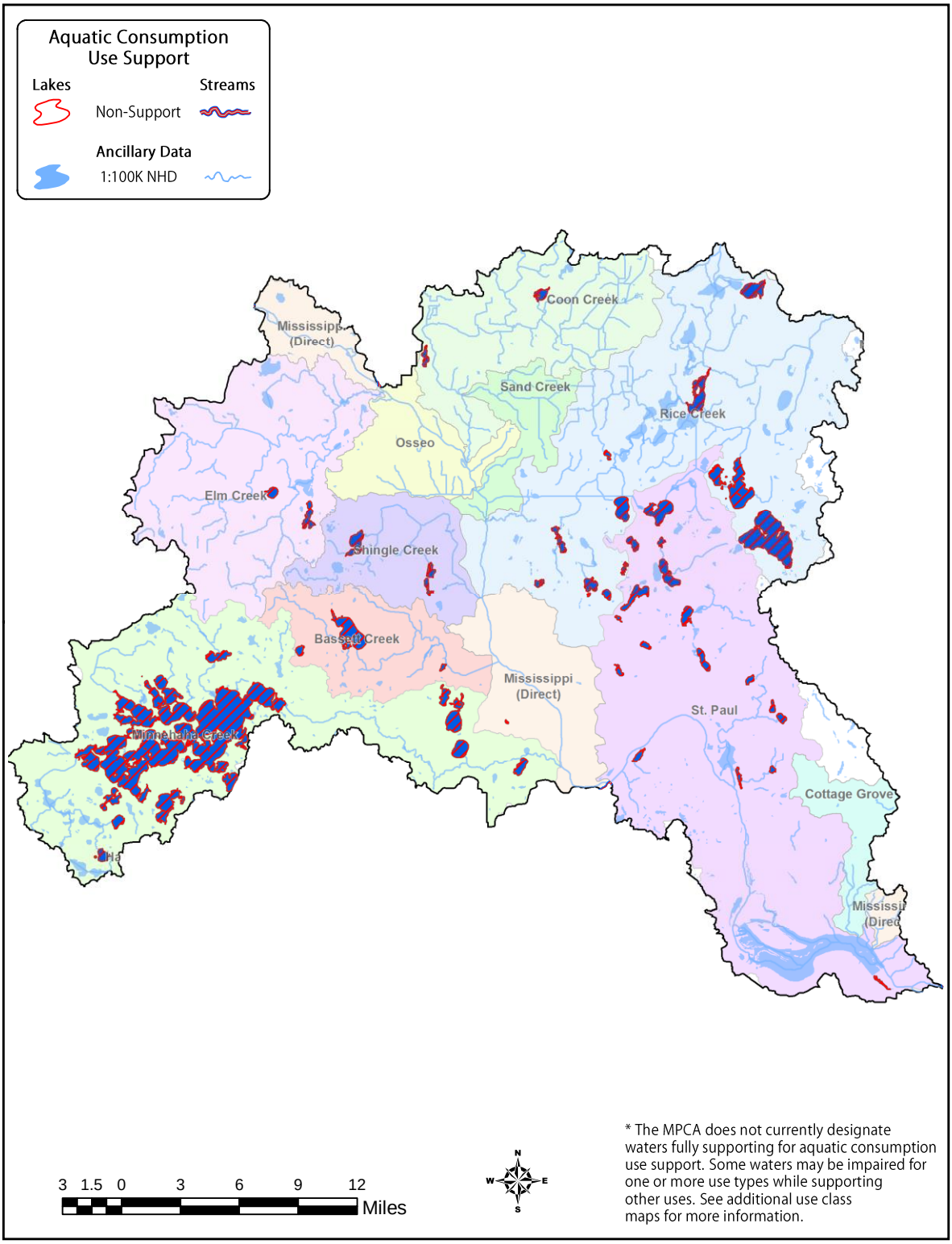

Figure 49. Aquatic consumption use support in the Mississippi River-Twin Cities Watershed.

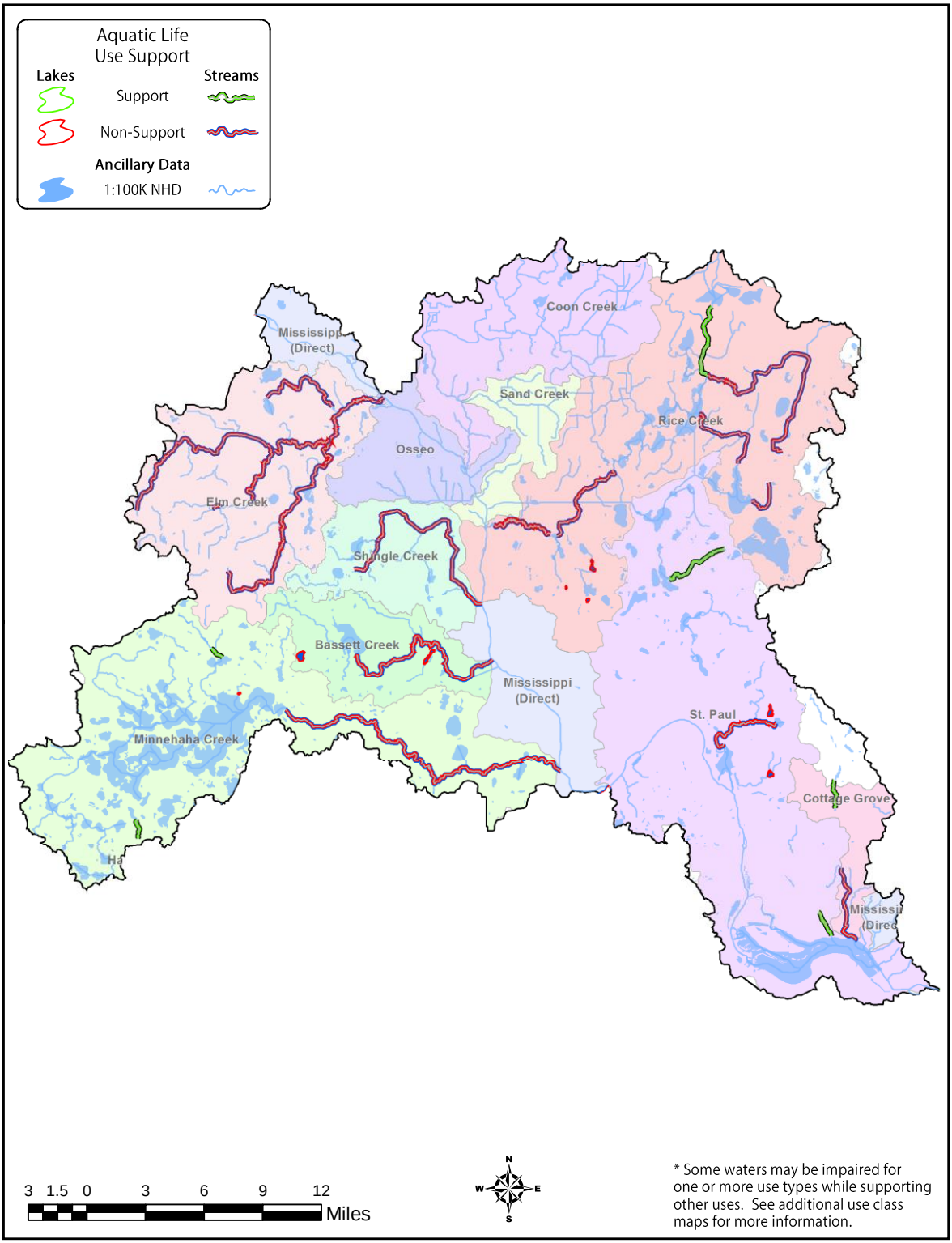

Figure 50. Aquatic life use support in the Mississippi River-Twin Cities Watershed.

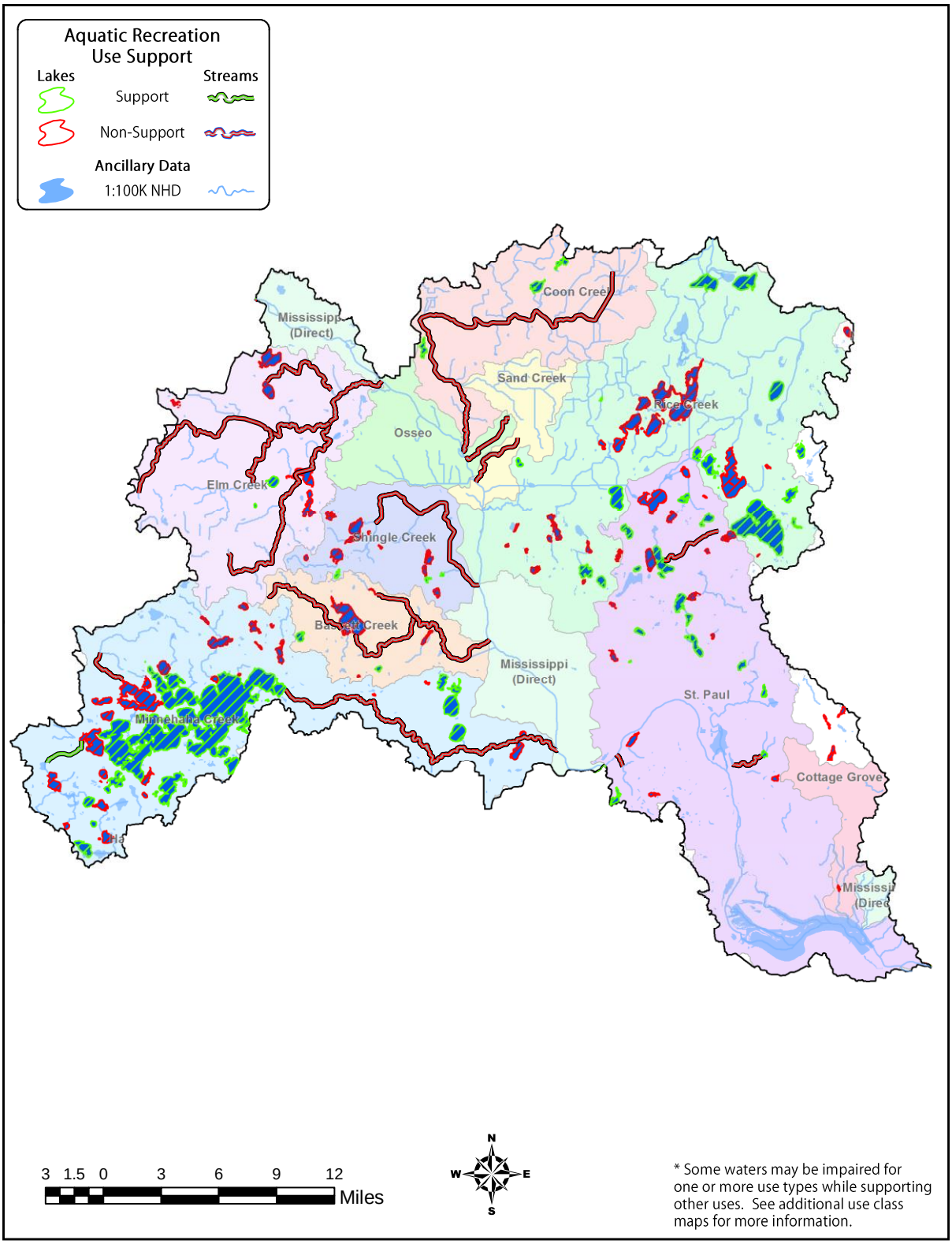

Figure 51. Aquatic recreation use support in the Mississippi River-Twin Cities Watershed.

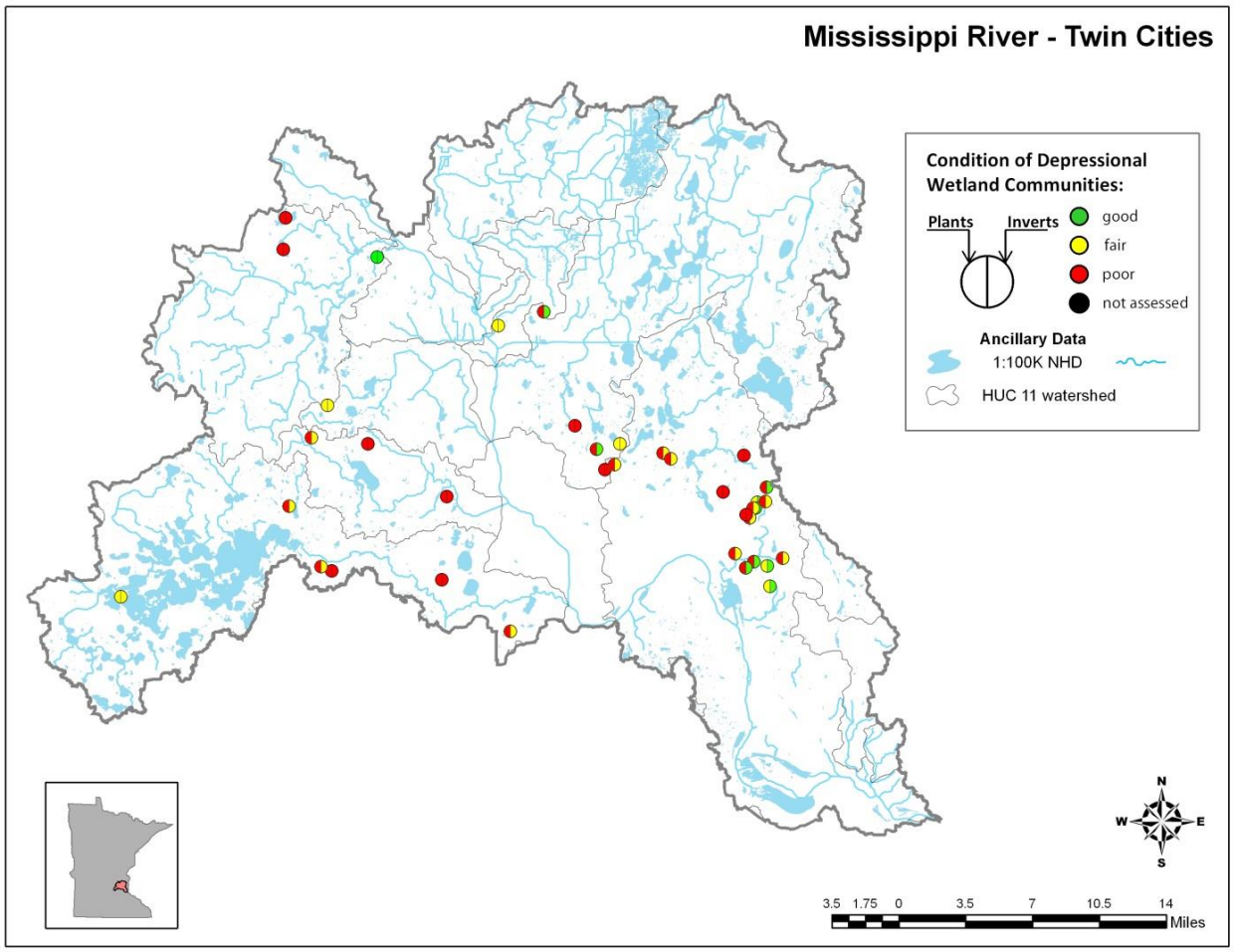

Figure 52. Depressional wetland condition in the Mississippi River-Twin Cities Watershed.

VI. Mississippi River-Twin Cities Watershed trends

Water quality trends

The MPCA calculates trends on transparency data collected on lakes and streams annually. A minimum of eight years of data is required to provide a statistically significant trend; for this analysis a seasonal Kendal test is run using the statistical package "R." Eleven stream sites in the watershed had sufficient data for analysis; of those, only one exhibited a trend. Minnehaha Creek, just upstream of Minnehaha Falls is exhibiting a declining trend in Secchi tube transparency (Figure 53). One hundred forty-six lakes had sufficient data for trend analysis. Thirteen lakes had declining trends in transparency, 45 had improving trends and 88 did not exhibit a trend or change in transparency.

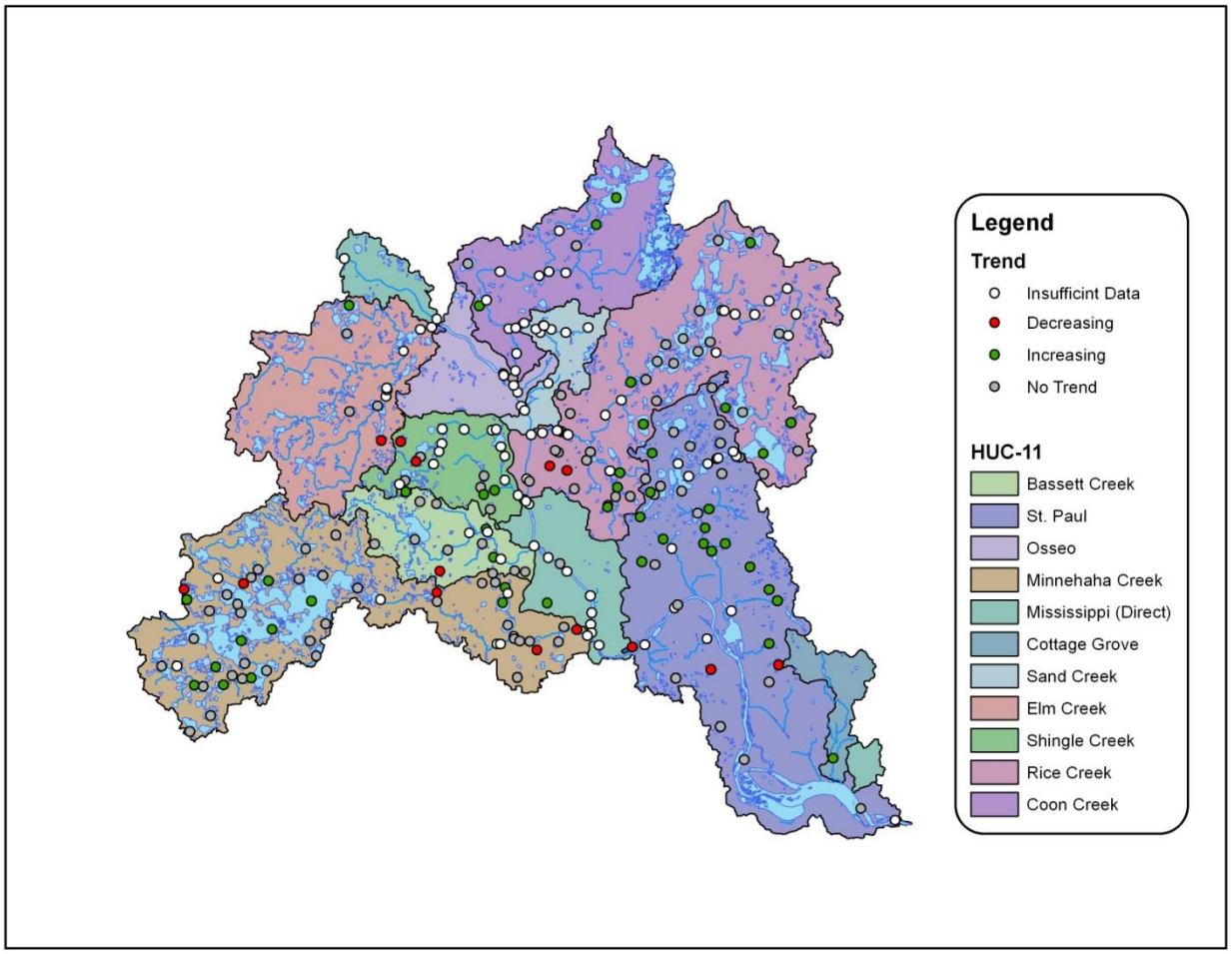

Figure53. Lake and stream transparency trends for the Mississippi River-Twin Cities Watershed.

VII. Summaries and recommendations

While improvements have been made to the water quality of the Mississippi River-Twin Cities Watershed over the last 30 years with regards to point source discharges, many waterbodies struggle to attain water quality standards due to non-point sources of pollution.

During this assessment, 84 lakes and 17 stream reaches were assessed as not supporting aquatic recreation. Eight lakes that were previously impaired for aquatic recreation are now meeting standards and are proposed to be removed from the Impaired Waters List in 2014. For aquatic life use support, seven lakes were determined to be impaired due to elevated chloride. For streams, 16 reaches were found to be not supporting aquatic life with 25 listed impairments (six fish bioassessments, seven aquatic macroinvertebrate bioassessments, eight dissolved oxygen and four chloride toxicity). A number of TMDLs/WRAPS are in development or subwatershed projects are already underway to address many of these impairments (http://www.pca.state.mn.us/oxpgf2c).

Due to the extent of channelization in the low-gradient headwaters as well as the urban core, many stream reaches AUIDs are currently not assessible or are being deferred until TALU biological criteria are developed. Many of these channelized reaches were rated fair to poor for fish and/or macroinvertebrate communities, with the potential that many of these reaches will be found to be impaired when assessed with new TALU criteria. Hence, watershed remediation strategies that are developed to deal with existing and new impairments found during the 2012 assessment cycle should not exclude these unassessed reaches from consideration.

Land use in the watershed varies from wetland/lake-dominated regions with farmland and low-density development largely to the west and north, to areas within the I-494/694 corridor that are densely urbanized with a high percentage of impervious cover. Because of the dynamic differences between these land use types, impairments and stressors are likely to vary in location and extent across the watershed.

Across the watershed, 50 of 78 lakes tested (64%) are impaired for fish consumption use due to elevated mercury, PCBs and/or PFOs in fish tissue and consumption advisories have been posted for many metropolitan lakes (http://www.health.state.mn.us/divs/eh/fish/eating/sitespecific.html). The aquatic recreation impairments for lakes are largely due to excess nutrients causing unsightly and sometimes toxic algal blooms and reduced water clarity. For streams, elevated bacteria levels were found which can indicate conditions that are unsafe for swimming or wading, and secondary body contact such as fishing from a boat or shore. Currently, seven lakes have elevated chloride levels that can create toxic conditions for fish and other aquatic life; however, this number may increase after assessment of additional lakes in summer 2013. Aquatic life impairments for streams include loss of sensitive fish and macroinvertebrate species and poor water quality conditions (e.g., low-dissolved oxygen, excess turbidity, chloride toxicity). Candidate causes which may directly or indirectly affect aquatic biota include: channelization, excess nutrients, flashier stream flows, channel instability, bank erosion, damming and elevated chloride concentrations from the use of deicers.

The Twin Cities metropolitan area is a densely urban watershed with a long history of stream channelization and routing of streams underground through storm culverts and sewers. Channelization can reduce habitat quality required by all but the most tolerant of aquatic organisms to reproduce and survive. In addition, altered hydrology from impervious pavement, roads, and storm drains has caused flashier flows which exacerbate bank erosion and enlarge stream channels. As a result, excess sedimentation and loss of deep pool habitat can limit feeding, spawning, and refuge areas for aquatic organisms. A number of stream restoration projects have been completed or are planned throughout the metro area that rehabilitate lost habitat quality and reduce peak flows. However, improved habitat conditions without reductions in nutrients and chloride may see limited results. Additional measures can be implemented watershed-wide that enhance the success of these efforts, such as local entity and

landowner initiatives that manage nutrients and the volume of water leaving their properties (e.g., installing rain barrels, rain gardens).

Lawn fertilizer, grass clippings, pet waste, and leaf litter are all sources of nutrients that can enter lakes and streams directly from the shoreline or get transported to waterbodies during rain events through storm sewers. Excess nutrients can fuel plant and algal growth creating unsightly, and potentially toxic conditions and reduce dissolved oxygen in the water that limit the ability of biological organisms to survive. A phosphorus lawn fertilizer law was enacted for the Twin Cities seven-county metropolitan area in 2004 and then expanded statewide in 2005 in attempt to greatly reduce excess phosphorus entering lakes and streams. Additional measures can be implemented to achieve greater nutrient reduction. Some examples include: street and driveway sweeping to collect leaves and grass clippings, properly disposing of pet waste, planting native grasses and plants along shorelines to reduce runoff and erosion, raingardens, and enforcing existing buffer laws. Watershed activities can be successful in returning impaired lakes to acceptable conditions. A number of TMDLs and implementation plans have been completed that reduce nutrients and better manage stormwater entering lakes; consequently, eight lakes within the watershed have been or are proposed to be removed from the Impaired Waters List due to improvements in clarity and algal concentrations. For example, Keller Lake in Ramsey County has benefitted from improved stormwater treatment with the installation of sedimentation ponds upstream of the basin. Howard Lake in Anoka County has benefitted from management of the rough fish population and the reestablishment of rooted aquatic vegetation. Within this densely developed watershed, in order to sustain improved water quality ongoing maintenance will be critical—from stormwater basin management to rough fish control.

Sources of bacteria that have the potential to cause water borne illnesses in streams include: outdated or underperforming septic systems and animal waste (e.g., livestock, pets, wildlife). The Upper Mississippi River Bacteria TMDL Study and Protection Plan is in its final stages of development (http://www.pca.state.mn.us/ktqha48). The TMDL aims to address aquatic recreation use impairments along the Mississippi River corridor (including six impaired reaches within the Mississippi River-Twin Cities Watershed) as well as protect unimpaired waterbodies from further contamination.

Excess deicer application to roads, driveways, and sidewalks is a main contributor to toxic chloride conditions for lake and stream biota. The Twin Cities Metropolitan Area Chloride Project is under development, slated to be completed in 2014 (http://www.pca.state.mn.us/r0pgb86). Many state and local applicators have been trained in how to better manage salt storage and use, and more effectively time applications in order to maintain public safety while reducing the volume of salt applied through improved technologies and techniques (http://www.pca.state.mn.us/index.php/about-mpca/mpca-events-and-training/road-salt-education-program.html#certified).

Impacts to groundwater quality can be minimized at the local level by identifying outdated and underperforming septic systems, through proper maintenance of municipal waste and sewer infrastructure, improved road salt storage and application procedures and by protecting groundwater recharge zones.

Groundwater quantity and its effects on surface water bodies is an area of growing concern for municipalities – especially those within the Twin Cities metropolitan area. The link between groundwater use and declining lake levels in White Bear Lake has given urgency to the concern to find a sustainable rate of groundwater use and to find new and innovative ways to manage water to prevent negative effects on aquatic consumption, aquatic life and aquatic recreational use.

Additional monitoring may be needed to determine the extent and nature of existing and new impairments. This information should better inform where to target implementation strategies to best address the sources and causes identified. Improvements in water quality will protect drinking water and provide scenic and recreational opportunities that enhance the quality of life and economic vitality of the Mississippi River-Twin Cites Watershed.

Literature cited

Emmons & Olivier Resources, Inc. (EOR). 2009. Hardwood Creek Impaired Biota (Fish) and Dissolved Oxygen TMDL Implementation Plan. July 2009. 37 http://www.pca.state.mn.us/index.php/view-document.html?gid=7927.

McCollor, S., and S. Heiskary. 1993. Selected Water Quality Characteristics of Minimally Impacted Streams from Minnesota's Seven Ecoregions. Addendum to Fandrei, G., S. Heiskary, and S. McCollor. 1988. Descriptive Characteristics of the Seven Ecoregions in Minnesota. Division of Water Quality, Program Development Section, Minnesota Pollution Control Agency, Saint Paul, Minnesota. 140 p.

National Land Cover Dataset. 2006.

Metropolitan Council. 2013. Groundwater Digest. March 2013. Twin Cities Metropolitan Area, Minnesota. Publication 32-13-011. St Paul, Minnesota. 16 p.

Minnehaha Creek Watershed District (MCWD). 2010. Minnehaha Creek Watershed District 2009 Hydrologic Data Monitoring Report. April 2010. Minnehaha Creek Watershed District. Deephaven, Minnesota. 576 p.

Minnesota Pollution Control Agency (MPCA). 2007a. Guidance Manual for Assessing the Quality of Minnesota Surface Waters for the Determination of Impairment 305(b) Report and 303(d) List. Environmental Outcomes Division, Minnesota Pollution Control Agency, Saint Paul, Minnesota.

Minnesota Pollution Control Agency (MPCA). 2007b. Minnesota Statewide Mercury Total Maximum Daily Load. Minnesota Pollution Control Agency, Saint Paul, Minnesota.

Minnesota Pollution Control Agency (MPCA). 2008a. Watershed Approach to Condition Monitoring and Assessment. Appendix 7 *in* Biennial Report of the Clean Water Council. Minnesota Pollution Control Agency, Saint Paul, Minnesota.

Minnesota Pollution Control Agency (MPCA). 2010a. Aquatic Life Water Quality Standards Draft Technical Support Document for Total Suspended Solids (Turbidity). http://www.pca.state.mn.us/index.php/view-document.html?gid=14922.

Minnesota Pollution Control Agency (MPCA). 2010c. Guidance Manual for Assessing the Quality of Minnesota Surface Water for the Determination of Impairment: 305(b) Report and 303(d) List. Environmental Outcomes Division, Minnesota Pollution Control Agency, Saint Paul, Minnesota.

Minnesota Pollution Control Agency (MPCA). 2010d. Minnesota Milestone River Monitoring Report. http://www.pca.state.mn.us/index.php/water/water-types-and-programs/surface-water/streams-and-rivers/minnesota-milestone-river-monitoring-program.html.

Minnesota Pollution Control Agency (MPCA). 2010e. Regionalization of Minnesota's Rivers for Application of River Nutrient Criteria. http://www.pca.state.mn.us/index.php/view-document.html?gid=6072.

Minnesota Rules Chapter 7050. 2008. Standards for the Protection of the Quality and Purity of the Waters of the State. Revisor of Statutes and Minnesota Pollution Control Agency, Saint Paul, Minnesota.

Omernik, J.M. and A.L. Gallant. 1988. Ecoregions of the Upper Midwest States. EPA/600/3-88/037. Corvallis, OR: United States Environmental Protection Agency. 56 p.

Rice Creek Watershed District (RCWD). 2011. Report on Jones Lake Phosphorus Study. March 2001. Prepared by Montgomery Watson. Wayzata, Minnesota. 14 p.

Robison, M.O. 1958. Minnesota Pioneers. Brigs Press, T.S. Denison & Company. Minneapolis, Minnesota. 143 p.

Shingle Creek Watershed Management Commission (SCWMC) & Minnesota Pollution Control Agency (MPCA). 2010. Shingle Creek and Bass Creek Biotic Integrity Stressor ID. Wenck File #1240-83. Prepared by Wenck Associates, Inc. Maple Plain, Minnesota. 104 p.

Starrett, W.C. 1950. Distribution of the fishes of Boone County, Iowa, with special reference to the minnows and darters. American Midland Naturalist. 43:112—127.

State Climatology Office- MDNR Division of Ecological and Water Resources. 2010. http://www.climate.umn.edu/doc/hydro_yr_pre_maps.htm.

Wenck Associates (2009), Phase 1 Chloride Feasibility Study for the Twin Cities Metropolitan Area, edited, Wenck Associates, Maple Plain, Minnesota.

Wirth, T. 2006. Minneapolis Park System 1883 – 1944: Retrospective glimpses into the history of the board of park commissioners of Minneapolis, Minnesota and the city's park, parkway, and playground system. Limited edition. The Minneapolis Parks Legacy Society. Minneapolis, Minnesota. 352 p.

United States Environmental Protection Agency (USEPA). 2010. Primary Distinguishing Characteristics of Level III Ecoregions of the Continental United States. Version July 2010. http://www.epa.gov/wed/pages/ecoregions/level_iii_iv.htm#Level III.

University of Missouri Extension. 1999. Agricultural Phosphorus and Water Quality. Pub. G9181. http://extension.missouri.edu/publications/DisplayPub.aspx?P=G9181.

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.

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

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

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

Total Phosphorus (TP) – Nitrogen (N), phosphorus (P) and potassium (K) are essential macronutrients and are required for growth by all animals and plants. 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.

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

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

Appendix 2 – Intensive watershed monitoring water chemistry stations in the Mississippi River-Twin Cities 8-HUC Watershed

Biological Station ID	STORET/ EQuIS ID	Waterbody Name	Location	11-digit HUC Subwatershed
10EM167	S004-222	Elm Creek	Elm Creek at Elm Creek Rd, 1 mi. SW of Dayton	07010206820
10UM003	S003-993	Coon Creek	Coon Creek, at bike bridge at Vale St NW, in Coon Rapids	07010206850
97UM005	S003-049	Rice Creek	Rice Creek, 150m W of Central Ave (Hwy 61), in Fridley	07010206860
08UM083	S001-946	Shingle Creek	Shingle Creek at 45th Ave & RR Track, in Minneapolis	07010206870
00UM105	S005-017	Bassett Creek	Bassett Creek at Irving Ave, in Minneapolis	07010206890
08UM075	S001-375	Minnehaha Creek	Minnehaha Creek, near 36th Ave South in Minneapolis	07010206900

Appendix 3.1 – Table of stream assessment results (by parameter and beneficial use)

AUID DESCRIPTIONS					USES						BIOLOGICAL CRITERIA				WATER QUALITY STANDARDS				
Local Jurisdiction	Assessment Unit ID (AUID)	Stream Reach Name	Reach Description	Reach Length (Miles)	Use Class	Aquatic Life	Aquatic Recreation	Aquatic Consumption	Drinking Water		Fish	Macroinvertebrates	Dissolved Oxygen	Turbidity	Chloride	pH	NH3	Pesticides	Bacteria (Aquatic Recreation)
HUC 11: 7010206810 (Mississippi (Direct) - Champlin)																			
NONE																			
HUC 11: 7010206820 (Elm Creek)																			
ECWMC	07010206-525	Diamond Creek	Headwaters (French Lk 27-0127-00) to Unnamed lk	5.9	2B	NS	NS	--	--		EXS	EXP	EXS	MTS	MTS	MTS	MTS	--	EX
ECWMC	07010206-760	Rush Creek, South Fork	Unnamed ditch to County Ditch 16	0.5	2B	NS	NA	--	--		EXS	EXP	IF	MTS	--	MTS	--	--	--
ECWMC	07010206-732	Rush Creek, South Fork	Unnamed lk (27-0439-00) to Rush Cr	4.2	2B	NS	NS	--	--		EXS	EXS	EXS	MTS	--	MTS	MTS	--	EX
ECWMC	07010206-528	Rush Creek	Headwaters to Elm Cr	16.9	2B	NS	NS	--	--		EXS	EXS	EXS	MTS	--	MTS	--	--	EX
ECWMC	07010206-508	Elm Creek	Headwaters (Lk Medina 27-0146-00) to Mississippi R	21.1	2B	NS	NS	--	--		EXS	EXP	EXS	MTS	EXS	MTS	MTS	IF	EX
HUC 11: 7010206830 (Osseo)																			
CCWD	07010206-594	Unnamed ditch	Headwaters to Mississippi River	3.7	2B	NA	NS	--	--		--	--	EXP	MTS	MTS	MTS	--	--	EX
HUC 11: 7010206840 (Sand Creek)																			
CCWD	07010206-737	Unnamed creek	Unnamed cr to Sand Cr	0.5	2B	IF	NA	--	--		--	--	IF	MTS	MTS	MTS	--	--	--
CCWD	07010206-744	Unnamed ditch	Unnamed ditch to Unnamed cr	2.0	2B	IF	NA	--	--		--	--	IF	MTS	MTS	MTS	--	--	--
CCWD	07010206-748	Unnamed ditch	Unnamed ditch to Unnamed cr	0.9	2B	IF	NA	--	--		--	--	IF	MTS	MTS	MTS	--	--	--
CCWD	07010206-749	Unnamed ditch	Headwaters to Sand Cr	1.9	2B	IF	NA	--	--		--	--	IF	MTS	MTS	MTS	--	--	--

Full Support (FS); Not Supporting (NS); Insufficient Data (IF); Not Assessed (NA); Meets standards or ecoregion expectations (MT/MTS), Potential Exceedance (EXP), Exceeds standards (EX/EXS).
Key for Cell Shading: = existing impairment, listed prior to 2012 reporting cycle; = new impairment; = full support of designated use. *Aquatic Life assessment and/or impairments have been deferred until the adoption of Tiered Aquatic Life Uses due to the AUID being predominantly (>50%) channelized or having biological data limited to a station occurring on a channelized portion of the stream.

AUID DESCRIPTIONS					USES						BIOLOGICAL CRITERIA				WATER QUALITY STANDARDS				
Local Jurisdiction	Assessment Unit ID (AUID)	Stream Reach Name	Reach Description	Reach Length (Miles)	Use Class	Aquatic Life	Aquatic Recreation	Aquatic Consumption	Drinking Water		Fish	Macroinvertebrates	Dissolved Oxygen	Turbidity	Chloride	pH	NH3	Pesticides	Bacteria (Aquatic Recreation)
HUC 11: 7010206840 (Sand Creek) cont.																			
CCWD	07010206-765	Unnamed ditch	Unnamed ditch to Unnamed ditch	0.8	2B	IF	NA	--	--		--	--	IF	MTS	MTS	MTS	--	--	--
CCWD	07010206-558	Sand Creek	Unnamed cr to Coon Cr	2.2	2B	IF*	NA	--	--		EXS*	EXS	IF	MTS	MTS	MTS	--	--	--
CCWD	07010206-557	County Ditch 17	Headwaters to Mississippi R	4.0	2B	IF*/IF	NS	--	--		--	--	IF	MTS	--	MTS	--	--	EX
HUC 11: 7010206850 (Coon Creek)																			
CCWD	07010206-530	Coon Creek	Unnamed cr to Mississippi R	24.6	2B	NA*	--	--	--		EXS*	EXP	MTS	MTS	MTS	MTS	MTS	--	EX
HUC 11: 7010206860 (Rice Creek)																			
RCWD	07010206-565	Unnamed ditch (Ramsey/Washington Judicial Ditch)	Headwaters to Bald Eagle Lk	2.3	2B	NS	NA	--	--		--	--	EXS	MTS	--	MTS	--	--	--
RCWD	07010206-595	Hardwood Creek	Headwaters to Hwy 61	8.3	2B	NS	NA	--	--		--	--	EXS	MTS	--	MTS	IF	--	--
RCWD	07010206-596	Hardwood Creek	Hwy 61 to Peltier Lk	5.4	2B	NS	NA	--	--		EXS	EXS	EXP	MTS	MTS	MTS	MTS	--	EX
RCWD	07010206-519	Clearwater Creek	Bald Eagle Lk to Peltier Lk	5.3	2B	NS	NA	--	--		EXS	--	IF*	IF*	--	EXP	--	--	EX
RCWD	07010206-583	Rice Creek	Unnamed lk (02-0041-00) to Long Lk	6.1	2Bd	NS	NA	--	--		EXS	EXP	IF	EXP	--	MTS	MTS	--	EX
RCWD	07010206-584	Rice Creek	Long Lk to Locke Lk	5.8	2Bd	NS	NS	--	--		EXS	EXS	IF	MTS	MTS	MTS	MTS	--	EX
RCWD	07010206-586	Rice Creek	Locke Lk to Mississippi R	0.5	2Bd	NA	IF	--	--		--	--	IF	MTS	--	MTS	--	--	--

Full Support (FS); Not Supporting (NS); Insufficient Data (IF); Not Assessed (NA); Meets standards or ecoregion expectations (MT/MTS), Potential Exceedance (EXP), Exceeds standards (EX/EXS).
Key for Cell Shading: = existing impairment, listed prior to 2012 reporting cycle; = new impairment; = full support of designated use. *Aquatic Life assessment and/or impairments have been deferred until the adoption of Tiered Aquatic Life Uses due to the AUID being predominantly (>50%) channelized or having biological data limited to a station occurring on a channelized portion of the stream.

AUID DESCRIPTIONS					USES						BIOLOGICAL CRITERIA				WATER QUALITY STANDARDS				
Local Jurisdiction	Assessment Unit ID (AUID)	Stream Reach Name	Reach Description	Reach Length (Miles)	Use Class	Aquatic Life	Aquatic Recreation	Aquatic Consumption	Drinking Water		Fish	Macroinvertebrates	Dissolved Oxygen	Turbidity	Chloride	pH	NH3	Pesticides	Bacteria Aquatic Recreation)
HUC 11: 7010206870 (Shingle Creek)																			
SCWMC	07010206-673	Unnamed cr	Unnamed cr to Bass Lk	1.3	2B	IF	NA	--	--		--	--	IF	MTS	MTS	MTS	MTS	--	--
SCWMC	07010206-506	Shingle Creek	Headwaters (Eagle Cr/Bass Cr) to Mississippi R	11.2	2B	NS	NS	--	--		--	--	EXS	EXS*	EX	MTS	MTS	--	EX
SCWMC	07010206-784	Bass Creek	Unnamed wetland (27-0096-00) to Eagle Cr	2.3	2B	NS	NA	--	--		--	--	--	--	EX	--	--	--	--
HUC 11: 07010206-880 (Mississippi (Direct) – Minneapolis)																			
NONE																			
HUC 11: 07010206-890 (Bassett Creek)																			
BCWMC	07010206-526	Unnamed creek	Headwaters to Medicine Lk	5.9	2B	IF*	NS	--	--		--	--	--	EXS	--	--			EX
BCWMC	07010206-734	Unnamed creek	Headwaters to Sweeney Lk	1.6	2B	IF	NA	--	--		--	--	--	EXS	--	--			
BCWMC	07010206-738	Unnamed creek	Headwaters to Sweeney Lk	0.8	2B	IF	NA	--	--		--	--	--	EXS	--	--			
BCWMC	07010206-739	Unnamed creek	Headwaters to Medicine Lk	1.7	2B	IF	NA	--	--		--	--	--	EXS	--	--			
BCWMC	07010206-552	Unnamed creek	Unnamed lk to Bassett Cr	2.6	2B	NA*	NS	--	--		--	--	--	--	--	--			EX
BCWMC	07010206-740	Unnamed creek	Unnamed cr to Medicine Lk	0.3	2B	IF	NA	--	--		--	--	--	EXS	--	--			
BCWMC	07010206-741	Unnamed creek	Headwaters to Unnamed Cr	0.7	2B	IF	NA	--	--		--	--	--	EXS	--	--			
BCWMC	07010206-538	Bassett Creek	Medicine Lk to Mississippi R	12.7	2B	NS	NS	IF	--		--	--	EXS	MTS	EX	IF		MTS	EX
HUC 11: 07010206-900 (Minnehaha Creek)																			
MCWD	07010206-712	Long Lake Creek	Long Lk to Lk Minnetonka	2.5	2B	IF*	NA	--	--		EXS*	EXP*	EXS*	MTS	MTS	MTS			
MCWD	07010206-551	Sixmile Creek	Mud Lk to Lk Minnetonka	2.5	2B	NA[¥]	FS	--	--		--	--	NA[¥]	NA[¥]	MTS	NA[¥]			MTS
MCWD	07010206-697	Painter Creek	Katrina Lk to Unnamed Cr	3.8	2B	IF*	NA	--	--		--	--	EXS[*]	--	MTS	--			
MCWD	07010206-700	Painter Creek	Unnamed cr to Lk Minnetonka	2.4	2B	NA*	NS	--	--		--	--	EXS[*]	--	MTS	--			EX
MCWD	07010206-674	Unnamed creek	Headwaters to Christmas Lk	0.7	2B	IF	NA	--	--		--	--	MTS	MTS	MTS	MTS			
MCWD	07010206-679	Unnamed creek	Headwaters to Peavey Lk	1.1	2B	IF	NA	--	--		--	--	IF	IF	--	EXS			
MCWD	07010206-703	Unnamed creek	Lk Classen to Lk Minnetonka	1.9	2B	IF	NA	--	--		--	--	EXP	--	MTS	MTS			
MCWD	07010206-704	Unnamed creek	Unnamed cr to Gleason Lk	1.1	2B	IF*	NA	--	--		--	--	EXS[*]	MTS	EXS	MTS			
MCWD	07010206-709	Unnamed creek	Unnamed cr to Long Lk	0.8	2B	FS	NA	--	--		--	--	MTS	MTS	MTS	MTS			
MCWD	07010206-716	Unnamed creek	Headwaters to Schultz Lk	1.1	2B	FS	NA	--	--		--	--	MTS	MTS	MTS	MTS			
MCWD	07010206-539	Minnehaha Creek	Lk Minnetonka to Mississippi R	21.2	2B	NS	NS	--	--		EXS	EXS	EXS	MTS	EX	MTS	IF	MTS	EX

AUID DESCRIPTIONS					USES						BIOLOGICAL CRITERIA				WATER QUALITY STANDARDS				
Local Jurisdiction	Assessment Unit ID (AUID)	Stream Reach Name	Reach Description	Reach Length (Miles)	Use Class	Aquatic Life	Aquatic Recreation	Aquatic Consumption	Drinking Water		Fish	Macroinvertebrates	Dissolved Oxygen	Turbidity	Chloride	pH	NH3	Pesticides	Bacteria Aquatic Recreation)
HUC 11: 07010206-910 (St. Paul)																			
LMRWMO	07010206-542	Unnamed creek	Unnamed cr to Mississippi R	0.7	2B	NA	NS	--	--		--	--	--	--	--	--	--	--	EX
RWMWD	07010206-592	Battle Creek	Battle Creek Lk to Pigs Eye Lk	5.0	2B	NS	IF	--	--		EXS	EXS	IF	MTS	EX	--	--	MTS	IF
RWMWD	07010206-606	Fish Creek	Carver Lk to Unnamed (North Star) lk	2.1	2C	IF	NS	--	--		--	--	--	MTS	MTS	--	--	MTS	EX
RWMWD	07010206-801	Unnamed ditch	Headwaters to Mississippi R	3.7	2B	NA	NS	--	--		--	--	EXP	MTS	MTS	MTS	--	--	EX
HUC 11: 07010206-920 (Cottage Grove)																			
SWWD	**07010206-517**	**Unnamed Creek**	Headwaters to Mississippi R	4.6	2B	NA	NA	--	--		--	--	--	--	--	--	--	--	--
HUC 11: 07010206-960 (Mississippi River (Direct) Hastings)																			
NONE																			

Local Jurisdiction codes: **BCWMC** = Bassett Creek Water Management Commission, **CCWD** = Coon Creek Watershed District, **CRWD** = Capital Region Watershed District, **ECWMC** = Elm Creek Water Management Commission, **LRRWMO** = Lower Rum River Water Management Organization, **MCWD** = Minnehaha Creek Watershed District, **MWMO** = Mississippi Watershed Management Organization, **RCWD** = Rice Creek Watershed District, **RWMWD** = Ramsey Washington Metro Watershed District, **SCWMC** = Shingle Creek Water Management Commission, **SWWD** = South Washington Watershed District, **VLAWMO** = Vadnais Lakes Area Watershed Management Organization, **VRWJPO** = Vermillion River Watershed Joint Powers Organization

Assessment results: Full Support (FS); Not Supporting (NS); Insufficient Data (IF); Not Assessed (NA); Meets standards or ecoregion expectations (MT/MTS), Potential Exceedence (EXP), Exceeds standards or ecoregion expectations (EX/EXS). *Aquatic Life assessment and/or impairments have been deferred until the adoption of Tiered Aquatic Life Uses due to the AUID being predominantly (>50%) channelized or having biological data limited to a station occurring on a channelized portion of the stream.

Key for Cell Shading: = existing impairment, listed prior to 2012 reporting cycle; = new impairment; = full support of designated use.

Appendix 3.2 – Assessment results for lakes in the Mississippi River-Twin Cities Watershed

Local Jurisdiction[1]	Lake ID	Lake Name	County	11-HUC	Ecoregion[2]	Lake Area (ha)[3]	Max Depth (m)[3]	Mean Depth (m)[3]	Watershed Area (ha)[3]	% Littoral	Aquatic Recreation Use Support[4]	Aquatic Life Use Support[4]	Aquatic Consump-tion Use Support[5]
BCWMC	27-0035-01	Sweeney	Hennepin	7010206890	NCHF	27.1	8.2	3.7	947	61	NS	NS	FS
BCWMC	27-0035-02	Twin	Hennepin	7010206890	NCHF	8.5	16.6	7.8	30.4	38	IF	NA	NA
BCWMC	27-0037-00	Wirth	Hennepin	7010206890	NCHF	15.8	7.6	4.3	140.4	61	IF	NA	NS
BCWMC	27-0103-00	Lost	Hennepin	7010206890	NCHF	8.9	1.8	1.1	24.7	100	IF	NA	--
BCWMC	27-0104-00	Medicine	Hennepin	7010206890	NCHF	384.9	14.9	4.8	4695.8	45	NS	IF	NS
BCWMC	27-0107-00	Parkers	Hennepin	7010206890	NCHF	38.8	11.3	3.7	384.5	70	FS	NS	NS
BCWMC	27-0627-00	Northwood	Hennepin	7010206890	NCHF	6.1	1.5	0.8	542.7	100	NS	NA	--
BCWMC	27-0711-00	Westwood	Hennepin	7010206890	NCHF	45.7	1.5	--	123.4	100	FS	NA	--
BCWMC	27-0734-00	Unnamed (Crane)	Hennepin	7010206890	NCHF	38.4	1.5	--	243	100	IF	NA	--
CCWD	02-0654-00	Unnamed (Cenaiko)	Anoka	7010206830	NCHF	1.2	11	3.7	17.4	--	FS	NA	NA
CCWD	02-0052-00	Netta	Anoka	7010206850	NCHF	108.9	5.8	1.3	229.5	--	FS	NA	--
CCWD	02-0053-00	Ham	Anoka	7010206850	NCHF	90.6	6.7	1.8	345.3	--	FS	NA	NS
CCWD	02-0084-00	Crooked	Anoka	7010206850	NCHF	35.6	7.9	2.7	190	74	FS	IF	NS
CCWD	02-0520-00	Unnamed	Anoka	7010206850	NCHF	611.9	--	--	1410.5	--	--	--	--
CCWD	02-0072-00	Laddie	Anoka	7010206860	NCHF	27.9	1.5	--	119	100	FS	--	NA
CCWD	02-0764-00	Club West	Anoka	7010206840	NCHF	--	--	--	--	--	--	--	FS
CRWD	62-0047-00	Crosby	Ramsey	7010206910	NCHF	25.1	5.2	0.9	94.7	97	IF	--	--
CRWD	62-0054-00	Mccarron	Ramsey	7010206910	NCHF	32.8	17.4	8.2	454	36	FS	--	NS
CRWD	62-0055-00	Como	Ramsey	7010206910	NCHF	28.7	4.7	2.2	738.3	100	NS	--	NS
CRWD	62-0231-00	Loeb	Ramsey	7010206910	NCHF	4	8.5	2.7	17.8	81	FS	--	FS
ECWMC	27-0061-00	Champlin Mill Pond	Hennepin	7010206820	NCHF	14.6	3.2	1	26935.8	100	IF	--	NA
ECWMC	27-0066-00	Lemans	Hennepin	7010206820	NCHF	40.1	--	--	319.5	--	--	--	--
ECWMC	27-0112-00	Mud	Hennepin	7010206820	NCHF	64.7	--	1	416.1	--	--	--	--

Local Jurisdiction[1]	Lake ID	Lake Name	County	11-HUC	Ecoregion[2]	Lake Area (ha)[3]	Max Depth (m)[3]	Mean Depth (m)[3]	Watershed Area (ha)[3]	% Littoral	Aquatic Recreation Use Support[4]	Aquatic Life Use Support[4]	Aquatic Consump-tion Use Support[5]
ECWMC	27-0116-01	Rice (Main)	Hennepin	7010206820	NCHF	124.2	3.4	1.7	7381.5	100	NS	--	NA
ECWMC	27-0116-02	Rice (West Bay)	Hennepin	7010206820	NCHF	13	3.4	0.5	5905.2	100	NS	--	NA
ECWMC	27-0117-00	Weaver	Hennepin	7010206820	NCHF	63.5	17.4	6.3	198	--	FS	--	NS
ECWMC	27-0118-00	Fish	Hennepin	7010206820	NCHF	119.4	18.6	6.2	921.2	45	NS	--	NS
ECWMC	27-0120-02	Cook (South Portion)	Hennepin	7010206820	NCHF	6.5	6.1	2.1	--	--	--	--	--
ECWMC	27-0121-00	Edward	Hennepin	7010206820	NCHF	10.9	--	--	--	--	--	--	--
ECWMC	27-0122-00	Goose	Hennepin	7010206820	NCHF	33.6	--	1	95.9	--	--	--	FS
ECWMC	27-0125-00	Diamond	Hennepin	7010206820	NCHF	183.7	2.4	1.7	1236.8	100	NS	--	NA
ECWMC	27-0127-00	French	Hennepin	7010206820	NCHF	147.7	--	0.9	387.7	--	NS	--	NA
ECWMC	27-0128-00	Hayden	Hennepin	7010206820	NCHF	161.9	--	--	26757.8	--	--	--	--
ECWMC	27-0129-00	Dubay	Hennepin	7010206820	NCHF	6.9	--	0.6	18.2	--	--	--	--
ECWMC	27-0130-00	Powers	Hennepin	7010206820	NCHF	64.7	--	--	263.5	--	--	--	FS
ECWMC	27-0165-00	Jubert	Hennepin	7010206820	NCHF	101.2	12.5	--	820.9	76	--	--	--
ECWMC	27-0175-00	Henry	Hennepin	7010206820	NCHF	28.7	1.5	1	307.9	100	NS	--	--
LMRWMO	19-0034-00	Unnamed	Dakota	7010206910	NCHF	8.5	--	--	--	--	--	--	--
LMRWMO	19-0035-00	Unnamed	Dakota	7010206910	NCHF	8.5	--	--	--	--	--	--	--
LMRWMO	19-0037-00	Unnamed (Simley)	Dakota	7010206910	NCHF	4.5	5.2	1.5	169.6	--	IF	--	FS
LMRWMO	19-0047-00	Hornbean	Dakota	7010206910	NCHF	8.1	--	1	144.9	--	IF	--	NA
LMRWMO	19-0048-00	Thompson	Dakota	7010206910	NCHF	--	--	--	--	--	--	--	FS
LMRWMO	19-0049-00	Unnamed (Golf Course Pnd)	Dakota	7010206910	NCHF	5.7	--	--	--	--	--	--	--
LMRWMO	19-0050-00	Sunfish	Dakota	7010206910	NCHF	20.6	9.8	2.1	95.5	87	NS	--	NA
LMRWMO	19-0052-00	Schmitt	Dakota	7010206910	NCHF	23.1	--	1.5	344.4	--	IF	--	NA
LMRWMO	19-0079-00	Pickerel	Dakota	7010206910	NCHF	59.1	3.4	1.2	459.6	100	NS	--	NS
LMRWMO	19-0080-00	Rogers	Dakota	7010206910	NCHF	43.3	2.4	1.3	193.9	100	FS	--	FS
LMRWMO	19-0103-00	Unnamed	Dakota	7010206910	NCHF	40.5	--	--	--	--	--	--	--

Local Jurisdiction[1]	Lake ID	Lake Name	County	11-HUC	Ecoregion[2]	Lake Area (ha)[3]	Max Depth (m)[3]	Mean Depth (m)[3]	Watershed Area (ha)[3]	% Littoral	Aquatic Recreation Use Support[4]	Aquatic Life Use Support[4]	Aquatic Consump-tion Use Support[5]
LRRMWO	02-0110-00	Itasca	Anoka	7010206810	NCHF	45.7	--	1	559.6	--	--	--	--
MCWD	27-0014-00	Powderhorn	Hennepin	7010206880	NCHF	4.5	6.1	1.2	129.5	95	IF	--	NS
MCWD	27-0022-00	Diamond	Hennepin	7010206900	NCHF	23.5	1.8	0.9	278.8	100	NA	--	NA
MCWD	27-0082-00	Windsor	Hennepin	7010206890	NCHF	5.3	1.5	1	67.2	100	NS	--	--
MCWD	10-0009-00	Minnewashta	Carver	7010206900	NCHF	298.7	21.3	5.2	944.9	50	FS	--	NS
MCWD	10-0010-00	Tamarack	Carver	7010206900	NCHF	25.9	25	9.1	77.7	41	NS	--	NA
MCWD	10-0011-00	St. Joe	Carver	7010206900	NCHF	19	15.8	4.6	59.5	47	FS	--	NA
MCWD	10-0015-00	Virginia	Carver	7010206900	NCHF	69.6	10.4	3.4	1572.2	28	NS	--	NS
MCWD	10-0018-00	Schutz	Carver	7010206900	NCHF	50.6	14.9	6.1	348.8	38	IF	--	NA
MCWD	10-0041-00	Zumbra-Sunny	Carver	7010206900	NCHF	89.4	17.7	4.3	146.5	55	FS	--	NS
MCWD	10-0042-00	Parley	Carver	7010206900	NCHF	165.5	5.5	1.9	5203.1	95	NS	--	FS
MCWD	10-0043-00	Lundsten	Carver	7010206900	NCHF	84.6	3	0.9	4010.7	100	IF	--	NA
MCWD	10-0044-01	West Auburn	Carver	7010206900	NCHF	57.5	25.6	7.6	3164.6	--	FS	--	FS
MCWD	10-0044-02	East Auburn	Carver	7010206900	NCHF	48.6	25.6	4.6	2926.3	--	NS	--	FS
MCWD	10-0045-00	Steiger	Carver	7010206900	NCHF	83.8	11.3	4	331.4	61	IF	--	NS
MCWD	10-0046-00	Church	Carver	7010206900	NCHF	10.5	16.5	9.1	114.1	59	IF	--	NA
MCWD	10-0048-00	Wassermann	Carver	7010206900	NCHF	105.2	12.5	3	1164.5	73	NS	--	NS
MCWD	10-0050-00	Carl Krey	Carver	7010206900	NCHF	32.4	--	1	137.2	--	FS	--	NA
MCWD	10-0051-00	Turbid	Carver	7010206900	NCHF	22.3	11.3	3	196.7	66	NS	--	NA
MCWD	10-0053-00	Piersons	Carver	7010206900	NCHF	144.1	12.2	5.4	476.6	35	FS	--	FS
MCWD	10-0054-00	Marsh	Carver	7010206900	NCHF	80.9	1.2	1	633.7	100	--	--	--
MCWD	10-0056-00	Stone	Carver	7010206900	NCHF	112.5	8.8	3	297.4	72	NS	--	NA
MCWD	10-0135-00	Unnamed	Carver	7010206900	NCHF	7.7	--	--	--	--	--	--	--
MCWD	10-0140-00	Unnamed	Carver	7010206900	NCHF	15.4	--	--	--	--	--	--	--
MCWD	10-0200-02	Unnamed (South Portion)	Carver	7010206900	NCHF	--	--	--	--	--	--	--	--

Local Jurisdiction[1]	Lake ID	Lake Name	County	11-HUC	Ecoregion[2]	Lake Area (ha)[3]	Max Depth (m)[3]	Mean Depth (m)[3]	Watershed Area (ha)[3]	% Littoral	Aquatic Recreation Use Support[4]	Aquatic Life Use Support[4]	Aquatic Consump-tion Use Support[5]
MCWD	27-0015-00	Bass	Hennepin	7010206900	NCHF	--	--	--	--	--	--	--	--
MCWD	27-0016-00	Harriet	Hennepin	7010206900	NCHF	138	26.5	9.8	3380.5	25	FS	--	NS
MCWD	27-0017-00	Cemetery	Hennepin	7010206900	NCHF	4	--	--	--	--	--	--	--
MCWD	27-0018-00	Hiawatha	Hennepin	7010206900	NCHF	26.7	9.4	4.6	45113.1	25	NS	--	FS
MCWD	27-0019-00	Nokomis	Hennepin	7010206900	NCHF	81.3	10.1	4.2	1190.4	51	NS	--	NS
MCWD	27-0023-00	Mother	Hennepin	7010206900	NCHF	55	1.4	1	119	100	--	--	--
MCWD	27-0031-00	Calhoun	Hennepin	7010206900	NCHF	165.1	25	10.1	2772.3	31	FS	--	NS
MCWD	27-0038-00	Brownie	Hennepin	7010206900	NCHF	4.5	14.3	6.7	150.9	63	IF	--	NS
MCWD	27-0039-00	Cedar	Hennepin	7010206900	NCHF	68.8	15.5	6	1004.2	37	FS	--	NS
MCWD	27-0040-00	Lake Of The Isles	Hennepin	7010206900	NCHF	51.8	9.4	2.3	1304.8	89	FS	NA	NS
MCWD	27-0052-00	Hannan	Hennepin	7010206900	NCHF	12.9	1.8	1	87.8	100	--	--	--
MCWD	27-0053-00	Unnamed	Hennepin	7010206900	NCHF	4.5	--	1	139.6	--	NS	NA	NA
MCWD	27-0054-00	Meadowbrook	Hennepin	7010206900	NCHF	33.6	--	--	--	--	--	--	--
MCWD	27-0085-00	Libbs	Hennepin	7010206900	NCHF	9.3	2.4	1	46.5	100	IF	NA	NA
MCWD	27-0086-00	Shaver	Hennepin	7010206900	NCHF	6.9	2.1	1	21.4	100	FS	NA	NA
MCWD	27-0087-00	Marion	Hennepin	7010206900	NCHF	17	13.7	4.6	87.8	--	FS	NA	NA
MCWD	27-0095-00	Gleason	Hennepin	7010206900	NCHF	63.1	4.9	2.3	991.1	--	NS	IF	NA
MCWD	27-0108-00	Snyder	Hennepin	7010206900	NCHF	6.1	--	1	131.9	--	NS	NA	NA
MCWD	27-0109-00	Hadley	Hennepin	7010206900	NCHF	23.9	--	1.5	69.6	--	NS	NA	NA
MCWD	27-0133-01	Minnetonka-Grays Bay	Hennepin	7010206900	NCHF	72.4	11	2.4	31876.9	--	FS	IF	NS
MCWD	27-0133-02	Minnetonka-Lower Lake	Hennepin	7010206900	NCHF	2381.2	10.4	8.5	32115.8	--	FS	IF	NS
MCWD	27-0133-03	Minnetonka-Carsons Bay	Hennepin	7010206900	NCHF	44.9	13.1	3.1	248.5	--	FS	IF	NS
MCWD	27-0133-04	Minnetonka-St. Albans Bay	Hennepin	7010206900	NCHF	65.2	25.6	4.4	460.9	--	FS	IF	NS
MCWD	27-0133-05	Minnetonka-Upper Lake	Hennepin	7010206900	NCHF	1696.8	25.3	6.6	13537.8	--	FS	IF	NS

Local Jurisdiction[1]	Lake ID	Lake Name	County	11-HUC	Ecoregion[2]	Lake Area (ha)[3]	Max Depth (m)[3]	Mean Depth (m)[3]	Watershed Area (ha)[3]	% Littoral	Aquatic Recreation Use Support[4]	Aquatic Life Use Support[4]	Aquatic Consump-tion Use Support[5]
MCWD	27-0133-06	Minnetonka-Black Lake	Hennepin	7010206900	NCHF	34	7.6	3	28.7	--	FS	IF	NS
MCWD	27-0133-07	Minnetonka-Seton Lake	Hennepin	7010206900	NCHF	17	27.7	--	--	--	IF	NA	NS
MCWD	27-0133-08	Minnetonka-Emerald Lake	Hennepin	7010206900	NCHF	5.7	27.7	--	--	--	--	--	NS
MCWD	27-0133-09	Minnetonka-Halsteds Bay	Hennepin	7010206900	NCHF	255	9.1	4	7476.2	--	NS	IF	NS
MCWD	27-0133-10	Minnetonka-Crystal Bay	Hennepin	7010206900	NCHF	321.7	21.3	8.6	7770	--	FS	IF	NS
MCWD	27-0133-11	Minnetonka-Maxwell Bay	Hennepin	7010206900	NCHF	121.8	9.1	4.3	899.2	--	FS	IF	NS
MCWD	27-0133-12	Minnetonka-Stubbs Bay	Hennepin	7010206900	NCHF	78.1	27.7	4.9	711	--	NS	IF	NS
MCWD	27-0133-13	Minnetonka-North Arm	Hennepin	7010206900	NCHF	153.8	17.7	4	169.2	--	FS	IF	NS
MCWD	27-0133-14	Minnetonka-West Arm	Hennepin	7010206900	NCHF	324.2	27.7	4	5568.5	--	NS	IF	NS
MCWD	27-0133-15	Minnetonka-Jennings Bay	Hennepin	7010206900	NCHF	118.6	6.7	3.4	4370.2	--	NS	IF	NS
MCWD	27-0134-00	Mooney	Hennepin	7010206900	NCHF	47.8	3	1	178	100	NS	IF	NA
MCWD	27-0137-00	Christmas	Hennepin	7010206900	NCHF	107.2	26.5	11.3	156.6	30	FS	IF	NS
MCWD	27-0138-00	Peavey	Hennepin	7010206900	NCHF	3.6	19.2	9.1	292.6	--	NS	NS	NA
MCWD	27-0139-00	Forest	Hennepin	7010206900	NCHF	51.4	12.8	4	380.8	--	NS	IF	NA
MCWD	27-0140-01	French Marsh (North)	Hennepin	7010206900	NCHF	10.1	1.8	--	--	100	--	--	--
MCWD	27-0140-02	French Marsh (South)	Hennepin	7010206900	NCHF	10.1	1.8	--	--	100	--	--	--
MCWD	27-0141-00	Tanager	Hennepin	7010206900	NCHF	29.9	7	1.5	3333.4	--	NS	IF	NA
MCWD	27-0144-00	Galpin	Hennepin	7010206900	NCHF	18.2	4	--	--	100	--	--	--
MCWD	27-0154-00	Katrina	Hennepin	7010206900	NCHF	--	--	--	--	--	--	--	--
MCWD	27-0150-00	Unnamed	Hennepin	7010206900	NCHF	48.6	--	--	--	--	--	--	--
MCWD	27-0156-00	Thies	Hennepin	7010206900	NCHF	12.1	8.2	3	83	75	--	--	--
MCWD	27-0157-00	Wolsfeld	Hennepin	7010206900	NCHF	18.2	7.9	3.4	630.5	74	NS	NA	NA
MCWD	27-0158-00	Holy Name	Hennepin	7010206900	NCHF	38	2.1	1.8	160.3	100	NS	NA	NA
MCWD	27-0160-00	Long	Hennepin	7010206900	NCHF	129.5	10.1	4.2	2768.2	50	NS	IF	NS

Local Jurisdiction[1]	Lake ID	Lake Name	County	11-HUC	Ecoregion[2]	Lake Area (ha)[3]	Max Depth (m)[3]	Mean Depth (m)[3]	Watershed Area (ha)[3]	% Littoral	Aquatic Recreation Use Support[4]	Aquatic Life Use Support[4]	Aquatic Consump-tion Use Support[5]
MCWD	27-0161-00	Dickey's	Hennepin	7010206900	NCHF	10.5	7.6	3.7	70	59	--	--	--
MCWD	27-0162-00	Classen	Hennepin	7010206900	NCHF	47.3	1.2	1	132.3	100	--	--	--
MCWD	27-0181-00	Dutch	Hennepin	7010206900	NCHF	97.5	13.1	4.4	723.1	52	NS	IF	FS
MCWD	27-0182-00	Langdon	Hennepin	7010206900	NCHF	73.7	11.6	2.3	443.3	84	NS	IF	NA
MCWD	27-0183-00	Unnamed	Hennepin	7010206900	NCHF	12.9	--	1	51.8	--	--	--	--
MCWD	27-0185-00	Saunders	Hennepin	7010206900	NCHF	21.4	--	1	186.6	--	IF	NA	--
MCWD	27-0186-00	Mud	Hennepin	7010206900	NCHF	--	--	--	--	--	--	--	--
MCWD	27-0408-00	Unnamed	Hennepin	7010206900	NCHF	12.9	--	--	--	--	--	--	--
MCWD	27-0521-00	Unnamed	Hennepin	7010206900	NCHF	13.8	--	--	--	--	--	--	--
MCWD	27-0522-00	Unnamed	Hennepin	7010206900	NCHF	4.5	--	--	--	--	--	--	--
MCWD	27-0656-00	Twin	Hennepin	7010206900	NCHF	5.3	--	1	743.4	--	NS	NA	NA
MCWD	27-0683-00	Taft	Hennepin	7010206900	NCHF	6.9	13.7	7.6	885.9	36	IF	IF	--
MWMO	02-0079-00	Unnamed (Highland)	Anoka	7010206860	NCHF	5.7	--	1	67.2	--	FS	NA	NA
MWMO	02-0080-00	Sandy	Anoka	7010206860	NCHF	7.7	--	1	217.7	--	NS	NA	NA
RCWD	02-0003-00	Otter	Anoka	7010206860	NCHF	272.8	6.4	1.6	609.2	99	FS	IF	NS
RCWD	02-0004-00	Peltier	Anoka	7010206860	NCHF	195.5	4.9	2	27937.1	89	NS	IF	NS
RCWD	02-0005-00	George Watch	Anoka	7010206860	NCHF	396.6	1.5	1.5	29108.6	100	NS	NA	NA
RCWD	02-0006-00	Centerville	Anoka	7010206860	NCHF	200.3	5.8	3.3	663.7	61	NS	IF	FS
RCWD	02-0007-00	Marshan	Anoka	7010206860	NCHF	144.5	1.1	1.2	30836.8	100	NS	NA	NA
RCWD	02-0008-00	Rice	Anoka	7010206860	NCHF	242	1.5	1.2	33040.9	100	NS	NA	NA
RCWD	02-0009-00	Reshanau	Anoka	7010206860	NCHF	162.3	3	1.5	1434.3	100	NS	IF	NA
RCWD	02-0010-00	Wards	Anoka	7010206860	NCHF	85.4	--	--	1108.2	--	--	--	--
RCWD	02-0011-00	Sherman	Anoka	7010206860	NCHF	17	1.5	--	--	100	--	--	--
RCWD	02-0013-00	Baldwin	Anoka	7010206860	NCHF	328.2	1.4	0.6	33347.4	100	NS	NA	NA
RCWD	02-0015-00	Rondeau	Anoka	7010206860	NCHF	223.4	3.7	0.9	1471.1	100	--	--	--

Local Jurisdiction[1]	Lake ID	Lake Name	County	11-HUC	Ecoregion[2]	Lake Area (ha)[3]	Max Depth (m)[3]	Mean Depth (m)[3]	Watershed Area (ha)[3]	% Littoral	Aquatic Recreation Use Support[4]	Aquatic Life Use Support[4]	Aquatic Consump-tion Use Support[5]
RCWD	02-0016-00	Howard	Anoka	7010206860	NCHF	218.9	1.7	1.2	2691.5	100	FS	NA	NA
RCWD	02-0019-00	Crossways	Anoka	7010206860	NCHF	214.5	2.7	1.2	853.1	100	--	--	--
RCWD	02-0041-00	Unnamed	Anoka	7010206860	NCHF	37.2	--	--	--	--	--	--	--
RCWD	02-0045-00	Golden	Anoka	7010206860	NCHF	23.5	7.3	2.4	2649.2	89	NS	NA	NS
RCWD	02-0071-00	Spring	Anoka	7010206860	NCHF	22.3	5.5	1.5	122.6	96	--	--	FS
RCWD	02-0075-01	East Moore	Anoka	7010206860	NCHF	12.1	6.7	1.6	268.7	79	NS	NA	FS
RCWD	02-0075-02	West Moore	Anoka	7010206860	NCHF	28.3	1.5	0.6	314.8	100	IF	NA	NA
RCWD	02-0077-00	Locke	Anoka	7010206860	NCHF	9.7	1.8	1.2	46774.7	100	--	--	--
RCWD	02-0585-00	Loch Ness	Anoka	7010206860	NCHF	21	--	1	344.4	--	FS	NA	FS
RCWD	62-0002-00	Bald Eagle	Ramsey	7010206860	NCHF	539	11.3	4.1	7920.8	58	NS	IF	NS
RCWD	62-0036-00	Priebe	Ramsey	7010206860	NCHF	2.8	--	1	28.3	--	NS	NA	NA
RCWD	62-0044-00	Poplar	Ramsey	7010206860	NCHF	63.1	--	1	156.2	--	--	--	--
RCWD	62-0049-01	Langton (N. Bay)	Ramsey	7010206860	NCHF	1.4	1.5	1.2	39.7	100	NA	IF	FS
RCWD	62-0049-02	Langton (S. Bay)	Ramsey	7010206860	NCHF	1.3	1.5	1.2	44.1	100	NA	NA	FS
RCWD	62-0057-00	Josephine	Ramsey	7010206860	NCHF	46.1	13.4	3.3	347.5	69	FS	IF	NS
RCWD	62-0058-00	Little Johanna	Ramsey	7010206860	NCHF	7.3	8.5	3	708.6	69	NS	NS	NS
RCWD	62-0059-00	Marsden	Ramsey	7010206860	NCHF	120.6	1.7	0.5	987.7	100	--	--	--
RCWD	62-0061-00	Turtle	Ramsey	7010206860	NCHF	179.7	8.5	3.4	314.7	60	FS	IF	NS
RCWD	62-0067-00	Long	Ramsey	7010206860	NCHF	73.7	7.3	3.4	46039.4	60	NS	IF	NS
RCWD	62-0068-00	Rush	Ramsey	7010206860	NCHF	33.2	1.8	0.5	112.1	100	IF	NA	NA
RCWD	62-0069-00	Pike	Ramsey	7010206860	NCHF	15.8	4.9	1.9	2382.8	91	NS	NA	NA
RCWD	62-0070-00	Round	Ramsey	7010206860	NCHF	50.6	2.1	0.8	188.2	100	--	--	--
RCWD	62-0071-00	Valentine	Ramsey	7010206860	NCHF	29.9	4	1.4	1038.4	100	NS	NS	NA
RCWD	62-0075-01	Island (Basin S. Of I-694)	Ramsey	7010206860	NCHF	17.6	2.7	1.4	37.2	100	NS	IF	NS
RCWD	62-0075-02	Island (Basin N. Of I-694)	Ramsey	7010206860	NCHF	7.5	2.7	0.9	74.1	100	NS	IF	NS

Local Jurisdiction[1]	Lake ID	Lake Name	County	11-HUC	Ecoregion[2]	Lake Area (ha)[3]	Max Depth (m)[3]	Mean Depth (m)[3]	Watershed Area (ha)[3]	% Littoral	Aquatic Recreation Use Support[4]	Aquatic Life Use Support[4]	Aquatic Consump-tion Use Support[5]
RCWD	62-0077-00	Poplar	Ramsey	7010206860	NCHF	4.9	1.5	0.5	43.7	100	--	--	--
RCWD	62-0078-00	Johanna	Ramsey	7010206860	NCHF	93.1	13.1	5.2	1474.9	45	FS	IF	NS
RCWD	62-0083-00	Silver (West)	Ramsey	7010206860	NCHF	30.4	14.3	2.3	195.4	90	NS	IF	NS
RCWD	62-0095-00	Evergreen Ponds	Ramsey	7010206860	NCHF	6.9	5.5	--	--	--	IF	NA	NA
RCWD	82-0072-00	White Rock	Washington	7010206860	NCHF	31.6	--	1	137.2	--	NS	NA	NA
RCWD	82-0121-00	Mann	Washington	7010206860	NCHF	31.2	--	--	1017.8	--	--	--	--
RCWD	82-0122-00	Pine Tree	Washington	7010206860	NCHF	69.6	9.1	3	1790.2	91	FS	IF	NA
RCWD	82-0130-00	Long	Washington	7010206860	NCHF	19.4	7.6	1.5	552.8	93	FS	NA	NA
RCWD	82-0134-01	Lost (Nw Bay)	Washington	7010206860	NCHF	5.7	--	1	178.9	--	IF	NA	NA
RCWD	82-0134-02	Lost (Se Bay)	Washington	7010206860	NCHF	--	7.9	--	--	--	--	--	--
RCWD	82-0136-00	Round	Washington	7010206860	NCHF	21.4	--	--	--	--	--	--	--
RCWD	82-0137-00	Fish	Washington	7010206860	NCHF	10.1	10.4	2.7	481.6	68	NS	NA	NA
RCWD	82-0138-00	Horseshoe	Washington	7010206860	NCHF	37.6	2.7	1.4	198.5	100	--	--	--
RCWD	82-0140-00	Oneka	Washington	7010206860	NCHF	153	2.1	1.2	317.7	100	FS	NA	NA
RCWD	82-0163-00	Clear	Washington	7010206860	NCHF	179.3	8.5	3.4	1033.6	63	FS	IF	NS
RCWD	82-0167-00	White Bear	Washington	7010206860	NCHF	984.2	25.3	5.2	3087.2	54	FS	IF	NS
RCWD	82-0168-00	Mud	Washington	7010206860	NCHF	93.1	1.2	1	1484.7	100	IF	NA	NA
RCWD	62-0072-00	Karth	Ramsey	7010206910	NCHF	6.1	4.3	1.5	47.8	100	IF	NA	NA
RWMWD	62-0004-00	Pigs Eye	Ramsey	7010206910	NCHF	206.8	1.2	1	21239.6	100	NA	--	FS
RWMWD	62-0005-00	Casey	Ramsey	7010206910	NCHF	5.7	1.1	1	97.1	100	--	--	FS
RWMWD	62-0007-00	Gervais	Ramsey	7010206910	NCHF	111.3	14.6	5.8	12860.3	40	FS	IF	NS
RWMWD	62-0008-00	Savage	Ramsey	7010206910	NCHF	8.1	1.8	--	102.4	100	--	--	--
RWMWD	62-0010-02	Keller (Main Bay)	Ramsey	7010206910	NCHF	29.1	2.4	2.1	13390.2	100	FS	IF	FS
RWMWD	62-0011-00	Wakefield	Ramsey	7010206910	NCHF	8.5	2.9	0.9	382	100	NS	IF	FS
RWMWD	62-0012-00	Round	Ramsey	7010206910	NCHF	12.1	5.2	2	13778.7	98	FS	IF	NA
RWMWD	62-0013-00	Phalen	Ramsey	7010206910	NCHF	74.5	27.7	7.1	14707.4	40	FS	IF	NS

Local Jurisdiction[1]	Lake ID	Lake Name	County	11-HUC	Ecoregion[2]	Lake Area (ha)[3]	Max Depth (m)[3]	Mean Depth (m)[3]	Watershed Area (ha)[3]	% Littoral	Aquatic Recreation Use Support[4]	Aquatic Life Use Support[4]	Aquatic Consump-tion Use Support[5]
RWMWD	62-0016-00	Beaver	Ramsey	7010206910	NCHF	38.8	3.4	1.2	778.4	100	FS	IF	NS
RWMWD	62-0017-00	Unnamed	Ramsey	7010206910	NCHF	20.2	--	--	--	--	--	--	--
RWMWD	62-0039-00	Twin	Ramsey	7010206910	NCHF	17	10.1	5.2	81.3	44	FS	IF	NA
RWMWD	62-0040-00	Willow	Ramsey	7010206910	NCHF	32.4	2.4	1	215.6	100	--	--	--
RWMWD	62-0042-00	Heiner's	Ramsey	7010206910	NCHF	4.9	--	--	--	--	--	--	--
RWMWD	62-0048-00	Bennett	Ramsey	7010206910	NCHF	15.4	2.7	1	303.1	100	NS	IF	NS
RWMWD	62-0056-00	Owasso	Ramsey	7010206910	NCHF	159	11.3	3.3	1227.3	76	IF	IF	NS
RWMWD	62-0073-00	Snail	Ramsey	7010206910	NCHF	67.6	9.1	2	425	87	FS	FS	NS
RWMWD	62-0074-00	Grass	Ramsey	7010206910	NCHF	57.1	--	1	2318	--	--	--	--
RWMWD	62-0080-00	Emily	Ramsey	7010206910	NCHF	5.3	--	--	--	--	IF	NA	NA
RWMWD	62-0081-00	Judy	Ramsey	7010206910	NCHF	6.5	--	1	44.1	--	--	--	--
RWMWD	62-0082-00	Wabasso	Ramsey	7010206910	NCHF	20.2	22.3	10.7	1349.2	55	FS	IF	NA
RWMWD	62-0141-00	Beam Pond	Ramsey	7010206910	NCHF	8.5	--	1	1349.2	--	--	--	--
RWMWD	62-0237-00	Unnamed	Ramsey	7010206910	NCHF	37.6	1.5	--	1456.4	100	--	--	NS
RWMWD	62-0243-00	Unnamed	Ramsey	7010206910	NCHF	10.1	--	--	--	--	--	--	--
RWMWD	82-0091-00	Battle Creek	Washington	7010206910	NCHF	61.5	4.7	1.1	1725.5	100	IF	IF	NS
RWMWD	82-0115-00	Tanners	Washington	7010206910	NCHF	31.6	13.7	6.1	663.6	40	FS	NS	NS
RWMWD	82-0166-00	Carver	Washington	7010206910	NCHF	21	11	4.6	907.5	49	FS	NS	NS
RWMWD	62-0006-00	Kohlman	Ramsey	7010206910	NCHF	58.3	2.7	1.2	3055.1	100	NS	IF	NA
RWMWD	62-0009-00	Round	Ramsey	7010206910	NCHF	4.9	2	1.2	460.9	100	--	--	--
SCWMC	27-0034-00	Crystal	Hennepin	7010206870	NCHF	28.3	11.9	3	500.6	68	NS	IF	FS
SCWMC	27-0042-01	Upper Twin	Hennepin	7010206870	NCHF	47.8	3	1.2	1479.9	100	NS	NA	NS
SCWMC	27-0042-02	Middle Twin	Hennepin	7010206870	NCHF	21.9	12.8	4.4	1623.2	58	NS	NA	NS
SCWMC	27-0042-03	Lower Twin	Hennepin	7010206870	NCHF	12.1	6.4	2.1	2128.2	85	FS	NA	NS
SCWMC	27-0057-00	Meadow	Hennepin	7010206870	NCHF	4.5	1.1	0.4	41.7	100	NS	IF	NA
SCWMC	27-0058-00	Ryan	Hennepin	7010206870	NCHF	14.2	10.1	4.6	2246	52	FS	IF	NA

Local Jurisdiction[1]	Lake ID	Lake Name	County	11-HUC	Ecoregion[2]	Lake Area (ha)[3]	Max Depth (m)[3]	Mean Depth (m)[3]	Watershed Area (ha)[3]	% Littoral	Aquatic Recreation Use Support[4]	Aquatic Life Use Support[4]	Aquatic Consump-tion Use Support[5]
SCWMC	27-0059-00	Palmer	Hennepin	7010206870	NCHF	109.7	1.2	--	6885.7	100	--	--	--
SCWMC	27-0065-00	Magda	Hennepin	7010206870	NCHF	4.9	2	0.6	27.7	100	NS	IF	NA
SCWMC	27-0100-00	Pomerleau	Hennepin	7010206870	NCHF	14.2	7.9	3.3	107.6	67	NS	NA	NA
SCWMC	27-0102-00	Schmidt	Hennepin	7010206870	NCHF	19	8.2	1.7	93.9	92	FS	NA	NA
SCWMC	27-0111-01	Eagle	Hennepin	7010206870	NCHF	116.1	11	3.3	1165.1	68	NS	NA	NS
SCWMC	27-0111-02	Pike	Hennepin	7010206870	NCHF	24.3	6.7	2.6	433.4	95	NS	NA	NS
SCWMC	27-0119-00	Cedar Island	Hennepin	7010206870	NCHF	32.4	2.1	1.1	259.8	100	NS	NA	NA
SWWD	25-0017-07	Conley	Goodhue	7010206910	NCHF	--	2.7	--	--	100	NA	--	--
SWWD	82-0089-00	Markgrafs	Washington	7010206910	NCHF	--	2.4	1.5	176.4	100	NS	NA	--
SWWD	82-0090-00	Wilmes	Washington	7010206910	NCHF	13.4	5.5	1.2	1312	92	NS	NA	--
SWWD	82-0092-00	Powers	Washington	7010206910	NCHF	17	12.5	4.9	560.1	48	IF	FS	FS
SWWD	82-0094-00	Colby	Washington	7010206910	NCHF	28.3	3.4	2.1	1148.9	100	NS	NA	FS
SWWD	82-0097-00	La	Washington	7010206910	NCHF	17	3	1.8	32.8	100	NS	NA	NA
SWWD	82-0116-01	Armstrong-North Portion	Washington	7010206910	NCHF	--	--	--	--	--	--	--	--
SWWD	82-0116-02	Armstrong-South Portion	Washington	7010206910	NCHF	--	1.5	1.2	229.1	100	IF	FS	NA
SWWD	82-0087-00	Unnamed	Washington	7010206920	WCBP	10.1	4.9	2.1	324.6	100	NS	IF	NA
VLAWMO	02-0014-00	Amelia	Anoka	7010206860	NCHF	79.3	0.6	1	279.8	100	FS	NA	NA
VLAWMO	62-0018-00	Deep	Ramsey	7010206910	NCHF	40.9	3.4	1	2331	100	IF	NA	NA
VLAWMO	62-0019-00	Black	Ramsey	7010206910	NCHF	34	2.4	1	520.4	100	FS	NA	NA
VLAWMO	62-0020-01	Mallard Pond (North)	Ramsey	7010206910	NCHF	--	--	--	--	--	--	--	--
VLAWMO	62-0022-00	Unnamed (Tamarack)	Ramsey	7010206910	NCHF	--	--	--	--	--	NS	--	NS
VLAWMO	62-0024-00	Birch	Ramsey	7010206910	NCHF	--	1.8	1	259.3	100	FS	NA	NA
VLAWMO	62-0027-00	Gilfillan	Ramsey	7010206910	NCHF	40.1	1.5	0.8	214.9	100	NS	NA	NA
VLAWMO	62-0028-00	Sucker	Ramsey	7010206910	NCHF	31.6	7.3	--	--	79	--	--	NS
VLAWMO	62-0034-00	East Goose	Ramsey	7010206910	NCHF	46.9	2.7	1.7	233.5	100	NS	NA	FS

Local Jurisdiction[1]	Lake ID	Lake Name	County	11-HUC	Ecoregion[2]	Lake Area (ha)[3]	Max Depth (m)[3]	Mean Depth (m)[3]	Watershed Area (ha)[3]	% Littoral	Aquatic Recreation Use Support[4]	Aquatic Life Use Support[4]	Aquatic Consump-tion Use Support[5]
VLAWMO	62-0037-00	Gem	Ramsey	7010206910	NCHF	8.1	5.2	2.6	123.8	80	NS	NA	NA
VLAWMO	62-0038-01	East Vadnais	Ramsey	7010206910	NCHF	61.9	2.7	7.6	6138.3	100	FS	IF	NS
VLAWMO	62-0038-02	West Vadnais	Ramsey	7010206910	NCHF	34.8	17.7	1.7	2471	35	NS	IF	NA
VLAWMO	62-0043-00	Wilkinson	Ramsey	7010206910	NCHF	39.3	1.2	0.5	1202.7	100	NS	NA	NA
VLAWMO	62-0046-00	Pleasant	Ramsey	7010206910	NCHF	283.7	17.7	5.1	3334.5	47	NS	IF	NS
VLAWMO	62-0062-00	Charley	Ramsey	7010206910	NCHF	18.6	6.1	1.5	297.8	93	IF	NA	--
VLAWMO	62-0126-00	Unnamed (West Goose)	Ramsey	7010206910	NCHF	9.7	2.1	1.3	96.3	100	NS	NA	FS
VRWJPO	19-0003-00	Rebecca	Dakota	7010206910	WCBP	10.5	4.6	--	--	100	--	--	NS
VRWJPO	19-0005-01	Spring	Dakota	7010206910	NCHF	--	5.2	--	--	--	NA	IF	NA

1. **BCWMC** = Bassett Creek Water Management Commission, **CCWD** = Coon Creek Watershed District, **CRWD** = Capital Region Watershed District, **ECWMC** = Elm Creek Water Management Commission, **LRRWMO** = Lower Rum River Water Management Organization, **MCWD** = Minnehaha Creek Watershed District, **MWMO** = Mississippi Watershed Management Organization, **RCWD** = Rice Creek Watershed District, **RWMWD** = Ramsey Washington Metro Watershed District, **SCWMC** = Shingle Creek Water Management Commission, **SWWD** = South Washington Watershed District, **VLAWMO** = Vadnais Lakes Area Watershed Management Organization, **VRWJPO** = Vermillion River Watershed Joint Powers Organization
2. NCHF = North Central Hardwood Forests, WCBP = Western Corn Belt Plains
3. Area and depth taken from the best available source (DNR, USGS, local jurisdiction unit)
4. NS = Not support, IF = Insufficient Information, FS = Full Support, NA = Not Assessed

Key for Cell Shading: = existing impairment; = new impairment; = full support of designated use; = previously impaired; delisting completed or proposed.

Appendix 4.1 – Minnesota statewide IBI thresholds and confidence limits

Class #	Class Name	Use Class	Threshold	Confidence Limit	Upper	Lower
Fish						
1	Southern Rivers	2B, 2C	39	±11	50	28
2	Southern Streams	2B, 2C	45	±9	54	36
3	Southern Headwaters	2B, 2C	51	±7	58	44
10	Southern Coldwater	2A	45	±9	58	32
4	Northern Rivers	2B, 2C	35	±9	44	26
5	Northern Streams	2B, 2C	50	±9	59	41
6	Northern Headwaters	2B, 2C	40	±16	56	24
7	Low Gradient	2B, 2C	40	±10	50	30
11	Northern Coldwater	2A	37	±10	47	27
Invertebrates						
1	Northern Forest Rivers	2B, 2C	51.3	±10.8	62.1	40.5
2	Prairie Forest Rivers	2B, 2C	30.7	±10.8	41.5	19.9
3	Northern Forest Streams RR	2B, 2C	50.3	±12.6	62.9	37.7
4	Northern Forest Streams GP	2B, 2C	52.4	±13.6	66	38.8
5	Southern Streams RR	2B, 2C	35.9	±12.6	48.5	23.3
6	Southern Forest Streams GP	2B, 2C	46.8	±13.6	60.4	33.2
7	Prairie Streams GP	2B, 2C	38.3	±13.6	51.9	24.7
8	Northern Coldwater	2A	26	±12.4	38.4	13.6
9	Southern Coldwater	2A	46.1	±13.8	59.9	32.3

Appendix 4.2 – Biological monitoring results - fish IBI for natural (non-channelized) reaches

Local Jurisdiction*	National Hydrography Dataset (NHD) Assessment Segment AUID	Biological Station ID	Stream Segment Name	Drainage Area mi^2	Fish Class	Threshold	FIBI	Visit Date
HUC 11: 07010206820 (Elm Creek)								
ECWMC	07010206-760	10UM014	Rush Creek, South Fork	10.3	6	40	0	17-Jun-10
ECWMC	07010206-525	10UM008	Diamond Creek	10.4	6	40	19	15-Jul-10
ECWMC	07010206-732	10UM011	Rush Creek, South Fork	21.5	6	40	20	14-Jul-10
ECWMC	07010206-528	99UM081	Rush Creek	49.8	6	40	26	19-Aug-10
ECWMC	07010206-508	10EM167	Elm Creek	84.8	5	50	24	13-Sep-10
HUC 11: 07010206840 (Sand Creek)								
CCWD	07010206-558	00UM065	Sand Creek	15.1	6	40	30	17-Jun-05
CCWD	07010206-558	00UM065	Sand Creek	15.1	6	40	11	12-Jul-10
CCWD	07010206-558	00UM065	Sand Creek	15.1	6	40	0	07-Jun-10
HUC 11: 07010206850 (Coon Creek)								
CCWD	07010206-530	10UM003	Coon Creek	91.6	5	50	33	21-Jun-10
HUC 11: 07010206860 (Rice Creek)								
RCWD	07010206-596	08UM073	Hardwood Creek	28.4	6	40	24	18-Jun-08
RCWD	07010206-596	06UM002	Hardwood Creek	29.1	6	40	31	21-Aug-06
RCWD	07010206-596	06UM002	Hardwood Creek	29.1	6	40	0	12-Jul-10
RCWD	07010206-596	08UM072	Hardwood Creek	29.3	6	40	16	05-Aug-08
RCWD	07010206-596	08UM072	Hardwood Creek	29.3	6	40	0	18-Jun-08
RCWD	07010206-596	99UM103	Hardwood Creek	30.0	6	40	28	18-Jun-08
RCWD	07010206-596	99UM103	Hardwood Creek	30.0	6	40	26	23-Aug-06
RCWD	07010206-596	99UM103	Hardwood Creek	30.0	6	40	30	31-Jul-08
RCWD	07010206-596	99UM103	Hardwood Creek	30.0	6	40	39	25-Aug-04
RCWD	07010206-596	99UM103	Hardwood Creek	30.0	6	40	31	12-Jul-10
RCWD	07010206-519	00UM084	Clearwater Creek	41.8	6	40	39	10-Sep-07
RCWD	07010206-583	99UM107	Rice Creek	155.9	5	50	25	23-Jun-10
RCWD	07010206-583	99UM107	Rice Creek	155.9	5	50	11	26-Aug-08
RCWD	07010206-584	97UM005	Rice Creek	182.9	5	50	25	23-Jun-10

Local Jurisdiction*	National Hydrography Dataset (NHD) Assessment Segment AUID	Biological Station ID	Stream Segment Name	Drainage Area mi^2	Fish Class	Threshold	FIBI	Visit Date
HUC 11: 07010206900 (Minnehaha Creek)								
MCWD	07010206-712	10UM006	Long Lake Creek	11.6	3	51	40	16-Jun-10
MCWD	07010206-539	10UM004	Minnehaha Creek	145.2	2	45	21	09-Jun-10
MCWD	07010206-539	97UM007	Minnehaha Creek	159.6	2	45	36	09-Jun-10
MCWD	07010206-539	08UM075	Minnehaha Creek	169.7	2	45	24	24-Jun-10
MCWD	07010206-539	08UM075	Minnehaha Creek	169.7	2	45	14	04-Jun-10
HUC 11: 07010206910 (St Paul)								
RWMWD	07010206-592	97UM008	Battle Creek	9.6	3	51	33	17-Jun-10
RWMWD	07010206-592	97UM008	Battle Creek	9.6	3	51	28	13-Jul-10

*__CCWD__ = Coon Creek Watershed District, __ECWMC__ = Elm Creek Watershed Management Commission, __MCWD__ = Minnehaha Creek Watershed District, __RWMWD__ = Ramsey Washington Metro Watershed District, __RCWD__ = Rice Creek Watershed District, __SCWMO__ = Shingle Creek Watershed Management Commission

Appendix 4.3 – Biological monitoring results-macroinvertebrate IBI for natural (non-channelized) reaches

Local Jurisdiction*	National Hydrography Dataset (NHD) Assessment Segment AUID	Biological Station ID	Stream Segment Name	Drainage Area mi^2	Invert Class	Threshold	MIBI	Visit Date
HUC 11: 07010206820 (Elm Creek)								
ECWMC	07010206-760	10UM014	Rush Creek, South Fork	10.3	6	46.8	37.9	02-Sep-10
ECWMC	07010206-525	10UM008	Diamond Creek	10.4	6	46.8	46.8	02-Sep-10
ECWMC	07010206-732	10UM011	Rush Creek, South Fork	21.5	6	46.8	31.3	02-Sep-10
ECWMC	07010206-528	99UM081	Rush Creek	49.8	6	46.8	42.6	02-Sep-10
ECWMC	07010206-508	10EM167	Elm Creek	84.8	6	46.8	45.1	03-Oct-00
ECWMC	07010206-508	00UM085	Elm Creek	85.4	6	46.8	65.1	02-Sep-10
HUC 11: 07010206840 (Sand Creek)								
CRWD	07010206-558	00UM065	Sand Creek	15.1	5	48.5	17.2	01-Sep-10
HUC 11: 07010206850 (Coon Creek)								
CRWD	07010206-530	10UM003	Coon Creek	91.6	6	46.8	48.9	01-Sep-10
CRWD	07010206-530	10UM003	Coon Creek	91.6	6	46.8	28.2	01-Sep-10
HUC 11: 07010206860 (Rice Creek)								
RCWD	07010206-596	08UM073	Hardwood Creek	28.4	6	46.8	24.6	03-Oct-08
RCWD	07010206-596	06UM002	Hardwood Creek	29.1	6	46.8	20.0	24-Aug-10
RCWD	07010206-596	08UM072	Hardwood Creek	29.3	5	48.5	17.1	28-Aug-08
RCWD	07010206-596	99UM103	Hardwood Creek	30.0	6	46.8	28.3	28-Aug-08
RCWD	07010206-596	99UM103	Hardwood Creek	30.0	6	46.8	40.9	24-Aug-10
RCWD	07010206-583	99UM107	Rice Creek	155.9	6	46.8	43.7	17-Sep-08
RCWD	07010206-583	99UM107	Rice Creek	155.9	6	46.8	56.6	30-Aug-10
RCWD	07010206-584	97UM005	Rice Creek	182.9	5	48.5	7.5	30-Aug-10
HUC 11: 07010206900 (Minnehaha Creek)								
MCWD	07010206-712	10UM006	Long Lake Creek	11.6	6	46.8	40.9	25-Aug-10
MCWD	07010206-539	10UM004	Minnehaha Creek	145.2	5	48.5	26.3	25-Aug-10
MCWD	07010206-539	97UM007	Minnehaha Creek	159.6	5	48.5	21.8	19-Aug-08
MCWD	07010206-539	97UM007	Minnehaha Creek	159.6	5	48.5	24.6	25-Aug-10
MCWD	07010206-539	08UM075	Minnehaha Creek	169.7	6	46.8	36.4	19-Aug-08
MCWD	07010206-539	08UM075	Minnehaha Creek	169.7	6	46.8	34.1	25-Aug-10
HUC 11: 07010206910 (St Paul)								
RWMWD	07010206-592	97UM008	Battle Creek	9.6	5	48.5	27.6	23-Aug-10
RWMWD	07010206-592	04UM011	Battle Creek	10.8	6	46.8	9.0	02-Sep-04

***CCWD** = Coon Creek Watershed District, **ECWMC** = Elm Creek Watershed Management Commission, **MCWD** = Minnehaha Creek Watershed District, **RWMWD** = Ramsey Washington Metro Watershed District, **RCWD** = Rice Creek Watershed District, **SCWMO** = Shingle Creek Watershed Management Commission

Appendix 5.1 – Good/fair/poor thresholds for biological stations on non-assessed channelized AUIDs

Ratings of **Good** for channelized streams are based on Minnesota's general use threshold for aquatic life (Appendix 4.1). Stations with IBIs that score above this general use threshold would be given a rating of **Good**. The **Fair** rating is calculated as a 15 point drop from the general use threshold. Stations with IBI scores below the general use threshold, but above the **Fair** threshold would be given a rating of **Fair**. Stations scoring below the **Fair** threshold would be considered **Poor**.

Class #	Class Name	Good	Fair	Poor
Fish				
1	Southern Rivers	>38	38-24	<24
2	Southern Streams	>44	44-30	<30
3	Southern Headwaters	>50	50-36	<36
4	Northern Rivers	>34	34-20	<20
5	Northern Streams	>49	49-35	<35
6	Northern Headwaters	>39	39-25	<25
7	Low Gradient Streams	>39	39-25	<25
10	Southern Coldwater	>43	43-17	<17
11	Northern Coldwater	>36	36-22	<22
Invertebrates				
1	Northern Forest Rivers	>51	52-36	<36
2	Prairie Forest Rivers	>31	31-16	<16
3	Northern Forest Streams RR	>50	50-35	<35
4	Northern Forest Streams GP	>52	52-37	<37
5	Southern Streams RR	>36	36-21	<21
6	Southern Forest Streams GP	>47	47-32	<32
7	Prairie Streams GP	>38	38-23	<23
8	Northern Coldwater	>23	23-11	<11
9	Southern Coldwater	>44	44-18	<18

Appendix 5.2 – Channelized stream reach and AUID IBI scores - fish

Local Jurisdiction*	National Hydrography Dataset (NHD) Assessment Segment AUID	Biological Station ID	Stream Segment Name	Drainage Area mi^2	Fish Class	Good	Fair	Poor	FIBI	Visit Date
HUC 11: 07010206820 (Elm Creek)										
ECWMC	07010206-761	10UM013	County Ditch 16	4.6	6	>39	39-25	<25	0	17-Jun-10
ECWMC	07010206-508	10UM034	Elm Creek	6.8	6	>39	39-25	<25	0	17-Jun-10
ECWMC	07010206-508	10UM035	Elm Creek	12.3	6	>39	39-25	<25	6	13-Jul-10
ECWMC	07010206-508	10UM035	Elm Creek	12.3	6	>39	39-25	<25	3	16-Jun-10
ECWMC	07010206-528	07UM097	Rush Creek	17.0	7	>39	39-25	<25	24	11-Jul-07
ECWMC	07010206-508	10UM009	Elm Creek	32.3	6	>39	39-25	<25	19	13-Jul-10
HUC 11: 07010206850 (Coon Creek)										
CCWD	07010206-756	10UM021	County Ditch 11	4.0	6	>39	39-25	<25	18	26-Jul-10
CCWD	07010206-636	10UM018	County Ditch 58	10.6	6	>39	39-25	<25	40	12-Jul-10
CCWD	07010206-530	10UM020	Coon Creek	20.0	7	>39	39-25	<25	52	13-Jul-10
CCWD	07010206-530	00UM059	Coon Creek	35.8	7	>39	39-25	<25	36	26-Jul-10
CCWD	07010206-530	10UM017	Coon Creek	68.9	5	>49	49-35	<35	27	07-Jun-10
HUC 11: 07010206860 (Rice Creek)										
RCWD	07010206-564	10UM026	Unnamed ditch (Anoka County Ditch 4)	5.5	7	>39	39-25	<25	0	12-Jul-10
RCWD	07010206-522	99UM100	County Ditch 2	5.8	6	>39	39-25	<25	0	07-Jun-10
RCWD	07010206-522	99UM100	County Ditch 2	5.8	6	>39	39-25	<25	0	16-Jun-10
RCWD	07010206-559	10UM024	Unnamed ditch (Anoka County Ditch 53-62)	9.5	6	>39	39-25	<25	9	13-Jul-10
RCWD	07010206-596	06UM001	Hardwood Creek	27.9	6	>39	39-25	<25	30	21-Aug-06
RCWD	07010206-519	07UM095	Clearwater Creek	39.3	6	>39	39-25	<25	24	02-Jul-07
RCWD	07010206-519	05UM001	Clearwater Creek	41.7	6	>39	39-25	<25	21	12-Jul-10
RCWD	07010206-519	05UM001	Clearwater Creek	41.7	6	>39	39-25	<25	5	10-Sep-07
RCWD	07010206-519	05UM001	Clearwater Creek	41.7	6	>39	39-25	<25	19	17-Jun-05
RCWD	07010206-583	99UM105	Rice Creek	152.9	5	>49	49-35	<35	6	10-Jun-10
RCWD	07010206-583	99UM105	Rice Creek	152.9	5	>49	49-35	<35	21	18-Aug-08
HUC 11: 07010206870 (Shingle Creek)										
SCWMC	07010206-784	10UM015	Bass Creek	7.7	6	>39	39-25	<25	5	17-Jun-10
SCWMC	07010206-506	10UM032	Shingle Creek	22.0	6	>39	39-25	<25	0	14-Jul-10
SCWMC	07010206-506	08UM083	Shingle Creek	42.5	6	>39	39-25	<25	0	21-Jun-10

Local Jurisdiction*	National Hydrography Dataset (NHD) Assessment Segment AUID	Biological Station ID	Stream Segment Name	Drainage Area mi^2	Fish Class	Good	Fair	Poor	FIBI	Visit Date
HUC 11: 07010206890 (Bassett Creek)										
RCWD	07010206-538	97UM006	Bassett Creek	31.9	6	>39	39-25	<25	14	28-Jul-08
RCWD	07010206-538	00UM105	Bassett Creek	38.7	7	>39	39-25	<25	21	24-Jun-10
RCWD	07010206-538	00UM105	Bassett Creek	38.7	7	>39	39-25	<25	24	17-Jun-08
HUC 11: 07010206900 (Minnehaha Creek)										
MCWD	07010206-700	10UM007	Painter Creek	12.8	3	>50	50-36	<36	68	16-Jun-10
MCWD	07010206-539	08UM077	Minnehaha Creek	129.4	2	>44	44-30	<30	38	04-Jun-10
MCWD	07010206-539	08UM076	Minnehaha Creek	137.1	2	>44	44-30	<30	46	09-Jun-10
HUC 11: 07010206910 (St Paul)										
RWMWD	07010206-758	10UM029	Unnamed Creek	3.3	3	>50	50-36	<36	0	15-Jun-10
RWMWD	07010206-910	10UM030	Unnamed creek	35.7	2	>44	44-30	<30	0	16-Jun-10

*__CCWD__ = Coon Creek Watershed District, __ECWMC__ = Elm Creek Watershed Management Commission, __MCWD__ = Minnehaha Creek Watershed District, __RWMWD__ = Ramsey Washington Metro Watershed District, __RCWD__ = Rice Creek Watershed District, __SCWMO__ = Shingle Creek Watershed Management Commission

Appendix 5.3 – Channelized stream reach and AUID IBI scores - macroinvertebrates

Local Jurisdiction*	National Hydrography Dataset (NHD) Assessment Segment AUID	Biological Station ID	Stream Segment Name	Drainage Area mi^2	Invert Class	Good	Fair	Poor	MIBI	Visit Date
HUC 11: 07010206820 (Elm Creek)										
ECWMC	07010206-761	10UM013	County Ditch 16	4.6	6	>47	47-32	<32	31.4	31-Aug-10
ECWMC	07010206-508	10UM034	Elm Creek	6.8	6	>47	47-32	<32	32.9	31-Aug-10
ECWMC	07010206-508	10UM035	Elm Creek	12.3	6	>47	47-32	<32	45.6	31-Aug-10
ECWMC	07010206-508	10UM035	Elm Creek	12.3	6	>47	47-32	<32	15.0	13-Aug-07
ECWMC	07010206-528	07UM097	Rush Creek	17.0	6	>47	47-32	<32	5.7	02-Sep-10
ECWMC	07010206-508	10UM009	Elm Creek	32.3	6	>47	47-32	<32	29.0	02-Sep-10
HUC 11: 07010206850 (Coon Creek)										
CCWD	07010206-756	10UM021	County Ditch 11	4.0	6	>47	47-32	<32	17.0	24-Aug-10
CCWD	07010206-636	10UM018	County Ditch 58	10.6	6	>47	47-32	<32	55.9	24-Aug-10
CCWD	07010206-530	10UM020	Coon Creek	20.0	6	>47	47-32	<32	34.6	24-Aug-10
CCWD	07010206-530	10UM020	Coon Creek	20.0	6	>47	47-32	<32	42.3	24-Aug-10
CCWD	07010206-530	00UM059	Coon Creek	35.8	6	>47	47-32	<32	52.5	21-Sep-00
CCWD	07010206-530	00UM059	Coon Creek	35.8	6	>47	47-32	<32	46.1	12-Oct-00
CCWD	07010206-530	00UM059	Coon Creek	35.8	6	>47	47-32	<32	48.0	24-Aug-10
CCWD	07010206-530	10UM017	Coon Creek	68.9	6	>47	47-32	<32	46.7	01-Sep-10
HUC 11: 07010206860 (Rice Creek)										
RCWD	07010206-519	10UM027	Clearwater Creek	0.7	6	>47	47-32	<32	19.2	30-Aug-10
RCWD	07010206-564	10UM026	Unnamed ditch (Anoka CD 4)	5.5	6	>47	47-32	<32	11.3	24-Aug-10
RCWD	07010206-522	99UM100	County Ditch 2	5.8	5	>36	36-21	<21	5.0	01-Sep-10
RCWD	07010206-559	10UM024	Unnamed ditch (Anoka CD 53-62)	9.5	6	>47	47-32	<32	17.6	30-Aug-10
RCWD	07010206-519	07UM095	Clearwater Creek	39.3	5	>36	36-21	<21	33.4	06-Aug-07
RCWD	07010206-519	00UM084	Clearwater Creek	41.7	5	>36	36-21	<21	21.6	21-Sep-00
RCWD	07010206-519	00UM084	Clearwater Creek	41.7	5	>36	36-21	<21	19.7	23-Aug-10
RCWD	07010206-583	99UM105	Rice Creek	152.9	6	>47	47-32	<32	33.5	17-Sep-08
RCWD	07010206-583	99UM105	Rice Creek	152.9	6	>47	47-32	<32	33.2	30-Aug-10
RCWD	07010206-583	00UM083	Rice Creek	154.9	5	>36	36-21	<21	24.8	03-Oct-00
HUC11: 07010206870 (Shingle Creek)										
SCWD	07010206-784	10UM015	Bass Creek	7.7	6	>47	47-32	<32	22.9	01-Sep-10
SCWD	07010206-506	10UM032	Shingle Creek	22.0	6	>47	47-32	<32	27.7	01-Sep-10
SCWD	07010206-506	00UM069	Shingle Creek	30.1	5	>36	36-21	<21	20.9	02-Oct-00
SCWD	07010206-506	08UM083	Shingle Creek	42.5	5	>36	36-21	<21	15.6	01-Sep-10
HUC11: 07010206890 (Bassett Creek)										
BCWMC	07010206-552	00UM094	Unnamed creek	2.9	5	>36	36-21	<21	9.8	12-Oct-00
BCWMC	07010206-552	00UM094	Unnamed creek	2.9	5	>36	36-21	<21	23.6	19-Aug-08

Local Jurisdiction*	National Hydrography Dataset (NHD) Assessment Segment AUID	Biological Station ID	Stream Segment Name	Drainage Area mi^2	Invert Class	Good	Fair	Poor	MIBI	Visit Date
BCWMC	07010206-552	00UM068	Unnamed creek	5.4	5	>36	36-21	<21	21.6	02-Oct-00
BCWMC	07010206-526	10UM033	Unnamed creek	6.7	5	>36	36-21	<21	24.9	31-Aug-10
BCWMC	07010206-538	08UM074	Bassett Creek	23.0	5	>36	36-21	<21	29.6	19-Aug-08
BCWMC	07010206-538	08UM074	Bassett Creek	23.0	5	>36	36-21	<21	23.0	31-Aug-10
BCWMC	07010206-538	97UM006	Bassett Creek	31.9	5	>36	36-21	<21	34.2	17-Sep-08
BCWMC	07010206-538	00UM105	Bassett Creek	38.7	6	>47	47-32	<32	8.2	19-Aug-08
BCWMC	07010206-538	00UM105	Bassett Creek	38.7	6	>47	47-32	<32	23.5	01-Sep-10
HUC11: 07010206900 (Minnehaha Creek)										
MCWD	07010206-700	10UM007	Painter Creek	12.8	6	>47	47-32	<32	5.3	25-Aug-10
MCWD	07010206-700	10UM007	Painter Creek	12.8	6	>47	47-32	<32	8.2	25-Aug-10
MCWD	07010206-539	08UM077	Minnehaha Creek	129.4	5	>36	36-21	<21	22.0	19-Aug-08
MCWD	07010206-539	08UM077	Minnehaha Creek	129.4	5	>36	36-21	<21	20.4	19-Aug-08
MCWD	07010206-539	08UM077	Minnehaha Creek	129.4	5	>36	36-21	<21	36.8	25-Aug-10
MCWD	07010206-539	08UM076	Minnehaha Creek	137.1	6	>47	47-32	<32	67.1	19-Aug-08
MCWD	07010206-539	08UM076	Minnehaha Creek	137.1	6	>47	47-32	<32	42.9	25-Aug-10
HUC11: 07010206910 (St Paul)										
RWMWD	07010206-758	10UM029	Kohlman Creek	3.3	6	>47	47-32	<32	39.8	23-Aug-10
RWMWD	07010206-910	10UM030	Gervais Creek	35.7	6	>47	47-32	<32	16.5	23-Aug-10
RWMWD	07010206-592	00UM071	Battle Creek	77.9	6	>47	47-32	<32	33.6	11-Sep-00

*__CCWD__ = Coon Creek Watershed District, __ECWMC__ = Elm Creek Watershed Management Commission, __MCWD__ = Minnehaha Creek Watershed District, __RWMWD__ = Ramsey Washington Metro Watershed District, __RCWD__ = Rice Creek Watershed District, __SCWMO__ = Shingle Creek Watershed Management Commission

Appendix 6.1 – Minnesota's ecoregion-based lake eutrophication standards

Ecoregion	TP µg/L	Chl-a µg/L	Secchi meters
NLF – Lake Trout (Class 2A)	< 12	< 3	> 4.8
NLF – Stream trout (Class 2A)	< 20	< 6	> 2.5
NLF – Aquatic Rec. Use (Class 2B)	< 30	< 9	> 2.0
NCHF – Stream trout (Class 2A)	< 20	< 6	> 2.5
NCHF – Aquatic Rec. Use (Class 2B)	< 40	< 14	> 1.4
NCHF – Aquatic Rec. Use (Class 2B) Shallow lakes	< 60	< 20	> 1.0
WCBP & NGP – Aquatic Rec. Use (Class 2B)	< 65	< 22	> 0.9
WCBP & NGP – Aquatic Rec. Use (Class 2B) Shallow lakes	< 90	< 30	> 0.7

Appendix 6.2 – MINLEAP modeling results

Local Jurisdiction*	Lake ID	Lake Name	Obs TP ug/L	MINLEAP TP ug/L	Obs Chl-a ug/L	MINLEAP Chl-a ug/L	Obs Secchi m	MINLEAP Secchi m	Average TP Inflow ug/L	TP Load kg/yr	Back-ground TP ug/L	P Reten-tion %	Outflow hm3/yr	Residence Time years	Areal Load m/yr
BCWMC	27-0104-00	Medicine	60	41	33.9	15	1.6	1.6	163	1019	23	75	6.26	2.9	1.63
BCWMC	27-0627-00	Northwood	204	109	35.7	62	1.1	0.7	150	106	--	28	0.71	0.1	11.66
BCWMC	27-0107-00	Parkers	31	42	11.8	16	2.4	1.5	166	86	25	74	0.52	2.8	1.33
BCWMC	27-0035-01	Sweeney	58	63	18.4	28	1.4	1.1	153	190	30	59	1.24	0.8	4.58
BCWMC	27-0035-02	Twin	19	22	2.9	6	3.2	2.7	196	8	--	89	0.04	15.5	0.5
BCWMC	27-0734-00	Unnamed (Crane)	66	61	15.3	27	0.9	1.1	176	58	--	65	0.33	1.2	0.86
BCWMC	27-0711-00	Westwood	55	51	11.8	21	1.2	1.3	210	37		76	0.18	2.6	0.39
BCWMC	27-0037-00	Wirth	39	38	16.9	14	2.3	1.7	168	32	25	77	0.19	3.6	1.2
CCWD	02-0084-00	Crooked	31	40	7.4	14	2	1.6	181	47	27	78	0.26	3.7	0.73
CCWD	02-0053-00	Ham	33	43	8	16	2.6	1.5	193	94	--	78	0.49	3.4	0.54
CCWD	02-0072-00	Laddie	33	56	5.6	24	1.1	1.2	189	31	--	70	0.17	1.7	0.59
CCWD	02-0052-00	Netta	26	43	6.4	16	3.6	1.5	225	77	--	81	0.34	4.2	0.31
CCWD	02-0654-00	Unnamed (Cenaiko)	16	48	2.4	19	2.5	1.4	161	4	--	70	0.02	1.9	1.9
CRWD	62-0055-00	Como	162	67	28.5	31	1.3	1	155	151	--	57	0.97	0.7	3.38
CRWD	62-0047-00	Crosby	85	56	16.2	24	2.3	1.2	193	26	--	71	0.13	1.7	0.53
CRWD	62-0231-00	Loeb	28	37	6.4	13	3.3	1.7	187	5	--	80	0.02	4.5	0.61
CRWD	62-0054-00	McCarron	23	34	9.3	11	3	1.8	161	97	--	79	0.6	4.5	1.84
ECWMC	27-0061-00	Champlin Mill Pond	306	137	9.8	87	1.8	0.6	148	5187	--	8	35.02	< 0.1	240.4
ECWMC	27-0022-00	Diamond	191	73	56.7	35	0.6	1	163	61	33	55	0.37	0.6	1.58
ECWMC	27-0125-00	Diamond	187	51	73.2	20	0.7	1.3	174	293	--	71	1.68	1.9	0.92
ECWMC	27-0118-00	Fish	48	31	27.6	10	1.3	2	171	213	--	82	1.25	5.9	1.04
ECWMC	27-0127-00	French	262	53	147.5	21	0.4	1.3	211	119	--	75	0.56	2.4	0.38
ECWMC	27-0175-00	Henry	171	69	39.5	32	0.8	1	165	68	--	58	0.41	0.7	1.43
ECWMC	27-0116-01	Rice (Main)	336	88	95.8	46	0.9	0.8	151	1457	--	42	9.65	0.2	7.78
ECWMC	27-0116-02	Rice (West Bay)	221	133	24.5	83	1.4	0.6	148	1140	54	10	7.68	< 0.1	59.09
ECWMC	27-0117-00	Weaver	36	23	16.8	6	2.8	2.6	202	57	21	89	0.28	14.2	0.45
LMRWMO	19-0047-00	Hornbean	57	78	21.6	38	1.4	0.9	158	30	--	51	0.19	0.4	2.37
LMRWMO	19-0079-00	Pickerel	116	61	63.7	27	0.9	1.1	171	106	35	64	0.62	1.1	1.05
LMRWMO	19-0080-00	Rogers	39	52	6.6	21	1.3	1.3	187	50	--	72	0.27	2	0.62
LMRWMO	19-0050-00	Sunfish	45	42	31.8	16	1.6	1.5	186	25	23	77	0.13	3.3	0.64
LMRWMO	19-0037-00	Unnamed (Simley)	52	83	27.6	42	1	0.9	153	34	--	46	0.22	0.3	4.99
MCWD	27-0038-00	Brownie	40	51	15.5	20	1.4	1.3	153	30	15	67	0.2	1.5	4.45

Local Jurisdiction*	Lake ID	Lake Name	Obs TP ug/L	MINLEAP TP ug/L	Obs Chl-a ug/L	MINLEAP Chl-a ug/L	Obs Secchi m	MINLEAP Secchi m	Average TP Inflow ug/L	TP Load kg/yr	Back-ground TP ug/L	P Reten-tion %	Outflow hm3/yr	Residence Time years	Areal Load m/yr
MCWD	27-0031-00	Calhoun	16	33	3.6	11	3.8	1.9	159	583	16	79	3.67	4.5	2.22
MCWD	10-0050-00	Carl Krey	25	56	6.4	24	2.3	1.2	189	36	--	70	0.19	1.7	0.59
MCWD	27-0039-00	Cedar	24	40	8.9	14	1.9	1.6	160	214	19	75	1.33	3.1	1.94
MCWD	27-0137-00	Christmas	14	14	2.2	3	5.7	3.9	253	62	17	94	0.25	49.4	0.23
MCWD	10-0046-00	Church	117	30	22.8	9	3	2.1	165	25	--	82	0.15	6.3	1.45
MCWD	27-0181-00	Dutch	53	36	33.8	12	1.1	1.8	172	168	24	79	0.98	4.4	1
MCWD	10-0044-02	East Auburn	49	69	36.3	32	1.2	1	151	578	--	55	3.82	0.6	7.87
MCWD	27-0139-00	Forest	61	37	50.7	13	0.9	1.7	172	89	24	78	0.52	3.9	1
MCWD	27-0095-00	Gleason	92	58	50	25	1.1	1.2	160	210	27	64	1.31	1.1	2.08
MCWD	27-0109-00	Hadley	57	43	16.4	16	1.7	1.5	205	21	--	78	0.1	3.6	0.42
MCWD	27-0016-00	Harriet	20	39	5.3	14	2.7	1.6	155	692	17	75	4.45	3	3.22
MCWD	27-0018-00	Hiawatha	74	124	20.7	75	1.4	0.6	148	8688	23	16	58.66	< 0.1	219.62
MCWD	27-0158-00	Holy Name	150	44	96.1	17	0.8	1.5	189	42	--	77	0.22	3.1	0.59
MCWD	27-0040-00	Lake of the Isles	46	66	32.1	30	1.4	1	155	267	26	57	1.72	0.7	3.31
MCWD	27-0182-00	Langdon	106	44	45.8	16	0.7	1.5	177	107	27	75	0.61	2.8	0.82
MCWD	27-0085-00	Libbs	19	58	1.9	25	1.8	1.2	183	12	--	68	0.06	1.4	0.69
MCWD	27-0160-00	Long	61	52	37.9	21	1	1.3	157	571	23	0.67	3.65	1.5	2.82
MCWD	10-0043-00	Lundsten	62	97	18.1	52	1.6	0.8	152	797	--	36	5.25	0.1	6.2
MCWD	27-0087-00	Marion	13	31	2.1	10	4	2	182	22	--	83	0.12	6.4	0.71
MCWD	27-0133-06	Minnetonka-Black Lake	29	25	15	7	2	2.4	309	16	26	92	0.05	20.3	0.15
MCWD	27-0133-03	Minnetonka-Carsons Bay	20	38	5.2	13	2.9	1.7	180	61	26	79	0.34	4.1	0.76
MCWD	27-0133-10	Minnetonka-Crystal Bay	24	41	10.7	15	2.2	1.6	156	1591	19	74	10.23	2.7	3.18
MCWD	27-0133-01	Minnetonka-Grays Bay	21	115	5	68	3	0.6	148	6155	28	22	41.47	< 0.1	57.25
MCWD	27-0133-09	Minnetonka-Halsteds Bay	89	58	63	25	0.9	1.2	154	1515	25	62	9.82	1	3.85
MCWD	27-0133-15	Minnetonka-Jennings Bay	97	65	66	29	0.9	1.1	153	876	26	57	5.73	0.7	4.83
MCWD	27-0133-02	Minnetonka-Lower Lake	21	33	5.4	11	3.3	1.9	161	6893	--	79	42.7	4.7	1.79
MCWD	27-0133-11	Minnetonka-Maxwell Bay	32	36	15.3	12	1.7	1.8	172	210	--	79	1.22	4.3	1
MCWD	27-0133-13	Minnetonka-North Arm	29	23	13.4	6	1.9	2.6	280	79	--	92	0.28	21.7	0.18
MCWD	27-0133-04	Minnetonka-St. Albans Bay	21	35	5.3	12	3.1	1.8	173	108	--	80	0.63	4.6	0.96
MCWD	27-0133-12	Minnetonka-Stubbs Bay	50	37	41.8	13	1	1.7	168	160	--	78	0.96	4	1.22
MCWD	27-0133-05	Minnetonka-Upper Lake	25	31	10.9	10	2.4	2	170	3114	20	82	18.28	6.1	1.08

Local Jurisdiction*	Lake ID	Lake Name	Obs TP ug/L	MINLEAP TP ug/L	Obs Chl-a ug/L	MINLEAP Chl-a ug/L	Obs Secchi m	MINLEAP Secchi m	Average TP Inflow ug/L	TP Load kg/yr	Back-ground TP ug/L	P Reten-tion %	Outflow hm3/yr	Residence Time years	Areal Load m/yr
MCWD	27-0133-14	Minnetonka-West Arm	57	49	51.7	19	1	1.4	159	1169	25	69	7.37	1.8	2.27
MCWD	10-0009-00	Minnewashta	21	25	9.7	7	2.5	2.4	201	271	22	87	1.35	11.5	0.45
MCWD	27-0134-00	Mooney	73	54	48.4	23	1	1.2	194	49	--	72	0.25	1.9	0.52
MCWD	27-0019-00	Nokomis	57	46	23.7	18	1.3	1.4	160	253	22	71	1.58	2.1	1.94
MCWD	10-0042-00	Parley	89	74	80	35	0.7	0.9	154	1051	31	52	6.83	0.5	4.13
MCWD	27-0138-00	Peavey	71	60	25	26	2.1	1.1	150	57	--	60	0.38	0.9	10.48
MCWD	10-0053-00	Piersons	25	25	9.5	7	2.5	2.4	199	135	21	87	0.68	11.5	0.47
MCWD	27-0014-00	Powderhorn	103	82	26.2	41	1.2	0.9	154	26	27	47	0.17	0.3	3.82
MCWD	10-0018-00	Schutz	37	30	21.2	10	1.8	2	174	82	21	83	0.47	6.5	0.94
MCWD	27-0086-00	Shaver	44	52	7.1	21	1.2	1.3	202	6	--	74	0.03	2.2	0.45
MCWD	27-0108-00	Snyder	72	81	41.3	41	1	0.9	156	27	--	48	0.17	0.3	2.87
MCWD	10-0011-00	St. Joe	26	27	6.2	8	2.8	2.3	202	17	--	87	0.08	10.2	0.45
MCWD	10-0045-00	Steiger	39	31	14.9	10	2	2	191	89	--	0.84	0.46	7.1	0.55
MCWD	10-0056-00	Stone	39	31	19	10	2.1	2	211	91	--	85	0.43	7.9	0.38
MCWD	27-0683-00	Taft	37	73	25.7	35	1.3	1	149	173	--	51	1.15	0.5	16.78
MCWD	10-0010-00	Tamarack	41	19	16.2	5	2.1	3	204	23	--	91	0.11	21.3	0.43
MCWD	27-0141-00	Tanager	71	102	72.7	56	1	0.7	150	650	--	32	4.35	0.1	14.51
MCWD	10-0051-00	Turbid	61	44	26.4	17	1.5	1.5	168	45	--	74	0.26	2.6	1.19
MCWD	27-0656-00	Twin	170	112	53.7	65	0.7	0.7	149	145	--	25	0.97	0.1	18.41
MCWD	27-0053-00	Unnamed	161	88	128.8	45	0.3	0.8	154	28	--	43	0.18	0.2	4.12
MCWD	10-0015-00	Virginia	53	57	33.3	24	1.3	1.2	156	323	26	64	2.07	1.1	2.98
MCWD	10-0048-00	Wassermann	71	47	46.9	18	1	1.4	164	256	28	0.71	1.56	2	1.48
MCWD	10-0044-01	West Auburn	32	57	11.5	24	2.4	1.2	151	626	--	62	4.14	1.1	7.2
MCWD	27-0082-00	Windsor	155	72	43.2	34	0.7	1	162	15	--	56	0.09	0.6	1.7
MCWD	27-0157-00	Wolsfeld	85	64	60.6	29	0.8	1.1	153	127	--	58	0.83	0.7	4.54
MCWD	10-0041-00	Zumbra-Sunny	26	24	10.4	7	2.8	2.5	243	55	--	90	0.23	16.9	0.25
MWMO	02-0080-00	Sandy	118	86	76.2	44	0.5	0.8	154	44	--	44	0.29	0.3	3.72
MWMO	02-0079-00	Unnamed (Highland)	293	71	177.9	33	0.3	1	163	15	--	57	0.09	0.6	1.58
RCWD	62-0002-00	Bald Eagle	60	46	33.5	18	1.3	1.4	160	1686	--	71	10.51	2.1	1.95
RCWD	02-0013-00	Baldwin	213	115	79.6	67	0.4	0.6	150	6514	--	23	43.48	< 0.1	13.25
RCWD	02-0006-00	Centerville	37	32	44.7	10	0.8	2	199	188	--	84	0.94	7	0.47
RCWD	82-0163-00	Clear	33	37	7.8	13	1.7	1.7	179	253	27	79	1.42	4.4	0.79
RCWD	82-0137-00	Fish	114	75	34.4	36	1.4	0.9	152	96	--	51	0.63	0.4	6.23
RCWD	02-0005-00	George Watch	205	94	64	51	0.5	0.8	151	5719	--	37	38	0.2	9.58
RCWD	02-0045-00	Golden	95	93	38.7	50	1.2	0.8	150	517	32	38	3.45	0.2	14.71
RCWD	02-0016-00	Howard	49	68	8.6	31	1.2	1	163	584	--	58	3.59	0.7	1.64

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RCWD	62-0075-02	Island (Basin N. Of I-694)	86	71	23.6	34	1.3	1	166	17	--	57	0.1	0.6	1.32
RCWD	62-0075-01	Island (Basin S. Of I-694)	82	42	29.7	15	1.2	1.6	225	12	--	81	0.06	4.6	0.31
RCWD	62-0078-00	Johanna	29	43	11.6	16	1.9	1.5	159	312	21	0.73	1.95	2.5	2.1
RCWD	62-0057-00	Josephine	32	41	12.3	15	1.9	1.6	172	81	--	76	0.47	3.2	1.02
RCWD	62-0072-00	Karth	51	56	34.2	24	1.1	1.2	171	11	--	67	0.06	1.4	1.06
RCWD	62-0049-01	Langton (N. Bay)	56	66	16.2	30	1	1	163	9	--	59	0.05	0.8	1.56
RCWD	62-0049-02	Langton (S. Bay)	63	69	15.9	32	1.2	1	161	9	--	57	0.06	0.7	1.83
RCWD	62-0058-00	Little Johanna	74	86	26.2	44	1.3	0.8	150	139	22	43	0.92	0.2	12.69
RCWD	02-0585-00	Loch Ness	30	76	8.6	37	2.4	0.9	159	73	--	52	0.46	0.5	2.17
RCWD	62-0067-00	Long	86	115	35.3	68	1.2	0.6	148	8880	--	22	59.88	< 0.1	81.3
RCWD	82-0130-00	Long	27	77	6.1	38	2.6	0.9	154	112	--	50	0.73	0.4	3.74
RCWD	82-0134-01	Lost (NW Bay)	61	88	15.2	45	1.7	0.8	154	36	--	43	0.23	0.2	4.12
RCWD	02-0007-00	Marshan	211	115	62.3	67	0.4	0.6	149	5976	--	23	40.15	< 0.1	27.79
RCWD	82-0168-00	Mud	199	75	7.6	36	1.1	0.9	159	314	--	53	1.97	0.5	2.11
RCWD	82-0140-00	Oneka	26	44	7.5	17	1.4	1.5	226	107	--	80	0.47	3.9	0.31
RCWD	02-0003-00	Otter	19	40	2.9	15	3.3	1.6	221	199	--	82	0.9	4.7	0.33
RCWD	02-0004-00	Peltier	251	101	101.6	55	1	0.7	149	5434	32	33	36.4	0.1	18.62
RCWD	62-0069-00	Pike	93	103	48.7	58	0.8	0.7	149	463	--	31	3.1	0.1	19.67
RCWD	82-0122-00	Pine Tree	28	61	8.9	27	2.2	1.1	155	365	--	61	2.36	0.9	3.38
RCWD	62-0036-00	Priebe	158	68	84.9	31	0.4	1	166	6	--	59	0.04	0.7	1.34
RCWD	02-0009-00	Reshanau	95	57	45	24	0.7	1.2	168	325	--	66	1.93	1.3	1.19
RCWD	02-0008-00	Rice	183	109	56.8	62	0.6	0.7	149	6430	--	27	43.05	0.1	17.79
RCWD	62-0083-00	Silver (West)	54	45	32.7	17	1	1.5	175	47	--	74	0.27	2.6	0.88
RCWD	62-0061-00	Turtle	19	27	5	8	2.4	2.3	238	114	--	89	0.48	12.8	0.27
RCWD	62-0071-00	Valentine	70	83	18.6	42	1.7	0.9	153	209	--	46	1.36	0.3	4.55
RCWD	82-0167-00	White Bear	19	25	5.1	7	3.4	2.4	202	889	--	87	4.41	11.6	0.45
RCWD	82-0072-00	White Rock	98	56	35.2	24	0.7	1.2	188	36	--	70	0.19	1.7	0.61
RWMWD	82-0091-00	Battle Creek	75	84	10.8	42	1.8	0.9	155	350	--	46	2.27	0.3	3.69
RWMWD	62-0016-00	Beaver	63	76	11.1	37	2	0.9	157	161	--	52	1.03	0.5	2.64
RWMWD	62-0048-00	Bennett	138	79	37.4	39	0.9	0.9	157	63	--	49	0.4	0.4	2.6
RWMWD	82-0166-00	Carver	42	62	14.7	28	1.8	1.1	152	181	--	59	1.19	0.8	5.65
RWMWD	62-0007-00	Gervais	28	76	10	37	2	0.9	150	2508	--	49	16.76	0.4	15.06
RWMWD	62-0010-02	Keller (main bay)	47	118	16.2	70	1.2	0.6	148	2585	--	21	17.42	--	59.78
RWMWD	62-0006-00	Kohlman	79	93	26.3	49	1.2	0.8	152	605	--	39	3.99	0.2	6.86
RWMWD	62-0056-00	Owasso	41	41	19.3	15	1.3	1.6	171	284	--	76	1.66	3.2	1.04

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RWMWD	62-0013-00	Phalen	22	83	6.7	42	3	0.9	149	2852	--	44	19.15	0.3	25.72
RWMWD	62-0012-00	Round	38	128	9.6	79	2.6	0.6	148	2655	--	13	17.92	< 0.1	147.6
RWMWD	62-0073-00	Snail	20	47	3.8	18	3.1	1.4	176	102	--	73	0.58	2.3	0.86
RWMWD	82-0115-00	Tanners	76	45	6	17	2.9	1.5	157	137	--	72	0.88	2.2	2.77
RWMWD	62-0039-00	Twin	22	29	5.4	9	3	2.1	184	21	--	84	0.11	7.8	0.66
RWMWD	62-0082-00	Wabasso	27	54	8.7	22	2.7	1.2	151	266	15	64	1.76	1.2	8.71
RWMWD	62-0011-00	Wakefield	107	96	28.8	52	1.5	0.8	152	76	--	37	0.5	0.2	5.88
SCWMC	27-0098-00	Bass	82	60	52.4	26	1.1	1.1	158	263	--	62	1.66	1	2.34
SCWMC	27-0119-00	Cedar Island	294	63	117.5	28	0.4	1.1	170	60	--	63	0.35	1	1.08
SCWMC	27-0034-00	Crystal	85	55	45.3	23	1.1	1.2	158	105	25	66	0.66	1.3	2.34
SCWMC	27-0111-01	Eagle	46	45	29.8	17	1.7	1.5	166	259	--	73	1.56	2.4	1.34
SCWMC	27-0042-03	Lower Twin	42	103	26.6	58	1.2	0.7	149	413	--	31	2.77	0.1	22.83
SCWMC	27-0065-00	Magda	161	71	91	33	0.4	1	179	7	--	60	0.04	0.8	0.78
SCWMC	27-0057-00	Meadow	282	85	148	44	0.5	0.8	167	9	--	49	0.06	0.4	1.26
SCWMC	27-0042-02	Middle Twin	51	73	19.7	35	1.3	1	150	319	--	51	2.12	0.5	9.7
SCWMC	27-0111-02	Pike	90	58	54.3	25	1	1.2	158	91	--	64	0.57	1.1	2.36
SCWMC	27-0100-00	Pomerleau	111	41	37.2	15	1.1	1.6	171	25	--	76	0.15	3.2	1.03
SCWMC	27-0058-00	Ryan	40	87	8.7	45	1.9	0.8	149	436	23	41	2.93	0.2	20.65
SCWMC	27-0102-00	Schmidt	42	47	12.9	18	2.4	1.4	183	24	--	74	0.13	2.5	0.68
SCWMC	27-0042-01	Upper Twin	156	84	111.7	43	0.5	0.8	154	299	--	45	1.94	0.3	4.07
SWWD	82-0116-02	Armstrong-South Portion	73	70	9.6	33	1	1	160	49	--	56	0.3	0.6	1.93
SWWD	82-0094-00	Colby	183	77	61.2	37	0.5	0.9	153	230	--	50	1.5	0.4	5.31
SWWD	82-0097-00	La	108	37	37.1	13	1.3	1.7	231	11	--	84	0.05	6.3	0.29
SWWD	82-0089-00	Markgrafs	174	62	68.2	28	0.4	1.1	163	38	--	62	0.24	0.9	1.61
SWWD	82-0092-00	Powers	40	56	23.4	24	1.7	1.2	154	113	--	63	0.73	1.1	4.32
SWWD	82-0087-00	Unnamed	74	72	33.4	34	1.3	1	154	65	--	53	0.43	0.5	4.21
SWWD	82-0090-00	Wilmes	78	103	31	58	1.3	0.7	150	256	--	31	1.71	0.1	12.81
VLAWMO	02-0014-00	Amelia	45	54	14	22	1.3	1.2	196	78	--	73	0.4	2	0.5
VLAWMO	62-0024-00	Birch	33	56	5.8	24	1.8	1.2	187	68	--	70	0.36	1.6	0.61
VLAWMO	62-0019-00	Black	33	75	6.3	36	1.8	0.9	160	110	--	53	0.69	0.5	2.03
VLAWMO	62-0062-00	Charley	79	67	12	31	1.3	1	159	63	--	58	0.39	0.7	2.12
VLAWMO	62-0018-00	Deep	88	98	26.8	53	1.1	0.7	151	461	--	35	3.05	0.1	7.45
VLAWMO	62-0034-00	East Goose	281	47	81.5	19	0.3	1.4	183	59	--	74	0.32	2.4	0.69
VLAWMO	62-0038-01	East Vadnais	27	51	7	21	3.1	1.3	153	1227	20	66	8.04	1.4	5.26
VLAWMO	62-0037-00	Gem	71	55	62.1	23	1.2	1.2	160	26	--	65	0.16	1.3	2.03
VLAWMO	62-0027-00	Gilfillan	109	64	29.3	29	0.8	1.1	181	53	--	65	0.3	1.1	0.74
VLAWMO	62-0046-00	Pleasant	57	39	19	14	2.6	1.6	163	272	23	76	4.45	3.3	1.57

Local Jurisdiction*	Lake ID	Lake Name	Obs TP ug/L	MINLEAP TP ug/L	Obs Chl-a ug/L	MINLEAP Chl-a ug/L	Obs Secchi m	MINLEAP Secchi m	Average TP Inflow ug/L	TP Load kg/yr	Back-ground TP ug/L	P Reten-tion %	Outflow hm3/yr	Residence Time years	Areal Load m/yr
VLAWMO	62-0126-00	Unnamed (West Goose)	258	62	56.8	27	0.2	1.1	166	21	--	63	0.13	1	1.33
VLAWMO	62-0038-02	West Vadnais	168	75	90	36	0.6	0.9	154	501	29	52	3.25	0.5	3.78
VLAWMO	62-0043-00	Wilkinson	123	100	23.8	55	0.9	0.7	154	243	--	35	1.58	0.1	4.02

*__BCWMC__ = Bassett Creek Water Management Commission, __CCWD__ = Coon Creek Watershed District, __CRWD__ = Capital Region Watershed District, __ECWMC__ = Elm Creek Water Management Commission, __LRRWMO__ = Lower Rum River Water Management Organization, __MCWD__ = Minnehaha Creek Watershed District, __MWMO__ = Mississippi Watershed Management Organization, __RCWD__ = Rice Creek Watershed District, __RWMWD__ = Ramsey Washington Metro Watershed District, __SCWMC__ = Shingle Creek Water Management Commission, __SWWD__ = South Washington Watershed District, __VLAWMO__ = Vadnais Lakes Area Watershed Management Organization, __VRWJPO__ = Vermillion River Watershed Joint Powers Organization

Appendix 7 – Summary statistics of mercury, PCBs, and PFOS, by waterway-species-year-anatomy

Waterway/ Impairments[1]	AUID	Spec-ies[2]	Year	Anat[3]	Total Fish	Samples	Length (in)			Mercury (mg/kg)[4]				PCBs (mg/kg)[4]				PFOS (µg/kg)[4]		
							Mean	Min	Max	N	Mean	Min	Max	N	Mean	Min	Max	N	Mean	Max
BASSETT CR., RM 57, BASSETT CR. VALLEY PARK IN MPLS	07010206 -538	WSU	1996	FILSK	4	2	10.4	8.1	12.8	2	0.026	0.017	0.034	2	<0.01	<0.01	<0.01			
AUBURN	10004400	BGS	2000	FILSK	10	1	6.5			1	0.060									
		BKB	2000	FILET	8	1	7.9			1	0.030									
		NP	2000	FILSK	6	6	23.7	18.5	28.8	6	0.162	0.120	0.230	1	< 0.01					
BALD EAGLE*	62000200	BGS	1992	FILSK	10	1	6.4			1	0.038									
			2007	FILSK	10	6	4.7	3.1	6.3									6	< 4.74	4.98
			2008	FILSK	10	1	6.4			1	0.039									
		BKS	1992	FILSK	10	1	8.2			1	0.100									
			2007	FILSK	5	5	7.5	6.7	9.4									5	7.57	10.5
			2008	FILSK	10	1	7.7			1	0.103									
		C	1992	FILSK	6	1	22.1			1	0.064			1	0.016					
		LMB	2007	FILSK	5	5	13.3	12.2	15.0									5	5.14	6.18
		NP	1992	FILSK	20	3	22.0	17.6	26.9	3	0.187	0.150	**0.260**	1	< 0.01					
			2008	FILSK	8	8	24.4	17.2	33.5	8	0.138	0.066	0.213							
		WE	1992	FILSK	19	3	17.5	13.0	22.5	3	0.217	0.120	**0.320**	1	0.013					
			2008	FILSK	6	6	20.7	15.9	26.8	6	0.182	0.096	**0.411**							
BATTLE CREEK*	82009100	BGS	2009	FILSK	5	1	6.1			1	0.047							1	49.3	
		BKB	2009	FILET	1	1	10.6			1	0.034									
		NP	2009	FILSK	9	9	25.1	20.7	27.5	6	0.161	0.076	0.206					3	81.1	102
BEAVER*	62001600	BGS	2005	FILSK	9	1	6.6			1	0.144									
		LMB	2005	FILSK	3	3	10.1	9.1	11.3	3	0.120	0.112	0.133							
		NP	2005	FILSK	5	5	22.3	21.0	23.7	5	0.224	0.155	**0.364**							
BENNETT*	62004800	BGS	2006	FILSK	9	1	5.7			1	0.074									
			2008	FILSK	12	7	5.7	4.7	6.7									7	39.6	57.1
		BKS	2008	FILSK	9	6	6.1	4.5	10.0									6	48.5	63
		CHC	2008	FILET	2	2	18.7	17.7	19.7	2	0.188	0.088	**0.288**	2	0.038					
		NP	2006	FILSK	7	7	21.3	16.1	28.7	7	0.239	0.067	**0.507**							
			2008	FILSK	5	5	21.0	19.3	23.2									5	50.98	65.6
BROWNIE*	27003800	BGS	1993	FILSK	10	1	6.2			1	0.130			1	0.016					
		C	1993	FILSK	1	1	19.9			1	0.160			1	0.044					
		NP	1993	FILSK	1	1	26.6			1	**0.340**			1	0.051					

Waterway/ Impairments[1]	AUID	Spec-ies[2]	Year	Anat[3]	Total Fish	Samples	Length (in)			Mercury (mg/kg)[4]				PCBs (mg/kg)[4]				PFOS (µg/kg)[4]		
							Mean	Min	Max	N	Mean	Min	Max	N	Mean	Min	Max	N	Mean	Max
		WE	1993	FILSK	1	1	20.1			1	**0.430**			1	0.017					
		WSU	1993	FILSK	8	2	17.4	16.3	18.4	2	0.094	0.078	0.110	2	0.081	0.032	0.13			
CALHOUN*#	27003100	BGS	1979	WHORG	10	2	6.1	6.1	6.1	2	0.065	0.040	0.090							
			1992	FILSK	10	1	7.0			1	0.160									
			2006	FILSK	5	5	5.9	5.1	6.3									5	**319**	**373**
			2008	FILSK	9	6	5.9	5.5	6.3									6	**214**	**267**
			2009	FILSK	5	5	6.3	5.9	6.5	3	0.179	0.079	**0.346**					5	158	198
		BKB	1979	WHORG	6	1	7.3			1	0.050									
		BKS	1996	FILSK	10	1	6.9			1	0.089			1	< 0.01					
			2008	FILSK	6	6	6.4	5.5	7.1									6	**267**	**376**
			2009	FILSK	5	5	7.0	6.7	7.5	3	0.171	0.091	**0.323**					5	**201**	**270**
		LMB	2008	FILSK	5	5	13.5	9.8	16.9									5	**425**	**546**
			2009	FILSK	5	5	13.3	11.4	14.6	5	**0.494**	**0.260**	**0.941**					5	**436**	**488**
		NP	1996	FILSK	18	4	24.3	19.7	29.7	4	**0.358**	0.210	**0.720**	1	0.02					
			2003	FILSK	22	22	23.2	20.0	30.3	22	**0.420**	**0.320**	**0.857**							
			2009	FILSK	16	16	23.9	18.5	27.3	11	**0.640**	**0.348**	**1.176**					5	**204**	**259**
		WE	1992	FILSK	7	3	19.1	14.0	25.0	3	**1.093**	0.180	**1.900**	1	0.073					
			1996	FILSK	15	4	18.7	13.8	23.9	4	**0.713**	0.240	**1.300**	1	0.06					
			2000	FILSK	24	24	17.5	11.1	22.2	24	**0.315**	0.150	**0.610**	2	< 0.01					
		WSU	1979	WHORG	4	1	19.0			1	0.140									
			1992	FILSK	5	1	18.0			1	0.180			1	< 0.05					
			1996	FILSK	13	4	17.5	13.6	21.2	4	0.120	0.031	0.200	3	0.023					
			2006	FILSK	5	5	11.9	10.6	13.8									5	12.6	49.1
		YEB	1979	WHORG	10	1	11.9			1	0.110									
		YP	2000	WHORG	10	10	6.1	5.7	6.3	10	**0.152**	**0.120**	**0.220**							
			2003	WHORG	8	2	5.6	5.6	5.6	2	**0.233**	**0.232**	**0.233**							
CARVER*	82016600	BGS	1993	FILSK	10	1	6.4			1	0.073									
			2009	FILSK	10	2	6.1	5.8	6.3	1	0.056							1	25.9	
		C	1993	FILSK	6	2	20.6	13.9	27.3	2	0.096	0.022	0.170	2	0.036					
		NP	1993	FILSK	12	4	23.6	19.0	30.1	4	**0.253**	0.190	**0.310**	1	0.013					
			1998	FILSK	19	19	21.2	17.6	29.6	19	0.147	0.100	**0.340**	1	0.03					
				WHORG	19	19	21.2	17.6	29.6	15	0.100	0.047	0.178							
			2009	FILSK	5	5	22.9	18.9	25.6	2	**0.276**	**0.271**	**0.280**					3	45.4	68.6
		YEB	1993	FILET	5	1	12.4	12.4	12.4	1	**0.300**			1	0.069					
		YP	1998	WHORG	7	7	5.2	4.2	8.3	7	0.053	0.022	0.150							
CASEY	62000500	BKS	2008	FILSK	10	6	5.2	4.5	5.5									6	12.8	16.7
CEDAR*	27003900	BGS	1992	FILSK	10	1	6.2			1	0.160									
			2007	FILSK	10	6	5.1	4.5	6.1									6	29.2	34

Waterway/ Impairments[1]	AUID	Spec-ies[2]	Year	Anat[3]	Total Fish	Samples	Length (in)			Mercury (mg/kg)[4]				PCBs (mg/kg)[4]				PFOS (µg/kg)[4]		
							Mean	Min	Max	N	Mean	Min	Max	N	Mean	Min	Max	N	Mean	Max
			2008	FILSK	8	8	6.3	4.9	7.1									8	50.1	111
			2009	FILSK	5	1	5.7			1	0.116							1	53.4	53.4
		BKS	2008	FILSK	2	2	6.9	5.9	7.9									2	68.2	73.3
			2009	FILSK	5	1	6.9			1	**0.254**							1	32.5	32.5
		C	1992	FILSK	6	2	19.4	18.7	20.1	2	0.106	0.091	0.120	2	0.074					
		LMB	1999	FILSK	14	14	12.5	8.9	16.7	14	**0.292**	0.130	**0.660**							
				WHORG	9	9	7.2	5.9	8.7	9	0.212	0.120	**0.340**							
			2007	FILSK	4	4	15.1	12.2	18.1									4	71.7	106.0
			2008	FILSK	5	5	14.3	12.2	17.3									5	137	306.0
			2009	FILSK	5	5	9.9	5.1	14.6									5	56.2	79.7
		NP	1992	FILSK	3	1	23.1			1	**0.300**			1	0.03					
			2000	FILSK	6	6	25.2	21.2	30.2	6	**0.552**	**0.250**	**0.700**	2	< 0.01					
			2005	FILSK	7	7	27.0	19.3	31.6	7	**0.638**	0.223	**1.174**							
			2009	FILSK	6	6	26.4	16.5	35.2	3	**0.792**	**0.449**	**1.151**					3	44.8	56.9
		WE	1992	FILSK	3	1	18.3			1	**0.270**	**0.270**	**0.270**	1	0.043					
			2009	FILSK	9	9	18.2	13.7	24.3	5	**0.603**	0.158	**1.385**					4	56.9	71.5
		YP	2000	WHORG	10	10	5.7	5.2	6.4	10	0.159	0.050	**0.380**							
			2005	WHORG	10	2	6.5	5.9	7.1	2	0.172	0.152	0.191							
CENTERVILLE	02000600	BGS	2002	FILSK	10	1	6.9			1	0.072									
			2007	FILSK	10	6	5.7	4.9	5.9									6	8.23	12.8
		BKS	2002	FILSK	10	1	7.9			1	0.027									
		C	2002	FILSK	2	1	27.4			1	0.036			1	0.02					
		NP	2002	FILSK	5	5	23.8	20.7	29.0	5	0.087	0.067	0.111							
			2007	FILSK	7	7	21.3	18.1	25.6									7	9.20	11.4
		WE	2002	FILSK	5	5	17.0	14.4	19.7	5	0.090	0.074	0.125							
		WSU	2002	FILSK	3	1	19.3			1	0.025									
CHRISTMAS*	27013700	BGS	1986	FILSK	5	1	7.5			1	0.220									
			1991	FILSK	11	1	5.7			1	0.080									
			1996	FILSK	10	1	6.1			1	0.110									
			2007	WHORG	8	3	5.8	4.8	6.8	3	0.061	0.047	0.085							
		C	1986	FILSK	1	1	28.0	28.0	28.0	1	0.050			1	0.206					
			1991	FILSK	2	2	29.8	28.7	30.8	2	0.079	0.060	0.097	2	0.069					
			1996	FILSK	3	2	23.6	14.9	32.3	2	0.069	0.027	0.110	2	< 0.05					
		NP	1986	FILSK	5	1	18.7			1	**0.280**			1	< 0.05					
			1991	FILSK	10	3	22.5	16.5	28.5	3	**0.377**	0.230	**0.490**	1	0.041					
			1996	FILSK	12	5	21.3	15.8	28.0	5	**0.354**	0.180	**0.640**							
			2001	FILSK	26	26	19.5	12.8	29.3	26	0.210	0.118	**0.512**	1	0.02					

Waterway/ Impairments[1]	AUID	Spec-ies[2]	Year	Anat[3]	Total Fish	Samples	Length (in)			Mercury (mg/kg)[4]				PCBs (mg/kg)[4]				PFOS (µg/kg)[4]		
							Mean	Min	Max	N	Mean	Min	Max	N	Mean	Min	Max	N	Mean	Max
			2007	FILSK	24	24	19.1	11.5	32.0	24	**0.241**	0.091	**0.506**							
		RBT	1996	FILSK	13	4	20.0	15.9	24.9	4	0.017	0.011	0.026	2	0.028					
		WSU	1991	FILSK	2	2	20.0	18.9	21.1	2	0.135	0.100	0.170	1	0.041					
		YP	2001	WHORG	3	3	6.9	5.8	7.6	3	0.081	0.069	0.093							
CLEAR*	82016300	BKS	1999	FILSK	10	1	7.5			1	0.050									
		C	1999	FILSK	3	1	19.9			1	0.060			1	0.046					
		WE	1999	FILSK	8	8	17.0	13.0	22.4	8	0.170	0.060	**0.310**	1	0.015					
CLUB WEST	02076400	BGS	2007	FILSK	10	1	6.2			1	0.117									
		BKS	2007	FILSK	9	1	7.7			1	0.152									
		NP	2007	FILSK	1	1	21.5			1	0.116									
		WE	2007	FILSK	2	2	16.9	16.2	17.5	2	0.163	0.156	0.170							
COLBY	82009400	BGS	2007	FILSK	20	7	4.7	3.7	5.8	1	0.074							6	22.3	32.8
		BKS	2007	FILSK	20	7	5.8	5.3	6.7	1	0.174							6	13.9	16.6
		NP	2007	FILSK	3	3	23.4	21.1	24.6	3	**0.378**	**0.298**	**0.441**							
COMO*	62005500	BGS	1990	FILSK	10	1	6.0			1	0.096			1	0.028					
			2007	FILSK	6	6	5.3	4.3	6.3									6	29.6	39
		BKS	2007	FILSK	5	5	8.9	6.3	12.6									5	65.9	104
		LMB	1990	FILSK	4	1	10.4			1	**0.280**			1	< 0.01					
			2007	FILSK	1	1	14.6											1	29.5	
		NP	2007	FILSK	4	4	20.9	18.9	26.0									4	42.6	47.3
		WE	1990	FILSK	8	1	18.3			1	**0.420**			1	0.023					
		YEB	1990	FILET	8	1	11.6			1	0.140			1	< 0.01					
CROOKED*	02008400	BGS	2004	FILSK	8	1	6.7			1	0.073									
			2009	FILSK	10	1	5.9											1	< 4.9	
		NP	2004	FILSK	5	5	25.3	21.8	28.9	5	**0.257**	0.177	**0.356**							
		WE	2009	FILSK	5	5	17.2	16.1	18.5									5	5.70	6.41
		WSU	2009	FILSK	6	6	17.6	16.1	19.3	2	0.025	0.023	0.027					6	< 4.73	4.95
		YEB	2004	FILET	4	1	11.7			1	**0.280**									
CRYSTAL	27003400	BGS	2009	FILSK	5	1	6.3			1	0.020							1	85.9	
		BKS	2009	FILSK	5	1	8.6			1	0.103							1	167	
		YP	2009	FILSK	5	1	6.9			1	0.034							1	132	
DUTCH	27018100	BGS	1996	FILSK	10	1	7.5			1	0.120									
			2009	FILSK	5	1	6.9			1	0.070							1	< 4.81	
		BKS	2009	FILSK	5	1	7.6			1	0.059							1	5.65	
		C	1996	FILSK	8	2	23.5	21.4	25.5	2	0.135	0.100	0.170	2	0.085					
		NP	1996	FILSK	10	3	20.8	17.9	23.6	3	0.147	0.070	0.200	1	< 0.01					
			2009	FILSK	5	5	21.4	16.5	25.4	5	0.069	0.034	0.085					5	< 4.80	4.98

Waterway/ Impairments[1]	AUID	Spec-ies[2]	Year	Anat[3]	Total Fish	Samples	Length (in)			Mercury (mg/kg)[4]				PCBs (mg/kg)[4]				PFOS (µg/kg)[4]		
							Mean	Min	Max	N	Mean	Min	Max	N	Mean	Min	Max	N	Mean	Max
EAGLE/PIKE*	27011100	BGS	1993	FILSK	10	1	6.7			1	0.053									
		BKS	2011	FILSK	10	2	7.6	7.3	7.9	2	0.076	0.068	0.084							
		C	1993	FILSK	4	2	20.3	17.9	22.6	2	0.048	0.046	0.049	2	0.023					
		NP	1993	FILSK	17	4	24.4	20.2	28.0	4	0.240	0.180	**0.300**	1	0.022					
			2006	FILSK	8	8	21.8	17.1	28.0	8	0.210	0.125	**0.468**							
		WE	1993	FILSK	6	3	21.6	19.4	24.4	3	**0.630**	**0.570**	**0.720**	3	0.078					
			2011	FILSK	3	3	21.6	20.5	23.2	3	**0.354**	0.230	**0.454**							
		YP	2006	WHORG	10	5	5.8	5.6	6.3	5	0.049	0.041	0.057							
EAST MOORE	02007501	BGS	2004	FILSK	8	1	6.1			1	0.025									
		BKB	2004	FILET	7	1	10.3			1	0.043									
		CHC	2004	FILET	1	1	25.5			1	0.084			1	< 0.05					
		NP	2004	FILSK	5	5	22.1	19.3	24.2	5	0.126	0.091	0.161							
EAST VADNAIS*	62003801	BGS	2008	FILSK	9	1	7.2			1	0.039									
		BKS	2008	FILSK	4	1	8.1			1	0.046									
		C	1991	FILSK	1	1	24.9			1	0.050			1	0.069					
		LMB	2008	FILSK	5	5	11.7	10.5	14.3	5	0.134	0.104	0.154							
		NP	1991	FILSK	2	1	16.2			1	0.040									
			2008	FILSK	5	5	22.0	19.8	24.4	5	0.222	0.185	**0.276**							
		WE	1991	FILSK	17	4	19.9	13.3	27.3	4	0.188	0.081	**0.390**	3	0.033	0.01	0.056			
			2008	FILSK	4	4	15.7	14.1	19.2	4	0.192	0.145	**0.272**							
		WHS	1991	FILSK	10	1	12.3			1	0.048			1	< 0.01					
		WSU	1991	FILSK	11	2	15.5	13.6	17.3	2	0.029	0.024	0.033	1	< 0.01					
		YEB	1991	FILET	4	1	12.2			1	0.130			1	0.03					
FISH*	27011800	BGS	2009	FILSK	3	1	5.8			1	0.050							1	11.3	
		BKS	2003	FILSK	7	1	7.1			1	0.144									
			2009	FILSK	3	1	6.6											1	12.2	
		C	2003	FILSK	3	1	22.0			1	0.091			1	0.02					
		LMB	2007	FILSK	6	6	13.0	11.1	16.3	6	0.108	0.045	**0.352**							
		NP	2003	FILSK	5	5	25.2	19.6	31.0	5	**0.302**	0.215	**0.361**							
			2009	FILSK	5	5	23.9	22.4	25.1	2	0.237	0.229	0.244					3	20.1	20.8
GERVAIS*	62000700	BGS	1995	FILSK	8	1	6.5			1	0.095									
			2007	FILSK	10	6	4.8	2.8	6.7									6	110	175
			2010	FILSK	5	1	6.5											1	40.2	
		BKS	2007	FILSK	5	5	7.6	6.3	9.1									5	157	**206**
		C	1995	FILSK	3	2	24.5	21.3	27.7	2	0.085	0.079	0.091	2	0.053					
			2011	FILSK	5	5	25.5	21.3	32.3									5	36.6	47.8
		LMB	2007	FILSK	5	5	13.2	11.0	18.5									5	184	**227**
			2010	FILSK	5	5	10.1	4.9	12.6									5	106	157

Waterway/ Impairments[1]	AUID	Spec-ies[2]	Year	Anat[3]	Total Fish	Samples	Length (in)			Mercury (mg/kg)[4]				PCBs (mg/kg)[4]				PFOS (µg/kg)[4]		
							Mean	Min	Max	N	Mean	Min	Max	N	Mean	Min	Max	N	Mean	Max
		NP	1995	FILSK	5	2	26.4	24.8	27.9	2	**0.260**	0.200	**0.320**	1	0.02					
			2000	FILSK	1	1	25.9			1	**0.370**									
			2011	FILSK	10	10	25.5	22.0	29.2	10	0.134	0.090	0.167							
		SMB	2010	FILSK	1	1	14.8											1	19.1	
		WE	1995	FILSK	13	2	19.0	17.8	20.2	2	**0.360**	**0.340**	**0.380**							
			2005	FILSK	9	9	23.1	20.4	26.5	9	**0.741**	**0.536**	**1.008**							
		YP	2000	WHORG	10	10	6.3	5.8	7.2	10	0.092	0.060	0.130							
			2005	WHORG	17	3	6.7	6.0	7.6	3	0.084	0.045	0.113							
GOLDEN*	02004500	BGS	2007	FILSK	10	1	6.6			1	0.218									
		BKB	2007	FILET	8	1	10.1			1	0.102									
		NP	2007	FILSK	6	6	22.9	17.5	26.9	6	**0.295**	0.161	**0.458**							
GOOSE	62003400	BGS	1992	FILSK	10	1	7.8			1	0.010			1	< 0.01					
		WSU	1992	FILSK	4	2	19.1	17.7	20.4	2	0.010	0.010	0.010	1	0.053					
HAM	02005300	BGS	2004	FILSK	10	1	5.9			1	0.075									
		NP	2004	FILSK	6	6	23.1	18.6	27.4	6	**0.263**	0.230	**0.351**							
		WSU	2004	FILSK	1	1	19.6	19.6	19.6	1	0.078									
HARRIET*#	27001600	BGS	1984	FILSK	4	1	4.5			1	0.070			1	< 0.05					
			2007	FILSK	10	6	3.9	2.8	5.0									6	110	163
			2008	FILSK	5	5	5.9	5.3	6.7									5	137	153
			2009	FILSK	5	1	5.9			1	0.152							1	112	
		BKS	1989	FILSK	5	1	7.0			1	0.086			1	< 0.01					
			1993	FILSK	8	1	6.1			1	0.072			1	< 0.01					
			2008	FILSK	5	5	7.4	6.7	7.9									5	138	168
			2009	FILSK	5	1	7.2			1	**0.625**							1	117	
		C	1989	FILSK	1	1	24.5			1	0.086			1	**0.41**					
		LMB	2007	FILSK	5	5	13.5	11.4	15.7									5	148	**254**
			2008	FILSK	5	5	13.1	11.4	16.9									5	**230**	**419.5**
			2009	FILSK	5	5	13.6	13.0	14.6	5	**0.402**	**0.257**	**0.716**					5	**213**	**263**
		NP	1996	FILSK	5	5	25.1	22.9	26.4	5	**0.288**	0.242	**0.335**							
			2003	FILSK	12	12	26.5	23.0	33.0	12	**0.472**	0.188	**0.881**							
			2009	FILSK	9	9	26.6	23.8	30.8	6	**0.633**	**0.304**	**1.470**					3	**205**	**246**
		WE	1984	FILSK	7	1	17.7			1	0.040			1	0.18					
			1989	FILSK	10	5	18.1	12.5	22.2	5	**0.900**	0.160	**1.700**	5	0.108					
			1993	FILSK	22	3	17.4	13.6	22.4	3	**0.593**	0.170	**1.200**	3	0.103					
			1996	FILSK	8	8	19.5	10.0	24.0	8	**0.761**	0.095	**1.824**							
			2000	FILSK	19	19	18.5	11.1	26.0	19	**0.429**	0.070	**1.030**	2	0.011					
			2009	FILSK	5	5	14.2	12.2	18.8	2	**0.338**	0.242	**0.434**					3	**206**	**272**
		WSU	1985	FILSK	5	1	13.6							1	< 0.05					

Waterway/ Impairments[1]	AUID	Spec-ies[2]	Year	Anat[3]	Total Fish	Samples	Length (in)			Mercury (mg/kg)[4]				PCBs (mg/kg)[4]				PFOS (µg/kg)[4]		
							Mean	Min	Max	N	Mean	Min	Max	N	Mean	Min	Max	N	Mean	Max
			1993	FILSK	8	1	16.1			1	0.140			1	0.031					
		YP	1989	WHORG	50	5	6.0	6.0	6.0	5	0.105	0.094	0.110	5	0.198					
			1993	FILSK	8	1	7.0			1	0.200			1	0.011					
				WHORG	42	5	6.4	5.7	7.4	5	0.126	0.086	0.190	1	0.058					
			2000	WHORG	10	10	5.6	5.2	5.9	10	0.067	0.040	0.130							
			2003	WHORG	10	2	6.2	5.9	6.5	2	0.109	0.097	0.120							
HIAWATHA	27001800	BGS	2007	FILSK	20	7	5.1	3.1	7.1	1	0.111							6	26.2	35
		BKS	2001	FILSK	10	1	6.9			1	0.020									
			2007	FILSK	5	5	7.4	6.7	8.5									5	39.6	71.7
		NP	2001	FILSK	6	6	22.1	19.0	24.7	6	0.132	0.099	0.160	1	0.18					
			2007	FILSK	6	6	23.9	18.1	30.3									6	28.9	62.5
		WSU	2001	FILSK	3	1	11.0			1	0.047									
ISLAND*	62007500	BGS	2004	FILSK	5	1	5.1			1	0.088									
		C	2004	FILSK	2	1	20.7			1	0.030									
		CHC	2010	FILET	8	8	15.3	12.4	20.4	8	0.020	0.010	0.086	1	< 0.025					
		NP	2004	FILSK	3	3	21.6	16.9	27.0	3	0.205	0.171	0.232							
		WE	2004	FILSK	5	5	17.6	15.1	22.8	5	**0.429**	0.223	1.175							
JOHANNA#	62007800	BGS	2003	FILSK	10	1	5.6			1	0.092									
			2007	FILSK	11	7	6.0	5.1	7.1									7	**217**	**292**
			2010	WHORG	25	7												7	150	**237**
		BKB	2010	WHORG	7	1												1	7.53	
		BKS	2003	FILSK	10	1	5.9			1	0.053									
			2007	FILSK	3	3	7.9	7.9	7.9									3	**222**	**384**
			2010	WHORG	5	1												1	162	
		C	1997	FILSK	6	1	22.2			1	0.070			1	0.115					
			2003	FILSK	5	1	16.8			1	0.027			1	< 0.01					
		LMB	2010	WHORG	25	7												7	**555**	**648**
		NP	1997	FILSK	15	15	24.8	14.8	34.1	15	0.217	0.060	**0.450**	3	0.017					
				WHORG	15	15	24.8	14.8	34.1	15	0.173	0.040	**0.390**							
			2010	WHORG	1	1												1	163	
		SF	2010	WHORG	11	6												6	113	150
		WE	2010	WHORG	5	5												5	**297**	**419**
		WSU	2003	FILSK	3	1	19.1			1	0.063									
		YP	1997	WHORG	10	10	5.7	5.5	6.1	10	0.066	0.040	0.110							
			2010	WHORG	22	2												2	**303**	**365**
JOSEPHINE*	62005700	BGS	1996	FILSK	10	1	6.2			1	0.099									
			2006	FILSK	12	7	5.3	4.3	6.3									7	87.8	188
		NP	1996	FILSK	18	4	21.5	17.9	26.2	4	0.184	0.097	**0.370**	1	< 0.01					

Waterway/ Impairments[1]	AUID	Spec-ies[2]	Year	Anat[3]	Total Fish	Samples	Length (in)			Mercury (mg/kg)[4]				PCBs (mg/kg)[4]				PFOS (µg/kg)[4]		
							Mean	Min	Max	N	Mean	Min	Max	N	Mean	Min	Max	N	Mean	Max
		YEB	1996	FILET	8	1	11.3			1	**0.330**									
KELLER	62001000	BGS	2007	FILSK	10	6	5.7	5.3	5.9									6	69	106
			2010	FILSK	5	1	6.0											1	51.7	
		LMB	2010	FILSK	5	5	6.5	4.5	9.4									5	71.5	109
LAKE OF THE ISLES*#	27004000	BGS	1993	FILSK	10	1	6.7			1	0.120			1	0.031					
			2008	FILSK	3	3	5.6	5.1	5.9									3	68.4	96.6
			2009	FILSK	5	5	5.5	4.5	6.5	3	0.037	0.033	0.041					5	87.7	159
		BKS	2008	FILSK	6	6	7.5	5.5	9.4									6	167	**298**
			2009	FILSK	5	5	7.3	6.7	8.1	3	0.106	0.077	0.136					5	132	**208**
		C	1993	FILSK	2	1	20.1			1	0.089			1	0.029					
			2000	FILSK	4	1	25.5			1	0.096			1	0.02					
		LMB	2008	FILSK	5	5	14.3	10.6	16.5									5	**212**	**388**
		ML	1993	FILSK	6	2	29.5	28.4	30.6	2	0.180	0.160	0.200	2	0.093	0.075	0.11			
		NP	2000	FILSK	4	4	26.6	24.6	29.9	4	0.200	0.150	0.230	1	< 0.01					
			2009	FILSK	5	5	25.8	23.6	29.1									5	138	177
		WE	1993	FILSK	2	2	17.9	14.4	21.3	2	**0.425**	0.120	**0.730**	2	0.107	0.023	0.19			
		WSU	1993	FILSK	13	2	17.3	17.1	17.4	2	0.059	0.055	0.063	1	0.039					
		YP	2000	FILSK	10	1	6.2			1	0.060									
LANGTON	62004900	BGS	2005	FILSK	8	1	6.9			1	0.053									
		BKB	2005	FILET	11	1	8.9			1	0.115									
		BKS	2005	FILSK	9	1	7.5			1	0.118									
LOCH NESS	02058500	BGS	2010	WHORG	7	1	4.7			1	0.089									
		BKB	2010	WHORG	6	1	4.6			1	0.062									
		HSF	2005	FILSK	9	1	6.8			1	0.116									
LOEB	62023100	BGS	2006	FILSK	10	1	5.9			1	0.024									
LONG*	27016000	BGS	1991	FILSK	1	1	7.1			1	0.100			1	< 0.01					
		BKS	1991	FILSK	16	2	7.9	7.4	8.3	2	0.190	0.140	0.240	2	< 0.01					
		C	1991	FILSK	9	8	21.0	11.4	27.6	8	0.104	0.040	0.200	8	0.033	0.01	0.076			
		NP	1991	FILSK	8	7	22.2	16.2	32.0	7	0.229	0.160	**0.320**	6	0.018	0.01	0.042			
			2006	FILSK	11	11	24.0	14.9	33.5	11	0.213	0.040	**0.669**							
		YP	2006	WHORG	7	5	7.3	6.1	8.0	5	0.041	0.032	0.051							
LONG*	62006700	BGS	1979	WHORG	5	1	7.8			1	0.060									
			1983	FILSK	5	1	7.4			1	0.090			1	< 0.05					
			1993	FILSK	10	1	6.5			1	0.051			1	< 0.01					
			2008	FILSK	8	1	6.3			1	0.047									
		BKS	1969	BRAIN	1	1								1	< 0.001					
				FILET	1	1								1	< 0.001					

Waterway/ Impairments[1]	AUID	Spec-ies[2]	Year	Anat[3]	Total Fish	Samples	Length (in)			Mercury (mg/kg)[4]				PCBs (mg/kg)[4]				PFOS (µg/kg)[4]		
							Mean	Min	Max	N	Mean	Min	Max	N	Mean	Min	Max	N	Mean	Max
		C	1969	BRAIN	1	1								1	< 0.001					
				FILET	1	1								1	< 0.001					
			1970	PLUG	1	1	13.0							1	**1.5**					
			1978	PLUSK	2	1	17.4			1	0.140			1	< 0.05					
				WHORG	2	1	17.3			1	0.080			1	0.066					
			1979	WHORG	10	2	19.4	19.0	19.7	2	0.095	0.080	0.110							
			1983	FILSK	5	1	15.3			1	0.100			1	0.088					
				WHORG	5	1	15.3													
			1993	FILSK	17	3	15.9	11.1	20.4	3	0.059	0.038	0.081	3	0.078	0.017	0.13			
			2008	FILSK	8	1	15.5			1	0.020									
		NP	1968	FILSK	5	1	22.1			1	**0.280**			1	< 0.05					
			1983	FILSK	5	1	19.6			1	0.080			1	< 0.05					
				WHORG	5	1	19.6													
			1993	FILSK	1	1	21.5			1	0.130			1	< 0.01					
			2008	FILSK	5	5	23.1	20.6	25.8	5	0.079	0.061	0.107							
		WE	1968	FILSK	5	1	17.6			1	**0.520**			1	< 0.05					
			1993	FILSK	13	3	16.5	11.9	20.1	3	0.204	0.072	0.360	3	0.026	0.01	0.039			
		WSU	1969	BRAIN	3	3								3	< 0.001					
				FILET	3	3								3	< 0.001					
			1978	PLUSK	4	1	14.0			1	0.130			1	< 0.025					
				WHORG	4	1	14.0			1	0.050			1	0.058					
MCCARRON*	62005400	BGS	2007	FILSK	5	1	6.4			1	0.118							1	47.3	
		LMB	2007	FILSK	8	8	11.3	10.5	12.6	8	0.214	0.185	**0.298**							
		NP	2003	FILSK	3	3	27.2	23.8	30.3	3	**0.555**	**0.262**	**0.717**							
		YP	2003	WHORG	17	3	6.1	5.7	6.6	3	0.109	0.106	0.115							
MEDICINE*	27010400		2008	FILSK	5	1	5.6											1	39.6	
		BGS	1979	WHORG	5	1				1	0.040									
			2004	FILSK	8	1	6.7			1	0.107									
			2006	FILSK	10	1	7.0			1	0.035									
			2008	FILSK	5	5	5.9	5.1	6.5									5	21.5	27.8
		BKS	1991	FILSK	10	1	6.7			1	0.093			1	< 0.01					
			2004	FILSK	8	1	7.6			1	0.080									
			2008	FILSK	10	6	5.9	5.3	6.5									6	38.1	52.2
		C	1991	FILSK	15	4	19.5	13.4	25.3	4	0.066	0.023	0.100	3	0.072	0.044	0.098			
		LMB	2008	FILSK	8	8	11.7	9.3	16.5									8	47.7	57.2
		NP	1991	FILSK	20	3	22.1	18.2	26.4	3	0.203	0.130	**0.290**	2	< 0.01					
			2004	FILSK	6	6	24.2	16.9	30.5	6	0.168	0.108	**0.259**							
		YEB	1979	WHORG	10	1	11.9			1	0.110									

Waterway/ Impairments[1]	AUID	Spec-ies[2]	Year	Anat[3]	Total Fish	Samples	Length (in)			Mercury (mg/kg)[4]				PCBs (mg/kg)[4]				PFOS (µg/kg)[4]		
							Mean	Min	Max	N	Mean	Min	Max	N	Mean	Min	Max	N	Mean	Max
			2006	FILET	9	2	11.9	11.3	12.4	2	0.067	0.048	0.086							
MINNETONKA*	27013300	BGS	1970	PLUG	2	2	6.5	6.2	6.7	2	0.180	0.070	**0.290**							
			1979	WHORG	5	1				1	0.040									
			1984	FILSK	10	1	6.0			1	0.110			1	< 0.05					
				WHORG	30	3	6.5	6.0	7.0											
			1992	FILSK	30	3	7.2	7.0	7.3	3	0.100	0.073	0.130							
			2000	FILSK	30	3	7.0	6.8	7.2	3	0.033	0.020	0.040							
			2007	FILSK	10	6	4.8	3.9	6.1									6	5.38	7.47
			2009	FILSK	5	1	6.0											1	6.72	
		BKB	1985	FILET	10	1	8.8							1	< 0.05					
		BKS	2007	FILSK	5	5	9.9	7.5	13.4									5	6.93	10.9
			2009	FILSK	5	1	6.8			1	0.032							1	< 5.03	5.03
		C	1979	WHORG	6	1				1	**0.900**									
			1984	FILSK	4	1	23.4			1	0.200			1	**0.475**					
				WHORG	4	1	23.4													
			1985	FILSK	10	2	22.0	21.9	22.0					2	**0.24**	0.081	**0.399**			
			1992	FILSK	92	11	24.3	17.5	31.8	11	0.090	0.044	0.150	5	0.140	0.052	**0.29**			
			2000	FILSK	5	3	28.0	25.7	30.0	3	0.047	0.030	0.060	3	0.011	0.01	0.012			
		LMB	1979	WHORG	5	1				1	0.190									
			2006	FILSK	5	5	12.2	10.0	14.3	5	0.107	0.064	0.140							
		NP	1970	PLUG	2	2	24.0	21.6	26.4	2	0.235	0.020	**0.450**							
			1992	FILSK	118	12	24.5	18.0	31.4	12	0.235	0.100	**0.440**	3	0.026	0.014	0.039			
			2000	FILSK	29	29	24.0	18.6	32.5	29	0.159	0.060	**0.250**	3	< 0.01					
			2007	FILSK	3	3	28.0	24.4	31.5									3	8.58	10.3
			2009	FILSK	14	14	23.2	14.5	33.4	9	0.190	0.067	**0.379**					5	6.28	8.99
		WE	1992	FILSK	86	11	19.9	12.8	26.6	11	**0.384**	0.140	**0.800**	3	< 0.05	0.044	0.054			
			2000	FILSK	29	29	19.4	14.0	27.0	29	0.243	0.070	**0.570**	3	< 0.01					
		WSU	2000	FILSK	2	1	16.8			1	0.010									
		YEB	1985	FILET	10	1	8.5							1	< 0.05					
MINNEWASHTA*	10000900	BGS	2001	FILSK	10	1	7.4			1	0.096									
			2011	FILSK	10	2	6.5	6.0	7.0	2	0.066	0.051	0.080							
		NP	2001	FILSK	7	7	22.8	18.8	27.1	7	0.236	0.137	**0.402**	1	< 0.01					
			2011	FILSK	5	5	21.6	19.1	23.2	5	0.186	0.136	**0.297**							
		YEB	2001	FILET	8	1	12.1			1	0.223									
			2003	FILET	6	1	11.9			1	**0.344**									
			2011	FILET	5	1	11.9			1	**0.433**									
NOKOMIS*$	27001900	BGS	2007	FILSK	17	8	5.4	4.3	6.3	1	0.012							8	8.83	13.4
		BKB	1979	WHORG	5	1	8.9			1	0.030									

Waterway/ Impairments[1]	AUID	Spec-ies[2]	Year	Anat[3]	Total Fish	Samples	Length (in)			Mercury (mg/kg)[4]				PCBs (mg/kg)[4]				PFOS (µg/kg)[4]		
							Mean	Min	Max	N	Mean	Min	Max	N	Mean	Min	Max	N	Mean	Max
			2007	FILET	5	1	8.9			1	0.013									
		BKS	1979	WHORG	5	1	8.1			1	0.070									
			1992	FILSK	15	1	6.1			1	0.025									
			1996	FILSK	15	1	5.8			1	0.026									
			2007	FILSK	5	5	7.0	6.4	7.5									5	9.99	12.3
			2010	FILSK	5	1	6.8											1	7.45	
		C	1992	FILSK	1	1	14.9			1	0.066			1	0.03					
			1996	FILSK	3	3	20.3	13.9	25.8	3	0.034	0.011	0.071	3	0.14	0.01	**0.32**			
		TMU	2007	FILSK	4	4	18.1	16.4	19.2	4	0.032	0.030	0.033							
		WE	1992	FILSK	14	7	19.2	15.6	24.6	7	0.174	0.120	**0.370**	2	**0.43**	**0.38**	**0.48**			
			1996	FILSK	21	6	18.8	9.6	27.0	6	0.212	0.029	**0.500**	1	< 0.025					
			2007	FILSK	2	2	21.6	21.5	21.6	2	0.194	0.069	**0.319**							
			2010	FILSK	5	5	17.6	15.7	20.1									5	6.788	8.66
		WSU	1979	FILSK	5	1	13.6							1	0.055					
				WHORG	5	1	15.1			1	0.040									
			1992	FILSK	1	1	15.9			1	0.084			1	**0.23**					
		YP	2007	WHORG	12	3	6.1	5.7	6.5	3	0.012	0.010	0.014							
NORTH STAR STEEL*$	62023700	BBU	1991	FILSK	1	1	19.5			1	0.059			1	**0.31**					
		BGS	1991	FILSK	6	1	6.6			1	0.078			1	0.011					
			2008	WHORG	14	1	2.6			1	< 0.010			1	< 0.05					
		BKB	1991	FILET	8	1	8.1			1	0.034			1	0.076					
		BKS	1991	FILSK	7	3	9.4	8.6	10.5	3	0.086	0.044	0.140	3	0.054	0.046	0.067			
			2008	WHORG	4	2	8.9	8.0	9.8	2	0.010	0.010	0.010	2	0.100					
		C	1991	FILSK	17	6	21.4	13.3	28.6	6	0.089	0.023	0.210	6	**0.243**	0.14	**0.32**			
			1997	FILSK	10	10	18.0	14.5	22.9	10	0.052	0.016	0.150	10	0.094	0.01	**0.3**			
				WHORG	10	10	18.0	14.5	22.9	10	0.038	0.016	0.078							
		FWD	1991	FILSK	1	1	13.6			1	0.110			1	0.140					
		GSH	2008	WHORG	55	4	6.4	5.3	7.2	4	< 0.010	< 0.010	< 0.010	4	0.115	0.08	0.16			
		LMB	2008	WHORG	22	3	5.9	5.4	6.2	3	< 0.010	< 0.010	< 0.010	3	0.063	0.04	0.09			
		NP	1991	FILSK	9	5	21.4	17.8	24.4	5	0.135	0.036	0.210	5	0.057	0.03	0.102			
			1997	FILSK	11	11	25.4	22.6	28.7	11	0.145	0.020	**0.400**	11	0.060	0.01	0.14			
				WHORG	11	11	25.4	22.6	28.7	11	0.168	0.054	**0.400**							
			2008	WHORG	22	3	11.7	9.9	13.5	3	< 0.010	< 0.010	< 0.010	3	0.04	0.025	0.07			
		QUB	2008	WHORG	63	3	5.4	4.3	6.4	3	< 0.010	< 0.010	< 0.010	3	< 0.025					
		SF	2008	WHORG	12	3	4.8	3.0	5.8	3	< 0.010	<	<	3	0.053	0.04	0.06			

Waterway/ Impairments[1]	AUID	Spec-ies[2]	Year	Anat[3]	Total Fish	Samples	Length (in)			Mercury (mg/kg)[4]				PCBs (mg/kg)[4]				PFOS (µg/kg)[4]		
							Mean	Min	Max	N	Mean	Min	Max	N	Mean	Min	Max	N	Mean	Max
												0.010	0.010							
		SUF	2008	WHORG	15	2	4.2	3.1	5.2	2	0.019	< 0.010	0.028	2	0.035	0.03	0.04			
		WSU	2008	WHORG	21	3	5.4	4.4	6.3	3	< 0.010	< 0.010	< 0.010	3	< 0.025					
		YEB	1991	FILET	2	2	12.5	11.1	13.8	2	0.146	0.091	0.200	2	0.042	0.01	0.074			
		YP	1997	WHORG	1	1	5.5			1	0.016			1	0.18	0.18	0.18			
			2008	WHORG	125	5	4.1	1.5	7.6	5	< 0.010	< 0.010	0.012	5	0.04	0.025	0.06			
OTTER*	02000300	BGS	2007	FILSK	10	1	6.1			1	0.070									
		BKB	2007	FILET	10	1	7.0			1	0.082									
		NP	2007	FILSK	6	6	22.4	19.5	26.6	6	**0.262**	0.203	**0.384**							
OWASSO*	62005600	BGS	1991	FILSK	10	1	6.2			1	0.110									
			1996	FILSK	8	1	6.6			1	0.085									
		BKB	1991	FILET	8	1	8.8			1	0.060									
		BKS	1991	FILSK	9	1	5.8			1	0.040									
		C	1991	FILSK	1	1	29.3			1	0.150			1	0.08					
		NP	1991	FILSK	5	3	27.1	23.4	30.5	3	**0.360**	0.140	**0.480**	1	0.043					
			1996	FILSK	20	5	26.0	18.9	33.6	5	0.173	0.087	**0.330**	1	< 0.01					
			2001	FILSK	24	24	25.1	20.2	32.6	24	0.210	0.097	**0.359**	1	< 0.01					
			2006	FILSK	25	25	26.0	21.8	36.1	25	**0.256**	0.095	**0.619**							
		WE	1991	FILSK	10	3	17.3	10.8	22.2	3	**0.313**	0.190	**0.560**	1	0.058					
			1996	FILSK	10	3	17.1	14.9	19.4	3	0.123	0.110	0.140							
		WSU	1991	FILSK	2	1	11.9			1	< 0.010									
		YEB	1991	FILET	1	1	11.7			1	0.130									
		YP	1991	FILSK	4	1	7.0			1	0.100									
			2001	WHORG	11	2	6.1	5.8	6.3	2	0.049	0.039	0.058							
			2006	WHORG	12	5	6.1	5.7	6.5	5	0.045	0.029	0.053							
PARKERS*	27010700	BGS	1995	FILSK	10	1	6.5			1	0.160									
			2001	FILSK	10	1	6.9			1	0.071									
		NP	1995	FILSK	18	4	23.8	19.4	28.0	4	**0.678**	0.220	**1.300**	1	< 0.01					
			2001	FILSK	7	7	23.7	17.6	33.1	7	**0.410**	0.185	**1.081**	1	0.03					
			2007	FILSK	24	24	22.9	17.7	31.2	24	**0.619**	**0.266**	**0.923**							
		WSU	1995	FILSK	2	1	19.0			1	0.043									
		YEB	2001	FILET	6	1	10.9			1	0.128									
			2007	FILET	8	2	11.8	11.1	12.5	2	0.151	0.123	0.179							
PARLEY	10004200	BGS	2004	FILSK	6	1	6.4			1	0.020									
		BKB	2004	FILET	8	1	10.9			1	0.054									
		BKS	2004	FILSK	9	1	7.1			1	0.038									

Waterway/ Impairments[1]	AUID	Spec-ies[2]	Year	Anat[3]	Total Fish	Samples	Length (in)			Mercury (mg/kg)[4]				PCBs (mg/kg)[4]				PFOS (µg/kg)[4]		
							Mean	Min	Max	N	Mean	Min	Max	N	Mean	Min	Max	N	Mean	Max
		C	1988	FILSK	2	1	22.2			1	0.048			1	< 0.01					
		NP	1988	FILSK	5	1	24.7			1	0.059			1	< 0.01					
			2004	FILSK	5	5	22.7	19.2	27.2	5	0.053	0.042	0.068							
PELTIER*	02000400	BGS	2002	FILSK	10	1	7.1			1	0.070									
			2007	FILSK	5	5	5.3	4.5	6.2									5	12.13	17.6
			2008	FILSK	11	1	7.5			1	0.034									
			2009	FILSK	5	1	6.8											1	9	
		BKB	2009	FILET	6	1	12.9			1	0.056									
		LMB	2008	FILSK	5	5	10.9	9.8	14.4	5	0.104	0.085	0.130							
		NP	2002	FILSK	5	5	21.0	17.4	24.2	5	0.129	0.083	0.217							
			2007	FILSK	5	5	19.1	16.9	21.3									5	14.02	20.7
			2009	FILSK	8	8	22.5	18.0	26.6	5	0.104	0.074	0.126					3	6.8	8.72
		SF	2008	FILSK	5	1	5.2			1	0.016									
		WSU	2002	FILSK	2	1	17.1			1	0.082									
PHALEN*	62001300	BGS	2007	FILSK	10	6	5.0	3.9	6.3									6	82.8	156
			2009	FILSK	10	2	6.4	6.2	6.5	1	0.072							1	64.0	
		BKS	2007	FILSK	3	3	5.6	4.7	6.7									3	71.3	104
		C	2009	FILSK	4	1	28.0			1	0.120									
		LMB	2007	FILSK	5	5	15.9	13.2	16.9									5	142	183
		NP	2009	FILSK	12	12	23.4	17.7	27.0	7	**0.362**	**0.260**	**0.485**					5	103	128
		WE	1989	FILSK	2	2	13.5	12.4	14.5	2	0.190	0.140	0.240	2	< 0.01					
			2009	FILSK	4	4	21.4	19.2	25.4	4	**1.095**	**0.969**	**1.181**							
		WSU	2009	FILSK	1	1	17.3			1	0.024									
		YP	1989	WHORG	20	5	6.2	6.2	6.2	5	0.098	0.072	0.120	5	0.102	0.064	0.14			
			2009	FILSK	5	1	7.5			1	0.185									
PICKEREL*	19007900	BGS	1985	FILSK	5	1	6.1			1	0.150			1	< 0.05					
		NP	1985	FILSK	5	1	21.1			1	0.330			1	0.078					
PIERSONS	10005300	BGS	2001	FILSK	10	1	6.8			1	0.042									
		BKS	2007	FILSK	11	1	7.9			1	0.182									
		C	2001	FILSK	5	1	17.1			1	0.041			1	< 0.01					
		NP	2001	FILSK	6	6	22.4	18.1	28.2	6	0.106	0.069	0.187							
		YEB	2007	FILET	8	1	10.7			1	0.172									
PIGS EYE	62000400	BGS	1984	FILSK	6	1	5.5			1	0.080			1	< 0.05					
			1985	FILSK	10	1	5.2			1	0.030			1	0.067					
		C	1985	FILSK	1	1	17.0			1	0.070			1	**0.472**					
		NP	1984	FILSK	3	1	18.0			1	0.100			1	0.067					
			1985	FILSK	2	1	27.2			1	0.100			1	0.207					
PLEASANT*	62004600	BGS	2009	FILSK	8	6	7.3	6.7	7.5	1	0.037							5	6.76	8.28

Waterway/ Impairments[1]	AUID	Spec-ies[2]	Year	Anat[3]	Total Fish	Samples	Length (in)			Mercury (mg/kg)[4]				PCBs (mg/kg)[4]				PFOS (µg/kg)[4]		
							Mean	Min	Max	N	Mean	Min	Max	N	Mean	Min	Max	N	Mean	Max
		BKS	2000	FILSK	11	1	8.7			1	0.100									
			2009	FILSK	9	7	11.1	9.1	13.8	2	0.120	0.053	0.187					5	8.19	13
		CHC	2000	FILET	1	1	20.1			1	0.160			1	< 0.01					
		RHS	2009	FILSK	4	1	20.5			1	0.122									
		SMB	2000	FILSK	3	3	12.9	11.5	15.6	3	0.087	0.060	0.130	1	< 0.01					
			2009	FILSK	8	8	12.2	9.1	18.9	3	0.106	0.088	0.137					5	15.2	26.9
		WE	2000	FILSK	6	6	18.7	14.1	24.1	6	0.177	0.080	**0.310**	1	< 0.01					
		WHB	2000	FILSK	10	1	12.8			1	0.130			1	< 0.01					
			2006	FILSK	5	5	14.1	12.6	15.5	5	**0.306**	0.243	**0.353**							
			2009	FILSK	8	8	13.6	9.4	16.0	3	**0.318**	0.243	**0.397**	1	< 0.025			5	16.6	19.1
POWDERHORN *	27001400	BGS	2003	FILSK	8	1	6.7			1	0.091									
		BKB	2003	FILET	9	1	8.9			1	0.069			1	< 0.01					
		BKS	2003	FILSK	10	1	9.4			1	**0.298**									
POWERS	82009200	BGS	2007	FILSK	20	7	5.9	5.1	6.7	1	0.177							6	43.8	65.3
		BKS	2007	FILSK	10	6	7.7	7.5	7.9	1	0.149							5	50.7	63.9
		NP	2007	FILSK	7	7	27.3	23.4	33.2	4	**0.799**	**0.761**	**0.874**					3	68.6	71.9
		YP	2007	FILSK	5	1	5.9											1	41.6	
RAVINE	82008700	BGS	2007	FILSK	10	6	5.3	3.9	7.7									6	22.5	45.1
		BKS	2007	FILSK	5	5	5.7	5.5	5.9									5	60.0	77.8
		LMB	2007	FILSK	5	5	13.5	12.8	14.4									5	62.5	107
REBECCA*	19000300	BGS	1983	FILSK	5	1	8.6			1	0.150			1	< 0.05					
			1990	FILSK	10	1	7.3			1	0.110			1	0.014					
		BKS	1996	FILSK	10	1	6.1			1	0.046									
		C	1990	FILSK	4	2	19.4	17.2	21.5	2	0.026	0.024	0.028	2	0.03	0.028	0.032			
			1996	FILSK	7	3	25.3	21.0	28.8	3	0.140	0.070	0.230	2	0.063	0.03	0.095			
		LMB	1990	FILSK	4	2	10.8	6.6	15.0	2	0.068	0.041	0.094	1	< 0.01					
		NP	1990	FILSK	4	2	24.1	21.1	27.1	2	0.072	0.063	0.080	2	0.023	0.01	0.036			
			1996	FILSK	13	3	26.7	22.1	32.6	3	0.143	0.120	0.190	1	< 0.01					
		WE	1983	FILSK	5	1	10.4			1	0.140			1	< 0.05					
			1990	FILSK	3	3	23.1	19.1	27.2	**3**	**0.223**	0.140	**0.350**	3	0.111	0.034	0.19			
		YEB	1990	FILET	8	1	9.4			1	0.024			1	< 0.01					
ROGERS	19008000	BGS	2008	FILSK	8	1	6.2			1	0.188									
		NP	2008	FILSK	2	2	30.6	30.4	30.8	2	**0.480**	**0.448**	**0.512**							
SILVER*	62008300	BGS	2007	FILSK	10	6	5.5	5.1	6.3									6	25.7	33.7
		BKB	2006	FILET	6	1	8.0			1	0.033									
		BKS	2006	FILSK	10	1	6.3			1	0.068									
			2007	FILSK	10	6	6.9	6.3	7.5									6	32.9	45

Waterway/ Impairments[1]	AUID	Spec-ies[2]	Year	Anat[3]	Total Fish	Samples	Length (in)			Mercury (mg/kg)[4]				PCBs (mg/kg)[4]				PFOS (µg/kg)[4]		
							Mean	Min	Max	N	Mean	Min	Max	N	Mean	Min	Max	N	Mean	Max
		CHC	2007	FILET	2	2	15.7	15.7	15.7	2	0.084	0.071	0.097	1	0.04					
		WE	2006	FILSK	6	6	22.0	19.3	24.5	6	**0.384**	**0.286**	**0.449**							
			2007	FILSK	4	4	17.2	10.6	20.5									4	16.6	26.6
SIMLEY	19003700	BGS	2007	FILSK	7	1	5.6			1	0.055							1	5.13	
		BKS	2007	FILSK	7	1	6.1			1	0.102									
		NP	2007	FILSK	1	1	26.6			1	**0.986**									
		WE	2007	FILSK	3	3	17.6	17.2	18.0	3	**0.714**	**0.682**	**0.742**							
SNAIL*	62007300	BGS	1999	FILSK	10	1	6.6			1	0.150									
		LMB	1999	FILSK	4	4	10.0	9.5	10.3	4	0.155	0.130	0.190							
		NP	1999	FILSK	8	8	21.4	16.5	27.2	8	**0.375**	0.170	**0.670**	1	< 0.01					
SPRING	02007100	BGS	2008	FILSK	12	7	5.5	4.7	6.3									7	5.95	8.57
STEIGER*	10004500	BGS	1988	FILSK	10	1	6.5			1	**0.310**			1	< 0.01					
			2008	FILSK	4	4	5.5	5.1	6.1									4	5.55	7.19
			2009	FILSK	3	1	6.7			1	0.123							1	< 4.85	
		BKS	2003	FILSK	8	1	7.3			1	**0.340**									
			2008	FILSK	2	2	5.5	5.1	5.9									2	5.31	5.69
			2009	FILSK	3	1	7.3											1	< 4.81	
		C	2003	FILSK	3	1	22.9							1	< 0.01					
		LMB	2008	FILSK	5	5	14.3	10.6	15.4									5	9.49	12
		NP	1988	FILSK	3	2	27.3	24.5	30.0	2	**1.300**	**1.200**	**1.400**	2	< 0.01					
			2003	FILSK	5	5	23.1	19.6	26.5	5	**0.621**	**0.420**	**0.725**							
		YEB	2009	FILET	5	1	12.6			1	**0.343**									
SUCKER*	62002800	BGS	1995	FILSK	10	1	5.9			1	0.022									
		BKB	1995	FILET	8	1	11.3			1	**0.330**									
		NP	1995	FILSK	9	2	16.7	15.4	18.0	2	0.051	0.047	0.055							
		WE	1995	FILSK	7	2	16.4	15.4	17.4	2	**0.290**	**0.270**	**0.310**	1	< 0.01					
SWEENEY	27003501	BGS	2008	FILSK	5	5	5.2	5.1	5.3									5	26.2	32.1
		BKS	2008	FILSK	3	3	5.9	5.5	6.3									3	28.5	48.5
		LMB	2008	FILSK	5	5	14.8	11.4	17.3									5	49.8	69.4
TANNERS*	82011500	BGS	2007	FILSK	10	6	5.7	3.9	7.1									6	72.5	105
		BKS	2007	FILSK	5	5	6.8	5.9	7.3									5	118	**265**
		CHC	2000	FILET	3	3	16.1	14.6	17.2	2	0.100	0.090	0.110	3	< 0.01					
		LMB	2007	FILSK	5	5	16.0	13.8	19.7									5	79.6	96.5
		NP	2000	FILSK	3	3	27.3	24.6	29.6	3	**0.447**	**0.410**	**0.480**							
			2005	FILSK	3	3	25.7	24.2	27.6	3	**0.490**	**0.337**	**0.751**							
			2011	FILSK	11	11	21.9	16.6	26.6	11	0.166	0.091	**0.302**							
		YP	2000	WHORG	10	10	5.9	5.0	6.8	10	0.081	0.030	0.130							
			2005	WHORG	1	1	5.8			1	0.029									

Waterway/ Impairments[1]	AUID	Spec-ies[2]	Year	Anat[3]	Total Fish	Samples	Length (in)			Mercury (mg/kg)[4]				PCBs (mg/kg)[4]				PFOS (µg/kg)[4]		
							Mean	Min	Max	N	Mean	Min	Max	N	Mean	Min	Max	N	Mean	Max
THOMPSON	19004800	BGS	2003	FILSK	11	1	4.7			1	0.056									
			2008	FILSK	9	1	6.7			1	0.035									
		BKS	2008	FILSK	3	1	8.7			1	0.115									
		GSF	2003	FILSK	9	1	5.8			1	0.138									
		SNL	2002	SOFT	10	1				1	0.032			1	< 0.01					
TURTLE*	62006100	BGS	2007	WHORG	14	2	3.6	3.4	3.8	2	0.029	0.027	0.031							
		C	1997	FILSK	8	1	21.3	21.3	21.3	1	0.060			1	0.06					
		NP	1997	FILSK	24	24	24.4	20.4	31.5	24	**0.486**	0.220	**0.820**	4	< 0.01					
				WHORG	24	24	24.4	20.4	31.5	24	**0.358**	0.180	**0.520**							
			2002	FILSK	17	17	21.9	15.9	33.9	17	**0.305**	0.111	**0.879**							
			2007	FILSK	16	16	18.7	16.2	24.1	16	**0.273**	0.150	**0.504**							
		YP	1997	WHORG	4	4	7.6	6.5	8.7	4	0.173	0.130	**0.250**							
TWIN*#$	27004200	BGS	2008	FILSK	16	7	5.3	5.1	5.9	1	0.041							6	**397**	**493**
			2009	FILSK	5	1	5.9											1	157	
		BKS	1995	FILSK	10	1	7.1			1	0.093									
			2002	FILSK	12	1	7.4			1	0.115									
			2008	FILSK	5	5	6.9	5.9	7.1									5	**419**	**501**
			2009	FILSK	5	1	6.8											1	**275**	
		C	1995	FILSK	6	1	16.7			1	0.065			1	**0.25**					
			2002	FILSK	4	1	24.3			1	0.057			1	0.07					
		LMB	2008	FILSK	5	5	13.2	9.8	16.5									5	**480**	**587**
			2009	FILSK	5	5	11.6	10.6	13.0	5	0.085	0.038	0.150					5	176	**267**
		NP	1995	FILSK	22	4	22.8	18.1	30.5	4	0.228	0.140	**0.410**	1	0.04					
			2002	FILSK	5	5	27.4	24.8	29.5	5	**0.275**	0.188	**0.340**							
VIRGINIA*	10001500	BGS	2003	FILSK	9	1	6.7			1	0.069									
			2009	FILSK	5	1	6.0											1	8.64	
		BKS	2009	FILSK	5	1	7.5			1	0.093							1	8.37	
		C	2003	FILSK	3	1	25.1			1	0.085			1	< 0.01					
		NP	2003	FILSK	5	5	24.1	20.2	28.1	5	0.169	0.089	**0.368**							
			2009	FILSK	5	5	19.9	13.4	25.6									5	8.97	11.5
WAKEFIELD	62001100	BGS	2006	FILSK	9	1	5.9			1	0.057									
		BKS	2006	FILSK	3	1	6.0			1	0.078									
WASSERMANN*	10004800	BGS	1988	FILSK	10	1	5.8			1	0.044			1	< 0.01					
			2005	FILSK	9	1	6.4			1	0.057									
		BKB	2005	FILET	8	1	10.6			1	0.133									
		BKS	2005	FILSK	8	1	6.6			1	0.078									
			2011	FILSK	10	2	8.1	7.8	8.3	2	0.052	0.046	0.058							
		C	1988	FILSK	1	1	26.0			1	0.160			1	< 0.01					

Waterway/ Impairments[1]	AUID	Spec-ies[2]	Year	Anat[3]	Total Fish	Samples	Length (in)			Mercury (mg/kg)[4]				PCBs (mg/kg)[4]				PFOS (µg/kg)[4]		
							Mean	Min	Max	N	Mean	Min	Max	N	Mean	Min	Max	N	Mean	Max
			2005	FILSK	4	1	21.0			1	0.135									
		NP	1988	FILSK	3	2	25.9	21.4	30.4	2	0.200	0.140	**0.260**	2	< 0.01					
			2005	FILSK	5	5	27.1	24.5	29.4	5	0.208	0.110	**0.251**							
			2011	FILSK	8	8	23.4	19.7	31.8	8	0.122	0.072	**0.333**							
		YEB	2011	FILET	5	1	9.9			1	0.058									
		YP	2011	FILSK	9	2	8.0	7.5	8.5	2	0.060	0.060	0.060							
WEAVER*	27011700	BGS	1995	FILSK	10	1	6.8			1	0.230									
			2002	FILSK	10	1	6.2			1	0.089									
		NP	1995	FILSK	24	5	24.9	19.2	32.3	5	**0.322**	**0.280**	**0.360**	1	< 0.01					
		YEB	1995	FILET	10	1	11.5			1	**0.260**									
			2002	FILET	8	1	12.0			1	0.137									
WHITE BEAR*	82016700	BGS	1979	**WHORG**	**5**	**1**	**6.7**			**1**	**0.050**									
			1984	FILSK	5	1	6.6			1	0.100			1	< 0.05					
			1999	FILSK	10	1	7.3			1	0.090									
			2007	FILSK	10	6	5.7	2.8	10.0									6	< 5.62	< 8.13
			2010	FILSK	6	1	6.4			1	0.046									
		BKS	1999	FILSK	9	1	9.3			1	0.080									
			2007	FILSK	2	2	10.0	8.3	11.8									2	24.6	30.8
			2010	FILSK	5	1	8.1			1	0.041									
		LMB	2007	FILSK	5	5	13.2	12.2	14.4									5	< 5.67	9.07
		NP	1984	FILSK	5	1	17.1			1	0.180			1	< 0.05					
			1999	FILSK	8	8	23.1	17.5	31.8	8	**0.559**	**0.310**	**1.330**	1	0.03					
			2010	FILSK	8	8	20.8	14.4	24.0	8	0.185	0.078	0.235							
		WE	1999	FILSK	8	8	18.5	14.0	23.6	8	**0.351**	0.210	**0.490**	1	0.063					
		WSU	1979	WHORG	2	1	21.5			1	0.090									
			1999	FILSK	1	1	21.6			1	0.110			1	0.033					
		YEB	1979	WHORG	5	1	11.7			1	0.100									
WIRTH*	27003700	BKS	1990	FILSK	1	1	8.9			1	0.075			1	< 0.01					
		C	1990	FILSK	8	3	18.6	10.1	26.8	3	0.079	0.034	0.130	3	0.068	0.033	0.13			
		CHC	1990	FILET	2	2	16.4	15.2	17.5	2	0.104	0.077	0.130	2	0.105	0.079	0.13			
		NP	1990	FILSK	2	2	21.6	19.5	23.7	2	0.145	0.110	0.180	2	0.011					
			1996	FILSK	10	10	20.3	11.6	34.8	10	0.142	0.063	**0.332**							
			2007	FILSK	11	11	25.1	20.1	30.2	11	**0.253**	0.190	**0.302**							
		WE	1990	FILSK	9	4	17.1	12.7	22.2	4	0.138	0.075	0.200	4	0.014	0.01	0.025			
			1996	FILSK	4	4	16.9	16.0	18.8	4	0.160	0.136	0.169							
		WSU	1990	FILSK	4	1	17.0			1	0.070			1	0.044					
ZUMBRA-SUNNY*	10004100	BGS	2004	FILSK	10	1	6.1			1	0.088									

Waterway/ Impairments[1]	AUID	Spec-ies[2]	Year	Anat[3]	Total Fish	Samples	Length (in)			Mercury (mg/kg)[4]				PCBs (mg/kg)[4]				PFOS (µg/kg)[4]		
							Mean	Min	Max	N	Mean	Min	Max	N	Mean	Min	Max	N	Mean	Max
		BKB	2004	FILET	8	1	8.4			1	0.093									
		BKS	2004	FILSK	8	1	7.8			1	0.128									
		NP	1988	FILSK	5	1	24.0			1	**0.350**			1	< 0.01					
			2004	FILSK	5	5	24.1	23.8	24.9	5	0.206	0.140	**0.342**							

1 Impairment codes: Mercury = *, PFOS = #, PCBs = $

2 Species codes: BU = Bigmouth Buffalo, BGS = Bluegill Sunfish, BKB = Black Bullhead, BKS = Black Crappie, C = Common Carp, CHC = Channel Catfish, FWD = Freshwater Drum, GSF = Green Sunfish, HSF = Hybrid Sunfish, LMB = Largemouth Bass, ML = Muskellunge, NP = Northern Pike, RBT = Rainbow Trout, RHS = Redhorse, unknown species, SF = Pumpkinseed Sunfish, SMB = Smallmouth Bass, TMU = Tiger Muskie Hybrid, WE = Walleye, WHB = White Bass, WSU = White Sucker, YEB = Yellow Bullhead, YP = Yellow Perch

3 Anatomy codes: FILSK – fillet skin-on; FILET – fillet skin-off; WHORG – whole

4 In red are results that are above the impairment threshold: Mercury = 0.2 mg/kg, PCBs = 0.22 mg/kg, PFOs = 200 µg /kg

Appendix 8 – Fish species found during biological monitoring surveys of the Mississippi River – Twin Cities Watershed.

Common Name	Quantity of stations where present	Quantity of individuals collected
banded killifish	*1*	*1*
bigmouth buffalo	*9*	*30*
bigmouth shiner	*34*	*2439*
*black buffalo**	*1*	*1*
black bullhead	*71*	*1004*
black crappie	*42*	*299*
blackchin shiner	*2*	*219*
blacknose dace	*32*	*742*
blacknose shiner	*1*	*4*
blackside darter	*13*	*462*
*blue sucker**	*1*	*1*
bluegill	*74*	*3222*
bluntnose minnow	*40*	*1940*
bowfin	*4*	*5*
brassy minnow	*22*	*177*
brook silverside	*6*	*17*
brook stickleback	*69*	*1301*
brown bullhead	*1*	*1*
bullhead minnow	*9*	*187*
burbot	*3*	*6*
central mudminnow	*97*	*4970*
central stoneroller	*2*	*25*
channel catfish	*18*	*233*
channel shiner	*1*	*2*
common carp#	*65*	*1634*
common shiner	*17*	*119*
creek chub	*41*	*2194*
emerald shiner	*17*	*21067*
fantail darter	*1*	*2*
fathead minnow	*112*	*6861*
flathead catfish	*8*	*26*
freshwater drum	*12*	*75*
gizzard shad	*12*	*1524*
golden redhorse	*1*	*1*
golden shiner	*24*	*103*
Goldfish#	*4*	*23*

Common Name	Quantity of stations where present	Quantity of individuals collected
green sunfish	*107*	*2624*
highfin carpsucker	*2*	*2*
hornyhead chub	*9*	*65*
hybrid sunfish	*48*	*529*
Iowa darter	*13*	*45*
johnny darter	*73*	*2711*
largemouth bass	*52*	*370*
logperch	*14*	*104*
longnose dace	*10*	*429*
mimic shiner	*4*	*22*
mooneye	*2*	*2*
mottled sculpin	*6*	*24*
northern hogsucker	*3*	*19*
northern pike	*51*	*219*
northern redbelly dace	*10*	*207*
orangespotted sunfish	*8*	*50*
pumpkinseed	*54*	*466*
quillback	*7*	*23*
river carpsucker	*3*	*5*
river darter	*3*	*14*
rock bass	*3*	*8*
sand shiner	*8*	*407*
sauger	*9*	*77*
shorthead redhorse	*16*	*189*
silver chub	*6*	*13*
silver redhorse	*13*	*52*
slenderhead darter	*7*	*73*
smallmouth bass	*18*	*960*
smallmouth buffalo	*10*	*37*
spotfin shiner	*39*	*2904*
spottail shiner	*9*	*92*
stonecat	*1*	*9*
tadpole madtom	*8*	*13*
tiger musky	*1*	*1*
trout-perch	*3*	*13*
walleye	*23*	*99*
white bass	*11*	*340*
white crappie	*2*	*5*
white sucker	*94*	*6029*
yellow bullhead	*38*	*290*
yellow perch	*38*	*193*

*Designated special concern or threatened by MNDNR.